



**National Aeronautics and  
Space Administration  
Langley Research Center**

**Scientific and Technical  
Information Program Office**

# **Scientific and Technical Aerospace Reports**

# STAIR

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- **TECHNICAL TRANSLATION.** English-language translations of foreign scientific and technical material pertinent to NASA's mission.

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- Fax your question to the NASA STI Help Desk at 443-757-5803
- Phone the NASA STI Help Desk at 443-757-5802
- Write to:  
NASA STI Help Desk  
NASA Center for AeroSpace Information  
7115 Standard Drive  
Hanover, MD 21076-1320

# Introduction

*Scientific and Technical Aerospace Reports (STAR)* is an online information resource listing citations and abstracts of NASA and worldwide aerospace-related scientific and technical information (STI). Updated biweekly, *STAR* highlights the most recent additions to the NASA Aeronautics and Space Database. Through this resource, the NASA STI Program provides timely access to the most current aerospace-related research and development (R&D) results.

*STAR* subject coverage includes all aspects of aeronautics and space research and development, supporting basic and applied research, and application, as well as aerospace aspects of Earth resources, energy development, conservation, oceanography, environmental protection, urban transportation and other topics of high national priority. The listing is arranged first by 11 broad subject divisions, then within these divisions by 76 subject categories and includes two indexes: subject and author.

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- NASA, NASA contractor, and NASA grantee reports
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- Other U.S. Government agency and foreign patents and patent applications
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The NASA STI Program was established to support the objectives of NASA's missions and research to advance aeronautics and space science. By sharing information, the NASA STI Program ensures that the U.S. maintains its preeminence in aerospace-related industries and education, minimizes duplication of research, and increases research productivity.

Through the NASA Center for AeroSpace Information (CASI), the NASA STI Program acquires, processes, archives, announces, and disseminates both NASA's internal STI and worldwide STI. The results of 20th and 21st century aeronautics and aerospace research and development, a worldwide investment totaling billions of dollars, have been captured, organized, and stored in the NASA Aeronautics and Space Database. New information is continually announced and made available as it is acquired, making this a dynamic and historical collection of value to business, industry, academia, federal institutions, and the general public.

The STI Program offers products and tools that allow efficient access to the wealth of information derived from global R&D efforts. In addition, customized services are available to help tailor this valuable resource to meet your specific needs.

For more information on the most up-to-date NASA STI, visit the STI Program's Web site at <http://www.sti.nasa.gov>.

# NASA STI Availability Information

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NASA STI is also available to the public through Federal information organizations. NASA CASI disseminates publicly available NASA STI to the National Technical Information Service (NTIS) and to the Federal Depository Library Program (FDLP) through the Government Printing Office (GPO). In addition, NASA patents are available online from the U.S. Patent and Trademark Office.

## National Technical Information Service (NTIS)

The National Technical Information Service serves the American public as a central resource for unlimited, unclassified U.S. Government scientific, technical, engineering, and business related information. For more than 50 years NTIS has provided businesses, universities, and the public timely access to well over 2 million publications covering over 350 subject areas. Visit NTIS at <http://www.ntis.gov>.

## The Federal Depository Library Program (FDLP)

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## The U.S. Patent and Trademark Office (USPTO)

The U.S. Patent and Trademark Office provides online access to full text patents and patent applications. The database includes patents back to 1976 plus some pre-1975 patents. Visit the USPTO at <http://www.uspto.gov/patft/>.

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# SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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01

## AERONAUTICS (GENERAL)

Includes general research topics related to manned and unmanned aircraft and the problems of flight within the Earth's atmosphere. Also includes manufacturing, maintenance, and repair of aircraft. For specific topics in aeronautics, see categories 02 through 09. For information related to space vehicles see 12 Astronautics.

**20080047254** Nanjing Univ., China

**Transactions of Nanjing University of Aeronautics & Astronautics, Vol. 25, No. 2, June 2008**

Jun. 2008; 86 pp.; In Chinese

Report No.(s): PB2009-101682; No Copyright; Avail.: CASI: [A05](#), Hardcopy

This document focuses on the research achievements in aeronautics, civil aviation, astronautics and their theoretical basis.  
NTIS

*Aeronautical Engineering; Civil Aviation*

**20080048307** QSS Group, Inc., Cleveland, OH, USA

**User's Manual for LEWICE Version 3.2**

Wright, William; November 2008; 454 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS3-00145; WBS 75280.02.07.03.02

Report No.(s): NASA/CR-2008-214255; E-15537; Copyright; Avail.: CASI: [A20](#), Hardcopy

A research project is underway at NASA Glenn to produce a computer code which can accurately predict ice growth under a wide range of meteorological conditions for any aircraft surface. This report will present a description of the code inputs and outputs from version 3.2 of this software, which is called LEWICE. This version differs from release 2.0 due to the addition of advanced thermal analysis capabilities for de-icing and anti-icing applications using electrothermal heaters or bleed air applications, the addition of automated Navier-Stokes analysis, an empirical model for supercooled large droplets (SLD) and a pneumatic boot option. An extensive effort was also undertaken to compare the results against the database of electrothermal results which have been generated in the NASA Glenn Icing Research Tunnel (IRT) as was performed for the validation effort for version 2.0. This report will primarily describe the features of the software related to the use of the program. Appendix A has been included to list some of the inner workings of the software or the physical models used. This information is also available in the form of several unpublished documents internal to NASA. This report is intended as a replacement for all previous user manuals of LEWICE. In addition to describing the changes and improvements made for this version, information from previous manuals may be duplicated so that the user will not need to consult previous manuals to use this software.

Author

*Ice Formation; Thermal Analysis; Deicing; User Manuals (Computer Programs); Aircraft Icing; Computer Programs; Heat Transfer*

**20080048351** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Improving the Efficiency of Aerodynamic Shape Optimization on Unstructured Meshes**

Carpentieri, G.; Van Tooren, M. J. L.; Koren, B.; Jan. 2006; 22 pp.; In English

Report No.(s): PB2008-106027; MAS-E0604; Copyright; Avail.: National Technical Information Service (NTIS)

In this paper the exact discrete adjoint of a finite volume formulation on unstructured meshes for the Euler equations in two dimensions is derived and implemented to support aerodynamic shape optimization. The accuracy of the discrete exact adjoint is demonstrated and compared with that of the approximate adjoint. A solution process for the adjoint equations, which is similar to that used for the flow equations, is modified to account for multiple functionals. An optimization framework,



which couples an analytical shape parameterization to the flow/adjoint solver and to a Sequential Quadratic Programming optimization algorithm, is tested on constrained and unconstrained airfoil design cases. Preliminary results are also presented for a Sequential Linear Programming algorithm, which appears to be able to deal properly with constrained design in spite of its simplicity.

NTIS

*Aerodynamic Configurations; Differential Equations; Finite Volume Method; Shape Optimization; Unstructured Grids (Mathematics)*

**20080048376** Wisconsin Dept. of Health and Family Services, Madison, WI, USA

**Fatality Assessment and Control Evaluation (FACE) for Wisconsin: Parachute Jump Instructor and Jump Student Die From Fall After Chute Lines Became Entangled During Tandem Jump From Plane**

May 1994; 2 pp.; In English

Report No.(s): PB2009-102447; FACE-93-WI-226; No Copyright; Avail.: CASI: [A01](#), Hardcopy

A 33-year-old male parachute jump instructor (victim 1) and a 29-year-old jump student (victim 2) died upon impact with the ground following an unsuccessful tandem parachute jump. Victim 2 had contacted the victim No. 1 for a formal parachute lesson. The lesson included connecting two harnesses together which allowed victim 1 and victim 2 to jump as one unit. Victim 1 carried the chute pack on his back and victim 2 was attached to his chest via the harness in a back-to-chest position. On the day of the incident, a number of parachutists boarded a plane and ascended to an elevation of 10,500 feet. The tandem jumpers jumped from the plane, and were followed by two other single jumpers. Victim 1's drogue chute, which positions the jumpers and pulls out the main chute, deployed, and shortly thereafter the main chute began to deploy. Subsequently, the main chute and reserve chute lines became entangled in the drogue lines, and the chutes were unable to fully deploy. Victim 1 worked to free the tangled lines as two victims continued to fall. These attempts were unsuccessful, and the two victims struck the ground at a golf course. EMS responders and the medical examiner arrived, and the victims were pronounced dead at the scene and were transported to the county morgue. The Wisconsin FACE investigator concluded that, to prevent similar occurrences, parachute jumpers, organizations, and manufacturers should: continue to support and conduct research efforts on incorporating fail-safe systems into the maintenance, preparation and use of parachutes and equipment.

NTIS

*Accident Investigation; Instructors; Parachutes; Parachute Descent*

## 02 AERODYNAMICS

Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans, and other elements of turbomachinery. For related information see also 34 Fluid Mechanics and Thermodynamics.

**20080047470** NASA Ames Research Center, Moffett Field, CA, USA

**Comparison of Rotor Structural Loads Calculated using Comprehensive Analysis**

Johnson, Wayne; Yeo, Hyeonsoo; September 13, 2005; 18 pp.; In English; 31st European Rotorcraft Forum, 13-15 Sep. 2005, Florence, Italy; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047470>

Blade flap and chord bending and torsion moments are investigated for six rotors operating at transition and high speed: H-34 in flight and wind tunnel, SA 330 (research Puma), SA 349/2, UH-60A full-scale, and BO-105 model (HART-I). The measured data from flight and wind tunnel tests are compared with calculations obtained using the comprehensive analysis CAMRAD II. The calculations were made using two free wake models: rolled-up and multiple-trailer with consolidation models. At transition speed, there is fair to good agreement for the flap and chord bending moments between the test data and analysis for the H-34, research Puma, and SA 349/2. Torsion moment correlation, in general, is fair to good for all the rotors investigated. Better flap bending and torsion moment correlation is obtained for the UH-60A and BO-105 rotors by using the multiple-trailer with consolidation wake model. In the high speed condition, the analysis shows generally better correlation in magnitude than in phase for the flap bending and torsion moments. However, a significant underprediction of chord bending moment is observed for the research Puma and UH-60A. The poor chord bending moment correlation appears to be caused by the airloads model, not the structural dynamics.

Author

*Aerodynamic Loads; Dynamic Structural Analysis; Flight Tests; Wakes; Bending Moments; Flapping*

**20080047659** NASA Ames Research Center, Moffett Field, CA, USA

**Airloads and Wake Geometry Calculations for an Isolated Tiltrotor Model in a Wind Tunnel**

Johnson, Wayne; September 11, 2001; 12 pp.; In English; 27th European Rotorcraft Forum, 11-14 Sep. 2001, Moscow, Russia; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: **A03**, Hardcopy  
ONLINE: <http://hdl.handle.net/2060/20080047659>

Comparisons of measured and calculated aerodynamic behavior of a tiltrotor model are presented. The test of the Tilt Rotor Aeroacoustic Model (TRAM) with a single, 0.25-scale V-22 rotor in the German-Dutch Wind Tunnel (DNW) provides an extensive set of aeroacoustic, performance, and structural loads data. The calculations were performed using the rotorcraft comprehensive analysis CAMRAD II. Presented are comparisons of measured and calculated performance for hover and helicopter mode operation, and airloads for helicopter mode. Calculated induced power, profile power, and wake geometry provide additional information about the aerodynamic behavior. An aerodynamic and wake model and calculation procedure that reflects the unique geometry and phenomena of tiltrotors has been developed. There are major differences between this model and the corresponding aerodynamic and wake model that has been established for helicopter rotors. In general, good correlation between measured and calculated performance and airloads behavior has been shown. Two aspects of the analysis that clearly need improvement are the stall delay model and the trailed vortex formation model.

Author

*Aeroacoustics; Aerodynamic Loads; Wakes; Tilt Rotor Aircraft; Rotary Wing Aircraft; Loads (Forces); Aerodynamic Characteristics*

**20080047669** NASA Ames Research Center, Moffett Field, CA, USA

**Advanced Rotor Aerodynamics Concepts with Application to Large Rotorcraft**

Floros, Matthew W.; Johnson, Wayne; Scully, Michael P.; January 23, 2002; 14 pp.; In English; AHS Aerodynamics, Acoustics, and Test and Evaluation Specialists Conference, 23-25 Jan. 2008, San Francisco, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

A study was conducted using the comprehensive analysis CAMRAD II to explore performance enhancements to large rotorcraft. The aircraft considered were a 125 foot diameter six-bladed rotor helicopter and an 85 foot diameter four-bladed rotor tilt rotor. The objectives were to reduce power required and increase maximum lift. The effects of improved airfoils and active controls were investigated. Airfoils with higher maximum lift and with reduced drag were investigated. Results showed a moderate improvement in the maximum lift capability for the helicopter and a large improvement for the tilt rotor. For the helicopter, 2/rev individual blade control resulted in modest power savings in cruise flight, which increased with control amplitude and forward speed. The optimum phase for the individual blade control was relatively insensitive to both amplitude and forward speed. The influences of active twist, increased chord, increments in airfoil properties, and tilt rotor tip extensions were also investigated.

Author

*Rotor Aerodynamics; Tilt Rotor Aircraft; Helicopters; Active Control; Drag; Airfoils*

**20080047682** NASA Ames Research Center, Moffett Field, CA, USA

**Vortex Wake Geometry of a Model Tilt Rotor in Forward Flight**

Yamauchi, G. K.; Johnson, W.; Wadcock, A. J.; November 11, 2002; 16 pp.; In English; Heli Japan 2002, AHS International Meeting on Advanced Rotorcraft Technology and Life Saving Activities, 11-13 Nov. 2002, Tochigi, Japan; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

The vortex wake trajectory from one rotor of a 0.25-scale V-22 tiltrotor model was measured for four test conditions in the NASA Ames 40- by 80-Foot Wind Tunnel. Vortex wake images were acquired using a laser light sheet and video camera. Wake trajectories were constructed by extracting vortex positions from the video images. Wake trajectories were also calculated using the comprehensive analysis CAMRAD II. Measured and calculated wake geometries exhibit similar trends when advance ratio is varied at fixed thrust or when thrust is varied at fixed advance ratio.

Author

*Vortices; Wakes; Tilt Rotor Aircraft; Flight Paths; Horizontal Flight*

**20080047759** Maryland Univ., College Park, MD, USA

**Safety Study of Wire Strike Devices Installed on Civil and Military Helicopters**

Nagaraj, V. T.; Chopra, I.; Sep. 2008; 151 pp.; In English

Report No.(s): PB2009-102149; No Copyright; Avail.: National Technical Information Service (NTIS)

Wire strike accidents involving USA military and civil helicopters for the period 1994-2004 were analyzed using military and the National Transportation Safety Board databases. The objective of the research was to conduct a study on wire strike accidents of civil and military helicopters between 1994 and 2004 to establish trends, assess the potential of existing technology for reducing wire strike accidents, and to recommend solutions that could substantially reduce the number of wire strike accidents. Trends in accidents were established for both military and civil wire strike accidents. The age group and experience profiles of the pilots involved in civil helicopter wire strike accidents were found to be similar to those found in an earlier study. Devices available for warning pilots about the proximity of wires are described and their relative merits assessed. Recommendations are made for reducing the number of helicopter wire strike accidents.

NTIS

*Helicopters; Military Helicopters; Safety; Warning Systems; Wire*

**20080047799** Air Force Research Lab., Mesa, AZ USA

**Energy Based Aerodynamic Modeling: Increasing Fidelity of Fixed-Wing Constructive Entities**

Pohlman, Mitch; Kam, Clinton; Mar 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-4924

Report No.(s): AD-A489562; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Distributed Mission Operations (DMO) is an ideal setting for practicing Beyond Visual Range air-to-air tactics. Hardware and software limitations often dictate the use of simplified aerodynamic models for control of fixed wing constructive entities within synthetic environments. In many tactical situations the long range fight will disintegrate into close-in air combat, which for a variety of reason is difficult to represent in virtual simulators. The eXperimental Common Immersive Theatre Environment (XCITE) developed at Warfighter Readiness Research Division (AFRL/HEA) was designed to provide a physics based high-fidelity threat environment for training and rehearsal in a DMO environment. Feedback by operational pilots identified unrealistic constructive flight performance as a critical shortfall of XCITE. Here we will discuss the development, testing and validation of an energy based aerodynamic model in an effort to provide a more effective threat environment for DMO. Specific Excess Power (Ps) tables were created using thrust, drag, lift and loading data for each aircraft; these tables then provide accurate acceleration figures that are feed back into the original aero-model. In testing, aircraft flight performance was compared against data obtained from aerodynamic models in both 6-DOF Full Mission Trainers and the baseline XCITE aero model.

DTIC

*Aerodynamics; Aircraft Configurations; Fixed Wings; Flight Simulators*

**20080048070** Raytheon Information Technology and Scientific Services, Moffett Field, CA, USA; NASA Ames Research Center, Moffett Field, CA, USA

**Assessment of Comprehensive Analysis Calculation of Airloads on Helicopter Rotors**

Yeo, Hyeonsoo; Johnson, Wayne; January 21, 2004; 29 pp.; In English; American Helicopter Society 4th Decennial Specialist's Conference on Aeromechanics, 21-23 Jan. 2004, San Francisco, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

Blade section normal force and pitching moment were investigated for six rotors operating at transition and high speeds: H-34 in flight and wind tunnel, SA 330 (research Puma), SA 349/2, UH-60A full-scale and BO-105 model (HART-I). The measured data from flight and wind tunnel tests were compared with calculations obtained using the comprehensive analysis CAMRAD II. The calculations were made using two free wake models: rolled-up and multiple-trailer with consolidation models. At transition speed, there is fair to good agreement for the blade section normal force between the test data and analysis for the H-34, research Puma, and SA 349/2 with the rolled-up wake. The calculated airloads differ significantly from

the measurements for the UH-60A and BO-105. Better correlation is obtained for the UH-60A and BO-105 by using the multiple-trailer with consolidation wake model. In the high speed condition, the analysis shows generally good agreement with the research Puma flight data in both magnitude and phase. However, poor agreement is obtained for the other rotors examined. The analysis shows that the aerodynamic tip design (chord length and quarter chord location) of the Puma has an important influence on the phase correlation.

Author

*Rotor Aerodynamics; Rotor Blades; Aerodynamic Loads; Pitching Moments; Force Distribution; Rotor Speed*

**20080048071** NASA Ames Research Center, Moffett Field, CA, USA

**Rotorcraft Technology for HALE Aeroelastic Analysis**

Young, Larry; Johnson, Wayne; September 10, 2008; 12 pp.; In English; Original contains color illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080048071>

Much of technology needed for analysis of HALE nonlinear aeroelastic problems is available from rotorcraft methodologies. Consequence of similarities in operating environment and aerodynamic surface configuration. Technology available - theory developed, validated by comparison with test data, incorporated into rotorcraft codes. High subsonic to transonic rotor speed, low to moderate Reynolds number. Structural and aerodynamic models for high aspect-ratio wings and propeller blades. Dynamic and aerodynamic interaction of wing/airframe and propellers. Large deflections, arbitrary planform. Steady state flight, maneuvers and response to turbulence. Linearized state space models. This technology has not been extensively applied to HALE configurations. Correlation with measured HALE performance and behavior required before can rely on tools.

Author

*Aerodynamic Characteristics; Aeroelasticity; Control Surfaces; Low Reynolds Number; Propeller Blades; Rotary Wing Aircraft; Subsonic Speed; Turbulence; Rotor Speed*

**20080048204** NASA Langley Research Center, Hampton, VA, USA

**Spline-Based Smoothing of Airfoil Curvatures**

Li, W.; Krist, S.; NASA Tech Briefs, September 2008; September 2008, pp. 40-41; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): LAR-17227-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3152>

Constrained fitting for airfoil curvature smoothing (CFACS) is a splinebased method of interpolating airfoil surface coordinates (and, concomitantly, airfoil thicknesses) between specified discrete design points so as to obtain smoothing of surface-curvature profiles in addition to basic smoothing of surfaces. CFACS was developed in recognition of the fact that the performance of a transonic airfoil is directly related to both the curvature profile and the smoothness of the airfoil surface. Older methods of interpolation of airfoil surfaces involve various compromises between smoothing of surfaces and exact fitting of surfaces to specified discrete design points. While some of the older methods take curvature profiles into account, they nevertheless sometimes yield unfavorable results, including curvature oscillations near end points and substantial deviations from desired leading-edge shapes. In CFACS as in most of the older methods, one seeks a compromise between smoothing and exact fitting. Unlike in the older methods, the airfoil surface is modified as little as possible from its original specified form and, instead, is smoothed in such a way that the curvature profile becomes a smooth fit of the curvature profile of the original airfoil specification. CFACS involves a combination of rigorous mathematical modeling and knowledge-based heuristics. Rigorous mathematical formulation provides assurance of removal of undesirable curvature oscillations with minimum modification of the airfoil geometry. Knowledge-based heuristics bridge the gap between theory and designers best practices. In CFACS, one of the measures of the deviation of an airfoil surface from smoothness is the sum of squares of the jumps in the third derivatives of a cubicspline interpolation of the airfoil data. This measure is incorporated into a formulation for minimizing an overall deviation- from-smoothness measure of the airfoil data within a specified fitting error tolerance. CFACS has been extensively tested on a number of supercritical airfoil data sets generated by inverse design and optimization computer programs. All of the smoothing results show that CFACS is able to generate unbiased smooth fits of curvature profiles, trading small modifications of geometry for increasing curvature smoothness by eliminating curvature oscillations and bumps (see figure).

Author

*Airfoils; Curvature; Smoothing; Splines*

**AIR TRANSPORTATION AND SAFETY**

Includes passenger and cargo air transport operations; airport ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in 09 Research and Support Facilities (Air). Air traffic control is covered in 04 Aircraft Communications and Navigation. For related information see also 16 Space Transportation and Safety and 85 Technology Utilization and Surface Transportation.

**20080047257** Federal Aviation Administration, Washington, DC, USA

**FAA Aerospace Forecasts, Fiscal Years 2005-2016**

January 2008; 270 pp.; In English

Report No.(s): PB2009-101898; No Copyright; Avail.: CASI: [A12](#), Hardcopy

Last year's 'Aerospace Forecasts' again proved to be an accurate depiction of aviation demand. We correctly anticipated the number of commercial industry seats miles and enplanements. And we were close in other areas as well, coming within two percentage points of predicting precise figures for FAA instrument tower operations. Activity en route centers exceeded our expectations. This year, we foresee that the demand for aviation products and services will continue to increase from the low level of the past few years, with most measures of aviation activity predicted to return to pre-September 11th levels in 2005.

NTIS

*Aerospace Systems; Economic Analysis; Forecasting*

**20080047297** Federal Aviation Administration, Washington, DC USA

**Plan for the Future 2007-2016: The Federal Aviation Administration's 10-Year Strategy for the Air Traffic Control Workforce**

Mar. 2007; 64 pp.; In English

Report No.(s): PB2009-101906; No Copyright; Avail.: National Technical Information Service (NTIS)

Air traffic controllers are an integral part of the National Airspace System (NAS). The work they do, every day of the year, is essential to the mission of the Federal Aviation Administration, providing the safest, most efficient aerospace system in the world. The FAA employs more than 14,000 air traffic controllers. They work in air traffic facilities of all sizes, safely guiding about 50,000 aircraft through the system each day. These employees provide air navigation services to aircraft in the U.S. domestic airspace, and in the 24.6 million square miles of international oceanic airspace delegated to the USA by the International Civil Aviation Organization. Over the next decade, approximately 72 percent of this workforce will become eligible to retire. In order to meet the challenges of this wave of retirements and the increasing demand for air travel, the FAA will hire and train more than 15,000 new air traffic controllers over the next 10 years. The plan for fiscal year 2007 includes hiring more than 1,300 new controllers from the thousands of qualified applicants waiting to be hired.

NTIS

*Air Traffic Control; Air Traffic Controllers (Personnel); Management*

**20080047311** Government Accountability Office, Washington, DC, USA

**Aviation and the Environment: Initial Voluntary Airport Low Emissions Program Projects Reduce Emissions, and FAA Plans to Assess the Programs' Overall Performance as Participation Increases**

Nov. 2008; 32 pp.; In English

Report No.(s): PB2009-102109; GAO-09-37; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In 2003, Congress established a program to reduce airport ground emissions at commercial service airports in areas failing to meet or maintain air quality standards. The Federal Aviation Administration (FAA) administers the Voluntary Airport Low Emissions (VALE) Program and oversees the program's two sources of funding: Airport Improvement Program (AIP) federal grants or Passenger Facility Charges (PFC), which airports can collect from passengers. Participating airports also receive credits for the emission reductions achieved through VALE projects in accordance with the law and guidance. Airports can use these credits to offset emissions resulting from development projects to comply with federal Clean Air Act requirements. GAO was asked to determine (1) how the VALE program has been implemented, including airport participation levels, types of projects, and program expenditures, and (2) the outcomes attributable to the VALE program. To do this, GAO reviewed FAA data on VALE projects for all nine participating airports; visited two of these airports; obtained information from the remaining seven participating airports and four nonparticipating airports; and interviewed officials from FAA, Environmental

Protection Agency (EPA), and airport associations. FAA generally agreed with the reports findings, and FAA and EPA offered technical clarifications.

NTIS

*Air Pollution; Airports; Pollution Control*

**20080047346** NASA Langley Research Center, Hampton, VA, USA

**A Performance Assessment of a Tactical Airborne Separation Assistance System using Realistic, Complex Traffic Flows**  
Smith, Jeremy C.; Neitzke, Kurt W.; Bussink, Frank J. L.; November 2008; 39 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 411931.02.71.07.01

Report No.(s): NASA/TM-2008-215546; L-19519; Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper presents the results from a study that investigates the performance of aspects of an Airborne Separation Assistance System (ASAS) under varying demand levels using realistic traffic patterns. This study only addresses the tactical aspects of an ASAS using aircraft state data (latitude, longitude, altitude, heading and speed) to detect and resolve projected conflicts. The main focus of this paper is to determine the extent to which sole reliance on the proposed tactical ASAS can maintain aircraft separation at demand levels up to three times current traffic. The effect of mixing ASAS equipped aircraft with non-equipped aircraft that do not have the capability to self-separate is also investigated.

Author

*Separators; Longitude; Latitude; Altitude; Airborne Equipment*

**20080047756** Federal Aviation Administration, Washington, DC, USA

**FAA Aerospace Forecasts: Fiscal Years 2008-2025**

January 2008; 96 pp.; In English

Report No.(s): PB2009-101908; No Copyright; Avail.: National Technical Information Service (NTIS)

Aviation is the safest its ever been. Its also an industry that has challenges headed its way. As the market stands now, trends suggest an industry continuing to change over the next several years with international markets growing twice as fast as domestic markets. In addition, we expect the numbers of larger regional jets flying to increase while many smaller regional jets are retired. There will be increases in corporate jet flights, fractional ownership, and very light jets. Finally, airline operations are expected to return to traditional levels at most 'hub-and-spoke' airports. In 2008, we expect minimal gains in domestic capacity, with larger gains coming in international markets, especially in the Atlantic, as the US-EU open skies accord is implemented. The size of aircraft in domestic markets will fall slightly as airlines continue to adjust their operations to better match demand.

NTIS

*Aerospace Systems; Economic Analysis; Forecasting*

**20080047776** Federal Aviation Administration, Washington, DC USA

**Aviation Industry Performance: A Review of Summer 2007 Aviation System Performance**

Dec. 27, 2007; 58 pp.; In English

Report No.(s): PB2008-105564; No Copyright; Avail.: National Technical Information Service (NTIS)

This is the ninth in a series of periodic updates to our aviation industry performance report. The performance metrics were developed in 2002 as a mechanism for monitoring aviation industry trends, including domestic demand and capacity, aviation system performance, airline finances and air service in small communities. Given the intense public interest in the summer of 2007 period, this report will focus specifically on industry performance, during the June through August 2007 period. Record numbers of passengers, coupled with constraints on capacity growth by the airlines, yielded record high passenger load factors for domestic airlines during the summer of 2007. However, flight disruptions and long delays led to a sharp rise in consumer complaints. Consequently, industry performance has captured the attention of many constituencies, including Congress, the Secretary of Transportation and notably the President of the USA.

NTIS

*Air Transportation; Aircraft Industry; Evaluation; Industries; Performance Tests; Summer*

**20080047784** Congressional Research Service, Washington, DC, USA

**CRS Report for Congress. National Aviation Security Policy, Strategy, and Mode-Specific Plans: Background and Considerations for Congress**

Elias, B.; Jan. 02, 2008; 27 pp.; In English

Report No.(s): PB2008-105628; RL34302; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In the years leading up to the terrorist attacks of September 11, 2001, the USA lacked a comprehensive national policy and strategy for aviation security. The approach to aviation security was largely shaped by past events, such as the bombing of Pan Am flight 103 in December 1988, rather than a comprehensive evaluation of the full range of security risks. The 9/11 Commission concluded that the terrorist attacks of September 11, 2001 revealed failures of imagination, policy, capabilities, and management by both the FAA and the U.S. intelligence community. Following the September 11, 2001 attacks, U.S. aviation security policy and strategy was closely linked to the changes called for in the Aviation and Transportation Security Act (ATSA, P.L. 107-71), which emphasized sweeping changes to the security of passenger airline operations. While the importance of strategic planning was recognized, it was not a priority. The 9/11 Commission Report concluded that the TSA had failed to develop an integrated strategy for the transportation sector and mode specific plans, prompting Congress to mandate the development of these strategies and plans in the Intelligence Reform and Terrorism Prevention Act of 2004 (P.L. 108-458). While the TSA has developed these strategies and plans, the documents have been considered security sensitive thus limiting public discourse on the DHS strategy for aviation security. However, in June 2006 President Bush directed the DHS to establish and implement a national strategy for aviation security and an accompanying set of supporting plans.

NTIS

*Aircraft Safety; Airspace; Flight Safety; Policies; Security; Surveillance; Terrorism*

**20080047792** Massachusetts Dept. of Public Health, Boston, MA, USA

**Fatality Assessment and Control Evaluation (FACE) for Massachusetts: Airport Ramp Worker Dies after Being Struck by a Deicing Truck**

Jan. 2007; 12 pp.; In English

Report No.(s): PB2008-105052; FACE-04-MA-043; No Copyright; Avail.: CASI: [A03](#), Hardcopy

On December 7, 2004, a 43-year-old male airport ramp worker (the victim) was fatally injured after being struck by a deicing truck while walking across the area around an airport terminal where aircraft are loaded and unloaded (apron). The deicing truck was being driven by a co-worker across the apron from the airlines gate area to the hangar. The victim was struck by the right side of the deicing trucks bumper and was run over by the trucks right side front and rear wheels. Calls were placed to emergency medical services (EMS). EMS personnel arrived at the site to attend to the victim who was pronounced dead at the airport. The Massachusetts Fatality Assessment and Control Evaluation (FACE) Program concluded that to prevent similar occurrences in the future, employers should: (1) Purchase and use deicing equipment that does not obstruct the view of the vehicle operator while driving. (2) Designate pedestrian walkways within the airport apron for ground crew. (3) Prohibit employees from wearing loose hoods while working around moving vehicles and equipment on airport aprons. (4) Supply and ensure that employees wear appropriate personal protective equipment, such as the American National Standard Institute (ANSI) compliant high visibility safety apparel. (5) Ensure that their comprehensive written health and safety program includes specific training for deicing operators and workers on foot regarding areas around vehicles and equipment where operators would have obstructed views. Also, employers using deicing vehicles where operators have obstructed views while driving should: (6) Require a second employee to assist the vehicle operator during driving of the vehicle. (7) Consider installing after market devices (e.g., camera, radar, and sonar) on vehicles and equipment to help monitor the presence of workers on foot. In addition, manufacturers of aircraft deicing equipment and vehicles should: (8) Design equipment such that the operators view is not obstructed while driving. (9) Explore the possibility of incorporating new monitoring technology (e.g., radio frequency identification (RFID) tags and tag readers) on equipment to help monitor the presence of workers on foot and in blind areas.

NTIS

*Accident Investigation; Airports; Deicing; Dies; Health; Safety; Trucks*

**20080048309** NASA Langley Research Center, Hampton, VA, USA; Raytheon Co., Hampton, VA, USA

**Wake Turbulence Mitigation for Departures (WTMD) Prototype System - Software Design Document**

Sturdy, James L.; December 2008; 200 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): L70750D; WBS 305295.02.07.07.20

Report No.(s): NASA/CR-2008-215549; CONITS-TP-139; Copyright; Avail.: CASI: [A09](#), Hardcopy

This document describes the software design of a prototype Wake Turbulence Mitigation for Departures (WTMD) system

that was evaluated in shadow mode operation at the Saint Louis (KSTL) and Houston (KIAH) airports. This document describes the software that provides the system framework, communications, user displays, and hosts the Wind Forecasting Algorithm (WFA) software developed by the M.I.T. Lincoln Laboratory (MIT-LL). The WFA algorithms and software are described in a separate document produced by MIT-LL.

Author

*Airports; Wakes; Software Engineering; Display Devices; Forecasting*

**20080048360** Army Engineer Waterways Experiment Station, Vicksburg, MS, USA

**Advanced Pavement Design: Finite Element Modeling for Rigid Pavement Joints, Report 3: Model Simplification and Application**

Hammons, M. I.; Freeman, R. B.; Nov. 2007; 31 pp.; In English

Contract(s)/Grant(s): DTFA03-94-X-00010

Report No.(s): PB2008-106466; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A rational, three-dimensional (3D) finite element technique was applied to model the structural response of the jointed concrete airport pavement system. Modeling features include explicit 3D modeling of the slab continua, load transfer capability at the joint, explicit 3D modeling of the base course continua, load transfer capability across the cracks in the base course, and contact interaction between the slabs and base course. The results of these models were simplified for incorporation into concrete pavement design applications. A set of joint response algorithms was developed that provides a complete system for relating commonly used deflection- and stress-based metrics of joint response to a dimensionless quantity that can be used to establish joint properties for finite element calculations. They may be readily implemented in personal computer spreadsheets or calculated by hand using an electronic calculator. Multivariate statistical analysis techniques were applied to increase understanding of the contribution of the input variables to variability of load transfer estimates and the sensitivity of the model to changes in input variables.

NTIS

*Airports; Finite Element Method; Mathematical Models; Pavements; Simplification*

**20080048361** Federal Aviation Administration, Atlantic City, NJ, USA

**Identification Techniques to Reduce Confusion Between Taxiways and Adjacent Runways**

Patterson, J. W.; Frierson, R. N.; Sep. 2007; 46 pp.; In English

Report No.(s): PB2008-106479; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The National Transportation Safety Board accident/incident database and the Aviation Safety Reporting System have reported pilots mistakenly landing on the taxiways adjacent to runways. As of August 23, 2007, 267 such events have occurred at 110 airports in the USA. These inadvertent landings create a safety hazard that must be eliminated. This technical note provides guidance on techniques that can be implemented at airports to reduce or eliminate this problem. Two scenarios were considered during this research effort: (1) prevent the pilot from inadvertently lining up with the taxiway during the approach, and (2) prevent the pilot from landing on the taxiway if the first effort fails. Four visual aid enhancements were tested at Seattle-Tacoma International Airport and Palm Beach International Airport: an elevated lighted X, artificial turf, omnidirectional runway end identifier lights, and an in-pavement lighted X. Each piece of equipment was placed on the taxiway and was evaluated one at a time while making final approaches to the runway with the exception of the artificial turf and omnidirectional lights, which were turned on constantly. Based on the results, it was concluded that an elevated lighted X and an in-pavement lighted X were seen at an average distance of 4.5 nm. Omnidirectional lights and green artificial turf were seen at a distance of 5.0 nm.

NTIS

*Airports; Runways*



## AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes all modes of communication with and between aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information see also 06 Avionics and Aircraft Instrumentation; 17 Space Communications, Spacecraft Communications, Command and Tracking; and 32 Communications and Radar.

**20080047442** NASA Glenn Research Center, Cleveland, OH, USA

### **Application of the Iridium Satellite System to Aeronautical Communications**

Kerczewski, Robert J.; Meza, Mike; Gupta, Om; September 24, 2008; 8 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 659877.02.03.0606.01; Copyright; Avail.: CASI: [A02](#), Hardcopy

The next generation air transportation system will require greater air-ground communications capacity to accommodate more air traffic with increased safety and efficiency. Communications will remain primarily terrestrially based, but satellite communications will have an increased role. Inmarsat's aeronautical services have been approved and are in use for aeronautical safety communications provided by geostationary satellites. More recently the approval process for the Iridium low earth orbit constellation is nearing completion. The current Iridium system will be able to provide basic air traffic services communications suitable for oceanic, remote and polar regions. The planned second generation of the Iridium system, called Iridium NEXT, will provide enhanced capabilities and enable a greater role in the future of aeronautical communications. This paper will review the potential role of satellite communications in the future of air transportation, the Iridium approval process and relevant system testing, and the potential role of Iridium NEXT.

Author

*Air Transportation; Synchronous Platforms; Satellite Communication; Low Earth Orbits; Air Traffic; INMARSAT Satellites; Geosynchronous Orbits*

**20080048195** NASA Ames Research Center, Moffett Field, CA, USA

### **Delay Banking for Managing Air Traffic**

Green, Steve; NASA Tech Briefs, September 2008; September 2008, pp. 39-40; In English; See also [20080048125](#)

Report No.(s): ARC-15392-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3151>

Delay banking has been invented to enhance air-traffic management in a way that would increase the degree of fairness in assigning arrival, departure, and en-route delays and trajectory deviations to aircraft impacted by congestion in the national airspace system. In delay banking, an aircraft operator (airline, military, general aviation, etc.) would be assigned a numerical credit when any of their flights are delayed because of an air-traffic flow restriction. The operator could subsequently bid against other operators competing for access to congested airspace to utilize part or all of its accumulated credit. Operators utilize credits to obtain higher priority for the same flight, or other flights operating at the same time, or later, in the same airspace, or elsewhere. Operators could also trade delay credits, according to market rules that would be determined by stakeholders in the national airspace system. Delay banking would be administered by an independent third party who would use delay banking automation to continually monitor flights, allocate delay credits, maintain accounts of delay credits for participating airlines, mediate bidding and the consumption of credits of winning bidders, analyze potential transfers of credits within and between operators, implement accepted transfers, and ensure fair treatment of all participating operators. A flow restriction can manifest itself in the form of a delay in assigned takeoff time, a reduction in assigned airspeed, a change in the position for the aircraft in a queue of all aircraft in a common stream of traffic (e.g., similar route), a change in the planned altitude profile for an aircraft, or change in the planned route for the aircraft. Flow restrictions are typically imposed to mitigate traffic congestion at an airport or in a region of airspace, particularly congestion due to inclement weather, or the unavailability of a runway or region of airspace. A delay credit would be allocated to an operator of a flight that has accepted, or upon which was imposed, a flow restriction. The amount of the credit would increase with the amount of delay caused by the flow restriction, the exact amount depending on which of several candidate formulas is eventually chosen. For example, according to one formula, there would be no credit for a delay smaller than some threshold value (e.g., 30 seconds) and the amount of the credit for a longer delay would be set at the amount of the delay minus the threshold value. Optionally, the value of a delay credit could be made to decay with time according to a suitable formula (e.g., an exponential decay). Also, optionally, a transaction charge could be assessed against the value of a delay credit that an operator used on a flight different from the one for which the delay originated or that was traded with a different operator. The delay credits accumulated by a given airline could be utilized in various ways. For example, an operator could enter a bid for priority handling in a new flow restriction that impacts one or more of the operator's flights; if the bid were unsuccessful, all or a portion of the credit would be returned

to the bidder. If the bid pertained to a single aircraft that was in a queue, delay credits could be consumed in moving the aircraft to an earlier position within the queue. In the case of a flow restriction involving a choice of alternate routes, planned altitude profile, aircraft spacing, or other non-queue flow restrictions, delay credits could be used to bid for an alternative assignment.

Author

*Air Traffic Control; Time Lag*

## 05

### AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance and evaluation, and aircraft and flight simulation technology. For related information see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics. For land transportation vehicles see 85 Technology Utilization and Surface Transportation.

**20080047312** Government Accountability Office, Washington, DC, USA

#### **Unmanned Aircraft Systems: Additional Actions Needed to Improve Management and Integration of DOD Efforts to Support Warfighter Needs**

Nov. 2008; 46 pp.; In English

Report No.(s): PB2009-102116; GAO-09-175; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The Department of Defense's (DOD) use of unmanned aircraft systems (UAS) continues to increase. In 2000, DOD components had fewer than 50 unmanned aircraft in their inventory. By May 2008, they had more than 6,000. However, DOD faces challenges, such as UAS acquisition and the integration of UAS into joint combat operations. GAO has made a series of recommendations to address challenges, including the need for a UAS strategic plan. To improve upon the management and use of UAS, DOD has implemented several actions, such as establishing new task forces. GAO was asked to (1) identify key DOD efforts to improve the management and operational use of UAS and (2) assess the extent to which these efforts constitute an overarching organizational framework to guide and oversee UAS efforts. GAO reviewed DOD documents such as directives and memorandums, and interviewed agency officials.

NTIS

*Drone Vehicles; Military Operations; Pilotless Aircraft*

**20080047462** NASA Ames Research Center, Moffett Field, CA, USA

#### **LCTR2 Design Study and Aeromechanics Analyses**

Acree, Cecil W.; October 07, 2008; 23 pp.; In English; Fundamental Aeronautics Program Annual Meeting, 7-9 Oct. 2008, Atlanta, GA, USA; Original contains color illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047462>

NASA Heavy Lift Rotorcraft systems Investigation produced the Large Civil Tiltrotor (LCTR) advanced conceptual design in 2005. The goal was to identify research requirements for large rotorcraft. New design, LCTR2, is sized to be representative of regional jets (90 passengers), convenient for technology investigations. Focus for near-term research is a more realistic assessment of technology requirements. Use LCTR2 to explore fundamental aeromechanics issues. Here present samples of performance optimization.

Author

*Rotary Wing Aircraft; Tilt Rotor Aircraft; Fluid Mechanics; Technology Assessment*

**20080047463** NASA Ames Research Center, Moffett Field, CA, USA

#### **Calculation of the Aerodynamic Behavior of the Tilt Rotor Aeroacoustic Model (TRAM) in the DNW**

Johnson, Wayne; May 09, 2001; 37 pp.; In English; American Helicopter Society 57th Annual Forum, 9-11 May 2001, Washington, DC, USA; Original contains color illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047463>

Comparisons of measured and calculated aerodynamic behavior of a tiltrotor model are presented. The test of the Tilt Rotor Aeroacoustic Model (TRAM) with a single, 1/4-scale V-22 rotor in the German-Dutch Wind Tunnel (DNW) provides an extensive set of aeroacoustic, performance, and structural loads data. The calculations were performed using the rotorcraft comprehensive analysis CAMRAD II. Presented are comparisons of measured and calculated performance and airloads for helicopter mode operation, as well as calculated induced and profile power. An aerodynamic and wake model and calculation procedure that reflects the unique geometry and phenomena of tiltrotors has been developed. There are major differences between this model and the corresponding aerodynamic and wake model that has been established for helicopter rotors. In

general, good correlation between measured and calculated performance and airloads behavior has been shown. Two aspects of the analysis that clearly need improvement are the stall delay model and the trailed vortex formation model.

Author

*Aeroacoustics; Rotary Wing Aircraft; Tilt Rotor Aircraft; Aerodynamic Loads; Rotary Wings*

**20080047498** Naval Postgraduate School, Monterey, CA USA

**Single Operator Control of Multiple Uninhabited Air Vehicles: Situational Awareness Requirement**

Sebalj, Derek; Sep 2008; 113 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489080; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489080>

Militaries around the world, as well as other government agencies, are increasingly using uninhabited vehicles to perform dull, dirty and dangerous work in the USA, laws currently mandate their increasing use throughout the armed services, with set percentages of overall vehicle fleets. Currently, teams of people operate these vehicles, especially Uninhabited Air vehicles (UAVs). For example,  $n:1$ , where  $n$  is the number of operators and  $n > 1$ . The ultimate goal, and the object of much research, is the technology to lower, or even invert the control ratio from many people to one vehicle to one operator of several vehicles, e.g.,  $1:m$ , where  $m$  is the number of vehicles and  $m$  greater than or equal to 1. While the technology to automate these vehicles continues to progress at a rapid pace, less attention has been paid to the Human Factors aspect. Theoretically, technology exists to enable single operator control of multiple UAVs; however, the human operator must interact with the vehicle, especially if the vehicle will be used to apply deadly force. What information does the operator readily need to make these critical decisions? How will the human operators be able maintain the situational awareness of all vehicles under their control and make informed decisions as to their employment in dynamic situations? One possible aid to maintaining Situational Awareness is an overall Situational Awareness display that gives an overview of the vehicle locations, both geographically and in relation to one another. The question to be answered is whether this display adds useful information to the operator without further straining the operator's limited attention resources. Experiment participants were tasked to provide supervisory control of four simulated UAVs in a simulated environment and make tasking decisions for the UAVs based on static ground targets that required investigation.

DTIC

*Drone Vehicles; Situational Awareness; Surveillance*

**20080047528** Naval Research Lab., Stennis Space Center, MS USA

**Moving-Map Composer-Personal Computer (MMCP) Version 1.0 for the Finland Air Force: Software User's Manual**

Myrick, Stephanie A; Trenchard, Michael E; Layne, Geary J; Gendron, Marlin L; Lohrenz, Maura C; Oct 21, 2008; 62 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489385; NRL/FR/7440--08-10131; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489385>

This report documents a substantial revision of the Moving-Map Composer (MMC) system designed and developed by scientists at the Naval Research Laboratory (NRL) Geospatial Processing and Analysis (GeoPAL) Team (Code 7440.1). This version of MMC has been extended for use on personal computers (PCs) and is referred to as MMCP. This is the first edition of the MMCP Software User's Manual, to be distributed with MMCP software release 1.0. MMCP is specifically designed and configured to support Finland Air Force (FiAF) F/A-18 mission planners and pilots in the field. MMCP is a software application developed for installation on a Windows XP computer configured with a standard 16-bit PCMCIA drive, or PC card drive, for reading and writing Tactical Aircraft Moving-Map Capability (TAMMAC) mission and theater map data loads. MMCP enables users to perform the following functions: process FiAF source Geo-referenced Tagged Image File Format (GEOTIFF) files into a Compressed Arc Digitized Raster Graphics (CADRG)-compatible format; process FiAF or National Geospatial-Intelligence Agency (NGA) source Digital Terrain Elevation Data (DTED) into a TAMMAC-compatible regridDED DTED format (RDTED); define and save regions of interest (ROIs) for mission and theater map data loads as a series of bitmap representations; populate these regions of interest with data from user-specified FiAF GeoTIFF files (converted to CADRG-like files via MMCP), NGA CADRG, FiAF and/or NGA RDTED, and NGA Controlled Image Base (CIB) databases; import and convert non-georeferenced images into TAMMAC-compatible data frames; write completed TAMMAC theater map data loads to PC cards for aircraft loading; and build Mission Planning loads from user-specified CADRG; RDTED, CIB, and data frames.

DTIC

*Data Processing; Fighter Aircraft; Finland; Jet Aircraft; Manuals; Maps; Personal Computers; Software Development Tools; User Manuals (Computer Programs)*

**20080047712** NASA Ames Research Center, Moffett Field, CA, USA

**Designs and Technology Requirements for Civil Heavy Lift Rotorcraft**

Johnson, Wayne; Yamauchi, Gloria K.; Watts, Michael E.; January 18, 2006; 26 pp.; In English; AHS Vertical Lift Aircraft Design Conference, 18-20 Jan. 2006, San Francisco, CA, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047712>

The NASA Heavy Lift Rotorcraft Systems Investigation examined in depth several rotorcraft configurations for large civil transport, designed to meet the technology goals of the NASA Vehicle Systems Program. The investigation identified the Large Civil Tiltrotor as the configuration with the best potential to meet the technology goals. The design presented was economically competitive, with the potential for substantial impact on the air transportation system. The keys to achieving a competitive aircraft were low drag airframe and low disk loading rotors; structural weight reduction, for both airframe and rotors; drive system weight reduction; improved engine efficiency; low maintenance design; and manufacturing cost comparable to fixed-wing aircraft. Risk reduction plans were developed to provide the strategic direction to support a heavy-lift rotorcraft development. The following high risk areas were identified for heavy lift rotorcraft: high torque, light weight drive system; high performance, structurally efficient rotor/wing system; low noise aircraft; and super-integrated vehicle management system.

Author

*Aircraft Configurations; Rotary Wing Aircraft; Tilt Rotor Aircraft; Airframes; Systems Integration*

**20080047713** NASA Ames Research Center, Moffett Field, CA, USA

**Performance of Advanced Heavy-Lift, High-Speed Rotorcraft Configurations**

Johnson, Wayne; Yeo, Hyeonsoo; Acree, C. W., Jr.; October 15, 2007; 28 pp.; In English; AHS International Forum on Rotorcraft Multidisciplinary Technology, 15-17 Oct. 2007, Seoul, Korea, Republic of; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047713>

The aerodynamic performance of rotorcraft designed for heavy-lift and high-speed cruise is examined. Configurations considered include the tiltrotor, the compound helicopter, and the lift-offset rotor. Design conditions are hover and 250-350 knot cruise, at 5k/ISA+20oC (civil) or 4k/95oF (military); with cruise conditions at 4000 or 30,000 ft. The performance was calculated using the comprehensive analysis CAMRAD II, emphasizing rotor optimization and performance, including wing-rotor interference. Aircraft performance was calculated using estimates of the aircraft drag and auxiliary propulsion efficiency. The performance metric is total power, in terms of equivalent aircraft lift-to-drag ratio  $L/D = WV/P$  for cruise, and figure of merit for hover.

Author

*Aerodynamic Configurations; Rotary Wing Aircraft; Lift Drag Ratio; Tilt Rotor Aircraft; Compound Helicopters*

**20080047715** NASA Ames Research Center, Moffett Field, CA, USA

**An Assessment of the State-of-the-art in Multidisciplinary Aeromechanical Analyses**

Datta, Anubhav; Johnson, Wayne; January 23, 2008; 36 pp.; In English; American Helicopter Society Specialists' Conference on Aeromechanics, 23-25 Jan. 2008, San Francisco, CA, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047715>

This paper presents a survey of the current state-of-the-art in multidisciplinary aeromechanical analyses which integrate advanced Computational Structural Dynamics (CSD) and Computational Fluid Dynamics (CFD) methods. The application areas to be surveyed include fixed wing aircraft, turbomachinery, and rotary wing aircraft. The objective of the authors in the present paper, together with a companion paper on requirements, is to lay out a path for a High Performance Computing (HPC) based next generation comprehensive rotorcraft analysis. From this survey of the key technologies in other application areas it is possible to identify the critical technology gaps that stem from unique rotorcraft requirements.

Author

*Rotary Wing Aircraft; Computational Fluid Dynamics; Dynamic Structural Analysis; Dynamic Response; Fixed Wings; Aircraft Configurations*

**20080047716** NASA Ames Research Center, Moffett Field, CA, USA

**Influence of Lift Offset on Rotorcraft Performance**

Johnson, Wayne; January 23, 2008; 31 pp.; In English; American Helicopter Society Specialists' Conference on Aeromechanics, 23-25 Jan. 2008, San Francisco, CA, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047716>

The influence of lift offset on the performance of several rotorcraft configurations is explored. A lift-offset rotor, or advancing blade concept, is a hingeless rotor that can attain good efficiency at high speed, by operating with more lift on the advancing side than on the retreating side of the rotor disk. The calculated performance capability of modern-technology coaxial rotors utilizing a lift offset is examined, including rotor performance optimized for hover and high-speed cruise. The ideal induced power loss of coaxial rotors in hover and twin rotors in forward flight is presented. The aerodynamic modeling requirements for performance calculations are evaluated, including wake and drag models for the high speed flight condition. The influence of configuration on the performance of rotorcraft with lift-offset rotors is explored, considering tandem and side-by-side rotorcraft as well as wing-rotor lift share.

Author

*Aerodynamic Characteristics; Horizontal Flight; Rotor Lift; Rotary Wing Aircraft; Wakes*

**20080047758** William J. Hughes Technical Center, Atlantic City, NJ, USA

**Vertical Impact Response Characteristics of Four Commuter/Regional Airplanes**

Abramowitz, A.; Vu, T.; Sep. 2008; 49 pp.; In English

Report No.(s): PB2009-102148; No Copyright; Avail.: National Technical Information Service (NTIS)

The Federal Aviation Administration (FAA) proposed seat dynamic performance standards for Title 14 of the Code of Federal Regulations (CFR) Part 23 commuter category airplanes. Current 14 CFR Parts 23 and 25 seat dynamic performance standards were established empirically using the results of prior airplane crash impact test programs. In the development of these standards, it was noted that the full-scale airplane impact test database did not include airplanes representative in size of commuter/regional airplanes. To provide data for these size airplanes, the FAA conducted four full-scale vertical impact tests of commuter/regional airplanes. The tests were conducted at the FAA William J. Hughes Technical Center, Atlantic City International Airport, New Jersey. The structural response of the airframes, seats, and anthropomorphic test dummies was measured for each test. The airplanes tested were a 19-passenger Fairchild Metro III, a 19-passenger Beechcraft 1900C, a 30-passenger Short Brothers 3-30, and a 42-passenger ATR 42-300. The results showed that flat-belly fuselages developed higher accelerations with shorter pulse durations than curved-belly fuselages, and the dynamic crush during the test was consistent with the results of an idealized triangular impact. The ATR 42 wing and the Shorts 3-30 overhead fuel tanks penetrated the occupied volume of the cabin after their support structures failed. The overall data showed two groups of fuselage responses: Group 1 with higher accelerations and shorter pulse durations and Group 2 with lower acceleration and longer pulse duration. Group 1 had an average crush depth of 10 inches and Group 2, 18 inches. Only one of the four fuselages was able to effectively use its underfloor crush depth to reduce fuselage acceleration.

NTIS

*Commuter Aircraft; Crashes; Drop Tests*

**20080047760** Boeing Commercial Airplane Co., Seattle, WA, USA; George Washington Univ., Ashburn, VA, USA

**Explicit Finite Element Analysis of 2024-T3/T351 Aluminum Material Under Impact Loading for Airplane Engine Containment and Fragment Shielding**

Buyuk, M.; Loikkanen, M.; Kan, C. D.; Sep. 2008; 48 pp.; In English

Report No.(s): PB2009-102150; No Copyright; Avail.: National Technical Information Service (NTIS)

Uncontained aircraft engine failure can cause catastrophic damaging effects to aircraft systems if not addressed in the aircraft design. The Federal Aviation Administration has commissioned and coordinated a research program associating industry, government agencies, national research laboratories, and universities to conduct research to mitigate the damaging effects of uncontained engine failure and improve the numerical modeling capability of these uncontained engine events. This joint Boeing and George Washington University report covers high strain rate material modeling efforts that have been conducted to simulate and validate ballistic impact tests on 2024-T3/T351 aluminum alloy, which is one of the most extensively used materials in the aircraft industry. Ballistic limits were evaluated using explicit finite element (FE) simulations based on the corresponding ballistic impact experiments for different target thicknesses that were conducted at the University of California at Berkeley. LS-DYNA was used as a nonlinear explicit dynamics FE code for the simulations. The Johnson-Cook material model was employed as a thermo-visco-plastic material model coupled with a nonlinear equation of

state and an accumulated damage evaluation algorithm for the numerical simulations. Predictive performance of the numerical models is discussed in terms of the material characterization efforts and material model parameter sensitivities.

NTIS

*Aircraft Engines; Aluminum; Aluminum Alloys; Containment; Engine Failure; Finite Element Method; Fragments; Impact Loads; Rotor Blades (Turbomachinery); Shielding*

**20080047761** William J. Hughes Technical Center, Atlantic City, NJ, USA

**Full-Scale Engine Detonation Tests of 47 Unleaded, High-Octane Blends**

Atwood, D.; Sep. 2008; 287 pp.; In English

Report No.(s): PB2009-102151; No Copyright; Avail.: National Technical Information Service (NTIS)

As of this writing, the Environmental Protection Agency's (EPA) exemption of general aviation from the 1990 Clean Air Act Amendments regarding the use of leaded fuel is still in effect. Recent petitions to the EPA have reignited the call for either a ban on leaded aviation fuels or commission a study on the health effects of leaded aviation fuels. It is likely that environmental and cost pressures of using leaded fuels will continue to increase for the general aviation community. Extensive testing by the Federal Aviation Administration (FAA) William J. Hughes Technical Center on an unleaded replacement for the current leaded 100 low-lead (100LL) aviation gasoline involved the use of specialty chemicals. Significant engine modifications may also be required on the high-compression engine legacy fleet to operate on a lower-octane, unleaded fuel, which would likely result in changes to engine and aircraft performance and pilot-operating procedures. Recent FAA tests confirmed that significant detonation performance differences exist between unleaded and leaded fuels of the same octane. The need for the FAA Propulsion and Fuel Systems Team to continue research on unleaded fuels and to evaluate engine technology is greater than ever as safety and certification concerns increase with the use of alternative fuels. Working in parallel with the Coordinating Research Council, the Propulsion and Fuel Systems Team was supplied with 47 separate blends of unleaded fuel containing various amounts of aviation alkylate, super alkylate, Toluene, Ethyl-tert-butyl-ether, tert-Butylbenzene, and meta-Toluidine. All blends contained 5% Isopentane. The blends compositions had motor octane numbers (MON) ranging from 97.6 to 106.3, and did not meet the current American Society for Testing and Materials (ASTM) D 910 leaded aviation gasoline specification. These 47 blends, along with a specially blended, minimum specification 100LL and unleaded reference fuels, were detonation-tested in a Lycoming IO540-K engine at the FAA William J. Hughes Technical Center. The goal was to address both the individual and synergistic compositional effects of the unleaded components on the full-scale engine detonation performance and on the ASTM D 2700 laboratory MON. The MON was correlated to the full-scale engine detonation performance and compared to the detonation performance of the specially blended 100LL. Four power settings, ranging from takeoff to economy cruise, were evaluated with fuel mixture strength varying from 0.600 brake-specific fuel consumption to 50DGF lean of peak exhaust gas temperature. Results show that the MON of the blends did trend with their detonation performance in the IO540-K engine, but equivalent unleaded blend performance of the specially blended 100LL required 2.0 greater MON. Nineteen of the 47 blends, all with higher than 102.5 MON, provided better detonation performance than the specially blended 100LL. Fourteen of the blends had higher MONs than the 100LL but performed worse in the full-scale engine.

NTIS

*Aircraft Fuels; Detonation; Engine Tests; Fuel Tests; Fuels; Full Scale Tests; Mixtures*

**20080047762** California Univ., Berkeley, CA USA

**Impact Tests of Aircraft Aluminums and Composites for Uncontained Engine Fragment Modeling**

Donovan, K.; Johnson, G.; Zohdi, T.; Oct. 2008; 58 pp.; In English

Report No.(s): PB2009-102152; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Transport aircraft design requires that manufacturers minimize the risk of a catastrophic failure resulting from an uncontained engine failure. This happens when one of the turbine engines rotating components fails, usually due to fatigue, and passes through the engine containment structure. While the loss of one engine is not enough to cause the complete failure of the commercial aircraft, the subsequent loss of critical components, such as the hydraulic or fuel lines, could result in losing control of the aircraft. Redundancy is a primary design feature that allows for the loss of an engine or major system without causing a catastrophic event. Separation of redundant systems is also a vital part of the design process. In cases where a critical component is vulnerable, shielding may be used to protect the component. To reduce the weight and operating cost for shielding, lightweight materials, such as aluminum, titanium, high-strength fabric, composites, and other materials, are being considered to act as barriers against engine fragments on critical aircraft systems. In developing a barrier, it is necessary to characterize the ballistic performance of these materials, which is typically done through testing. This report describes the tests performed at the University of California at Berkeley to aid in this characterization. In the experiments, 1/16-inch-thick

2024-T3 aluminum, 5/64-inch-thick 7075-T73 aluminum, and 8- and 16-ply unidirectional carbon fiber composite panels were impacted with 1/2-inch-diameter spheres, flat-ended cylinders, and hemispherically ended cylinders shot from a pneumatic gun. Impact curves were generated, and failure methods were observed. The composite panels failed by fracture, delamination, and plugging, depending on conditions such as projectile velocity, projectile tip shape, and target thickness. Projectile shape also affected the amount of energy required for a projectile to pass through the aluminum plates. For all materials tested, an assumption of constant projectile energy loss, independent of initial projectile speed, seemed valid.

NTIS

*Aluminum Alloys; Composite Materials; Engine Failure; Finite Element Method; Fragments; Impact Tests; Rotor Blades (Turbomachinery); Turbine Engines*

**20080047763** California Univ., Berkeley, CA, USA

**Impact and Delamination Failure Characterization of BMS 8-212 Composite Aircraft Material**

Powell, D.; Zohdi, T.; Johnson, G.; Oct. 2008; 40 pp.; In English

Report No.(s): PB2009-102153; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This study was part of a program, sponsored by the Federal Aviation Administration that focused on understanding the behavior of different aircraft materials under impact in the speed range generated from engine uncontained failures. This test program investigated the material response of 8-, 16-, and 32-ply BMS8-212 composite panels provided by The Boeing Company. All tests were performed at the University of California, Berkeley ballistics laboratory using a pneumatic gas gun and half-inch-diameter spherical and flat-ended cylindrical projectiles. The ballistic impact tests indicated that the amount of energy absorbed by a similar composite target panel during impacts above the ballistic limit was nearly constant, showing only a slight increase with increasing initial energy. The amount of energy absorbed per ply increased only slightly for thicker panels. The tests also showed that the cylindrical projectiles required more energy to penetrate the composite panels than the spherical projectiles.

NTIS

*Aircraft Structures; Composite Materials; Composite Structures; Delaminating; Engine Failure; Failure; Fragments; Impact Tests; Rotor Blades (Turbomachinery); Turbine Engines*

**20080047794** Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA

**Fiber Reinforcement for Rapid Stabilization of Soft Clay Soils**

Rafalko, Susan D; Brandon, Thomas L; Filz, George M; Mitchell, James K; Oct 2008; 11 pp.; In English

Contract(s)/Grant(s): FA4819-07-D-0001; Proj-4918

Report No.(s): AD-A489583; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Since World War II, the military has sought methods for rapid stabilization of weak soils for support of its missions worldwide. Over the past 60 years, cement and lime have been the most effective stabilizers for road and airfield applications, although recent developments show promise from nontraditional stabilizers, such as reinforcing fibers. The benefits derived from fibers may depend on whether they are used alone or in combination with chemical stabilizers. The ability of stabilizers to increase the strength of two soft clay soils within 72 hours to support C-17 and C-130 aircraft traffic on contingency airfields was investigated. Laboratory test results shows that longer fibers increased the strength and toughness the most for a clay treated only with fibers. For a clay treated with fibers in addition to a chemical stabilizer, shorter fibers increased toughness the most, but the fibers had little effect on strength. Higher dosage rates of fibers had increasing effectiveness, but mixing became difficult for fiber contents above 1%. Poly(vinyl) alcohol fibers were anticipated to perform better than other inert fibers because of hydrogen bonding between the fibers and clay minerals, but these fibers performed similarly to other fibers.

DTIC

*Clays; Reinforcing Fibers; Soils*

**20080047812** Air Force Research Lab., Wright-Patterson AFB, OH USA

**High Temperature Thermocouple Installation Methods for Hypersonic Vehicles**

Feie, John; Kretz, Larry; Mar 2008; 14 pp.; In English

Contract(s)/Grant(s): Proj-A0AX

Report No.(s): AD-A489406; AFRL-RB-WP-TM-2008-3165; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This presentation discusses the joint effort between the Air Force Research Laboratory (AFRL) and NASA Langley Research Center to establish a process for bonding type C and type K thermocouples to high temperature materials. Bonded

samples of both type C and type K thermocouples will be tested in a combined thermal-vibration environment. A baseline and alternate installation method will be tested. The instrumented specimens will be mounted on a shaker and heated with quartz lamps. The specimens will be exposed to three different environments: a launch vibration spectrum, a re-entry vibration spectrum, and a high temperature degradation environment. The installation methods that are capable of withstanding these three environments will be considered for use in hypersonic flight testing.

DTIC

*High Temperature; Hypersonic Vehicles; Installing; Thermocouples*

**20080047849** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Additive Manufacturing of Superalloys for Aerospace Applications (Preprint)**

Kinsella, Mary E; Mar 2008; 7 pp.; In English

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A489302; AFRL-RX-WP-TP-2008-4318; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489302>

The Air Force Research Laboratory has been exploring the possibility of using metal additive manufacturing processes for depositing superalloy materials in engine component applications. Through the Metals Affordability Initiative, managed by the Metals Branch in the Materials and Manufacturing Directorate, the 'Additive Manufacturing of Superalloys' project has demonstrated the deposition of nickel superalloy features on substrates using two different process. The goals of the project are to determine the quality and mechanical property capabilities of these processes while developing a cost model to measure economic feasibility.

DTIC

*Additives; Aerospace Engineering; Deposition; Engine Parts; Heat Resistant Alloys; Laser Deposition; Manufacturing; Powder (Particles)*

**20080047853** Applied Research Associates, Inc., Tyndall AFB, FL USA

**Extractive Sampling and Optical Remote Sensing of F-100 Aircraft Engine Emissions (PREPRINT)**

Cowen, Kenneth; Goodwin, Bradley; Satola, Jan; Kagann, Robert; Hashmonay, Ram; Spicer, Chester; Holdren, Michael; Mayfield, Howard T; Oct 2008; 30 pp.; In English

Contract(s)/Grant(s): W912HQ-05-C-0002; Proj-DODT

Report No.(s): AD-A489258; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489258>

The Strategic Environmental Research and Development Program (SERDP) has initiated several programs to develop and evaluate techniques to characterize emissions from military aircraft, in order to meet increasingly stringent regulatory requirements. This paper describes the results of a recent field study using extractive and optical remote sensing (ORS) techniques to measure emissions from six F-15 fighter aircraft. Testing was performed between November 14 and 16, 2006 on the trim pad facility at Tyndall Air Force Base (AFB) in Panama City, FL. Measurements were made on eight different F-100 engines, and the engines were tested on-wing of in-use aircraft. A total of 39 test runs were performed at engine power levels that ranged from idle to military power. The approach adopted for these tests involved extractive sampling with collocated ORS measurements at a distance of approximately 20-25 nozzle diameters downstream of the engine exit plane. The emission indices calculated for CO<sub>2</sub>, CO, NO and several volatile organic compounds showed very good agreement when comparing the extractive and ORS sampling methods.

DTIC

*Combustion Products; Detection; Emission; Exhaust Emission; Exhaust Gases; F-100 Aircraft; Jet Engines; Optical Measurement; Remote Sensing; Remote Sensors; Sampling*

**20080048161** NASA Glenn Research Center, Cleveland, OH, USA

**Simulating Operation of a Large Turbofan Engine**

Litt, Jonathan S.; Frederick, Dean K.; DeCastro, Jonathan; NASA Tech Briefs, September 2008; September 2008, pp. 48; In English; See also [20080048125](#)

Report No.(s): LEW-18315-1; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3190>

The Commercial Modular Aero- Propulsion System Simulation (C-MAPSS) is a computer program for simulating



transient operation of a commercial turbofan engine that can generate as much as 90,000 lb (.0.4 MN) of thrust. It includes a power-management system that enables simulation of open- or closed-loop engine operation over a wide range of thrust levels throughout the full range of flight conditions. C-MAPSS provides the user with a set of tools for performing open- and closed-loop transient simulations and comparison of linear and non-linear models throughout its operating envelope, in an easy-to-use graphical environment.

Derived from text

*Turbofan Engines; Computerized Simulation; Flight Simulation; Flight Conditions*

**20080048335** Lee and Hayes, PLLC, Spokane, WA, USA

**Control Surface Assemblies with Torque Tube Base**

Russom, J. D., Inventor; White, L. R., Inventor; Greenwood, J., Inventor; 21 Jan 05; 7 pp.; In English

Contract(s)/Grant(s): F33615-98-9-2880

Patent Info.: Filed 21 Jan 05; US-Patent-Appl-SN-11-043 918

Report No.(s): PB2008-104829; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Control surface assemblies having a torque tube base are disclosed. In one embodiment, a control surface assembly includes a control surface portion and a base portion. The base portion has a hollow, shell-like base portion coupled to a first end portion of the control surface portion, and is adapted to be coupled to a supporting structure such that the control surface portion projects outwardly from the supporting structure. In one aspect, the base portion includes an elongated, closed section portion adapted to be coupled to the supporting structure. In a further aspect, the base portion includes an elongated, closed section portion adapted to be coupled to the supporting structure, and a pair of tapered end portions formed at opposing ends of the closed section portion.

NTIS

*Control Surfaces; Patent Applications; Torque*

**20080048372** William J. Hughes Technical Center, Atlantic City, NJ, USA

**Development of a Laboratory-Scale Test for Evaluating the Decomposition Projects Generated Inside an Intact Fuselage During a Simulated Postcrash Fuel Fire**

Marker, T. R.; Speitel, L. C.; Aug. 2008; 48 pp.; In English

Report No.(s): PB2009-102419; No Copyright; Avail.: National Technical Information Service (NTIS)

This report summarizes the research effort undertaken by the Federal Aviation Administration to develop a laboratory-scale test method for evaluating the products of combustion inside an intact transport category fuselage during exposure to a simulated external fuel fire. An oil-fired burner, configured in accordance with Title 14 Code of Federal Regulations Part 25.856(b) Appendix F Part VII, was used to simulate the fuel fire, and a 4- by 4- by 4-foot steel cube box was used to mount representative test samples. The cube box simulated an intact fuselage and served as an enclosure to collect emitted gases during fire exposure. Test samples representing a variety of fuselage constructions were evaluated, including a noncontemporary prototype structural composite material (without thermal acoustic insulation). A typical cross section consists of a 40- by 40-inch aluminum panel representing the fuselage skin and the accompanying thermal acoustic insulation blanket behind the skin. Two thermal acoustical configurations were also tested. The first contained a heat-stabilized polyacrylonitrile fiber blanket. The second contained a ceramic paper barrier sandwiched under a fiberglass blanket. Each was encased by a thin metallized polyvinylfluoride moisture barrier. These burnthrough-resistant configurations were primarily run to provide a baseline for comparing the emitted gas concentrations with that of the prototype structural composite material.

NTIS

*Composite Materials; Decomposition; Fires; Fuselages*

**20080048373** Government Accountability Office, Washington, DC, USA

**Defense Acquisitions: Timely and Accurate Estimates of Costs and Requirements Are Needed to Define Optimal Future Strategic Airlift Mix**

Nov. 2008; 33 pp.; In English

Report No.(s): PB2009-102426; GAO-09-50; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The Department of Defense (DOD) C-5 Galaxy and C-17 Globemaster III aircraft play key roles in transporting weapons and other cargo. Since September 2001, these aircraft have delivered over 2.4 million tons of cargo to staging and operating bases in Iraq and Afghanistan. Yet determining the number and mix to meet current and future airlift requirements has become increasingly challenging given distinct differences between the two aircraft. While the C-5 can carry more cargo, the newer

C-17 is more flexible since it can deliver to forward-deployed bases and has a higher mission capable rate. GAO was asked to identify the impact C-5 modernization cost increases have had on the mix of aircraft; assess the current C-5 modernization cost estimate; and identify C-17 production plans and issues related to production line shutdown. To conduct its work, GAO reviewed options DOD considered to meet its current and future strategic airlift requirements, and evaluated C-5 modernization and C-17 production line shut down cost estimates. GAO is making recommendations to help DOD identify the appropriate strategic airlift mix and improve cost estimates for the C-5 program and C-17 production shutdown. DOD concurred with one recommendation and partially concurred with another, but believes updated C-5 cost estimates are not warranted. GAO believes this recommendation is still valid.

NTIS

*Cargo Aircraft; Cost Estimates; Costs; Estimates*

**20080048421** Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, MD USA

**Small UAS Analysis of Laser Designation and Search and Target Acquisition Capabilities in an Urban Environment**

Harclerode, Eric; Jun 2008; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489842; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489842>

Conclusions: -Small UAS has extreme difficulty lasing moving targets in high density urban environments -Lasing moving targets in medium density terrain is possible but not certain -Lasing of stationary targets is not an issue given LOS -Perch-and-Stare may be the best choice for surveillance of a point or intersection -Surveillance of an intersection by hovering gives better performance than a circular flight path around the area \*Next Steps -TRAC used this data in conjunction with Soldier interviews on the operational ability/benefits of the FW and RW Small UAS when compiling the final report -AMSAA will be conducting an additional UAS Mix Analysis using improved methodology for FOCUS

DTIC

*Cities; Laser Target Designators; Lasers; Target Acquisition*

**20080048478** Naval Air Warfare Center, Patuxent River, MD USA

**Analysis and Testing of Fleet Corroded F/A-18C/D Arrestment Shanks**

Rusk, David T; Pierce, Jennifer; Hoppe, Wally; Lancaster, Brent; Actis, Ricardo; Szabo, Barna; Jun 20, 2008; 70 pp.; In English

Report No.(s): AD-A489911; NAWCADPAX/TR-2008/9; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The global maritime operating environment of U.S. Naval Aviation assets necessitates their prolonged exposure to severe corrosive environments. The resulting corrosion damage on flight critical structural components has a significant adverse impact on fleet readiness and total ownership costs. To address these issues, NAVAIR has initiated a multiyear research program to investigate and quantify the fatigue life reduction due to corrosion on high-strength steels, and to develop models and metrics to implement actionable maintenance criteria for corrosion damage. The service component selected for analysis and testing was the F/A-18C/D arresting shank (P/N 74A480617). Five arresting shanks that were rejected for depot-level rework due to excessive corrosion damage were shipped by the Boeing Co. in Mesa, Arizona, to NAVAIR for inspection. Of the five, three were selected for fatigue testing due to the severity of the corrosion present and their overall condition. The three arresting shanks that were tested all exhibited a significant degree of fatigue resistance to fleet induced corrosion damage. This would imply that improvements in service life intervals for arresting shanks may be possible if the corrosion-fatigue damage resistance can be adequately characterized. All three shanks that were tested exhibited critical fatigue failures due to fretting at the hook end. As a result, fretting fatigue should be considered the primary fatigue failure mode for service-damaged arresting shanks.

DTIC

*Airframes; Corrosion; Evaluation; Fighter Aircraft; Jet Aircraft; Joints (Junctions); Maintenance; Structural Design*

**20080048484** Army War Coll., Carlisle Barracks, PA USA

**USA Rotorcraft Technology Investment: Is There a Lack of a Vision**

Grotophorst, Jean A; May 9, 2008; 37 pp.; In English

Report No.(s): AD-A489929; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Army's Comanche Program was terminated in February 2004. The Comanche was being designed to be the Army's premier rotorcraft, incorporating the latest technology. Then in January of 2005 the production contract for the Presidential

helicopter, Marine One, was awarded to the Lockheed Martin led team in association with AgustaWestland and Bell Helicopter Textron. The teaming with AgustaWestland, a foreign company, served as a catalyst to question the type and amount of investments the USA was spending in new rotorcraft technologies or improvements to existing technologies. Interestingly, by November 2007 the controversy has not faded in that the Marine One (or the VH-71) program is facing a five-year delay in part due to requirements issues (which has a relationship to new technology) and funding. The termination of Comanche and the utilization of a foreign owned company's helicopter platform suggests that the USA and the Department of Defense are not investing in rotorcraft technology and, moreover, that the Army lacks a vision for its rotorcraft fleet. The future of USA rotorcraft technology is dependent upon research and development, as well as a long term national vision for this dynamic technology.

DTIC

*Military Technology; Rotary Wing Aircraft; United States*

**20080048492** Massachusetts Inst. of Tech., Lexington, MA USA

**Uncorrelated Encounter Model of the National Airspace System, Version 1.0**

Kochenderfer, M J; Kuchar, J K; Espindle, L P; Griffith, J D; Nov 14, 2008; 113 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0002

Report No.(s): AD-A489955; PR-ATC-345; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Airspace encounter models, covering close encounter situations that may occur after standard separation assurance has been lost, are a critical component in the safety assessment of aviation procedures and collision avoidance systems. Of particular relevance to unmanned aircraft systems (UAS) is the potential for encountering general aviation aircraft that are flying under visual flight rules (VFR) and which may not be in contact with air traffic control. In response to the need to develop a model of these types of encounters, Lincoln Laboratory undertook an extensive radar data collection and modeling effort involving more than 120 sensors across the U.S. This report describes the structure and content of that encounter model. The model is based on the use of Bayesian networks to represent relationships between dynamic variables and to construct random aircraft trajectories that are statistically similar to those observed in the radar data. The result is a framework from which representative intruder trajectories can be generated and used in fast-time Monte-Carlo simulations to provide accurate estimates of collision risk.

DTIC

*Aeronautics; Air Traffic Control; Airspace; Collision Avoidance; National Airspace System*

**20080048493** General Accounting Office, Washington, DC USA

**Unmanned Aircraft Systems: Additional Actions Needed to Improve Management and Integration of DOD Efforts to Support Warfighter Needs**

Pickup, Sharon L; Lentini, Patricia; Hawthorne, Susannah; Lawson, James; Mateja, Brian; Thornton, Karen; Ullengren, Matthew; Weissman, Cheryl; Nov 2008; 47 pp.; In English

Report No.(s): AD-A489968; GAO-09-175; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Department of Defense's (DoD) use of unmanned aircraft systems (UAS) continues to increase. In 2000, DoD components had fewer than 50 unmanned aircraft in their inventory. By May 2008, they had more than 6,000. However, DoD faces challenges, such as UAS acquisition and the integration of UAS into joint combat operations. GAO has made a series of recommendations to address challenges, including the need for a UAS strategic plan. To improve upon the management and use of UAS, DoD has implemented several actions, such as establishing new task forces. GAO was asked to do the following: (1) identify key DoD efforts to improve the management and operational use of UAS, and (2) assess the extent to which these efforts constitute an overarching organizational framework to guide and oversee UAS efforts. GAO reviewed DoD documents such as directives and memorandums, and interviewed agency officials. GAO recommends DoD designate a single entity accountable for integrating efforts related to UAS; define roles, responsibilities, and relationships among UAS-related entities; and develop a UAS strategic plan to align and integrate efforts and funding with long-term goals. DoD partially concurred with one recommendation and did not concur with two recommendations, citing actions it has already taken. GAO recognizes DoD's efforts to date, but continues to believe additional actions are needed.

DTIC

*Defense Program; Drone Vehicles; Management Planning; Pilotless Aircraft; Unmanned Aircraft Systems*

**20080048494** General Accounting Office, Washington, DC USA

**Defense Acquisitions: Timely and Accurate Estimates of Costs and Requirements Are Needed to Define Optimal Future Strategic Airlift Mix**

Fairbairn, Bruce; Andrew, Cheryl; Bonner, Marvin; Crawford, John; Sloan, Karen; Richey, Karen; Ahearn, Marie; Nov 2008; 34 pp.; In English

Report No.(s): AD-A489969; GAO-09-50; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Department of Defense's (DoD) C-5 Galaxy and C-17 Globemaster III aircraft play key roles in transporting weapons and other cargo. Since September 2001, these aircraft have delivered over 2.4 million tons of cargo to staging and operating bases in Iraq and Afghanistan. Yet determining the number and mix to meet current and future airlift requirements has become increasingly challenging given distinct differences between the two aircraft. While the C-5 can carry more cargo, the newer C-17 is more flexible since it can deliver to forward-deployed bases and has a higher mission capable rate. GAO was asked to identify the impact that C-5 modernization cost increases have had on the mix of aircraft; assess the current C-5 modernization cost estimate; and identify C-17 production plans and issues related to production line shutdown. To conduct its work, GAO reviewed options DoD considered to meet its current and future strategic airlift requirements, and evaluated C-5 modernization and C-17 production line shutdown cost estimates. GAO is making recommendations to help DoD identify the appropriate strategic airlift mix and improve cost estimates for the C-5 program and C-17 production shutdown. DoD concurred with one recommendation and partially concurred with another, but believes updated C-5 cost estimates are not warranted. GAO believes this recommendation is still valid.

DTIC

*Cost Estimates; Costs; Estimates; Government Procurement; Retirement; Transport Aircraft*

**20080048520** Air Force Logistics Management Center, Gunter AFS, AL USA

**Modeling the Effects of Maintenance Capabilities on Aircraft Operations**

Walston, Jennifer G; Antoline, Anthony; Pendley, Scotty; Iubelt, Frank; Jul 2008; 22 pp.; In English; Original contains color illustrations

Report No.(s): AD-A490153; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Presentation outline: 1. Background: Aircrew/Aircraft Tasking System (AATS), AFLMA Study; 2. Modeling Maintenance Capabilities: Net Effective Personnel (NEP); 3. What is the effect?

DTIC

*Aircraft Maintenance; Allocations; Maintenance; Manpower; Personnel*

**20080048539** L-3 Communications Corp., Mesa, AZ USA

**Measuring Visuospatial Working Memory Using Path Visualization**

Lyon, Don R; Jan 2004; 13 pp.; In English

Contract(s)/Grant(s): F41624-97-D-5000; Proj-2313

Report No.(s): AD-A490229; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The term visuospatial working memory (VSWM) refers to a set of cognitive processes that people use to visualize spatial configurations. VSWM is involved in most spatial solving. It may be crucial for Uninhabited Aerial Vehicle operators because they must hold in memory spatial information that would normally be visible from a panoramic cockpit view. This paper describes a new technique called Path Visualization (PV) for measuring VSWM. The PV paradigm yields accuracy and response-time data that can be used to quantify various aspects of human spatial visualization.

DTIC

*Drone Vehicles; Sensorimotor Performance; Visual Perception*

## 06

### AVIONICS AND AIRCRAFT INSTRUMENTATION

Includes all avionics systems, cockpit and cabin display devices, and flight instruments intended for use in aircraft. For related information see also 04 Aircraft Communications and Navigation; 08 Aircraft Stability and Control; 19 Spacecraft Instrumentation and Astrionics; and 35 Instrumentation and Photography.

**20080048159** NASA Johnson Space Center, Houston, TX, USA

#### **Simulating Avionics Upgrades to the Space Shuttles**

Deger, Daniel; Hill, Kenneth; Braaten, Karsten E.; NASA Tech Briefs, September 2008; September 2008, pp. 45-46; In English; See also [20080048125](#)

Report No.(s): MSC-23453-1/15-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3183>

Cockpit Avionics Prototyping Environment (CAPE) is a computer program that simulates the functions of proposed upgraded avionics for a space shuttle. In CAPE, pre-existing space-shuttle-simulation programs are merged with a commercial-off-the-shelf (COTS) display-development program, yielding a package of software that enables high-fidelity NASA Tech Briefs, September 2008 delity simulation while making it possible to rapidly change avionic displays and the underlying model algorithms. The pre-existing simulation programs are Shuttle Engineering Simulation, Shuttle Engineering Simulation II, Interactive Control and Docking Simulation, and Shuttle Mission Simulator playback. The COTS program Virtual Application Prototyping System (VAPS) not only enables the development of displays but also makes it possible to move data about, capture and process events, and connect to a simulation. VAPS also enables the user to write code in the C or C++ programming language and compile that code into the end-product simulation software. As many as ten different avionic-upgrade ideas can be incorporated in a single compilation and, thus, tested in a single simulation run. CAPE can be run in conjunction with any or all of four simulations, each representing a different phase of a space-shuttle flight.

Author

*Avionics; Computerized Simulation; Space Shuttle Missions; Display Devices; Cockpits*

**20080048162** NASA Langley Research Center, Hampton, VA, USA

#### **2D/3D Synthetic Vision Navigation Display**

Prinzel, Lawrence J., III; Kramer, Lynda J.; Arthur, J. J., III; Bailey, Randall E.; Sweeters, Jason L.; NASA Tech Briefs, September 2008; September 2008, pp. 53-54; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): LAR-17354; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3201>

Flight-deck display software was designed and developed at NASA Langley Research Center to provide two-dimensional (2D) and three-dimensional (3D) terrain, obstacle, and flight-path perspectives on a single navigation display. The objective was to optimize the presentation of synthetic vision (SV) system technology that permits pilots to view multiple perspectives of flight-deck display symbology and 3D terrain information. Research was conducted to evaluate the efficacy of the concept. The concept has numerous unique implementation features that would permit enhanced operational concepts and efficiencies in both current and future aircraft.

Derived from text

*Flight Control; Navigation Aids; Enhanced Vision; Display Devices*

## 07

### AIRCRAFT PROPULSION AND POWER

Includes primary propulsion systems and related systems and components, e.g., gas turbine engines, compressors, and fuel systems; and onboard auxiliary power plants for aircraft. For related information see also 20 Spacecraft Propulsion and Power; 28 Propellants and Fuels; and 44 Energy Production and Conversion.

**20080047340** NASA Glenn Research Center, Cleveland, OH, USA

#### **TBCC Fan Stage Operability and Performance**

Suder, Kenneth L.; October 31, 2007; 24 pp.; In English; NASA Fundamental Aeronautics Program 2007 Annual Meeting, 31 Oct. - 01 Nov. 2007, Louisiana; Original contains color and black and white illustrations; No Copyright; Avail.: CASI:

[A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047340>

NASA's Fundamental Aeronautics Program is investigating turbine-based propulsion systems for access to space because

it provides the potential for aircraft-like, space-launch operations that may significantly reduce launch costs and improve safety. Studies performed under NASA's NGLT and the NASP High Speed Propulsion Assessment (HiSPA) program indicated a variable cycle turbofan/ramjet was the best configuration to satisfy access-to-space mission requirements because this configuration maximizes the engine thrust-to-weight ratio while minimizing frontal area. To this end, NASA and GE teamed to design a Mach 4 variable cycle turbofan/ramjet engine for access to space. To enable the wide operating range of a Mach 4+ variable cycle turbofan/ramjet required the development of a unique fan stage design capable of multi-point operation to accommodate variations in bypass ratio (10X), fan speed (7X), inlet mass flow (3.5X), inlet pressure (8X), and inlet temperature (3X). The primary goal of the fan stage was to provide a high pressure ratio level with good efficiency at takeoff through the mid range of engine operation, while avoiding stall and losses at the higher flight Mach numbers, without the use of variable inlet guide vanes. Overall fan performance and operability therefore requires major consideration, as competing goals at different operating points and aeromechanical issues become major drivers in the design. To mitigate risk of meeting the unique design requirements for the fan stage, NASA and GE teamed to design and build a 57% engine scaled fan stage to be tested in NASA's transonic compressor facility. The objectives of this test are to assess the aerodynamic and aeromechanical performance and operability characteristics of the fan stage over the entire range of engine operation including: 1) sea level static take-off, 2) transition over large swings in fan bypass ratio, 3) transition from turbofan to ramjet, and 4) fan windmilling operation at high Mach flight conditions. In addition, the fan stage design was validated by performing pre-test CFD analysis using both GE proprietary and NASA's APNASA codes. Herein we will discuss 1) the fan stage design, 2) the experiment including the unique facility and instrumentation, and 3) the comparison of pre-test CFD analysis to initial aerodynamic test results for the baseline fan stage configuration. Measurements and pre-test analysis will be compared at 37%, 50%, 80%, 90%, and 100% of design speed to assess the ability of state-of-the-art design and analysis tools to meet the fan stage performance and operability requirements for turbine based propulsion for access to space.

Author

*Propulsion System Configurations; Computational Fluid Dynamics; Design Analysis; High Speed; Propulsion System Performance; Inlet Pressure*

**20080047415** Cleveland State Univ., Cleveland, OH, USA

#### **Multiplexed Predictive Control of a Large Commercial Turbofan Engine**

Richter, hanz; Singaraju, Anil; Litt, Jonathan S.; AIAA Journal of Guidance, Control, and Dynamics; March 2008; ISSN 0731-5090; Volume 31, No. 2, pp. 273-281; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNC05GA73G; Copyright; Avail.: CASI: A02, Hardcopy

Model predictive control is a strategy well-suited to handle the highly complex, nonlinear, uncertain, and constrained dynamics involved in aircraft engine control problems. However, it has thus far been infeasible to implement model predictive control in engine control applications, because of the combination of model complexity and the time allotted for the control update calculation. In this paper, a multiplexed implementation is proposed that dramatically reduces the computational burden of the quadratic programming optimization that must be solved online as part of the model-predictive-control algorithm. Actuator updates are calculated sequentially and cyclically in a multiplexed implementation, as opposed to the simultaneous optimization taking place in conventional model predictive control. Theoretical aspects are discussed based on a nominal model, and actual computational savings are demonstrated using a realistic commercial engine model.

Author

*Turbofan Engines; Aircraft Control; Engine Control; Engine Design; Actuators*

**20080047455** Army Research Lab., Cleveland, OH, USA

#### **An Optimal Orthogonal Decomposition Method for Kalman Filter-Based Turbofan Engine Thrust Estimation**

Litt, Jonathan S.; Journal of Engineering for Gas Turbine and Power; 26 Dec. 2007; Volume 130, Issue 1; 12 pp.; In English; ASNE Turbo Expo 2005: Land, Sea and Air (GT2005), 6-9 Jun. 2005, Reno, NV, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 457280.02.07.03.04.03

Report No.(s): Paper No. GT2005-68808; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1115/1.2747254>

A new linear point design technique is presented for the determination of tuning parameters that enable the optimal estimation of unmeasured engine outputs, such as thrust. The engine's performance is affected by its level of degradation, generally described in terms of unmeasurable health parameters related to each major engine component. Accurate thrust reconstruction depends on knowledge of these health parameters, but there are usually too few sensors to be able to estimate their values. In this new technique, a set of tuning parameters is determined that accounts for degradation by representing the

overall effect of the larger set of health parameters as closely as possible in a least-squares sense. The technique takes advantage of the properties of the singular value decomposition of a matrix to generate a tuning parameter vector of low enough dimension that it can be estimated by a Kalman filter. A concise design procedure to generate a tuning vector that specifically takes into account the variables of interest is presented. An example demonstrates the tuning parameters ability to facilitate matching of both measured and unmeasured engine outputs, as well as state variables. Additional properties of the formulation are shown to lend themselves well to diagnostics.

Author

*Diagnosis; Kalman Filters; Turbofan Engines; Tuning; Engine Parts; Thrust*

**20080047695** NASA Glenn Research Center, Cleveland, OH, USA

**A Numerical Study of Anti-Vortex Film Cooling Designs at High Blowing Ratio**

Heidmann, James D.; November 2008; 18 pp.; In English; ASME Turbo Expo 2008 Gas Turbine Technical Congress and Exposition, 9-13 Jun. 2008, Berlin, Germany; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.21.02

Report No.(s): NASA/TM-2008-215209; GT2008-50845; E-16482; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047695>

A concept for mitigating the adverse effects of jet vorticity and liftoff at high blowing ratios for turbine film cooling flows has been developed and studied at NASA Glenn Research Center. This 'anti-vortex' film cooling concept proposes the addition of two branched holes from each primary hole in order to produce a vorticity counter to the detrimental kidney vortices from the main jet. These vortices typically entrain hot freestream gas and are associated with jet separation from the turbine blade surface. The anti-vortex design is unique in that it requires only easily machinable round holes, unlike shaped film cooling holes and other advanced concepts. The anti-vortex film cooling hole concept has been modeled computationally for a single row of 30deg angled holes on a flat surface using the 3D Navier-Stokes solver Glenn-HT. A modification of the anti-vortex concept whereby the branched holes exit adjacent to the main hole has been studied computationally for blowing ratios of 1.0 and 2.0 and at density ratios of 1.0 and 2.0. This modified concept was selected because it has shown the most promise in recent experimental studies. The computational results show that the modified design improves the film cooling effectiveness relative to the round hole baseline and previous anti-vortex cases, in confirmation of the experimental studies.

Author

*Vorticity; Turbine Blades; Blowing; Film Cooling; High Temperature Gases; Free Flow; Holes (Mechanics)*

**20080048289** Carlson, Gaskey and Olds, PC, Birmingham, MI, USA; United Technologies Corp., East Hartford, CT, USA

**Cooled Dual Wall Liner Closeout**

Murphy, M. J., Inventor; Lavin, J., Inventor; Farah, J., Inventor; Coreano, L., Inventor; Huizinga, H., Inventor; 14 Feb 05; 7 pp.; In English

Contract(s)/Grant(s): N00019-02-C-3003

Patent Info.: Filed Filed 14 Feb 05; US-Patent-Appl-SN-11-057 892

Report No.(s): PB2008-105844; No Copyright; Avail.: CASI: [A02](#), Hardcopy

An example exhaust duct assembly includes a front liner, an intermediate liner and a rear liner. Each of the front, intermediate and rear liners include an inner liner exposed to combustion gases and an outer liner spaced radially apart from the inner liner. An air passage defined between the inner liner and the outer liner provides cooling air utilized for insulating an inner surface of the exhaust duct assembly. A closeout member is provided between the inner and outer liner and defines a portion of an air passage between the closeout member and the inner liner. Air flowing through the air passage is injected into a joint to provide cooling. The closeout member includes a horizontal leg that is bendable in a radial direction to accommodate relative movement between the inner liner and the outer liner.

NTIS

*Air Flow; Cooling; Ducts; Linings; Patent Applications; Walls*

**AIRCRAFT STABILITY AND CONTROL**

Includes flight dynamics, aircraft handling qualities, piloting, flight controls, and autopilots. For related information see also 05 Aircraft Design, Testing and Performance; and 06 Avionics and Aircraft Instrumentation.

**20080047731** NASA Glenn Research Center, Cleveland, OH, USA

**Development of a Temperature Sensor for Jet Engine and Space Mission Applications**

Patterson, Richard L.; Hammoud, Ahmad; Elbuluk, Malik; Culley, Dennis; May 12, 2008; 5 pp.; In English; HiTEC 2008 High Temperature Electronics Conference/International Microelectronics and Packaging society (IMAPS), 12-15 May 2008, Albuquerque, NM, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC06BA07B; WBS 561581.02.08.03.17.03; Copyright; Avail.: CASI: [A01](#), Hardcopy

Electronics for Distributed Turbine Engine Control and Space Exploration Missions are expected to encounter extreme temperatures and wide thermal swings. In particular, circuits deployed in a jet engine compartment are likely to be exposed to temperatures well exceeding 150 C. To meet this requirement, efforts exist at the NASA Glenn Research Center (GRC), in support of the Fundamental Aeronautics Program/Subsonic Fixed Wing Project, to develop temperature sensors geared for use in high temperature environments. The sensor and associated circuitry need to be located in the engine compartment under distributed control architecture to simplify system design, improve reliability, and ease signal multiplexing. Several circuits were designed using commercial-off-the-shelf as well as newly-developed components to perform temperature sensing at high temperatures. The temperature-sensing circuits will be described along with the results pertaining to their performance under extreme temperature.

Author

*Active Control; Engine Control; High Temperature Environments; Temperature Sensors; Control Systems Design; Multiplexing*

**ASTRONAUTICS (GENERAL)**

Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms. For specific topics in astronautics see *categories 13 through 20*. For extraterrestrial exploration see *91 Lunar and Planetary Science and Exploration*.

**20080047252** Institute of Space Medico-Engineering, Beijing, China

**Space Medicine and Medical Engineering (Hangtian Yixue Yu Yuixue Gongcheng). Volume 21, Number 4, August 2008**

Aug. 2008; 40 pp.; In Chinese

Report No.(s): PB2009-100980; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This document presents original research on the space medicine and medical engineering. It also includes the brief report and the literature review.

NTIS

*Aerospace Medicine; China*

**20080047253** Institute of Space Medico-Engineering, Beijing, China

**Space Medicine and Medical Engineering (Hangtian Yixue Yu Yuixue Gongcheng). Volume 21, Number 5, October 2008**

Oct. 2008; 82 pp.; In Chinese

Report No.(s): PB2009-101681; No Copyright; Avail.: CASI: [A05](#), Hardcopy

This document presents original research on the space medicine and the medical engineering. It also includes the brief report and the literature review.

NTIS

*Aerospace Medicine; China*



**20080047508** Executive Office of the President, Washington, DC USA

**A Renewed Spirit of Discovery: The President's Vision for U.S. Space Exploration**

Jan 2004; 10 pp.; In English

Report No.(s): AD-A489187; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489187>

This Executive Office paper contains the following sections: I. Background; II. Goal and Objectives; and III. Bringing the Vision to Reality. Section III contains the following subsections: (A) Exploration Activities in Low Earth Orbit, including the Space Shuttle and International Space Station; (B) Space Exploration Beyond Low Earth Orbit, including the Moon, Mars, and Other Destinations; (C) Space Transportation Capabilities Supporting Exploration; and (D) International and Commercial Participation.

DTIC

*Commerce; International Relations; Space Exploration; Space Transportation*

**20080047838** Air Force Research Lab., Wright-Patterson AFB, OH USA; UES, Inc., Dayton, OH, USA

**Defect Occurrence and Modeling for the Thermomechanical Processing of Aerospace Alloys (Preprint)**

Semiatin, S L; Nicolaou, P D; Thomas, J P; Turner, T J; Jul 2007; 41 pp.; In English

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A489600; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Mechanism-based models for the evolution of defects during the thermomechanical processing of aerospace titanium- and nickel-base alloys are described. These defects include those comprising microstructural/metal-flow irregularities and those that are damage-related (i.e., cracks and cavities.). The development of undesirable/non-uniform microstructures and cavities during the mill processing of alpha/beta titanium alloys is addressed first. Relatively simple, diffusion-based models of spheroidization and coarsening are applied to quantify the propensity for microstructure non-uniformities. Similarly, first order micromechanical models have been formulated to estimate the effect of local crystallographic texture on non-uniform flow, the generation of triaxial stresses, and cavity growth/closure in alpha/beta titanium alloys with a colony-alpha microstructure. The occurrence of non-uniform grain structures (and so-called ALA, or 'as large as,' grains) in cast, wrought, and powder-metallurgy superalloys are also discussed. A physics-based model to treat the topology of recrystallization and the evolution of ALA grains in such materials is proposed.

DTIC

*Aerospace Systems; Alloys; Defects; Nickel Alloys; Thermodynamics; Thermomechanical Treatment; Titanium Alloys*

**20080047859** Executive Office of the President, Washington, DC USA

**U.S. National Space Policy**

Aug 31, 2006; 11 pp.; In English

Report No.(s): AD-A489005; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489005>

The President authorized a new national space policy on August 31, 2006 that establishes overarching national policy that governs the conduct of U.S. space activities. This policy supersedes Presidential Decision Directive/NSC-49/NSTC-8, National Space Policy, dated September 14, 1996. For five decades, the USA has led the world in space exploration and use and has developed a solid civil, commercial, and national security space foundation. Space activities have improved life in the USA and around the world, enhancing security, protecting lives and the environment, speeding information flow, serving as an engine for economic growth, and revolutionizing the way people view their place in the world and the cosmos. Space has become a place that is increasingly used by a host of nations, consortia, businesses, and entrepreneurs. In this new century, those who effectively utilize space will enjoy added prosperity and security and will hold a substantial advantage over those who do not. Freedom of action in space is as important to the USA as air power and sea power. In order to increase knowledge, discovery, economic prosperity, and to enhance the national security, the USA must have robust, effective, and efficient space capabilities.

DTIC

*Aerospace Engineering; Space Exploration; Space Law*

## 13 ASTRODYNAMICS

Includes powered and free flight trajectories; orbital and launching dynamics.

**20080048155** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA; California Inst. of Tech., Pasadena, CA, USA

### **Short- and Long-Term Propagation of Spacecraft Orbits**

Smith, John C., Jr.; Sweetser, Theodore; Chung, Min-Kun; Yen, Chen-Wan L.; Roncoli, Ralph B.; Kwok, Johnny H.; Vincent, Mark A.; NASA Tech Briefs, September 2008; September 2008, pp. 50; In English; See also [20080048125](#)  
Report No.(s): NPO-45418; Copyright; Avail.: CASI: [A01](#), Hardcopy  
ONLINE: <http://www.techbriefs.com/component/content/article/3195>

The Planetary Observer Planning Software (POPS) comprises four computer programs for use in designing orbits of spacecraft about planets. These programs are the Planetary Observer High Precision Orbit Propagator (POHOP), the Planetary Observer Long-Term Orbit Predictor (POLOP), the Planetary Observer Post Processor (POPP), and the Planetary Observer Plotting (POPLOT) program. POHOP and POLOP integrate the equations of motion to propagate an initial set of classical orbit elements to a future epoch. POHOP models short-term (one revolution) orbital motion; POLOP averages out the short-term behavior but requires far less processing time than do older programs that perform long-term orbit propagations. POPP postprocesses the spacecraft ephemeris created by POHOP or POLOP (or optionally can use a less accurate internal ephemeris) to search for trajectory-related geometric events including, for example, rising or setting of a spacecraft as observed from a ground site. For each such event, POPP puts out such user-specified data as the time, elevation, and azimuth. POPLOT is a graphics program that plots data generated by POPP. POPLOT can plot orbit ground tracks on a world map and can produce a variety of summaries and generic ordinate-vs.-abscissa plots of any POPP data.

Author

*Spacecraft Orbits; Propagation; Celestial Mechanics; Orbital Elements; Central Processing Units*

## 14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and test chambers and simulators. Also includes extraterrestrial bases and supporting equipment. For related information see also *09 Research and Support Facilities (Air)*.

**20080047286** NASA Stennis Space Center, Stennis Space Center, MS, USA

### **2008 Year in Review**

Figuroa, Jorge Fernando; [2008]; 2 pp.; In English; Original contains color illustrations  
Report No.(s): SSTI-2200-0107; No Copyright; Avail.: CASI: [A01](#), Hardcopy  
ONLINE: <http://hdl.handle.net/2060/20080047286>

In February of 2008; NASA Stennis Space Center (SSC), NASA Kennedy Space Center (KSC), and The Applied Research Laboratory at Penn State University demonstrated a pilot implementation of an Integrated System Health Management (ISHM) capability at the Launch Complex 20 of KSC. The following significant accomplishments are associated with this development: (1) implementation of an architecture for ground operations ISHM, based on networked intelligent elements; (2) Use of standards for management of data, information, and knowledge (DIaK) leading to modular ISHM implementation with interoperable elements communicating according to standards (three standards were used: IEEE 1451 family of standards for smart sensors and actuators, Open Systems Architecture for Condition Based Maintenance (OSA-CBM) standard for communicating DIaK describing the condition of elements of a system, and the OPC standard for communicating data); (3) ISHM implementation using interoperable modules addressing health management of subsystems; and (4) use of a physical intelligent sensor node (smart network element or SNE capable of providing data and health) along with classic sensors originally installed in the facility. An operational demonstration included detection of anomalies (sensor failures, leaks, etc.), determination of causes and effects, communication among health nodes, and user interfaces.

Author

*Launching Bases; Ground Operational Support System; Systems Integration; Management Information Systems; Information Management; Detection; Architecture (Computers)*

## LAUNCH VEHICLES AND LAUNCH OPERATIONS

Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also *18 Spacecraft Design, Testing and Performance*; and *20 Spacecraft Propulsion and Power*.

**20080047449** NASA Dryden Flight Research Center, Edwards, CA, USA

### **Preliminary Design of a Ramjet for Integration with Ground-Based Launch Assist**

Sayles, Emily L.; November 12, 2008; 44 pp.; In English; Minority Students in Science and Technology (MUST) Leadership Symposium, 12-16 Nov. 2008, Phoenix, Az, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: **A03**, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047449>

This viewgraph presentation reviews the preliminary design of a ramjet for integration with a ground based launch assist. The reasons for the use of ground-based launch assist and the proposed mechanism for a system are reviewed. The use of a Optimal Trajectory by Implicit Simulation (OTIS), to model the flight and comparison with an actual rocket trajectory is given. The OTIS system is reviewed, The benefits of a launch assist system are analyzed concluding that a launch assist can provide supersonic speeds thus allowing ignition of ramjet without an onboard compressor. This means a further reduction in total launch weight. The Ramjet study is reviewed next. This included a review of the ONX simulations, the verification of the ONX results with the use of Holloman Sled experiment data as derived from the Feasibility of Ramjet Engine Test Capability on The Holloman AFB Sled Track. The conclusion was that the ONX system was not sufficient to meet the needs for the modeling required. The GECAT (Graphical Engine Cycle Analysis Tool) is examined. The results of the GECAT simulations was verified with data from Stataltex and D21 flights. The Next steps are: to create a GECAT Model of a launch assist ramjet, to adjust the geometry to produce the desired thrust, and to survey the ramjet's performance over a range of Mach numbers. The assumptions and requirements of a launch assist ramjet are given, and the acceptable flight regimes are reviewed.

CASI

*Ramjet Engines; Simulation; Launch Vehicles*

**20080048100** NASA Marshall Space Flight Center, Huntsville, AL, USA

### **Ares V Launch Vehicle: An Enabling Capability for Future Space Science Missions**

Stahl, H. Philip; Sumrall, Phil; Hopkins, Randall; [2008]; 17 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

NASA's planned Ares V cargo launch vehicle offers the potential to completely change the paradigm of future space science mission architectures. Future space science telescopes desire increasingly larger telescope collecting aperture. But, current launch vehicle mass and volume constraints are a severe limit. The Ares V greatly relaxes these constraints. For example, while current launch vehicles have the ability to launch approximate a 4.5 meter diameter payload with a mass of 13,000 kg to Earth-Sun L2, the Ares V is projected to have the ability to launch an 8.8 meter diameter payload with a mass of 55,600 kg to L2 or a mass of 140,000 kg to Low Earth Orbit. Also, Ares V could launch approximately 3,000 kg (13,000 kg with a Centaur upper stage) to Saturn in 6.1 years with a C3 of 106 km(exp 2)/sec(exp 2). This paper summarizes the current planned Ares V payload launch capability.

Author

*Ares 5 Cargo Launch Vehicle; Payload Mass Ratio*

**20080048217** NASA Marshall Space Flight Center, Huntsville, AL, USA

### **Rapid Trajectory Optimization for the ARES I Launch Vehicle**

Dukeman, Greg A.; Hill, Ashley D.; August 18, 2008; 6 pp.; In English; 2008 AIAA Guidance, Navigation and Control Conference, 18-21 Aug. 2008, Honolulu, HI, USA; Original contains color illustrations; Copyright; Avail.: CASI: **A02**, Hardcopy

A simplified ascent trajectory optimization procedure has been developed with application to NASA's proposed Ares I launch vehicle. In the interest of minimizing bending loads and ensuring safe separation of the first-stage solid rocket motor, the vehicle is constrained to follow a gravity-turn trajectory. This reduces the design space to just two free parameters, the pitch rate after a short vertical rise phase to clear the launch pad, and initial launch azimuth. The pitch rate primarily controls the in-plane parameters (altitude, speed, flight path angle) of the trajectory whereas the launch azimuth primarily controls the

out-of-plane portion (velocity heading.) Thus, the optimization can be mechanized as two one-dimensional searches that converge quickly and reliably. The method is compared with POST-optimized trajectories to verify its optimality.

Author

*Ares I Launch Vehicle; Trajectory Optimization; Ascent Trajectories; Loads (Forces); Flight Paths; Solid Propellant Rocket Engines*

**20080048218** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Dynamical Modeling and Control Simulation of a Large Flexible Launch Vehicle**

Du, Wei; Wie, Bong; Whorton, Mark; August 18, 2008; 17 pp.; In English; 2008 AIAA Guidance, Navigation and Control Conference, 18-21 Aug. 2008, Honolulu, HI, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper presents dynamical models of a large flexible launch vehicle. A complete set of coupled dynamical models of propulsion, aerodynamics, guidance and control, structural dynamics, fuel sloshing, and thrust vector control dynamics are described. Such dynamical models are used to validate NASA's SAVANT Simulink-based program which is being used for the preliminary flight control systems analysis and design of NASA's Ares-1 Crew Launch Vehicle. SAVANT simulation results for validating the performance and stability of an ascent phase autopilot system of Ares-1 are also presented.

Author

*Launch Vehicles; Dynamic Control; Dynamic Structural Analysis; Control Simulation; Systems Analysis; Thrust Vector Control; Aerodynamics; Liquid Sloshing; Ares I Launch Vehicle; Automatic Pilots*

**20080048227** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Evaluation of Ares-I Control System Robustness to Uncertain Aerodynamics and Flex Dynamics**

Jang, Jiann-Woei; VanTassel, Chris; Bedrossian, Nazareth; Hall, Charles; Spanos, Pol; August 18, 2008; 16 pp.; In English; 2008 AIAA Guidance, Navigation and Control Conference, 18-21 Aug. 2008, Honolulu, HI, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper discusses the application of robust control theory to evaluate robustness of the Ares-I control systems. Three techniques for estimating upper and lower bounds of uncertain parameters which yield stable closed-loop response are used here: (1) Monte Carlo analysis, (2) mu analysis, and (3) characteristic frequency response analysis. All three methods are used to evaluate stability envelopes of the Ares-I control systems with uncertain aerodynamics and flex dynamics. The results show that characteristic frequency response analysis is the most effective of these methods for assessing robustness.

Author

*Robustness (Mathematics); Aerodynamics; Feedback Control; Monte Carlo Method; Frequency Response; Control Theory; Ares I Launch Vehicle*

**20080048228** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Ares I Flight Control System Overview**

Hall, Charles; Lee, Chong; Jackson, Mark; Whorton, Mark; West, mark; Brandon, Jay; Hall, Rob A.; Jang, Jimmy; Bedrossian, Naz; Compton, Jimmy; Rutherford, Chad; August 18, 2008; 10 pp.; In English; 2008 AIAA Guidance, Navigation and Control Conference, 18-21 Aug. 2008, Honolulu, HI, USA; Original contains color illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

This paper describes the control challenges posed by the Ares I vehicle, the flight control system design and performance analyses used to test and verify the design. The major challenges in developing the control system are structural dynamics, dynamic effects from the powerful first stage booster, aerodynamics, first stage separation and large uncertainties in the dynamic models for all these. Classical control techniques were employed using innovative methods for structural mode filter design and an anti-drift feature to compensate for translational and rotational disturbances. This design was coded into an integrated vehicle flight simulation and tested by Monte Carlo methods. The product of this effort is a linear, robust controller design that is easy to implement, verify and test.

Author

*Ares I Launch Vehicle; Control Systems Design; Dynamic Structural Analysis; Flight Simulation; Structural Design; Dynamic Models; Flight Control*

**20080048254** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Analysis of Ares 1 Ascent Navigation Options**

Norris, Lee; Tao, Yee-Chee; Hall, Robert; Chuang, Jason; Whorton, Mark; August 18, 2008; 10 pp.; In English; 2008 AIAA Guidance, Navigation and Control Conference, 18-21 Aug. 2008, Honolulu, HI, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

The paper documents a collaborative analysis of ascent Navigation options for the Ares 1 launch vehicle by the NASA Marshall Space Flight Center (MSFC) and the C. S. Draper Laboratory. The objective of the work was the development of a Navigation concept and supporting requirements which meet the Ares 1 accuracy specification in a manner which is straightforward, reliable, and cost effective. Six primary Navigation architectures were considered. In each case analysis was performed to determine under what conditions the required accuracy at second stage cutoff could be achieved. Those architectures which met the accuracy requirements were then assessed in terms of cost, complexity, and reliability to determine a baseline Navigation approach and the primary supporting requirements.

Author

*Ares 1 Launch Vehicle; Ascent; Navigation; Reliability; Accuracy*

**20080048261** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Ares-I Bending Filter Design using a Constrained Optimization Approach**

Hall, Charles; Jang, Jiann-Woei; Hall, Robert; Bedrossian, Nazareth; August 18, 2008; 16 pp.; In English; 2008 AIAA Guidance, Navigation and Control Conference, 18-21 Aug. 2008, Honolulu, HI, USA; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Ares-I launch vehicle represents a challenging flex-body structural environment for control system design. Software filtering of the inertial sensor output is required to ensure adequate stable response to guidance commands while minimizing trajectory deviations. This paper presents a design methodology employing numerical optimization to develop the Ares-I bending filters. The design objectives include attitude tracking accuracy and robust stability with respect to rigid body dynamics, propellant slosh, and flex. Under the assumption that the Ares-I time-varying dynamics and control system can be frozen over a short period of time, the bending filters are designed to stabilize all the selected frozen-time launch control systems in the presence of parameter uncertainty. To ensure adequate response to guidance command, step response specifications are introduced as constraints in the optimization problem. Imposing these constraints minimizes performance degradation caused by the addition of the bending filters. The first stage bending filter design achieves stability by adding lag to the first structural frequency to phase stabilize the first flex mode while gain stabilizing the higher modes. The upper stage bending filter design gain stabilizes all the flex bending modes. The bending filter designs provided here have been demonstrated to provide stable first and second stage control systems in both Draper Ares Stability Analysis Tool (ASAT) and the MSFC MAVERIC 6DOF nonlinear time domain simulation.

Author

*Ares 1 Launch Vehicle; Control Systems Design; Design Optimization; Dynamic Control; Structural Design; Tracking (Position); Trajectories; Rigid Structures; Stabilization; Bending*

**20080048263** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Development of a Smooth Trajectory Maneuver Method to Accommodate the Ares I Flight Control Constraints**

Pinson, Robin M.; Schmitt, Terri L.; Hanson, John M.; August 18, 2008; 12 pp.; In English; 2008 AIAA Guidance, Navigation and Control Conference, 18-21 Aug. 2008, Honolulu, HI, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080048263>

Six degree-of-freedom (DOF) launch vehicle trajectories are designed to follow an optimized 3-DOF reference trajectory. A vehicle has a finite amount of control power that it can allocate to performing maneuvers. Therefore, the 3-DOF trajectory must be designed to refrain from using 100% of the allowable control capability to perform maneuvers, saving control power for handling off-nominal conditions, wind gusts and other perturbations. During the Ares I trajectory analysis, two maneuvers were found to be hard for the control system to implement; a roll maneuver prior to the gravity turn and an angle of attack maneuver immediately after the J-2X engine start-up. It was decided to develop an approach for creating smooth maneuvers in the optimized reference trajectories that accounts for the thrust available from the engines. A feature of this method is that no additional angular velocity in the direction of the maneuver has been added to the vehicle after the maneuver completion. This paper discusses the equations behind these new maneuvers and their implementation into the Ares I trajectory design

cycle. Also discussed is a possible extension to adjusting closed-loop guidance.

Author

*Ares I Launch Vehicle; Trajectory Analysis; Feedback Control; Degrees of Freedom; Controllability; Angle of Attack; Flight Control*

**20080048265** NASA Marshall Space Flight Center, Huntsville, AL, USA

**How Might the Ares V Change the Need for Future Mirror Technology**

Stahl, H. Philip; August 25, 2008; 29 pp.; In English; 8th Annual Mirror Technology Days in the Government, 25-27 Aug. 2008, Albuquerque, NM, USA; Original contains color illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080048265>

More Massive Missions do not need to be More Expensive. Simple, robust, low-risk, high-TRL mission is likely to be low cost. It is also likely to be more massive than a complex, high-risk, low TRL mission. The challenge will be to overcome human nature. Launch Date Constrained Missions Cost Less

Author

*Low Cost; Ares 5 Cargo Launch Vehicle; Costs*

## 16

### SPACE TRANSPORTATION AND SAFETY

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information see also *03 Air Transportation and Safety; 15 Launch Vehicles and Launch Operations; and 18 Spacecraft Design, Testing and Performance*. For space suits see *54 Man/System Technology and Life Support*.

**20080047723** NASA Johnson Space Center, Houston, TX, USA

**Carbon Dioxide Removal Troubleshooting aboard the International Space Station (ISS) during Space Shuttle (STS) Docked Operations**

Matty, Christopher M.; Cover, John M.; [2009]; 1 pp.; In English; International Conference on Environmental Systems, 12-16 Jul. 2009, Savannah, GA, USA; No Copyright; Avail.: Other Sources; Abstract Only

The International Space Station (ISS) represents a largely closed-system habitable volume which requires active control of atmospheric constituents, including removal of exhaled Carbon Dioxide (CO<sub>2</sub>). The ISS provides a unique opportunity to observe system requirements for (CO<sub>2</sub>) removal. CO<sub>2</sub> removal is managed by the Carbon Dioxide Removal Assembly (CDRA) aboard the US segment of ISS and by Lithium Hydroxide (LiOH) aboard the Space Shuttle (STS). While the ISS and STS are docked, various methods are used to balance the CO<sub>2</sub> levels between the two vehicles, including mechanical air handling and management of general crew locations. Over the course of ISS operation, several unexpected anomalies have occurred which have required troubleshooting, including possible compromised performance of the CDRA and LiOH systems, and possible imbalance in CO<sub>2</sub> levels between the ISS and STS while docked. This paper will cover efforts to troubleshoot the CO<sub>2</sub> removal systems aboard the ISS and docked STS.

Author

*International Space Station; Carbon Dioxide Removal; Lithium Hydroxides; Space Shuttles; Atmospheric Composition; Active Control*

## 17

### SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes space systems telemetry; space communications networks; astronavigation and guidance; and spacecraft radio blackout. For related information see also *04 Aircraft Communications and Navigation; and 32 Communications and Radar*.

**20080048040** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Simulating Attitudes and Trajectories of Multiple Spacecraft**

Stoneking, Eric; NASA Tech Briefs, December 2008; December 2008, pp. 18; In English; See also [20080048022](#)

Report No.(s): GSC-14817-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3444>

A computer program called '42' simulates the attitudes and trajectories of multiple spacecraft flying in formation anywhere in the Solar System.

Derived from text

*Computer Programs; Formation Flying; Simulation; Spacecraft Trajectories; Satellite Constellations; Spacecraft Control; Spacecraft Guidance*

**20080048059** California Inst. of Tech., Pasadena, CA, USA

**Multibeam Altimeter Navigation Update Using Faceted Shape Model**

Bayard, David S.; Brugarolas, Paul; Broschart, Steve; NASA Tech Briefs, December 2008; December 2008, pp. 7-8; In English; See also [20080048022](#); Original contains color illustrations  
Report No.(s): NPO-44428; Copyright; Avail.: CASI: [A01](#), Hardcopy  
ONLINE: <http://www.techbriefs.com/component/content/article/3412>

A method of incorporating information, acquired by a multibeam laser or radar altimeter system, pertaining to the distance and direction between the system and a nearby target body, into an estimate of the state of a vehicle upon which the system is mounted, involves the use of a faceted model to represent the shape of the target body. Fundamentally, what one seeks to measure is the distance from the vehicle to the target body.

Derived from text

*Altimeters; Navigation; Optical Radar; Distance Measuring Equipment; Spacecraft Guidance; Navigation Aids*

**20080048062** Intelligent Automation Corp., USA

**Radio Ranging System for Guidance of Approaching Spacecraft**

Manikonda, Vikram; vanDoom, Eric; NASA Tech Briefs, December 2008; December 2008, pp. 11; In English; See also [20080048022](#)

Report No.(s): MSC-23474-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3422>

A radio communication and ranging system has been proposed for determining the relative position and orientations of two approaching spacecraft to provide guidance for docking maneuvers. On Earth, the system could be used similarly for guiding approaching aircraft and for automated positioning of large, heavy objects. In principle, the basic idea is to (1) measure distances between radio transceivers on the two spacecraft and (2) compute the relative position and orientations from the measured distances.

Derived from text

*Radio Communication; Ranging; Spacecraft Guidance; Rendezvous Guidance; Docking*

**20080048179** California Inst. of Tech., Pasadena, CA, USA

**DSN Array Simulator**

Tikidjian, Raffi; Mackey, Ryan; NASA Tech Briefs, September 2008; September 2008, pp. 59; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): NPO-44506; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3211>

The DSN Array Simulator (wherein 'DSN' signifies NASA's Deep Space Network) is an updated version of software previously denoted the DSN Receive Array Technology Assessment Simulation. This software (see figure) is used for computational modeling of a proposed DSN facility comprising user-defined arrays of antennas and transmitting and receiving equipment for microwave communication with spacecraft on interplanetary missions. The simulation includes variations in spacecraft tracked and communication demand changes for up to several decades of future operation. Such modeling is performed to estimate facility performance, evaluate requirements that govern facility design, and evaluate proposed improvements in hardware and/or software. The updated version of this software affords enhanced capability for characterizing facility performance against user-defined mission sets. The software includes a Monte Carlo simulation component that enables rapid generation of key mission-set metrics (e.g., numbers of links, data rates, and data volumes), and statistical distributions thereof as functions of time. The updated version also offers expanded capability for mixed-asset network modeling--for example, for running scenarios that involve user-definable mixtures of antennas having different diameters (in contradistinction to a fixed number of antennas having the same fixed diameter). The improved version also affords greater simulation fidelity, sufficient for validation by comparison with actual DSN operations and analytically predictable performance metrics.

Author

*Deep Space Network; Computerized Simulation; Computer Programs; Interplanetary Communication*

**20080048264** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Orbital Express Advanced Video Guidance Sensor: Ground Testing, Flight Results and Comparisons**

Pinson, Robin M.; Howard, Richard T.; Heaton, Andrew F.; August 18, 2008; 12 pp.; In English; 2008 AIAA Guidance, Navigation and Control Conference, 18-21 Aug. 2008, Honolulu, HI, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080048264>

Orbital Express (OE) was a successful mission demonstrating automated rendezvous and docking. The 2007 mission consisted of two spacecraft, the Autonomous Space Transport Robotic Operations (ASTRO) and the Next Generation Serviceable Satellite (NEXTSat) that were designed to work together and test a variety of service operations in orbit. The Advanced Video Guidance Sensor, AVGS, was included as one of the primary proximity navigation sensors on board the ASTRO. The AVGS was one of four sensors that provided relative position and attitude between the two vehicles. Marshall Space Flight Center was responsible for the AVGS software and testing (especially the extensive ground testing), flight operations support, and analyzing the flight data. This paper briefly describes the historical mission, the data taken on-orbit, the ground testing that occurred, and finally comparisons between flight data and ground test data for two different flight regimes.

Author

*Attitude (Inclination); Spacecraft Docking; Orbital Rendezvous; Navigation Instruments; Guidance Sensors; Flight Tests; Autonomy*

**18**

**SPACECRAFT DESIGN, TESTING AND PERFORMANCE**

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and spacecraft control and stability characteristics. For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance*; *39 Structural Mechanics*; and *16 Space Transportation and Safety*.

**20080047307** NASA Johnson Space Center, Houston, TX, USA

**Safe Manual Jettison**

Barton, Jay; October 06, 2008; 6 pp.; In English; Building, Together a Safe Space, 6-7 Nov. 2008, Rome, Italy; Copyright; Avail.: CASI: [A02](#), Hardcopy

In space, the controlled release of certain cargoes is no less useful than the maritime jettisons from which they take their name but is also much more dangerous. Experience has shown that jettisons can be performed safely, but the process is complicated with the path to performing a jettison taking months or even years. In the background, time is also required to write procedures, train the crew, configure the vehicle, and many other activities. This paper outlines the current process used by the National Aeronautics and Space Administration (NASA) for manual jettisons, detailing the methods used to assure that the jettisons and the jettisoned objects are as safe as achievable and that the crew is adequately trained to be able to affect the safe jettison. The goal of this paper is not only to capture what it takes to perform safe jettisons in the near Earth environment but to extrapolate this knowledge to future space exploration scenarios that will likely have Extravehicular Activity (EVA) and International Partner (IP) interfaces.

Author

*Jettisoning; NASA Programs; Extravehicular Activity; Cargo; Extrapolation*

**20080047339** NASA Glenn Research Center, Cleveland, OH, USA

**Application of an Elongated Kelvin Model to Space Shuttle Foams**

Sullivan, Roy M.; Ghosn, Louis J.; Lerch, Bradley A.; April 07, 2008; 30 pp.; In English; 49th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 7 - 10 Apr. 2008, Illinois, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047339>

Spray-on foam insulation is applied to the exterior of the Space Shuttle's External Tank to limit propellant boil-off and to prevent ice formation. The Space Shuttle foams are rigid closed-cell polyurethane foams. The two foams used most extensively on the Space Shuttle External Tank are BX-265 and NCFI24-124. Since the catastrophic loss of the Space Shuttle Columbia, numerous studies have been conducted to mitigate the likelihood and the severity of foam shedding during the Shuttle's ascent to space. Due to the foaming and rising process, the foam microstructures are elongated in the rise direction.



As a result, these two foams exhibit a non-isotropic mechanical behavior. In this paper, a detailed microstructural characterization of the two foams is presented. The key features of the foam cells are summarized and the average cell dimensions in the two foams are compared. Experimental studies to measure the room temperature mechanical response of the two foams in the two principal material directions (parallel to the rise and perpendicular to the rise) are also reported. The measured elastic modulus, proportional limit stress, ultimate tensile stress and the Poisson's ratios for the two foams are compared. The generalized elongated Kelvin foam model previously developed by the authors is reviewed and the equations which result from this model are presented. The resulting equations show that the ratio of the elastic modulus in the rise direction to that in the perpendicular-to-rise direction as well as the ratio of the strengths in the two material directions is only a function of the microstructural dimensions. Using the measured microstructural dimensions and the measured stiffness ratio, the foam tensile strength ratio and Poisson's ratios are predicted for both foams. The predicted tensile strength ratio is in close agreement with the measured strength ratios for both BX-265 and NCFI24-124. The comparison between the predicted Poisson's ratios and the measured values is not as favorable.

Author

*Foams; Insulation; External Tanks; Microstructure; Tensile Strength; Mechanical Properties; Polyurethane Foam; Tensile Stress; Sprayers*

**20080047343** NASA Glenn Research Center, Cleveland, OH, USA

#### **Seal Technology for Hypersonic Vehicle and Propulsion: An Overview**

Steinetz, Bruce M.; February 26, 2008; 103 pp.; In English; Short Course on Hypersonics Structures and Materials, 26 - 28 Feb. 2008, Virginia, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: **A06**, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047343>

Hypersonic vehicles and propulsion systems pose an extraordinary challenge for structures and materials. Airframes and engines require lightweight, high-temperature materials and structural configurations that can withstand the extreme environment of hypersonic flight. Some of the challenges posed include very high temperatures, heating of the whole vehicle, steady-state and transient localized heating from shock waves, high aerodynamic loads, high fluctuating pressure loads, potential for severe flutter, vibration, and acoustic loads and erosion. Correspondingly high temperature seals are required to meet these aggressive requirements. This presentation reviews relevant seal technology for both heritage (e.g. Space Shuttle, X-15, and X-38) vehicles and presents several seal case studies aimed at providing lessons learned for future hypersonic vehicle seal development. This presentation also reviews seal technology developed for the National Aerospace Plane propulsion systems and presents several seal case studies aimed at providing lessons learned for future hypersonic propulsion seal development.

Author

*Seals (Stoppers); Hypersonic Vehicles; Refractory Materials; Aerodynamic Loads; Airframes; High Temperature; Propulsion System Configurations; Pressure Distribution*

**20080047662** NASA Johnson Space Center, Houston, TX, USA

#### **Cammpp Team**

Evertt, Shonn F.; Collins, Michael; Hahn, William; October 03, 2008; 21 pp.; In English; BAH Texas 2008 Tech Day, 19 Nov. 2008, San Antonio, TX, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNJ04AA01C; Copyright; Avail.: CASI: **A03**, Hardcopy

The International Space Station (ISS) Configuration Analysis Modeling and Mass Properties (CAMMP) Team is presenting a demo of certain CAMMP capabilities at a Booz Allen Hamilton conference in San Antonio. The team will be showing pictures of low fidelity, simplified ISS models, but no dimensions or technical data. The presentation will include a brief description of the contract and task, description and picture of the Topology, description of Generic Ground Rules and Constraints (GGR&C), description of Stage Analysis with constraints applied, and wrap up with description of other tasks such as Special Studies, Cable Routing, etc. The models include conceptual Crew Exploration Vehicle (CEV) and Lunar Lander images and animations created for promotional purposes, which are based entirely on public domain conceptual images from public NASA web sites and publicly available magazine articles and are not based on any actual designs, measurements, or 3D models. Conceptual Mars rover and lander are completely conceptual and are not based on any NASA designs or data. The demonstration includes High Fidelity Computer Aided Design (CAD) models of ISS provided by the ISS 3D CAD Team which will be used in a visual display to demonstrate the capabilities of the Teamcenter Visualization software. The demonstration will include 3D views of the CAD models including random measurements that will be taken to demonstrate the measurement tool. A 3D PDF file will be demonstrated of the Blue Book fidelity assembly complete model with no

vehicles attached. The 3D zoom and rotation will be displayed as well as random measurements from the measurement tool. The External Configuration Analysis and Tracking Tool (ExCATT) Microsoft Access Database will be demonstrated to show its capabilities to organize and track hardware on ISS. The data included will be part numbers, serial numbers, historical, current, and future locations, of external hardware components on station. It includes dates of all external ISS events and flights and the associated hardware changes for each event. The hardware location information does not always reveal the exact location of the hardware, only the general location. In some cases the location is a module or carrier, in other cases it is a WIF socket, handrail, or attach point. Only small portions of the data will be displayed for demonstration purposes.

Author

*International Space Station; Spacecraft Configurations; Three Dimensional Models; Spacecrews; Display Devices; Computer Aided Design; Roving Vehicles; Mars Surface*

**20080047735** NASA Johnson Space Center, Houston, TX, USA

#### **High Pressure Quick Disconnect Particle Impact Tests**

Rosales, Keisa R.; Stoltzfus, Joel M.; [2009]; 26 pp.; In English; G04 12th International Symposium on Flammability and sensitivity of Materials in Oxygen-Enriched Atmospheres, 7-9 Oct. 2009, Berlin, Germany; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047735>

NASA Johnson Space Center White Sands Test Facility (WSTF) performed particle impact testing to determine whether there is a particle impact ignition hazard in the quick disconnects (QDs) in the Environmental Control and Life Support System (ECLSS) on the International Space Station (ISS). Testing included standard supersonic and subsonic particle impact tests on 15-5 PH stainless steel, as well as tests performed on a QD simulator. This paper summarizes the particle impact tests completed at WSTF. Although there was an ignition in Test Series 4, it was determined the ignition was caused by the presence of a machining imperfection. The sum of all the test results indicates that there is no particle impact ignition hazard in the ISS ECLSS QDs. KEYWORDS: quick disconnect, high pressure, particle impact testing, stainless steel

Author

*Impact Tests; Life Support Systems; Environmental Control; Stainless Steels; High Pressure; Ignition; Machining; International Space Station*

**20080047737** NASA Glenn Research Center, Cleveland, OH, USA

#### **Review of Full-Scale Docking Seal Testing Capabilities**

Dunlap, Patrick H., Jr.; Penney, Nicholas; Wasowski, Janice L.; Daniels, Christopher C.; Steinetz, Bruce M.; July 20, 2008; 20 pp.; In English; 44th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, 20-23 Jul. 2008, Hartford, CT, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 644423.06.31.04.01.03.22; Copyright; Avail.: CASI: [A03](#), Hardcopy

NASA is developing a new docking system to support future space exploration missions to low-Earth orbit, the Moon, and Mars. This mechanism, called the Low Impact Docking System (LIDS), is designed to connect pressurized space vehicles and structures including the Crew Exploration Vehicle, International Space Station, and lunar lander. NASA Glenn Research Center (GRC) is playing a key role in developing the main interface seal for this new docking system. These seals will be approximately 147 cm (58 in.) in diameter. To evaluate the performance of the seals under simulated operating conditions, NASA GRC is developing two new test rigs: a non-actuated version that will be used to measure seal leak rates and an actuated test rig that will be able to measure both seal leak rates and loads. Both test rigs will be able to evaluate the seals under seal-on-seal or seal-on-plate configurations at temperatures from -50 to 50 C (-58 to 122 F) under operational and pre-flight checkout pressure gradients in both aligned and misaligned conditions.

Author

*Docking; Space Exploration; Low Earth Orbits; Spacecrews; International Space Station; Pressure Gradients*

**20080047742** NASA Glenn Research Center, Cleveland, OH, USA

#### **Performance of Subscale Docking Seals Under Simulated Temperature Conditions**

Smith, Ian M.; Daniels, Christopher C.; October 2008; 18 pp.; In English; 44th Joint Propulsion Conference and Exhibit, 21-23 Jul. 2008, Hartford, CT, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC08CA35C; WBS 644423.06.31.04.01.03.22

Report No.(s): NASA/TM-2008-215428; AIAA Paper-2008-4713; E-16605; Copyright; Avail.: CASI: [A03](#), Hardcopy

A universal docking system is being developed by the National Aeronautics and Space Administration (NASA) to support

future space exploration missions to low Earth orbit (LEO), to the moon, and to Mars. The candidate docking seals for the system are a composite design consisting of elastomer seal bulbs molded into the front and rear sides of a metal ring. The test specimens were subscale seals with two different elastomer cross-sections and a 12-in. outside diameter. The seal assemblies were mated in elastomer seal-on-metal plate and elastomer seal-on-elastomer seal configurations. The seals were manufactured from S0383-70 silicone elastomer compound. Nominal and off-nominal joint configurations were examined. Both the compression load required to mate the seals and the leak rate observed were recorded while the assemblies were subjected to representative docking system operating temperatures of -58, 73, and 122 F (-50, 23, and 50 C). Both the loads required to fully compress the seals and their leak rates were directly proportional to the test temperature.

Author

*Docking; Leakage; NASA Space Programs; Space Exploration; Low Earth Orbits; Compression Loads*

**20080047969** Rose-Hulman Inst. of Tech., Terre Haute, IN, USA

**Simulink Model of the Ares I Upper Stage Main Propulsion System**

Burchett, Bradley T.; August 18, 2008; 18 pp.; In English; AIAA Modeling and Simulation Technologies Conference, 18-21 Aug. 2008, Honolulu, HI, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NNM07AA02A; Copyright; Avail.: CASI: [A03](#), Hardcopy

A numerical model of the Ares I upper stage main propulsion system is formulated based on first principles. Equation's are written as non-linear ordinary differential equations. The GASP fortran code is used to compute thermophysical properties of the working fluids. Complicated algebraic constraints are numerically solved. The model is implemented in Simulink and provides a rudimentary simulation of the time history of important pressures and temperatures during re-pressurization, boost and upper stage firing. The model is validated against an existing reliable code, and typical results are shown.

Author

*Ares I Upper Stage; Spacecraft Design; Spacecraft Propulsion; Propulsion System Configurations; Computer Programs; Computerized Simulation; Fault Detection; Algorithms; Numerical Analysis*

**20080048036** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Demisable Reaction-Wheel Assembly**

Roder, Russell; Ahronovich, Eliezer; Davis, Milton C., III; NASA Tech Briefs, December 2008; December 2008, pp. 25; In English; See also [20080048022](#)

Report No.(s): GSC-14845-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3461>

A document discusses the concept of a demisable motor-drive-and-flywheel assembly [reaction-wheel assembly (RWA)] used in controlling the attitude of a spacecraft. Demisable as used here does not have its traditional legal meaning; instead, it signifies susceptible to melting, vaporizing, and/or otherwise disintegrating during re-entry of the spacecraft into the atmosphere of the Earth so as not to pose a hazard to anyone or anything on the ground. Prior RWAs include parts made of metals (e.g., iron, steel, and titanium) that melt at high temperatures and include structures of generally closed character that shield some parts (e.g., magnets) against re-entry heating. In a demisable RWA, the flywheel would be made of aluminum, which melts at a lower temperature. The flywheel web would not be a solid disk but would have a more open, nearly-spoke-like structure so that it would disintegrate more rapidly; hence, the flywheel rim would separate more rapidly so that parts shielded by the rim would be exposed sooner to re-entry heating. In addition, clearances between the flywheel and other components would be made greater, imparting a more open character and thus increasing the exposure of those components.

Author

*Aerodynamic Heating; Attitude (Inclination); Flywheels; Reaction Wheels; Melting; Vaporizing; Disintegration; Reentry Effects; Aluminum*

**20080048046** Boeing Co., Houston, TX, USA

**Reducing Liquid Loss during Ullage Venting in Microgravity**

Nguyen, Bich; Nguyen, Lauren; NASA Tech Briefs, December 2008; December 2008, pp. 24; In English; See also [20080048022](#)

Report No.(s): MSC-23230-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3457>

A centripetal-force-based liquid/gas separator has been proposed as a means of reducing the loss of liquid during venting

of the ullage of a tank in microgravity as a new supply of liquid is pumped into the tank. Centripetal-force-based liquid/gas separators are used on Earth, where mechanical drives (e.g., pumps and spinners) are used to impart flow speeds sufficient to generate centripetal forces large enough to effect separation of liquids from gases. For the proposed application, the separator would be designed so that there would be no need for such a pump because the tank-pressure-induced outflow speed during venting of the ullage would be sufficient for centripetal separation. A relatively small pump would be used, not for separation, but for returning the liquid recovered by the separator to the tank.

Author

*Centripetal Force; Separators; Storage Tanks; Spacecraft Design; Venting; Ullage; Microgravity*

**20080048085** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Millimeter-wave High-Resolution Imaging of Space Shuttle External Fuel Tank Spray-on Foam Insulation (SOFI)**

Kharkovsky, S.; Zoughi, R.; Hepburn, F. L.; [2007]; 32 pp.; In English; Original contains black and white illustrations  
Contract(s)/Grant(s): NNM06AA08A; Copyright; Avail.: Other Sources

The Space Shuttle Columbia 's catastrophic structural failure was caused by a dislodged piece of spray on foam insulation (SOFI) from the external fuel tank. SeparatiOn of SOFI pieces may be caused by the presence of unwanted flaws within the foam such as voids, delaminations and disbonds. These unwanted flaws may occur during the spraying of the foam onto the external tank and/or due to post-spray damage. High spatial resolution millimeter wave nondestructive testing (NDT) and imaging techniques have shown great potential and overall system utility for evaluating internal SOFI structures. This paper presents the basic design of the imaging reflectometer system at 150 GHz as well as the results of a critical investigation of the real capabilities of this system by examining a SOFI panel with subtle embedded delaminations and voids without sharp boundaries and another special panel possessing unknown natural flaws (as a result of intentional manufacturing process). Finally, the information obtained from the millimeter wave images was correlated with information obtained from post-imaging dissection of the panel (i.e., corroborating detected shapes and locations of natural flaws with those obtained in the images). It was shown that 91% of the flaws (such as extended and localized voids and delaminations) were successfully identified using this millimeter wave imaging system.

Author

*Millimeter Waves; High Resolution; Imaging Techniques; Insulation; Foams; Structural Failure; Delaminating; External Tanks*

**20080048181** NASA Glenn Research Center, Cleveland, OH, USA

**Lightweight Carbon-Carbon High-Temperature Space Radiator**

Miller, W.O.; Shih, Wei; NASA Tech Briefs, September 2008; September 2008, pp. 43; In English; See also [20080048125](#)  
Report No.(s): LEW-18210-1; Copyright; Avail.: CASI: [A01](#), Hardcopy  
ONLINE: <http://www.techbriefs.com/component/content/article/3156>

A document summarizes the development of a carbon-carbon composite radiator for dissipating waste heat from a spacecraft nuclear reactor. The radiator is to be bonded to metal heat pipes and to operate in conjunction with them at a temperature approximately between 500 and 1,000 K. A goal of this development is to reduce the average areal mass density of a radiator to about 2 kg/m(exp 2) from the current value of approximately 10 kg/m(exp 2) characteristic of spacecraft radiators made largely of metals. Accomplishments thus far include: (1) bonding of metal tubes to carbon-carbon material by a carbonization process that includes heating to a temperature of 620 C; (2) verification of the thermal and mechanical integrity of the bonds through pressure-cycling, axial-shear, and bending tests; and (3) construction and testing of two prototype heat-pipe/carbon-carbon-radiator units having different radiator areas, numbers of heat pipes, and areal mass densities. On the basis of the results achieved thus far, it is estimated that optimization of design could yield an areal mass density of 2.2 kg/m (exp 2) close to the goal of 2 kg/m(exp 2).

Author

*Carbon-Carbon Composites; Spacecraft Radiators; Research and Development; Design Optimization; Prototypes; Weight Reduction*

## SPACECRAFT INSTRUMENTATION AND ASTRIONICS

Includes the design, manufacture, or use of devices for the purpose of measuring, detecting, controlling, computing, recording, or processing data related to the operation of space vehicles or platforms. For related information see also *06 Avionics and Aircraft Instrumentation*; for spaceborne instruments not integral to the vehicle itself see *35 Instrumentation and Photography*; for spaceborne telescopes and other astronomical instruments see *89 Astronomy*.

**20080048138** Aerospace Corp., USA; California Inst. of Tech., Pasadena, CA, USA

### **SPICE Module for the Satellite Orbit Analysis Program (SOAP)**

Coggi, John; Carnright, Robert; Hildebrand, Claude; NASA Tech Briefs, September 2008; September 2008, pp. 61-62; In English; See also [20080048125](#)

Report No.(s): NPO-45057; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3216>

A SPICE module for the Satellite Orbit Analysis Program (SOAP) precisely represents complex motion and maneuvers in an interactive, 3D animated environment with support for user-defined quantitative outputs. (SPICE stands for Spacecraft, Planet, Instrument, Camera-matrix, and Events). This module enables the SOAP software to exploit NASA mission ephemeris represented in the JPL Ancillary Information Facility (NAIF) SPICE formats. Ephemeris types supported include position, velocity, and orientation for spacecraft and planetary bodies including the Sun, planets, natural satellites, comets, and asteroids. Entire missions can now be imported into SOAP for 3D visualization, playback, and analysis. The SOAP analysis and display features can now leverage detailed mission files to offer the analyst both a numerically correct and aesthetically pleasing combination of results that can be varied to study many hypothetical scenarios. The software provides a modeling and simulation environment that can encompass a broad variety of problems using orbital prediction. For example, ground coverage analysis, communications analysis, power and thermal analysis, and 3D visualization that provide the user with insight into complex geometric relations are included. The SOAP SPICE module allows distributed science and engineering teams to share common mission models of known pedigree, which greatly reduces duplication of effort and the potential for error. The use of the software spans all phases of the space system lifecycle, from the study of future concepts to operations and anomaly analysis. It allows SOAP software to correctly position and orient all of the principal bodies of the Solar System within a single simulation session along with multiple spacecraft trajectories and the orientation of mission payloads. In addition to the 3D visualization, the user can define numeric variables and x-y plots to quantitatively assess metrics of interest.

Author

*Natural Satellites; Satellite Orbits; Solar System; Computer Animation; Computer Programs*

## SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information see also *07 Aircraft Propulsion and Power*, *28 Propellants and Fuels*, *15 Launch Vehicles and Launch Operations*, and *44 Energy Production and Conversion*.

**20080047350** NASA Glenn Research Center, Cleveland, OH, USA

### **The In-Space Propulsion Technology Project Low-Thrust Trajectory Tool Suite**

Dankanich, John W.; [2008]; 3 pp.; In English

Contract(s)/Grant(s): NNC07QA54D; WBS 346620.01.03.01; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047350>

The ISPT project released its low-thrust trajectory tool suite in March of 2006. The LTTT suite tools range in capabilities, but represent the state-of-the art in NASA low-thrust trajectory optimization tools. The tools have all received considerable updates following the initial release, and they are available through their respective development centers or the ISPT project website.

Author

*Low Thrust; Trajectories; Trajectory Analysis; Trajectory Optimization; Propulsion*

**20080047355** NASA Glenn Research Center, Cleveland, OH, USA

**A New Paradigm for Flow Analyses and a Novel Technique to Enhance the Thrust from Scarfed Nozzles**

Chang, I-Shih; Chang, Sin-Chung; Glick, Robert L.; Chang, Chau-Lyan; Glick, Mailyn P.; September 29, 2008; 12 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): FA8802-04-C-0001; WBS 599489.02.07.03.04.03.01

Report No.(s): IAC-08-C4.2.1; Copyright; Avail.: Other Sources

A new flow analysis paradigm and a novel technique to enhance scarfed nozzle thrust are presented. The new paradigm, the space-time Conservation Element and Solution Element (CESE) method, a truly unsteady and genuinely multi-dimensional flow solver that provides accurate solutions for Euler and Navier-Stokes flows, is well suited for next generation flow analyses. In this study, the space-time CESE method was applied to solve scarfed nozzles flow-fields. Nozzle scarfing is frequently used for vectoring control of a space propulsion sub-system; it reduces nozzle weight and length and lowers nozzle thrust. A novel technique to enhance scarfed nozzles' thrust is discussed and investigated. Results of 2D and 3D flow analyses are presented.

Author

*Flow Distribution; Nozzles; Unsteady Flow; Navier-Stokes Equation; Scarfing*

**20080047373** NASA Glenn Research Center, Cleveland, OH, USA

**NASA's In-Space Propulsion Technology Project Overview, Near-term Products and Mission Applicability**

Dankanich, John; Anderson, David J.; August 2008; 13 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC07QA54D; WBS 346620.01.03.01; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047373>

The In-Space Propulsion Technology (ISPT) Project, funded by NASA's Science Mission Directorate (SMD), is continuing to invest in propulsion technologies that will enable or enhance NASA robotic science missions. This overview provides development status, near-term mission benefits, applicability, and availability of in-space propulsion technologies in the areas of aerocapture, electric propulsion, advanced chemical thrusters, and systems analysis tools. Aerocapture investments improved (1) guidance, navigation, and control models of blunt-body rigid aeroshells, 2) atmospheric models for Earth, Titan, Mars and Venus, and 3) models for aerothermal effects. Investments in electric propulsion technologies focused on completing NASA's Evolutionary Xenon Thruster (NEXT) ion propulsion system, a 0.6-7 kW throttle-able gridded ion system. The project is also concluding its High Voltage Hall Accelerator (HiVHAC) mid-term product specifically designed for a low-cost electric propulsion option. The primary chemical propulsion investment is on the high-temperature Advanced Material Bipropellant Rocket (AMBR) engine providing higher performance for lower cost. The project is also delivering products to assist technology infusion and quantify mission applicability and benefits through mission analysis and tools. In-space propulsion technologies are applicable, and potentially enabling for flagship destinations currently under evaluation, as well as having broad applicability to future Discovery and New Frontiers mission solicitations.

Author

*Propulsion System Configurations; Ion Propulsion; Liquid Rocket Propellants; Chemical Propulsion; Aerothermodynamics; Electric Propulsion; Temperature Effects; Rocket Engines; Propulsion System Performance*

**20080047414** NASA Glenn Research Center, Cleveland, OH, USA

**100-LBF LO2/LCH4 - Reaction Control Engine Technology Development for Future Space Vehicles**

Robinson, Philip J.; Veith, Eric M.; Hurlbert, Eric A.; Jimenez, Rafael; Smith, Timothy D.; September 29, 2008; 11 pp.; In English; International Astronautical Congress 2008, 29 Sep. 3 Oct. 2008, Glasgow, Scotland, UK; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC06CB64C; WBS 253225.01.03; Copyright; Avail.: CASI: [A03](#), Hardcopy

The National Aeronautics and Space Administration (NASA) has identified liquid oxygen (LO2)/liquid methane (LCH4) propulsion systems as promising options for some future space vehicles. NASA issued a contract to Aerojet to develop a 100-lbf (445 N) LO2/LCH4 Reaction Control Engine (RCE) aimed at reducing the risk of utilizing a cryogenic reaction control system (RCS) on a space vehicle. Aerojet utilized innovative design solutions to develop an RCE that can ignite reliably over a broad range of inlet temperatures, perform short minimum impulse bits (MIB) at small electrical pulse widths (EPW), and produce excellent specific impulse (Isp) across a range of engine mixture ratios (MR). These design innovations also provide a start transient with a benign MR, ensuring good thrust chamber compatibility and long life. In addition, this

RCE can successfully operate at MRs associated with main engines, enabling the RCE to provide emergency backup propulsion to minimize vehicle propellant load and overall system mass.

Author

*Liquid Oxygen; Propulsion System Configurations; Engine Design; Liquefied Gases; Specific Impulse; Methane; Cryogenics; Propellants; Propulsion System Performance*

**20080047425** NASA Glenn Research Center, Cleveland, OH, USA

**Polymeric Materials for Aerospace Power and Propulsion-NASA Glenn Overview**

Meador, Michael A.; February 04, 2008; 26 pp.; In English; High Temple Workshop, 4-7 Feb. 2008, Savannah, GA; Original contains color illustrations

Contract(s)/Grant(s): WBS 561581.02.10.03.06; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047425>

Use of lightweight materials in aerospace power and propulsion components can lead to significant reductions in vehicle weight and improvements in performance and efficiency. Polymeric materials are well suited for many of these applications, but improvements in processability, durability and performance are required for their successful use in these components. Polymers Research at NASA Glenn is focused on utilizing a combination of traditional polymer science and engineering approaches and nanotechnology to develop new materials with enhanced processability, performance and durability. An overview of these efforts will be presented.

Author

*Nanotechnology; Spacecraft Propulsion; Engine Parts; Weight Reduction; Polymers*

**20080047426** NASA Glenn Research Center, Cleveland, OH, USA

**New Frontiers AO: Advanced Materials Bi-propellant Rocket (AMBR) Engine Information Summary**

Liou, Larry C.; August 2008; 9 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 346620.01.03.01; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047426>

The Advanced Material Bi-propellant Rocket (AMBR) engine is a high performance ( $I_{sp}$ ), higher thrust, radiation cooled, storable bi-propellant space engine of the same physical envelope as the High Performance Apogee Thruster (HiPAT(TradeMark)). To provide further information about the AMBR engine, this document provides details on performance, development, mission implementation, key spacecraft integration considerations, project participants and approach, contact information, system specifications, and a list of references. The In-Space Propulsion Technology (ISPT) project team at NASA Glenn Research Center (GRC) leads the technology development of the AMBR engine. Their NASA partners were Marshall Space Flight Center (MSFC) and Jet Propulsion Laboratory (JPL). Aerojet leads the industrial partners selected competitively for the technology development via the NASA Research Announcement (NRA) process.

Author

*Liquid Rocket Propellants; Rocket Engines; Thrust; High Thrust; Apogees*

**20080047435** NASA Glenn Research Center, Cleveland, OH, USA

**Observation of Turbulent Mixing in Lean Direct Injection (LDI) Swirl-Stabilized Combustion at Elevated Pressure Via Single-Shot Spontaneous Raman Spectroscopy**

Kojima, Jun; Nguyen, Quang-Viet; October 2007; 30 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.19.03; Copyright; Avail.: Other Sources

We report the first quantitative single-shot multiscalar data obtained from a realistic air-fed lean direct injection (LDI) burner operating on gaseous methane ( $CH_4$ ) fuel at elevated pressure (5 atm) using a single-shot spontaneous Raman spectroscopy. From a statistical analysis of the multiscalar data, we present spatially-mapped probability density functions (PDFs) of the concentration of  $CH_4$  and  $O_2$ , and the instantaneous temperature. The measured three-scalar correlations and PDFs provide insights into the nature and extent of the turbulent mixing process and its impact on the subsequent combustion process. The data will also prove to be well-suited for comparison with the various turbulence-chemistry interaction models such as large-eddy simulation (LES). The swirl-stabilized flame investigated in this report was characterized as a partially-premixed combustion and dominated by the high-degree turbulence-chemistry interactions achieved by the LDI configuration. While a majority of the data indicated complete or near-complete reaction including stoichiometric combustion,

considerable numbers of samples exhibited pre-heated non-reacted mixing-only conditions or incomplete combustion with substantial fuel residual at intermediate temperatures.

Author

*Turbulent Mixing; Turbulence Models; Statistical Analysis; Probability Density Functions; Large Eddy Simulation; Premixing; Gaseous Fuels; Combustion*

**20080047440** NASA Glenn Research Center, Cleveland, OH, USA

**Propulsion and Cryogenics Advanced Development (PCAD) Project Propulsion Technologies for the Lunar Lander**

Klem, Mark D.; Smith, Timothy D.; February 12, 2008; 20 pp.; In English; 6th Space Technology and Applications International Forum: Space Colonization, 10-14 Feb. 2008, Albuquerque, NM, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047440>

The Propulsion and Cryogenics Advanced Development (PCAD) Project in the Exploration Technology Development Program is developing technologies as risk mitigation for Orion and the Lunar Lander. An integrated main and reaction control propulsion system has been identified as a candidate for the Lunar Lander Ascent Module. The propellants used in this integrated system are Liquid Oxygen (LOX)/Liquid Methane (LCH<sub>4</sub>) propellants. A deep throttle pump fed Liquid Oxygen (LOX)/Liquid Hydrogen (LH<sub>2</sub>) engine system has been identified for the Lunar Lander Descent Vehicle. The propellant combination and architecture of these propulsion systems are novel and would require risk reduction prior to detailed design and development. The PCAD Project addresses the technology requirements to obtain relevant and necessary test data to further the technology maturity of propulsion hardware utilizing these propellants. This plan and achievements to date will be presented.

Author

*Lunar Module; Propulsion System Configurations; Liquid Oxygen; Hydrogen Oxygen Engines; Cryogenics; Systems Integration; Liquefied Gases*

**20080047459** NASA Glenn Research Center, Cleveland, OH, USA

**Characterization and Simulation of Thermoacoustic Instability in a Low Emissions Combustor Prototype**

DeLaat, John C.; Paxson, Daniel E.; October 07, 2008; 23 pp.; In English; Fundamental Aeronautics Program Annual Meeting, 7-9 Oct. 2008, Atlanta, GA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.19.04; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047459>

Extensive research is being done toward the development of ultra-low-emissions combustors for aircraft gas turbine engines. However, these combustors have an increased susceptibility to thermoacoustic instabilities. This type of instability was recently observed in an advanced, low emissions combustor prototype installed in a NASA Glenn Research Center test stand. The instability produces pressure oscillations that grow with increasing fuel/air ratio, preventing full power operation. The instability behavior makes the combustor a potentially useful test bed for research into active control methods for combustion instability suppression. The instability behavior was characterized by operating the combustor at various pressures, temperatures, and fuel and air flows representative of operation within an aircraft gas turbine engine. Trends in instability behavior vs. operating condition have been identified and documented. A simulation developed at NASA Glenn captures the observed instability behavior. The physics-based simulation includes the relevant physical features of the combustor and test rig, employs a Sectored 1-D approach, includes simplified reaction equations, and provides time-accurate results. A computationally efficient method is used for area transitions, which decreases run times and allows the simulation to be used for parametric studies, including control method investigations. Simulation results show that the simulation exhibits a self-starting, self-sustained combustion instability and also replicates the experimentally observed instability trends vs. operating condition. Future plans are to use the simulation to investigate active control strategies to suppress combustion instabilities and then to experimentally demonstrate active instability suppression with the low emissions combustor prototype, enabling full power, stable operation.

Author

*Gas Turbine Engines; Pressure Oscillations; Air Flow; Combustion Stability; Fuel-Air Ratio*



**20080047732** NASA Glenn Research Center, Cleveland, OH, USA

**The NASA Evolutionary Xenon Thruster (NEXT): NASA's Next Step for U.S. Deep Space Propulsion**

Schmidt, George R.; Patterson, Michael J.; Benson, Scott W.; September 29, 2008; 8 pp.; In English; IAC 2008 59th International Astronautical Congress, 29 Sep. - 3 Oct. 2008, Glasgow, Scotland, UK; Original contains color illustrations

Contract(s)/Grant(s): WBS 562282.01.03.02.02.15; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047732>

NASA's Evolutionary Xenon Thruster (NEXT) project is developing next generation ion propulsion technologies to enhance the performance and lower the costs of future NASA space science missions. This is being accomplished by producing Engineering Model (EM) and Prototype Model (PM) components, validating these via qualification-level and integrated system testing, and preparing the transition of NEXT technologies to flight system development. The project is currently completing one of the final milestones of the effort, that is operation of an integrated NEXT Ion Propulsion System (IPS) in a simulated space environment. This test will advance the NEXT system to a NASA Technology Readiness Level (TRL) of 6 (i.e., operation of a prototypical system in a representative environment), and will confirm its readiness for flight. Besides its promise for upcoming NASA science missions, NEXT may have excellent potential for future commercial and international spacecraft applications.

Author

*Ion Propulsion; Ion Engines; Systems Engineering; Cost Reduction; Systems Integration*

**20080047824** Air Force Research Lab., Edwards AFB, CA USA; Michigan Univ., Ann Arbor, MI, USA; Engineering Research and Consulting, Inc., USA

**Standardization of Hall Thruster Efficiency Analysis: Methodology and Historical Perspective**

Brown, Daniel L; Larson, C W; Hargus, Jr, William A; Gallimore, Alec D; Feb 25, 2008; 27 pp.; In English

Contract(s)/Grant(s): Proj-33SP

Report No.(s): AD-A489529; AFRL-RZ-ED-JA-2008-112; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The rocket power efficiency equation was analytically decomposed to explicitly account for the effects of energy conversion losses, plume divergence, and the velocity distribution function of the propellant jet. In this approach, thruster efficiency is the product of (1) energy efficiency and (2) propellant utilization efficiency. Energy efficiency is expressed as the product of voltage utilization efficiency and current utilization efficiency, and incorporates losses from Joule heating, radiation, and ionization processes. Energy efficiency contains no information about the vector properties of the jet. Propellant utilization efficiency incorporates losses from plume divergence and ion jet composition, and is unity for 100% ionization to a single ion species whose velocity vectors are directed along the thrust axis. The efficiency architecture is derived from first principles and is applicable to all propulsion employing electrostatic acceleration, including Hall thrusters and ion engines. The analysis is compared to past methodologies and is illustrated with thrust and far-field plume measurements of a laboratory Hall thruster.

DTIC

*Hall Thrusters; Histories; Standardization*

**20080048092** NASA Marshall Space Flight Center, Huntsville, AL, USA

**FPP Results**

Ferguson, Dale C.; [2007]; 7 pp.; In English; Original contains color illustrations; No Copyright; Avail.: Other Sources

The Floating Potential Probe (FPP) operated on the International Space Station (ISS) from December 2000 to April 2001. During that time, it took many measurements of the ISS floating potential and the Low Earth Orbit (LEO) electron density and temperature. Those measurements were used as inputs to the Environment WorkBench (EWB) model of ISS potentials (originally developed by the Science Applications International Corporation [SAIC] for NASA, but now sometimes called the Boeing Plasma Interaction Model [PIM]) that is used even today to predict charging levels for ISS. FPP is now completely defunct, having been removed and jettisoned from ISS. With the advent of the new Floating Potential Measurement Unit (FPMU) on ISS, and the beginning of ISS operations with two large sets of solar array panels instead of just one, a review of FPP measurements can offer comparisons with the new FPMU data and perhaps improve the accuracy of future ISS charging predictions. In particular, FPP measurements during times of low electron temperature and high electron density (the times of worst ISS charging) will be brought forward for comparison with the newly obtained FPMU data.

Author

*International Space Station; Space Probes; Plasmas (Physics)*

**20080048098** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Operational Characteristics of a Low-Energy FARAD Thruster**

Polzin, Kurt A.; Rose, M. Frank; Miller, Robert; July 20, 2008; 8 pp.; In English; 44th AIAA/ASME/SAE/ASEE Joint Propulsion Conference/American Institute of Aeronautics and Astronautics, 20-23 Jul. 2008, Hartford, CT, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNM06AA17G

Report No.(s): AIAA Paper-2008-5011; Copyright; Avail.: CASI: [A02](#), Hardcopy

Data from a 100 J per pulse electrodeless accelerator employing pulsed RF-preionization are presented to gain insight into the accelerator's operating characteristics. The data suggest that the propellant distribution is highly unoptimized, with most of the gas inaccessible to the discharge and the remainder mostly concentrated at the inner radius of the coil. The pulsed RF-preionization discharge produces a visible plasma, but like the gas distribution it mostly appears concentrated at the inner radius of the thruster. Magnetic field probes in the discharge point to a current sheet that is not magnetically impermeable. These data also exhibit signs of nonrepeatability, and time-integrated discharge photography shows signs of spatial nonuniformity in both the radial and azimuthal directions. Terminal voltage measurements on the two capacitor banks of the thruster do not exhibit the asymmetric nature (in time) typically associated with an efficient pulsed plasma accelerator. Based on the experimental evidence, the poor performance of the thruster is thought to be due to insufficient preionization, which at these low discharge energy levels severely limits the ability of the main current pulse to couple with and effectively accelerate the propellant.

Author

*Plasma Accelerators; Performance Tests; Technology Assessment; Research and Development; Electric Propulsion; Spacecraft Propulsion*

**20080048103** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Preliminary Development and Testing of a Self-Injecting Gallium MPD Thruster**

Thomas, Robert E.; Burton, Rodney L.; Polzin, Kurt A.; July 20, 2008; 12 pp.; In English; 44th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, 20-23 Jul. 2008, Hartford, CT, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Discharge current and terminal voltage measurements were performed on a gallium electromagnetic thruster at discharge currents in the range of 20-54 kA. It was found that the arc impedance has a value of 6-7 m( $\Omega$ ) at peak current. The absence of high-frequency oscillations in the terminal voltage trace indicates lack of the 'onset' condition often seen in MPD arcs, suggesting that a sufficient number of charge carriers are present for current conduction. The mass ablated per pulse was not measured experimentally; however the mass flow rate was calculated using an ion current assumption and an anode power balance. Measurement of arc impedance predicts a temperature of 3.5 eV which from Saha equilibrium corresponds to  $Z = 2.0 - 3.5$ , and assuming  $Z = 2$  yields an Isp of 3000 s and thrust efficiency of 50%.

Author

*Gallium; Mass Flow Rate; Magnetoplasmadynamic Thrusters; Impedance Measurement; Electrical Measurement; Charge Carriers*

**20080048109** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Validation of High-Fidelity CFD Simulations for Rocket Injector Design**

Tucker, P. Kevin; Menon, Suresh; Merkle, Charles L.; Oefelein, Joseph C.; Yang, Vigor; July 21, 2008; 20 pp.; In English; 44th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 21-23 Jul. 2008, Hartford, CT, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Computational fluid dynamics (CFD) has the potential to improve the historical rocket injector design process by evaluating the sensitivity of performance and injector-driven thermal environments to the details of the injector geometry and key operational parameters. Methodical verification and validation efforts on a range of coaxial injector elements have shown the current production CFD capability must be improved in order to quantitatively impact the injector design process. This paper documents the status of a focused effort to compare and understand the predictive capabilities and computational requirements of a range of CFD methodologies on a set of single element injector model problems. The steady Reynolds-Average Navier-Stokes (RANS), unsteady Reynolds-Average Navier-Stokes (URANS) and three different approaches using the Large Eddy Simulation (LES) technique were used to simulate the initial model problem, a single element coaxial injector using gaseous oxygen and gaseous hydrogen propellants. While one high-fidelity LES result matches the experimental combustion chamber wall heat flux very well, there is no monotonic convergence to the data with increasing computational tool fidelity. Systematic evaluation of key flow field regions such as the flame zone, the head end recirculation

zone and the downstream near wall zone has shed significant, though as of yet incomplete, light on the complex, underlying causes for the performance level of each technique. 1 Aerospace Engineer and Combustion CFD Team Leader, MS ER42, NASA MSFC, AL 35812, Senior Member, AIAA. 2 Professor and Director, Computational Combustion Laboratory, School of Aerospace Engineering, 270 Ferst Dr., Atlanta, GA 30332, Associate Fellow, AIAA. 3 Reilly Professor of Engineering, School of Mechanical Engineering, 585 Purdue Mall, West Lafayette, IN 47907, Fellow, AIAA. 4 Principal Member of Technical Staff, Combustion Research Facility, 7011 East Avenue, MS9051, Livermore, CA 94550, Associate Fellow, AIAA. 5 J. L. and G. H. McCain Endowed Chair, Mechanical Engineering, 104 Research Building East, University Park, PA 16802, Fellow, AIAA. American Institute of Aeronautics and Astronautics 1

Author

*Computational Fluid Dynamics; Large Eddy Simulation; Flow Distribution; Combustion Chambers; Aerospace Engineering; Propellants; Navier-Stokes Equation; Injectors*

**20080048211** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Reusability Studies for Ares I and Ares V Propulsion**

Williams, Thomas J.; Priskos, Alex S.; Schorr, Andrew A.; Barrett, Greg; July 20, 2008; 14 pp.; In English; Joint Propulsion Conference, 20-23 Jul. 2008, Hartford, CT, USA; Original contains color illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080048211>

With a mission to continue to support the goals of the International Space Station (ISS) and explore beyond Earth orbit, the USA National Aeronautics and Space Administration (NASA) is in the process of launching an entirely new space exploration initiative, the Constellation Program. Even as the Space Shuttle moves toward its final voyage, Constellation is building from nearly half a century of NASA spaceflight experience, and technological advances, including the legacy of Shuttle and earlier programs such as Apollo and the Saturn V rocket. Out of Constellation will come two new launch vehicles: the Ares I crew launch vehicle and the Ares V cargo launch vehicle. With the initial goal to seamlessly continue where the Space Shuttle leaves off, Ares will firstly service the Space Station. Ultimately, however, the intent is to push further: to establish an outpost on the Moon, and then to explore other destinations. With significant experience and a strong foundation in aerospace, NASA is now progressing toward the final design of the First Stage propulsion system for the Ares I. The new launch vehicle design will considerably increase safety and reliability, reduce the cost of accessing space, and provide a viable growth path for human space exploration. To achieve these goals, NASA is taking advantage of Space Shuttle hardware, safety, reliability, and experience. With efforts to minimize technical risk and life-cycle costs, the First Stage office is again pulling from NASA's strong legacy in aerospace exploration and development, most specifically the Space Shuttle Program. Trade studies have been conducted to evaluate life-cycle costs, expendability, and risk reduction. While many first stage features have already been determined, these trade studies are helping to resolve the operational requisites and configuration of the first stage element. This paper first presents an overview of the Ares missions and the genesis of the Ares vehicle design. It then looks at one of the most important trade studies to date, the 'Ares I First Stage Expendability Trade Study.' The purpose of this study was to determine the utility of flying the first stage as an expendable booster rather than making it reusable. To lower the study complexity, four operational scenarios (or cases) were defined. This assessment then included an evaluation of the development, reliability, performance, and transition impacts associated with an expendable solution. This paper looks at these scenarios from the perspectives of cost, reliability, and performance.

Author

*Ares I Launch Vehicle; Ares V Cargo Launch Vehicle; Propulsion; Reliability; Earth Orbits; Life Cycle Costs*

**20080048219** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Nonnuclear Testing of Fission Systems: Advanced Thermal Simulator Design and Test**

Bragg-Sitton, Shannon M.; Dickens, Ricky; Dixon, David; Reid, Robert; Adams, Mike; Davis, Joe; [2008]; 34 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

Fission power can enable the accomplishment of ambitious space missions by providing rapid, affordable access to any point in the solar system. Despite the tremendous potential of space fission systems, the development and application of these systems has proven elusive. Previous space fission development programs have relied heavily on nuclear testing for system development, causing many programs to delay the accomplishment of major milestones and to experience cost overruns. The recent genesis of space nuclear reactor development has focused on systems that can be developed in an affordable and timely fashion, while adhering to a strict safety culture. These goals lend support to the development of a strong nonnuclear (electrically heated) test program that can be applied in component and system testing, characterizing system properties and behaviors and identifying potential failures both quickly and accurately. Performed in the early stages of design, nonnuclear

tests can provide valuable input to overall system design. When used in coordination with a judicious selection of nuclear tests, this test approach can enhance the design process and lead to more rapid development of a flight system. In a nonnuclear test bed, electric heaters are used to simulate the heat from nuclear fuel. The work presented in this paper seeks to develop highly instrumented, high fidelity, electrically heated thermal simulators that represent fuel elements in a potential nuclear reactor design. The simulators that are currently being tested correspond to a liquid metal cooled reactor design that could be applied for Lunar surface power. These simulators are designed to meet the geometric and power requirements of a proposed surface power reactor design, accommodate testing of various axial power profiles, and incorporate imbedded instrumentation. This paper reports the results of thermal simulator analysis and testing in a bare element configuration, which does not incorporate active heat removal, and testing in a water-cooled calorimeter designed to mimic the heat removal that would be experienced in a reactor core.

Author

*Fission; Aerospace Systems; Propulsion; Nuclear Fuels; Heaters; Thermal Analysis; Nuclear Reactors; Reactor Design; Liquid Metal Cooled Reactors*

## 23

### CHEMISTRY AND MATERIALS (GENERAL)

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see *categories 25 through 29*. For astrochemistry see category *90 Astrophysics*.

**20080047255** Chinese Inst. of Engineers, Taipei, Taiwan, Province of China

**Journal of the Chinese Institute of Engineers, Vol. 31, No. 5, July 2008. Transactions of the Chinese Institute of Engineers, Series A**

Jul. 2008; 172 pp.; In English

Report No.(s): PB2009-101685; No Copyright; Avail.: CASI: [A08](#), Hardcopy

This document publishes original research papers on all aspects of engineering and related fields in applied sciences.

NTIS

*China; Engineers*

**20080047271** Forest Products Lab., Madison, WI USA; Wisconsin Univ., Madison, WI, USA

**Engineering Properties of Douglas-Fir Lumber Reclaimed from Deconstructed Buildings**

Falk, R. H.; Maul, D. G.; Cramer, S. M.; Evans, J.; Herian, V.; January 2008; 51 pp.; In English

Report No.(s): PB2009-102368; FPL-FSRP-650; No Copyright; Avail.: CASI: [A04](#), Hardcopy

A vast wood resource exists in our Nations wood-framed building infrastructure. As the buildings in this infrastructure age and are remodeled or removed for redevelopment, the wood framing residing in these buildings has the potential to be recovered for reuse. However, little technical information exists on the residual engineering properties of reclaimed dimensional lumber. Our study was undertaken to quantify the engineering strength and stiffness of dimensional Douglas-fir 2-by lumber recovered from building dismantlement or deconstruction. These data can serve as a basis for establishing formal recognition of this resource in current grading rules and engineering design standards.

NTIS

*Buildings; Conifers; Stiffness*

**20080047359** NASA Glenn Research Center, Cleveland, OH, USA

**Novel Carbon Dioxide MicroSensor Based on Tin Oxide Nanomaterial Doped with Copper Oxide**

Xu, Jennifer C.; Hunter, Gary W.; Lukco, Dorothy; Liu, Chung-Chiun; Ward, Benjamin J.; [2008]; 2 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 645846.02.07.03.03.01; Copyright; Avail.: Other Sources

Carbon dioxide (CO<sub>2</sub>) is one of the major indicators of fire and therefore its measurement is very important for low-false-alarm fire detection and emissions monitoring. However, only a limited number of CO<sub>2</sub> sensing materials exist due to the high chemical stability of CO<sub>2</sub>. In this work, a novel CO<sub>2</sub> microsensor based on nanocrystalline tin oxide (SnO<sub>2</sub>) doped with copper oxide (CuO) has been successfully demonstrated. The CuO-SnO<sub>2</sub> based CO<sub>2</sub> microsensors are fabricated by means of microelectromechanical systems (MEMS) technology and solgel nanomaterial-synthesis processes. At a doping level of CuO : SnO<sub>2</sub> = 1:8 (molar ratio), the resistance of the sensor has a linear response to CO<sub>2</sub> concentrations for the range of

1% to 4% CO<sub>2</sub> in air at 450 C. This approach has demonstrated the use of SnO<sub>2</sub>, typically used for the detection of reducing gases, in the detection of an oxidizing gas.

Author

*Carbon Dioxide Concentration; Microelectromechanical Systems; Copper Oxides; Detection; Doped Crystals; Sol-Gel Processes; Tin Oxides*

**20080047424** NASA Glenn Research Center, Cleveland, OH, USA

**Aromatic Diimides - Potential Dyes for Use in Smart Films and Fibers**

Meador, Michael A.; Tyson, Daniel S.; Ilhan, Faysal; Carbaugh, Ashley; June 03, 2008; 44 pp.; In English; Advances in Colorants, Chemicals, Finishes and Fibrous Materials Symposium, 3-4 Jun. 2008, Greenville, SC, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC07BA13B; WBS 561581.02.10.03.06; Copyright; Avail.: CASI: [A03](#), Hardcopy

New aromatic diimide fluorescent dyes have been prepared with potential for use as chemical sensors and in chromogenic polymers. These dyes have been designed to utilize excited state electron transfer reactions as the means for sensing chemical species. For example, an aniline end-capped anthryl diimides functions effectively as an 'on-off' sensor for pH and the detection of phosphoryl halide based chemical warfare agents, such as Sarin. In the absence of analytes, fluorescence from this dye is completely quenched by excited state electron transfer from the terminal amines. Reaction of these amines inhibits electron transfer and activates the fluorescence of the dye. Another substituted anthryl diimide is presented with the capability to detect pH and nitroaromatic compounds, such as TNT. Films prepared by doping small amounts (less than 0.1 weight percent) of several of these dyes in polymers such as linear low density polyethylene exhibit thermochromism. At room temperature, these films fluoresce reddish-orange. Upon heating, the fluorescence turns green. This process is reversible cooling the films to room temperature restores the orange emission.

Author

*Dyes; Aromatic Compounds; Smart Materials; Fluorescence; Chemical Warfare*

**20080047453** NASA Glenn Research Center, Cleveland, OH, USA

**High Temperature Aerogels for Thermal Protection Systems**

Hurwitz, Frances I.; Mbah, Godfrey C.; January 27, 2008; 24 pp.; In English; 32nd Annual Conference on Composites, Materials and Structures, 27 Jan. - 1 Feb. 2008, Daytona Beach, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.16.03; Copyright; Avail.: CASI: [A03](#), Hardcopy

High temperature aerogels in the Al<sub>2</sub>O<sub>3</sub>-SiO<sub>2</sub> system are being investigated as possible constituents for lightweight integrated thermal protection system (TPS) designs for use in supersonic and hypersonic applications. Gels are synthesized from ethoxysilanes and AlCl<sub>3</sub>.6H<sub>2</sub>O, using an epoxide catalyst. The influence of Al:Si ratio, solvent, water to metal and water to alcohol ratios on aerogel composition, morphology, surface area, and pore size distribution were examined, and phase transformation on heat treatment characterized. Aerogels have been fabricated which maintain porous, fractal structures after brief exposures to 1000 C. Incorporation of nanofibers, infiltration of aerogels into SiC foams, use of polymers for crosslinking the aerogels, or combinations of these, offer potential for toughening and integration of TPS with composite structure. Woven fabric composites having Al<sub>2</sub>O<sub>3</sub>-SiO<sub>2</sub> aerogels as a matrix also have been fabricated. Continuing work is focused on reduction in shrinkage and optimization of thermal and physical properties.

Author

*Aluminum Oxides; Silicon Dioxide; Aerogels; High Temperature; Thermal Protection; Thermodynamic Properties; Fractals; Heat Treatment*

**20080047486** Naval Ammunition Depot, Crane, IN USA

**Initial Feasibility Study of the Use of Polyurethane Foam in Conjunction with a Tension Structure as a Roof System**

Smith, Alvin; Colbert, Ted R; Dec 17, 1970; 27 pp.; In English

Report No.(s): AD-A489016; NAD-CR-RDTR-177; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489016>

A method of covering an octagon shaped area with a polyurethane roof supported on tension cables is discussed herein. The proposed roof structure is comprised primarily of a center supporting column, tension cables, compression ring, perimeter

columns, and foam roof system. It was concluded from the material covered in this report that construction of this type of roof system is economically and structurally feasible.

DTIC

*Feasibility; Foams; Polyurethane Foam; Polyurethane Resins; Roofs*

**20080047525** Air Force Research Lab., Edwards AFB, CA USA

**Design of Energetic Ionic Liquids**

Boatz, Jerry A; Li, Hui; Gordon, Mark S; Aug 27, 2007; 5 pp.; In English

Contract(s)/Grant(s): Proj-23030423

Report No.(s): AD-A489372; AFRL-PR-ED-JA-2007-417; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489372>

An essential need of the US Air Force is the discovery, development, and fielding of new, energetic materials for advanced chemical propulsion in space and missile applications. Some of the key factors driving the requirement for new chemical propellants include: (a) improved performance in terms of increased specific impulse and density, (b) reduced sensitivity to external stimuli such as impact, friction, shock, and electrostatic discharge, and (c) mitigation of environmental and toxicological hazards (and the resulting costs) associated with currently used propellants.

DTIC

*Electrostatics; Explosives; Hydrazines; Liquids; Propellants*

**20080047699** Texas A&M Univ., College Station, TX USA

**Guidelines for Routine Maintenance of Concrete Pavement**

su Jung, Y.; Freeman, T. J.; Zollinger, D. G.; Jul. 2008; 146 pp.; In English

Report No.(s): PB2009-102117; REPT-0-5821-1; No Copyright; Avail.: National Technical Information Service (NTIS)

Concrete pavement has shown great performance in urban area and interstate highway settings for many years because of its low maintenance requirements and capability for long service life. However, rapidly increasing heavy traffic accelerates pavement deterioration and increases the need for more maintenance than in the past. If proper maintenance is not employed at low levels of deterioration, in a timely manner, acute degradation of pavement serviceability will occur and major repair costs may be needed. This report discusses the visual identification of various distress types and introduces evaluation techniques using nondestructive testing (NDT), which are key to determining proper routine maintenance activities. According to the areas selected from the simplified checklist of visual distress types, falling weight deflectometer (FWD) for structural condition evaluation, ground penetration radar (GPR) for detecting voids below the slab and the presence of trapped water, and dynamic cone penetrometer (DCP) for estimating the in situ strength of base and subgrade soils are used to provide current information on pavement condition for selection of needed repair methods using a simple, systematic decision process. Key routine maintenances activities are categorized into five levels: performance monitoring, preservative, functional concrete pavement repair (CPR), structural CPR, and remove and replace. During field investigations, poorly performing areas were identified and possible fixes determined as a means of guideline development.

NTIS

*Concretes; Highways; Maintenance; Pavements*

**20080047700** Texas Univ., Austin, TX, USA

**Evaluation of Bonded Concrete Overlay on IH 610 in Houston, Texas**

Kim, D.; Won, M.; Feb. 2008; 42 pp.; In English

Report No.(s): PB2009-102119; REPT-0-4893-3; Copyright; Avail.: National Technical Information Service (NTIS)

Bonded concrete overlays could provide cost-effective rehabilitation methods for structurally deficient Portland cement concrete (PCC) pavements. Four-inch bonded concrete overlay (BCO) placed in 1986 on Houstons IH 610 North has provided quite satisfactory performance for more than 20 years. Ten test sections were placed as a part of the BCO project during the construction, and after 20 years, they provide invaluable information on the long-term performance of BCO. The variables included in the test sections are reinforcement, coarse aggregate type, and existing pavement condition. The overall performance of 4-in. BCO has been excellent, even though there were a few patches made to address partial depth punchouts. Four-inch BCO over 8-in. continuously reinforced concrete pavement (CRCP) reduced deflections by about one-third, which is good evidence for BCOs ability to enhance the structural capacity of under-designed PCC pavements. Between the two

reinforcement types used, welded wire fabric and steel fibers, welded wire fabric provided better performance.

NTIS

*Concretes; Houston (TX); Pavements*

**20080047701** Texas Univ., Austin, TX, USA

**Inspection Manual for Self-Consolidating Concrete in Precast Members**

Koehler, E. P.; Fowler, D. W.; Aug. 2007; 35 pp.; In English

Report No.(s): PB2009-102121; REPT-0-5134-P1; Copyright; Avail.: National Technical Information Service (NTIS)

This manual discusses quality control and testing procedures for SCC used in precast elements. It is intended for use by field inspectors responsible for pre-qualifying mixtures and assuring concrete quality. The information presented is of a general nature and may not be appropriate for all projects. The manual is written on the assumption that the reader already has basic background knowledge of general concrete material properties and construction practices. Chapter 2 provides basic background information on SCC. Guidelines for SCC quality control and quality assurance are presented in Chapter 3. SCC is a specialized material and requires specialized knowledge to evaluate it.

NTIS

*Concretes; Inspection; Structural Design*

**20080047765** Molecular Imprints, Inc., Austin, TX, USA

**Method of Providing Desirable Wetting and Release Characteristics Between a Mold and a Polymerizable Composition**

Xu, F. Y., Inventor; Lad, P. B., Inventor; McMackin, I. M., Inventor; Truskett, V. N., Inventor; Fletcher, E. B., Inventor; 5 Oct 05; 30 pp.; In English

Contract(s)/Grant(s): NIST-70NANB4H3012

Patent Info.: Filed Filed 5 Oct 05; US-Patent-Appl-SN-11-244 428

Report No.(s): PB2008-105469; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention provides a method that features improved wetting characteristics while allowing preferential adhesion and release characteristics with respect to a substrate and a mold having imprinting material disposed therebetween. The method includes coating a surface of the mold with a volume of surfactant containing solution. The surfactant in the solution includes a hydrophobic component consisting essentially of a plurality of fluorine-containing molecules. The distribution of the plurality of the fluorine atoms in the fluorine-containing molecules, as well as the fluorine-containing molecules throughout the volume provides a desired contact angle with respect to a polymerizable composition disposed on the substrate. The contact angle is in a range of 50 degrees or less.

NTIS

*Molds; Patent Applications; Wetting*

**20080047788** Molecular Imprints, Inc., Austin, TX, USA

**Imprint Lithography Template to Facilitate Control of Liquid Movement**

McMackin, I. M., Inventor; Lad, P. B., Inventor; Truskett, V. N., Inventor; 4 Feb 05; 8 pp.; In English

Contract(s)/Grant(s): 70NANB4H3012

Patent Info.: Filed Filed 4 Feb 05; US-Patent-Appl-SN-11-051 941

Report No.(s): PB2008-105656; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The present invention is directed to a template that features a control surface extending from a periphery of a mold toward a recessed surface of the template forming an oblique angle between a portion of the control surface disposed proximate to the periphery.

NTIS

*Lithography; Patent Applications; Templates*

**20080047796** Air Force Research Lab., Edwards AFB, CA USA

**Reaction to Halogens and Interhalogens with 4-Halo-1,1,2-trifluorobut-1-enes: Rearrangement of 3-Membered Halonium to 5-Membered Trifluorotetramethylene Halonium Ion Intermediates and Comparison of Open-Chloronium Fluorosubstituted Ions to Fluorocarbocations from Protons (Preprint)**

Shellhamer, Dale F; Davenport, Kevyn J; Forberg, Heidi K; Herrick, Matthew P; Jones, Rachel N; Rodriguez, Sean J; Sanabria, Sunamita; Trager, Nicole N; Weiss, Ryan J; Heasley, Victor L; Feb 28, 2008; 22 pp.; In English

Contract(s)/Grant(s): NSF CHE-0345551; NSF CHE-0640547; NSF CHE-0417731; Proj-2303

Report No.(s): AD-A489565; AFRL-RZ-ED-JA-2008-082; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper we investigate the influence that a 4-halosubstituent has on formation of three-membered halonium ions and their rearrangement to five-membered ring intermediates when chloronium, bromonium and iodonium ions from alkenes 1, 2 and 3 are formed in aprotic solvent (Scheme 1). We also compare the open-ion chloronium ions with the open-carbocations from addition of a proton to terminal fluorosubstituted alkenes.

DTIC

*Alkenes; Chemical Reactions; Halogenation; Halogens; Halos; Ions; Protons*

**20080047818** Air Force Research Lab., Edwards AFB, CA USA; Clemson Univ., SC, USA

**Fluorinated Polyhedral Oligomeric Silsesquioxanes (F-POSS)**

Mabry, Joseph M; Vij, Ashwani; Iacono, Scott T; Viers, Brent D; Jan 2008; 5 pp.; In English

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A489458; AFRL-RZ-ED-JA-2007-480; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Water-repellent materials, possessing a high degree of hydrophobicity are currently under a spotlight. Preparative approaches are often inspired by naturally evolved biological systems. Specifically, a leaf of the lotus plant exhibits an inherent self-cleaning mechanism resulting from micron-sized waxy nodes protruding from its surface such that water is naturally repelled, removing any foreign debris. This cleansing mechanism, commonly referred to as the 'lotus effect,' has been artificially reproduced in order to prepare materials with pronounced hydrophobicity. Utilized techniques include surface patterning, molecular self-assembly, deposition, and etching. However, these examples often require aggressive chemical surface treatments, high temperature post-surface modification, or elaborate patterning. For such reasons, there exists a demand to engineer hydrophobic materials that are easy to prepare on a large scale.

DTIC

*Fluorination; Oligomers; Siloxanes*

**20080047916** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**Reactive Geochemical Transport Modeling of Concentrated Aqueous Solutions: Supplement to TOUGHREACT User's Guide for the Pitzer Ion-Interaction Model**

Zhang, G.; Spycher, N.; Xu, T.; Sonnenthal, E.; Steefel, C.; Dec. 2006; 48 pp.; In English

Report No.(s): DE2007-919388; LBNL-62718; No Copyright; Avail.: Department of Energy Information Bridge

In this report, we present: The Pitzer ion-interaction theory and models; Input file requirements for using the TOUGHREACT Pitzer ion-interaction model; and associated databases; Run-time error messages; Verification test cases and application examples. For the main code structure, features, overall solution methods, description of input/output files for parameters other than those specific to the implemented Pitzer model, and error messages, see the TOUGHREACT Users Guide (Xu et al., 2005). The TOUGHREACT Pitzer version runs on a DEC-alpha architecture CPU, under OSF1 V5.1, with Compaq Digital Fortran Compiler. The compiler run-time libraries are required for execution as well as compilation. The code also runs on Intel Pentium IV and higher-version CPU-based machines with Compaq Visual Fortran Compiler or Intel Fortran Compiler (integrated with the Microsoft Development Environment). The minimum hardware configuration should include 1 GB RAM and 1 GB (2 GB recommended) of available disk space.

NTIS

*Aqueous Solutions; Geochemistry; Reactivity*



**20080047952** NASA Johnson Space Center, Houston, TX, USA; Wyle Integrated Science and Engineering Group, Houston, TX, USA

**Development and Certification of Station Development Test Objective (SDTO) Experiment # 15012-U, ‘Near RealTime Water Quality Monitoring Demonstration for ISS Biocides Using Colorimetric Solid Phase Extraction (CSPE)’**

Gazda, Daniel B.; Nolan, Daniel J.; Rutz, Jeffrey A.; Shultz, John R.; Siperko, Lorraine M.; Porter, Marc D.; Lipert, Robert J.; Limardo, Jose G.; McCoy, J. Torin; [2009]; 1 pp.; In English; 39th International Conference on Environmental Systems, 12-16 Jul. 2009, Savannah, GA, USA; Copyright; Avail.: Other Sources; Abstract Only

Scientists and engineers from the Wyle Integrated Science and Engineering Group are working with researchers at the University of Utah and Iowa State University to develop and certify an experimental water quality monitoring kit based on Colorimetric Solid Phase Extraction (CSPE). The kit will be launched as a Station Development Test Objective (SDTO) experiment and evaluated on the International Space Station (ISS) to determine the acceptability of CSPE technology for routine inflight water quality monitoring. Iodine and silver, the biocides used in the US and Russian on-orbit water systems, will serve as test analytes for the technology evaluation. This manuscript provides an overview of the CSPE SDTO experiment and details the development and certification of the experimental water quality monitoring kit. Initial results from reagent and standard solution stability testing and environmental testing performed on the kit hardware are also reported.

Author

*Water Quality; Solid Phases; Stability Tests; Iodine; Silver; Extraction; Colorimetry; Water*

**20080047953** Akron Univ., Akron, OH, USA; NASA Glenn Research Center, Cleveland, OH, USA

**Evaluating Dimethyldiethoxysilane for use in Polyurethane Crosslinked Silica Aerogels**

Randall, Jason P.; Meador, Mary Ann B.; Jana, Sadhan C.; August 17, 2008; 2 pp.; In English; 236th American Chemical Society Meeting, 17-21 Aug. 2008, Philadelphia, PA, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Silica aerogels are highly porous materials which exhibit exceptionally low density and thermal conductivity. Their ‘pearl necklace’ nanostructure, however, is inherently weak; most silica aerogels are brittle and fragile. The strength of aerogels can be improved by employing an additional crosslinking step using isocyanates. In this work, dimethyldiethoxysilane (DMDES) is evaluated for use in the silane backbone of polyurethane crosslinked aerogels. Approximately half of the resulting aerogels exhibited a core/shell morphology of hard crosslinked aerogel surrounding a softer, uncrosslinked center. Solid state NMR and scanning electron microscopy results indicate the DMDES incorporated itself as a conformal coating around the outside of the secondary silica particles, in much the same manner as isocyanate crosslinking. Response surface curves were generated from compression data, indicating levels of reinforcement comparable to that in previous literature, despite the core/shell morphology.

Author

*Aerogels; Silicon Dioxide; Scanning Electron Microscopy; Isocyanates; Brittleness; Crosslinking; Nanostructure (Characteristics); Thermal Conductivity; Porous Materials*

**20080047975** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Effect of Stepwise Pressure Change on Porosity Evolution during Directional Solidification in Small Cylindrical Channels**

Grugel, R.N.; Lee, C.P.; Cox, M.C.; Blandford, B.T.; Anilkumar, A.V.; [2008]; 1 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

Controlled directional solidification experiments were performed in capillary channels, using nitrogen-saturated succinonitrile, to examine the effect of an in-situ stepwise processing pressure increase on an isolated pore evolution. Two experiments were performed using different processing pressure input profiles. The results indicate that a processing pressure increase has a transient effect on pore growth geometry characterized by an initial phase of decreasing pore diameter, followed by a recovery phase of increasing pore diameter. The experimental results also show that processing pressure can be used as a control parameter to either increase or terminate porosity formation. A theoretical model is introduced which indicates that the pore formation process is limited by the diffusion of solute-gas through the melt, and that the observed response to a pressure increase is attributed to the re-equilibration of solute concentration in the melt associated with the increased melt pressure.

Author

*Directional Solidification (Crystals); Cylindrical Bodies; Pressure Distribution; Pressure Effects; Porosity*

**20080048084** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Characterization of Sprayed Rigid Closed Cell Polyurethane Foam Insulation: Polyurethane Foam Properties Change with Depth from Substrate**

Aucoin, Jed P.; Spiers, Lance; Bourgeois, Tammy; Bowman, Erin; Drouant, Mary; Doris, Rando; Copeland, Joel; [2007]; 19 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Large aerospace structures which are used to contain and supply cryogenic fuels can be thermally insulated with sprayed, rigid, closed cell, polyurethane foam. The physical, chemical, and thermal properties of polyurethane are dependent upon the depth of polyurethane sprayed on foam insulation (SOFI). Foam that is insulated between other layers of foam display properties that are not observed at the rind (last cured surface) and foam near the adherent or metal substrate. Characterization of the foam's rind, inner or mid pass, and foam/substrate interfacial regions have been conducted in order to aid in future identifications of spray or curing anomalies that may affect the insulating and flight performance of large aerospace structures. Photography, stereomicroscopy, and scanning electron microscopy (SEM) were used to document and characterize the differences observed in the physical appearance of the foam at varying layers. At the rind, the highest cells appear to be dome-shaped features which protrude above a uniform smooth surface. The insulated foam or mid-pass foam contains cells which are uniform and circular. Foam cells near the substrate are elongated and display no uniformity. Spectroscopic analysis of varying depths of the foam yielded information on the chemical composition of the foam such as the presence of carbodi-imide bonds which have been previously reported to be found in the interior of the foam. Thermal analysis of polyurethane foam at the rind, mid-pass, and interfacial regions indicated a shift in a DTG thermogram for cured foam at the mid-pass near 250 C, which may be due to the presence of more thermally stable linkages. The analysis and characterization of manually sprayed cured polyurethane foam has generated awareness that this foam exhibits different properties at different depths. This work contributes to the understanding of sprayed, rigid, closed cell, polyurethane foam. Future interests include characterizing sprayed foam applications on various substrates in order to support any new space program hardware materials.

Author

*Foams; Polyurethane Foam; Insulation; Spectroscopic Analysis; Thermal Analysis; Thermodynamic Properties; Chemical Composition; Cryogenics*

**20080048108** Pennsylvania State Univ., University Park, PA, USA

**Phase Stability under Irradiation of Precipitates and Solid Solutions in Model Alloys and in ODS Alloys Relevant for Gen IV (Final Report, 2004-2007) (DOE NEER Project)**

Motta, A. T.; January 2007; 29 pp.; In English

Contract(s)/Grant(s): DE-FG07-04ID14613

Report No.(s): DE2007-918694; No Copyright; Avail.: National Technical Information Service (NTIS)

The overall objective of this program is to investigate the irradiation-altered phase stability of oxide precipitates in ODS steels and of model alloy solid solutions of associated systems. This information can be used to determine whether the favorable mechanical properties of these steels are maintained under irradiation, thus addressing one of the main materials research issues for this class of steels as identified by the GenIV working groups. The research program will also create fundamental understanding of the irradiation precipitation/dissolution problem by studying a model system in which the variables can be controlled and their effects understood individually. In the course of the project, representative samples of several ODS (oxide-dispersion strengthened) steels obtained from three different sources (Pacific Northwest Laboratory, CEASaclay and Japan Nuclear Corporation) were characterized using synchrotron radiation diffraction and transmission electron microscopy (TEM) to identify which phases were present and to characterize microstructure. During the third year, a model was developed to predict the evolution of microstructure in the thin films under irradiation, as part of the Ph.D. thesis of Djamel Kaoumi at Penn State.

NTIS

*Irradiation; Oxides; Stability; Steels*

**20080048287** National Inst. of Standards and Technology, Gaithersburg, MD USA

**Small Fixed-Point Cells for Use in Dry Well Block Calibrators**

Strouse, G. F.; January 2008; 6 pp.; In English

Report No.(s): PB2008-105914; No Copyright; Avail.: CASI: [A02](#), Hardcopy

As part of a research project for the Combined Calibration Group (CCG) of the U.S. Armed Forces, three rugged fixed-point cells were developed for use in dry well block calibrators (DWBCs). The small fixed-point cells of the water triple point (0.01 DGC), the Ga melting point (29.7646 DGC), and the In melting point (156.5985 DGC) are intended to provide either calibration temperature points for industrial platinum resistance thermometers (IPRTs) or single-point calibration checks

on IPRTs for the CCG mobile calibration facilities. While the ITS-90 indium fixed point is defined as a freezing point, realization of the three fixed-point cells in the melting mode simplifies the realization process, yet still provides the required expanded uncertainty ( $k=2$ ) of less than 10 mDGC. These three fixed-point cells were tested in two DWBCs using standard platinum resistance thermometers (SPRTs) by measuring realization plateaus and by direct comparisons with the PRT Laboratory reference cells. Adequacy of immersion of the thermometers in the cells during realization of the fixed points in the DWBCs was checked and the results were used to quantify the immersion uncertainty. This paper presents the realization methods, behavior of the fixed-point cells in the DWBCs and the uncertainty assigned to each of cells.

NTIS

*Calibrating; Drying; Fixed Points (Mathematics)*

**20080048306** Geological Survey, Reston, VA USA

**Questa Baseline and Pre-Mining Ground-Water Quality Investigation. 19. Leaching Characteristics of Compositated Materials from Mine Waste-Rock Piles and Naturally Altered Areas near Questa, New Mexico**

January 2006; 59 pp.; In English

Report No.(s): PB2008-105743; USGS-SIR-2006-5165; No Copyright; Avail.: National Technical Information Service (NTIS)

The goal of this study is to compare and contrast the leachability of metals and the acidity from individual mine waste-rock piles and natural erosional scars in the study area near Questa, New Mexico. Surficial multi-increment (composite) samples less than 2 millimeters in diameter from five waste-rock piles, nine erosional-scar areas, a less-altered site, and a tailings slurry-pipe sample were analyzed for bulk chemistry and mineralogy and subjected to two back-to-back leaching procedures. The first leaching procedure, the U.S. Geological Survey Field Leach Test (FLT), is a short-duration leach (5-minute shaking and 10-minute settling) and is intended to leach readily soluble materials. The FLT was immediately followed by an 18-hour, end-over-end rotation leaching procedure. Comparison of results from the back-to-back leaching procedures can provide information about reactions that may take place upon migration of leachates through changing geochemical conditions (for example, pH changes), both within the waste-rock and scar materials and away from the source materials.

NTIS

*Field Tests; Ground Water; Leaching; Mining; Rocks; Surveys; Water Quality*

**20080048338** Foley and Lardner, LLP, Madison, WI, USA

**Plastic Cantilevers for Force Microscopy**

van der Weide, D. W., Inventor; Paulson, C. A., Inventor; Stevens, A. G., Inventor; 21 Jan 05; 10 pp.; In English

Contract(s)/Grant(s): AFOSR-F49620-03-1-0420

Patent Info.: Filed 21 Jan 05; US-Patent-Appl-SN-11-041 886

Report No.(s): PB2008-104832; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A method disclosed for producing polymer-based cantilevers for use in atomic force microscopy in a batch process. The method includes forming a mold in a mold material, for example PDMS, using a master cantilever, removing the master cantilever from the mold material to reveal a mold cavity, filling the mold cavity with plastic, for example polystyrene, to form a plastic cantilever in the mold, and removing the plastic cantilever from the mold, for example using adhesive tape or flexing the mold. At least one surface of the plastic cantilever can be coated with a reflective metal, such as gold. The plastic cantilever can be functionalized for use in magnetic force microscopy by attaching a probe tip formed of magnetic metal, for example a 10 .mu.m nickel sphere.

NTIS

*Atomic Force Microscopy; Microscopy; Patent Applications*

**20080048364** SRA International, Inc., San Antonio, TX, USA; William J. Hughes Technical Center, Atlantic City, NJ, USA

**Determination of the Heats of Gasification of Polymers Using Differential Scanning Calorimetry**

Stoliarox, S. I.; Walters, R. N.; Nov. 2007; 20 pp.; In English

Report No.(s): PB2008-106480; No Copyright; Avail.: National Technical Information Service (NTIS)

The amount of heat that is required to gasify unit mass of material is one of the key properties that define its ignition resistance and fire response. Knowledge of this property is necessary to assess a materials fire hazard in a particular fire scenario. Nevertheless, even for the most common polymers, the values of this property are not well established. Here, a

methodology is presented for determining the heat of gasification using differential scanning calorimetry and applied to a set of ten common plastics and engineering polymers.

NTIS

*Gasification; Heat Measurement*

**20080048381** National Inst. of Standards and Technology, Gaithersburg, MD USA

**Materials Science and Engineering Laboratory FY 2006 Programs and Accomplishments. Polymers Division**

Amis, E. J.; Snyder, C. R.; Feb. 2008; 66 pp.; In English

Report No.(s): PB2009-102525; NISTIR-7480; No Copyright; Avail.: National Technical Information Service (NTIS)

;Table of Contents: Executive Summary; Technical Highlights; Advanced Manufacturing Processes; Biomaterials; Materials for Electronics; Nanometrology; Safety and Reliability; Polymers Division FY06 Annual Report Publication List; Polymers Division; Research Staff and Organizational Charts.

NTIS

*Polymers; Manufacturing; Charts*

## 24

### COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

**20080047299** California Univ., Davis, CA, USA

**Seismic Design of Reinforced Concrete Special Moment Frames: A Guide for Practicing Engineers. NEHRP Seismic Design Technical Brief No. 1**

Moehle, J. P.; Hooper, J. D.; Lubke, C. D.; Aug. 2008; 31 pp.; In English

Report No.(s): PB2009-102037; NIST/GCR-8-917-1; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Reinforced concrete special moment frames are used as part of seismic force-resisting systems in buildings that are designed to resist earthquakes. Beams, columns, and beam-column joints in moment frames are proportioned and detailed to resist flexural, axial, and shearing actions that result as a building sways through multiple displacement cycles during strong earthquake ground shaking. Special proportioning and detailing requirements result in a frame capable of resisting strong earthquake shaking without significant loss of stiffness or strength. These moment-resisting frames are called Special Moment Frames because of these additional requirements, which improve the seismic resistance in comparison with less stringently detailed Intermediate and Ordinary Moment Frames. This guide is written mainly to clarify requirements of the Building Code, but it also introduces other guides such as ACI 352R-02 and it presents other recommendations for good design and construction practices. This guide is written to clearly differentiate between Building Code requirements and other recommendations.

NTIS

*Buildings; Composite Materials; Concretes; Engineers*

**20080047429** NASA Glenn Research Center, Cleveland, OH, USA

**Further Developments in Modeling Creep Effects Within Structural SiC/SiC Components**

Lang, Jerry; DiCarlo, James A.; January 30, 2008; 16 pp.; In English; 32nd Annual Conference Composites Materials and Structures, 27 Jan. - 1 Feb. 2008, Daytona Beach, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.16.03; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047429>

Anticipating the implementation of advanced SiC/SiC composites into turbine section components of future aero-propulsion engines, the primary objective of this on-going study is to develop physics-based analytical and finite-element modeling tools to predict the effects of constituent creep on SiC/SiC component service life. A second objective is to understand how to possibly manipulate constituent materials and processes in order to minimize these effects. Focusing on SiC/SiC components experiencing through-thickness stress gradients (e.g., airfoil leading edge), prior NASA creep modeling studies showed that detrimental residual stress effects can develop globally within the component walls which can increase the risk of matrix cracking. These studies assumed that the SiC/SiC composites behaved as isotropic viscoelastic continuum materials with creep behavior that was linear and symmetric with stress and that the creep parameters could be obtained from creep data as experimentally measured in-plane in the fiber direction of advanced thin-walled 2D SiC/SiC panels. The present study expands on those prior efforts by including constituent behavior with non-linear stress dependencies in order to predict

such key creep-related SiC/SiC properties as time-dependent matrix stress, constituent creep and content effects on composite creep rates and rupture times, and stresses on fiber and matrix during and after creep.

Author

*Composite Materials; Silicon Carbides; Creep Properties; Structural Design; Viscoelasticity; Turbines; Finite Element Method; Aircraft Engines*

**20080047464** NASA Glenn Research Center, Cleveland, OH, USA

**Micromechanics-Based Progressive Failure Analysis of Composite Laminates Using Different Constituent Failure Theories**

Moncada, Albert M.; Chattopadhyay, Aditi; Bednarczyk, Brett A.; Arnold, Steven M.; April 07, 2008; 24 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNX07AD70A; WBS 645846.02.07.03.03.02; Copyright; Avail.: CASI: [A03](#), Hardcopy

Predicting failure in a composite can be done with ply level mechanisms and/or micro level mechanisms. This paper uses the Generalized Method of Cells and High-Fidelity Generalized Method of Cells micromechanics theories, coupled with classical lamination theory, as implemented within NASA's Micromechanics Analysis Code with Generalized Method of Cells. The code is able to implement different failure theories on the level of both the fiber and the matrix constituents within a laminate. A comparison is made among maximum stress, maximum strain, Tsai-Hill, and Tsai-Wu failure theories. To verify the failure theories the Worldwide Failure Exercise (WWFE) experiments have been used. The WWFE is a comprehensive study that covers a wide range of polymer matrix composite laminates. The numerical results indicate good correlation with the experimental results for most of the composite layups, but also point to the need for more accurate resin damage progression models.

Author

*Polymer Matrix Composites; Failure Analysis; Laminates; Micromechanics; Stress-Strain Relationships*

**20080047465** Akron Univ., Akron, OH, USA

**Electrical Resistance as a NDE Technique to Monitor Processing and Damage Accumulation in SiC/SiC Composites**

Smith, Craig; Morscher, Gregory N.; Xia, Zhenhai; January 27, 2008; 17 pp.; In English; 32nd Annual Conference on Composites, Materials, and Structures, 27 Jan. - 1 Feb. 2008, Daytona Beach, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC07TA78T; NNC06ZA03A; WBS 599489.02.07.03.02.02.02; Copyright; Avail.: CASI: [A03](#), Hardcopy

Ceramic matrix composites are suitable for high temperature structural applications such as turbine airfoils and hypersonic thermal protection systems. The employment of these materials in such applications is limited by the ability to process components reliable and to accurately monitor and predict damage evolution that leads to failure under stressed-oxidation conditions. Current nondestructive methods such as ultrasound, x-ray, and thermal imaging are limited in their ability to quantify small scale, transverse, in-plane, matrix cracks developed over long-time creep and fatigue conditions. Electrical resistance of SiC/SiC composites is one technique that shows special promise towards this end. Since both the matrix and the fibers are conductive, changes in matrix or fiber properties should relate to changes in electrical conductivity along the length of a specimen or part. Initial efforts to quantify the electrical resistance of different fiber and different matrix SiC/SiC composites will be presented. Also, the effect of matrix cracking on electrical resistivity for several composite systems will be presented. The implications towards electrical resistance as a technique applied to composite processing, damage detection, and life-modeling will be discussed.

Author

*Ceramic Matrix Composites; Electrical Resistance; Silicon Carbides; Thermal Protection; Hypersonics; Airfoils; Nondestructive Tests*

**20080047466** NASA Glenn Research Center, Cleveland, OH, USA

**Reliability and Confidence Interval Analysis of a CMC Turbine Stator Vane**

Murthy, Pappu L. N.; Gyekenyesi, John P.; Mital, Subodh K.; March 16, 2008; 26 pp.; In English; ICCES08 - International Conference on Computational and Experimental Engineering and Sciences, 16-21 Mar. 2008, Honolulu, HI, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 510505.03.03.02.01; Copyright; Avail.: CASI: [A03](#), Hardcopy

High temperature ceramic matrix composites (CMC) are being explored as viable candidate materials for hot section gas

turbine components. These advanced composites can potentially lead to reduced weight, enable higher operating temperatures requiring less cooling and thus leading to increased engine efficiencies. However, these materials are brittle and show degradation with time at high operating temperatures due to creep as well as cyclic mechanical and thermal loads. In addition, these materials are heterogeneous in their make-up and various factors affect their properties in a specific design environment. Most of these advanced composites involve two- and three-dimensional fiber architectures and require a complex multi-step high temperature processing. Since there are uncertainties associated with each of these in addition to the variability in the constituent material properties, the observed behavior of composite materials exhibits scatter. Traditional material failure analyses employing a deterministic approach, where failure is assumed to occur when some allowable stress level or equivalent stress is exceeded, are not adequate for brittle material component design. Such phenomenological failure theories are reasonably successful when applied to ductile materials such as metals. Analysis of failure in structural components is governed by the observed scatter in strength, stiffness and loading conditions. In such situations, statistical design approaches must be used. Accounting for these phenomena requires a change in philosophy on the design engineer's part that leads to a reduced focus on the use of safety factors in favor of reliability analyses. The reliability approach demands that the design engineer must tolerate a finite risk of unacceptable performance. This risk of unacceptable performance is identified as a component's probability of failure (or alternatively, component reliability). The primary concern of the engineer is minimizing this risk in an economical manner. The methods to accurately determine the service life of an engine component with associated variability have become increasingly difficult. This results, in part, from the complex missions which are now routinely considered during the design process. These missions include large variations of multi-axial stresses and temperatures experienced by critical engine parts. There is a need for a convenient design tool that can accommodate various loading conditions induced by engine operating environments, and material data with their associated uncertainties to estimate the minimum predicted life of a structural component. A probabilistic composite micromechanics technique in combination with woven composite micromechanics, structural analysis and Fast Probability Integration (FPI) techniques has been used to evaluate the maximum stress and its probabilistic distribution in a CMC turbine stator vane. Furthermore, input variables causing scatter are identified and ranked based upon their sensitivity magnitude. Since the measured data for the ceramic matrix composite properties is very limited, obtaining a probabilistic distribution with their corresponding parameters is difficult. In case of limited data, confidence bounds are essential to quantify the uncertainty associated with the distribution. Usually 90 and 95% confidence intervals are computed for material properties. Failure properties are then computed with the confidence bounds. Best estimates and the confidence bounds on the best estimate of the cumulative probability function for R-S (strength - stress) are plotted. The methodologies and the results from these analyses will be discussed in the presentation.

Author

*Ceramic Matrix Composites; Reliability Analysis; Gas Turbine Engines; Component Reliability; Engine Parts; High Temperature; Composite Materials; Brittle Materials; Failure Analysis; Degradation; Stators; Vanes*

**20080047467** Akron Univ., Akron, OH, USA

#### **Electrical Resistance of Ceramic Matrix Composites for Damage Detection and Life-Prediction**

Smith, Craig; Morscher, Gregory N.; Xia, Zhenhai; January 27, 2008; 13 pp.; In English; 32nd International Conference and Exposition on Advanced Ceramic and Composites, 27 Jan. - 1 Feb. 2008, Daytona Beach, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC07TA78T; NNC06ZA03A; WBS 599489.02.07.03.02.02.02; Copyright; Avail.: CASI: [A03](#), Hardcopy

The electric resistance of woven SiC fiber reinforced SiC matrix composites were measured under tensile loading conditions. The results show that the electrical resistance is closely related to damage and that real-time information about the damage state can be obtained through monitoring of the resistance. Such self-sensing capability provides the possibility of on-board/in-situ damage detection or inspection of a component during 'down time'. The correlation of damage with appropriate failure mechanism can then be applied to accurate life prediction for high-temperature ceramic matrix composites.

Author

*Ceramic Matrix Composites; Woven Composites; Life (Durability); Fiber Composites; Electrical Resistance; Detection*

**20080047468** Akron Univ., Akron, OH, USA

#### **Monitoring Damage Accumulation in Ceramic Matrix Composites Using Electrical Resistivity**

Smith, Craig E.; Morscher, Gregory N.; Xia, Zhenhai H.; [2008]; 9 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC07BA13B; NNX07AN56H; WBS 599489.02.07.03.02.02.02; Copyright; Avail.: CASI: [A02](#), Hardcopy

The electric resistance of woven SiC fiber reinforced SiC matrix composites were measured under tensile loading

conditions. The results show that the electrical resistance is closely related to damage and that real-time information about the damage state can be obtained through monitoring of the resistance. Such self-sensing capability provides the possibility of on-board/in-situ damage detection and accurate life prediction for high-temperature ceramic matrix composites. Woven silicon carbide fiber-reinforced silicon carbide (SiC/SiC) ceramic matrix composites (CMC) possess unique properties such as high thermal conductivity, excellent creep resistance, improved toughness, and good environmental stability (oxidation resistance), making them particularly suitable for hot structure applications. In specific, CMCs could be applied to hot section components of gas turbines [1], aerjet engines [2], thermal protection systems [3], and hot control surfaces [4]. The benefits of implementing these materials include reduced cooling air requirements, lower weight, simpler component design, longer service life, and higher thrust [5]. It has been identified in NASA High Speed Research (HSR) program that the SiC/SiC CMC has the most promise for high temperature, high oxidation applications [6]. One of the critical issues in the successful application of CMCs is on-board or insitu assessment of the damage state and an accurate prediction of the remaining service life of a particular component. This is of great concern, since most CMC components envisioned for aerospace applications will be exposed to harsh environments and play a key role in the vehicle's safety. On-line health monitoring can enable prediction of remaining life; thus resulting in improved safety and reliability of structural components. Monitoring can also allow for appropriate corrections to be made in real time, therefore leading to the prevention of catastrophic failures. Most conventional nondestructive evaluation (NDE) techniques such as ultrasonic C-scan, x-ray, thermography, and eddy current are limited since they require structural components of complex geometry to be taken out of service for a substantial length of time for post-damage inspection and assessment. Furthermore, the typical NDE techniques are useful for identifying large interlaminar flaws, but insensitive to CMC materials flaws developed perpendicular to the surface under tensile creep conditions. There are techniques such as piezoelectric sensor [7,8], and optical fiber [9,10] that could be used for on-line health monitoring of CMC structures. However, these systems involve attaching an external sensor or putting special fibers in CMC composites, which would be problematic at high temperature applications.

Author

*Woven Composites; Electrical Resistance; Silicon Carbides; Ceramic Matrix Composites; Fiber Composites; Thermal Conductivity; Thermal Protection; Damage Assessment; High Temperature*

**20080047673** Ohio Aerospace Inst., Cleveland, OH, USA

### **Joining of ZrB<sub>2</sub>-Based UHTC Composites to Cu-Clad Molybdenum for Advanced Aerospace Applications**

Singh, Mrityunjay; Asthana, Rajiv; [2008]; 36 pp.; In English

Contract(s)/Grant(s): NNC07TB09T; WBS 599489.02.07.03.02.02.02; Copyright; Avail.: Other Sources

Three hot-pressed zirconium diboride (ZrB<sub>2</sub>)-based ultra-high-temperature ceramic composites (UHTCC), ZrB<sub>2</sub>-SiC (ZS), ZrB<sub>2</sub>-SiC-C (ZSC), and ZrB<sub>2</sub>-SCS<sub>9</sub>-SiC (ZSS), were joined to Cu-clad-Mo using two Ti-containing medium-temperature Ag-Cu brazes (Cusil-ABA and Ticusil, T(sub L) approx. 1073-1173 K) and two Pd-base high-temperature brazes (Palco and Palni, T(sub L) approx. 1493-1513 K). Scanning Electron Microscopy (SEM) coupled with energy-dispersive spectroscopy (EDS) revealed considerably greater dissolution and chemical interaction in joints made using Palco and Palni than in joints made using Ag-Cu-Ti active braze alloys although metallurgically sound joints formed with both types of brazes. The degree of densification achieved in the composite during fabrication by hot pressing influenced the Knoop hardness (HK) of the UHTCC and the hardness distribution across the braze interlayer. The braze region in Pd-base brazes displayed higher HK in joints made using fully-dense ZS composites than in joints made using partially-dense (30% porosity) ZSS composites and the carbon-containing ZSC composites. Residual stress calculations point toward negative elastic strain energy (and a corresponding increase in the UHTCC's fracture stress) up to a certain clad layer thickness (approx. 23% per side on Mo substrate), which is a consequence of  $\alpha(\text{sub Cu-clad-Mo}) < \alpha(\text{sub ZS})$  ( $\alpha = \text{CTE}$ ) unlike most ceramic/metal joints for which  $\alpha(\text{sub metal}) > \alpha(\text{sub ceramic})$ . Above this critical thickness,  $\text{Cu-clad-Mo} > \text{ZS}$ , strain energy in the UHTCC is positive, and it increases with increasing clad layer thickness. Projected reductions in the effective thermal resistance of the joint relative to the ZS composite highlight the potential benefits of joining the UHTCC to Cu-clad-Mo.

Author

*Zirconium; Hot Pressing; Ceramic Matrix Composites; Ceramic Bonding; Brazing; Titanium Alloys; Scanning Electron Microscopy; Densification; Thermal Resistance; Metal Bonding*

**20080047675** NASA Glenn Research Center, Cleveland, OH, USA

**Kevlar 49/Epoxy COPV Aging Evaluation**

Sutter, James K.; Salem, Jonathan L.; Thesken, John C.; Russell, Richard W.; Littell, Justin; Ruggeri, Charles; Leifeste, Mark R.; April 21, 2008; 23 pp.; In English; Aging Aircraft 2008, 21-24 Apr. 2008, Phoenix, AZ, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 510505.03.03.02.01; Copyright; Avail.: CASI: [A03](#), Hardcopy

NASA initiated an effort to determine if the aging of Kevlar 49/Epoxy composite overwrapped pressure vessels (COPV) affected their performance. This study briefly reviews the history and certification of composite pressure vessels employed on NASA Orbiters. Tests to evaluate overwrap tensile strength changes compared 30 year old samples from Orbiter vessels to new Kevlar/Epoxy pressure vessel materials. Other tests include transverse compression and thermal analyses (glass transition and moduli). Results from these tests do not indicate a noticeable effect due to aging of the overwrap materials.

Author

*Kevlar (Trademark); Composite Wrapping; Pressure Vessels; Epoxy Resins; Aging (Materials)*

**20080047739** Ohio Aerospace Inst., Cleveland, OH, USA

**Design Guidelines for In-Plane Mechanical Properties of SiC Fiber-Reinforced Melt-Infiltrated SiC Composites**

Morscher, Gregory N.; Pujar, Vijay V.; [2008]; 31 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC06ZA03A; WBS 599489.02.07.03.02.02.02; Copyright; Avail.: CASI: [A03](#), Hardcopy

In-plane tensile stress-strain, tensile creep, and after-creep retained tensile properties of melt-infiltrated SiC-SiC composites reinforced with different fiber types were evaluated with an emphasis on obtaining simple or first-order microstructural design guidelines for these in-plane mechanical properties. Using the mini-matrix approach to model stress-strain behavior and the results of this study, three basic general design criteria for stress and strain limits are formulated, namely a design stress limit, a design total strain limit, and an after-creep design retained strength limit. It is shown that these criteria can be useful for designing components for high temperature applications.

Author

*Tensile Properties; Stress-Strain Relationships; Mechanical Properties; Creep Strength; Fiber Composites*

**20080047815** Executive Control Board of the National Shipbuilding Program, Charleston, SC USA

**Smart Manufacturing Methods for Carbon/Vinyl Ester Structures**

Erickson, Curtis G; Oct 7, 2008; 19 pp.; In English

Contract(s)/Grant(s): N00014-03-C-0413

Report No.(s): AD-A489447; NGSB-5693-007-REV; AMT-KC1107-8027; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The US Navy is aggressively pursuing larger components constructed using fiber-reinforced plastic or composite materials. However, the overall processes involved in manufacturing high-strength low weight composite components are still relatively new to US Navy shipbuilders. Vacuum Assisted Resin Transfer Molding (VARTM) a common composite fabrication methodology for composite structures is extremely sensitive to the material systems used and the production set-up or design. Any infusion-related defects easily lead to significant rework costs and schedule interruptions. Focusing on the DDG 1000 composite deckhouse and hangar the objective of this project was to develop a resin infusion process for each of two carbon fiber/vinyl ester resin composite joints that is predictable repeatable and reduces the defect rate experienced with current processes. Two common types of DDG 1000 composite deckhouse joints were examined in this project. Computer software was used to model and analyze the proposed VARTM infusion process designs yielding optimized composite panel joint infusion processes. Resin flow sensors were installed in each joint and were used to monitor resin flow fronts for the VARTM infusions. Non-Destructive evaluation of test specimens was performed to identify any potential defects in the test articles produced and also validate the computer models.

DTIC

*Carbon; Carbon Fibers; Composite Structures; Esters; Fiber Composites; Manufacturing; Plastics; Ships; Structural Design*

**20080047929** Ohio Aerospace Inst., Cleveland, OH, USA

**Characterization of Brazed Joints of C-C Composite to Cu-clad-Molybdenum**

Singh, M.; Asthana, R.; [2008]; 23 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC07TB09T; WBS 877868.02.07.03.05.03; Copyright; Avail.: CASI: [A03](#), Hardcopy

Carbon-carbon composites with either pitch+CVI matrix or resin-derived matrix were joined to copper-clad molybdenum



using two active braze alloys, Cusil-ABA (1.75% Ti) and Ticusil (4.5% Ti). The brazed joints revealed good interfacial bonding, preferential precipitation of Ti at the composite/braze interface, and a tendency toward de-lamination in resin-derived C-C composite due to its low inter-laminar shear strength. Extensive braze penetration of the inter-fiber channels in the pitch+CVI C-C composites was observed. The relatively low brazing temperatures (<950 C) precluded melting of the clad layer and restricted the redistribution of alloying elements but led to metallurgically sound composite joints. The Knoop microhardness (HK) distribution across the joint interfaces revealed sharp gradients at the Cu-clad-Mo/braze interface and higher hardness in Ticusil (approx.85-250 HK) than in Cusil-ABA (approx.50-150 HK). These C-C/Cu-clad-Mo joints with relatively low thermal resistance may be promising for thermal management applications.

Author

*Carbon-Carbon Composites; Molybdenum; Temperature Control; Copper; Scanning Electron Microscopy; Microhardness*

**20080048016** California Inst. of Tech., Pasadena, CA, USA

#### **Hybrid Multifoil Aerogel Thermal Insulation**

Sakamoto, Jeffrey; Paik, Jong-Ah; Jones, Steven; Nesmith, Bill; NASA Tech Briefs, October 2008; October 2008, pp. 15-16; In English; See also [20080047981](#); Original contains color illustrations

Report No.(s): NPO-45219; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3273>

This innovation blends the merits of multifoil insulation (MFI) with aerogel-based insulation to develop a highly versatile, ultra-low thermally conductive material called hybrid multifoil aerogel thermal insulation (HyMATI). The density of the opacified aerogel is 240 mg/cm<sup>3</sup> and has thermal conductivity in the 20 mW/mK range in high vacuum and 25 mW/mK in 1 atmosphere of gas (such as argon) up to 800 C. It is stable up to 1,000 C. This is equal to commercially available high-temperature thermal insulation. The thermal conductivity of the aerogel is 36 percent lower compared to several commercially available insulations when tested in 1 atmosphere of argon gas up to 800 C.

Derived from text

*Aerogels; High Temperature; Thermal Insulation; Metal Foils*

**20080048030** NASA Glenn Research Center, Cleveland, OH, USA

#### **Predicting Properties of Unidirectional-Nanofiber Composites**

Chamis, Christos C.; Handler, Louis M.; Manderscheid, Jane; NASA Tech Briefs, December 2008; December 2008, pp. 22; In English; See also [20080048022](#)

Report No.(s): LEW-18366-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3452>

A theory for predicting mechanical, thermal, electrical, and other properties of unidirectional-nanofiber/matrix composite materials is based on the prior theory of micromechanics of composite materials. In the development of the present theory, the prior theory of micromechanics was extended, through progressive substructuring, to the level of detail of a nanoscale slice of a nanofiber. All the governing equations were then formulated at this level. The substructuring and the equations have been programmed in the ICAN/JAVA computer code, which was reported in 'ICAN/JAVA: Integrated Composite Analyzer Recoded in Java' (LEW-17247), NASA Tech Briefs, Vol. 26, No. 12 (December 2002), page 36. In a demonstration, the theory as embodied in the computer code was applied to a graphite-nanofiber/epoxy laminate and used to predict 25 properties. Most of the properties were found to be distributed along the through-the-thickness direction. Matrix-dependent properties were found to have bimodal through-the-thickness distributions with discontinuous changes from mode to mode.

Author

*Composite Materials; Nanocomposites; Predictions; Matrix Materials; Laminates; Java (Programming Language); Graphite-Epoxy Composites; Computer Programs*

**20080048055** Foster-Miller Associates, Inc., Waltham, MA, USA

#### **Progress toward Making Epoxy/Carbon-Nanotube Composites**

Tiano, Thomas; Roycastle, Margaret; Gassner, John; Kyle, William; NASA Tech Briefs, December 2008; December 2008, pp. 22; In English; See also [20080048022](#)

Report No.(s): MSC-23278-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3450>

A modicum of progress has been made in an effort to exploit single-walled carbon nanotubes as fibers in epoxy-matrix/fiber composite materials. Two main obstacles to such use of carbon nanotubes are the following: (1) bare

nanotubes are not soluble in epoxy resins and so they tend to agglomerate instead of becoming dispersed as desired; and (2) because of lack of affinity between nanotubes and epoxy matrices, there is insufficient transfer of mechanical loads between the nanotubes and the matrices. Part of the effort reported here was oriented toward (1) functionalization of single-walled carbon nanotubes with methyl methacrylate (MMA) to increase their dispersability in epoxy resins and increase transfer of mechanical loads and (2) ultrasonic dispersion of the functionalized nanotubes in tetrahydrofuran, which was used as an auxiliary solvent to aid in dispersing the functionalized nanotubes into an epoxy resin. In another part of this effort, poly(styrene sulfonic acid) was used as the dispersant and water as the auxiliary solvent. In one experiment, the strength of composite of epoxy with MMA-functionalized-nanotubes was found to be 29 percent greater than that of a similar composite of epoxy with the same proportion of untreated nanotubes.

Author

*Carbon Nanotubes; Epoxy Matrix Composites; Fabrication; Nanocomposites*

**20080048069** Army Research Lab., Cleveland, OH, USA; NASA Glenn Research Center, Cleveland, OH, USA

#### **Impact Resistance of Uncoated SiC/SiC Composites**

Bhatt, Ramakrishna T.; Choi, Sung R.; Cosgriff, Laura M.; Fox, Dennis S.; Lee, Kang N.; Materials Science and Engineering A; [2008]; Volume 476, Issues 1-2, pp. 20-28; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNC06GA15G; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1016/j.msea.2007.04.066>

Two-dimensional woven SiC/SiC composites fabricated by melt infiltration method were impact tested at room temperature and at 1316 C in air using 1.59-mm diameter steel-ball projectiles at velocities ranging from 115 to 400 m/s. The extent of substrate damage with increasing projectile velocity was imaged and analyzed using optical and scanning electron microscopy, and non-destructive evaluation (NDE) methods such as pulsed thermography, and computed tomography. The impacted specimens were tensile tested at room temperature to determine their residual mechanical properties. Results indicate that at 115 m/s projectile velocity, the composite showed no noticeable surface or internal damage and retained its as-fabricated mechanical properties. As the projectile velocity increased above this value, the internal damage increased and mechanical properties degraded: At velocities >300 m/s, the projectile penetrated through the composite, but the composite retained approx.50% of the ultimate tensile strength of the as-fabricated composite and exhibited non-brittle failure. Predominant internal damages are delamination of fiber plies, fiber fracture and matrix shearing.

Author

*Impact Resistance; Nondestructive Tests; Tensile Strength; Woven Composites; Delaminating; Mechanical Properties; Scanning Electron Microscopy; Silicon*

**20080048157** California Inst. of Tech., Pasadena, CA, USA

#### **Improved Silica Aerogel Composite Materials**

Paik, Jong-Ah; Sakamoto, Jeffrey; Jones, Steven; NASA Tech Briefs, September 2008; September 2008, pp. 18-19; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): NPO-44287; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3125>

A family of aerogel-matrix composite materials having thermal-stability and mechanical-integrity properties better than those of neat aerogels has been developed. Aerogels are known to be excellent thermal- and acoustic-insulation materials because of their molecular-scale porosity, but heretofore, the use of aerogels has been inhibited by two factors: (1) Their brittleness makes processing and handling difficult. (2) They shrink during production and shrink more when heated to high temperatures during use. The shrinkage and the consequent cracking make it difficult to use them to encapsulate objects in thermal-insulation materials. The underlying concept of aerogel-matrix composites is not new; the novelty of the present family of materials lies in formulations and processes that result in superior properties, which include (1) much less shrinkage during a supercritical-drying process employed in producing a typical aerogel, (2) much less shrinkage during exposure to high temperatures, and (3) as a result of the reduction in shrinkage, much less or even no cracking.

Derived from text

*Aerogels; Composite Materials; Encapsulating; Silicon Dioxide; Thermal Stability; Brittleness; Cracking (Fracturing); Elimination; Shrinkage*

**INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY**

Includes the analysis, synthesis, and use of inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see category *34 Fluid Dynamics and Thermodynamics*. For astrochemistry see category *90 Astrophysics*.

**20080047290** Savannah River National Lab., Aiken, SC, USA

**Enzyme Activity Probe and Geochemical Assessment for Potential Aerobic Cometabolism of Trichloroethene in Groundwater of the Northwest Plume, Paducah Gaseous Diffusion Plant, Kentucky**

Looney, B.; Hope-Lee, M.; Hampson, S. K.; Jun. 27, 2008; 86 pp.; In English

Contract(s)/Grant(s): WSRC-STI-2008-00309

Report No.(s): DE2008-934526; WSRC-STI-2008-00309; No Copyright; Avail.: National Technical Information Service (NTIS)

The overarching objective of the Paducah Gaseous Diffusion Plant (PGDP) enzyme activity probe (EAP) effort is to determine if aerobic cometabolism is contributing to the attenuation of trichloroethene (TCE) and other chlorinated solvents in the contaminated groundwater beneath PGDP. The site-specific objective for the EAP assessment is to identify if key metabolic pathways are present and expressed in the microbial community--namely the pathways that are responsible for degradation of methane and aromatic (e.g. toluene, benzene, phenol) substrates. The enzymes produced to degrade methane and aromatic compounds also break down TCE through a process known as cometabolism. EAPs directly measure if methane and/or aromatic enzyme production pathways are operating and, for the aromatic pathways, provide an estimate of the number of active organisms in the sampled groundwater. This study in the groundwater plumes at PGDP is a major part of a larger scientific effort being conducted by Interstate Technology and Regulatory Council (ITRC), U.S. Department of Energy (DOE) Office of Environmental Management (EM), Savannah River National Laboratory (SRNL), and North Wind Inc. in which EAPs are being applied to contaminated groundwater from diverse hydrogeologic and plume settings throughout the U.S. to help standardize their application as well as their interpretation.

NTIS

*Aerobes; Enzyme Activity; Gaseous Diffusion; Geochemistry; Ground Water; Plumes*

**20080047323** Sandia National Labs., Albuquerque, NM USA

**Tools for Characterizing Biomembranes: Final LDRD Report**

Alam, T. M.; Stevens, M.; Holland, G. P.; McIntyre, S. K.; Oct. 01, 2007; 164 pp.; In English

Contract(s)/Grant(s): DE-AC04-94AL85000

Report No.(s): DE2008-934587; SAND2007-6547; No Copyright; Avail.: National Technical Information Service (NTIS)

A suite of experimental nuclear magnetic resonance (NMR) spectroscopy tools were developed to investigate lipid structure and dynamics in model membrane systems. By utilizing both multinuclear and multidimensional NMR experiments a range of different intra- and inter-molecular contacts were probed within the membranes. Examples on pure single component lipid membranes and on the canonical raft forming mixture of DOPC/SM/Chol are presented. A unique gel phase pretransition in SM was also identified and characterized using these NMR techniques. In addition molecular dynamics into the hydrogen bonding network unique to sphingomyelin containing membranes were evaluated as a function of temperature, and are discussed.

NTIS

*Membranes; Nuclear Magnetic Resonance; Molecular Dynamics*

**20080047402** National Inst. of Standards and Technology, Gaithersburg, MD, USA

**Vapor Pressure of Mercury**

Huber, M. L.; Laesecke, A.; Friend, D. G.; Apr. 2006; 59 pp.; In English

Report No.(s): PB2009-102238; NISTIR-6634-1; No Copyright; Avail.: National Technical Information Service (NTIS)

In this report, we review the available measurements of the vapor pressure of mercury and develop a new correlation that is valid from the triple point to the critical point. The equation is a Wagner-type form, where the terms of the equation are selected by use of a simulated annealing optimization algorithm. In order to improve the reliability of the equation at low temperatures, heat capacity data were used in addition to vapor pressure data. We present comparisons with available experimental data and existing correlations. In the region of interest for this project, over the temperature range 0 DGC to 60

DGC, the estimated uncertainty (estimated as a combined expanded uncertainty with coverage factor of 2, 2 $\sigma$ ) of the correlation is 1 %.

NTIS

*Vapor Pressure; Low Temperature; Correlation; Critical Point*

**20080047454** NASA Glenn Research Center, Cleveland, OH, USA

**Measurement of Collision Broadening of the P1(5) Line of (0,0) Band of OH A $^2$ E $^+$   $\leftarrow$  X $^2$ PI Transition at High Temperatures**

Hwang, Soon Muk; Kojima, Jun N.; Nguyen, Quang-Viet; Rabinowitz, Martin J.; March 24, 2008; 22 pp.; In English  
Contract(s)/Grant(s): WBS 561581.02.08.03.16.02; Copyright; Avail.: Other Sources

Even for the well studied and ubiquitous species, OH, the current state of theoretical development of broadening theory does not allow extrapolation from low temperature laboratory measurements to the range of practical combustion devices. We performed a series of experiments at typical combustion conditions to determine the collision broadening of the P1(5) line of the (0,0) band of OH A $^2$ Sigma $^+$   $\leftarrow$  X $^2$ PI transition by Ar in shock heated H $_2$ -O $_2$ -Ar mixtures and by Air in H $_2$ -Air flames over a wider range of stoichiometry ( $\phi$ =0.01-10.0), temperature (T=780-2440 K), and pressure (p=0.7-10.0 atm). The values of the collision width,  $\Delta(\nu_c)$ , were acquired by fitting Voigt profiles to the measured spectral line shapes in flames and to the peak absorption coefficients (K $(\nu_0)$ ) in shock tube experiments. Collision broadening parameters ( $2\gamma(\text{sub Ar})$ ,  $2\gamma(\text{sub N}_2)$ , and  $2\gamma(\text{sub H}_2\text{O})$ ) were then calculated assuming the linear dependence of  $\Delta(\nu_c)$  with pressure -- the  $2\gamma(\text{sub N}_2)$  and  $2\gamma(\text{sub H}_2\text{O})$  values were inferred from  $2\gamma(\text{sub Air})$  and the equilibrium concentration of N $_2$  and H $_2$ ) of a given flame. The temperature dependences of  $2\gamma(\text{sub i})$  in our temperature range are, respectively, 1.0, 0.75, and 0.87 for Ar, N $_2$ , and H $_2\text{O}$ . The collision broadening cross sections ( $\sigma$ ) deduced from  $2\gamma(\text{sub i})$  values are expressed with an assumed form,  $\sigma(\text{sub i})(T)=\sigma(\text{sub i},0)(T_0/T)^k$ , T $_0$ =1000 K: for Ar,  $\sigma(\text{sub Ar}, 0)=63.3$  (A $^2$ ), k=0.50; for N $_2$ ,  $\sigma(\text{sub N}_2,0)=68.0$  (A $^2$ ), k=0.25; for H $_2$ ,  $\sigma(\text{sub H}_2,0)=188.8$  (A $^2$ ), k=0.37.

Author

*Hydroxyl Radicals; Chemical Reactions; Collisions; Line Spectra; Combustion; Transition Temperature; Reaction Kinetics*

**20080047504** National Cheng Kung Univ., Tainan, Taiwan, Province of China

**The Organic-Oxide Interfacial Layer on the Studies of Organic Electronics (Light-Emitting Diodes and Solar Cells)**

Guo, Tzung-Fang; Oct 9, 2008; 39 pp.; In English

Contract(s)/Grant(s): FA4869-07-1-4068

Report No.(s): AD-A489137; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489137>

This project investigated a novel approach to apply an organic-oxide interfacial layer to improve the performance of organic electronic devices, including organic light emitting diodes and organic solar cells.

DTIC

*Electronic Equipment; Light Emitting Diodes; Oxides; Photoelectron Spectroscopy; Solar Cells; X Ray Spectroscopy*

**20080047524** Air Force Research Lab., Edwards AFB, CA USA

**Liquid Azide Salts**

Schneider, Stefan; Rosander, Michael; Hudgens, Leslie; Warmoth, Greg; Hawkins, Tommy; Mills, Jeffrey; Brand, Adam; Vij, Ashwani; Sep 13, 2007; 9 pp.; In English

Report No.(s): AD-A489371; AFRL-PR-ED-JA-2007-422; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489371>

Ionic liquid azides from azidoethyl, alkyl and alkenyl substituted derivatives of 1,2,4- and 1,2,3-amino-triazoles, were prepared and examined for the first time in order to investigate their structural and physical properties. All reported salts possess melting points below 100 deg C. The unique character of these newly discovered ionic liquid azides is based upon the fact that these molecules are not simple protonated salts like previously reported substituted hydrazinium azides. The presence of quaternary nitrogen confers both thermal stability and negligible volatility.

DTIC

*Azides (Inorganic); Azides (Organic); Hydrazinium Compounds; Thermal Stability; Volatility*

**20080047569** Air Force Research Lab., Edwards AFB, CA USA

**Cation-Cation pi-pi Stacking in Small Ionic Clusters of 1,2,4-Triazolium**

Li, Hui; Boatz, Jerry A; Gordon, Mark S; Jan 2008; 3 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A489428; AFRL-PR-ED-JA-2007-366; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Aromatic cations such as imidazolium and its derivatives have delocalized charges and, therefore, are often used to synthesize functional nanomaterials, low-melting salts and ionic liquids. Recently, energetic low-melting salts and ionic liquids based on triazolium and its derivatives have received considerable attention. A characteristic property of aromatic compounds is their ability to form pi-pi stacking structures, which can have significant influence on properties. Cation-cation pi-pi stacking structures are less common, but have been observed in organometallic crystal and imidazolium salts. Cation-cation pi-pi stacking dimers can be formed in a dielectric solvent due to significant screening of the charge-charge repulsion forces. However, such species in small clusters have not been reported. Calculations reported in this work suggest that cation-cation pi-pi stacking structures can be formed between two 1,2,4-triazolium cations in small clusters of the two cations and two anions.

DTIC

*Cations; Clusters; Ions; Molecular Structure*

**20080047595** Software and Engineering Associates, Inc., Carson City, NV USA

**Aluminum Combustion in Solid Rocket Motor Chamber Environment (Preprint)**

King, Merrill K; Jul 2007; 42 pp.; In English

Contract(s)/Grant(s): FA9300-05-C-0011; Proj-4922

Report No.(s): AD-A489555; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A model for prediction of particle radius and oxide cap size/shape versus time for an aluminum particle tracking a stream-tube through a solid rocket motor port has been developed. Following preliminary calculations leading to a postulated flame structure, a quasi-steady model to predict instantaneous consumption of aluminum and generation of condensed oxide (both as a cap on the aluminum particle and as smoke) as a function of instantaneous particle size, ambient conditions, and cumulative amount of oxide in the cap was developed. Finally, this model was imbedded into a framework tracking evolution of particle size, oxide cap size, and ambient conditions, which change as the particle travels along a stream-tube consuming oxidizer and releasing heat. Qualitative agreement was found between predictions and limited observations.

DTIC

*Aluminum; Combustion; Mathematical Models; Metal Combustion; Solid Propellant Rocket Engines; Solid Rocket Propellants; Thermochemistry*

**20080047599** Army Research Lab., Aberdeen Proving Ground, MD USA

**Electrochemical Capacities of Commercially Available Structural Carbon Fibers, Fabrics, and Papers**

Wong, Emma L; Snyder, James F; Hubbard, Clifford W; Sep 2008; 26 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489577; ARL-TR-4574; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study focuses on the energy storage properties of commercial carbon fabric materials. Electrochemically active carbon fabrics could facilitate scalable development of multifunctional fiber-based structural composites or fabric-based wearable components that provide a secondary function as a battery or supercapacitor. Multifunctional composites are desirable to reduce system mass by integrating load-bearing and energy storage capabilities into a single material. Electrochemical capacity and double layer capacitance were evaluated for a wide range of structural carbon fibers based on poly(acrylonitrile) (PAN), pitch, or activated carbon; and papers made from carbon nanotubes or nanofoams. The impact of fiber sizing on electrochemical activity was also studied. The data is tabulated with manufacturer-reported material properties to enable rapid identification of fibers or fabrics for a wide range of potential applications. PAN- based fibers and nanofoam papers demonstrated reversible capacities as high as 186 mA\*h/g. Fiber sizing did not appear to be a detriment to electrochemical activity. The T-300 PAN-based fibers are most recommended for use in multifunctional composite batteries given their high tensile strength and high capacities. Double layer capacitances for activated carbon fibers, nanotube fibers, and nanofoam papers consistently approached or exceeded 10 F/g.

DTIC

*Activated Carbon; Carbon Fibers; Electrochemistry; Fabrics*

**20080047601** Air Force Research Lab., Edwards AFB, CA USA

**Hypergolic Ignition of Ionic Liquids (Preprint)**

Chambreau, Steven D; Schneider, Stefan; Rosander, Michael; Hawkins, Tom; Gallegos, Christopher J; Pastewait, Matthew F; Vaghjani, Ghanshyam L; Mar 27, 2008; 41 pp.; In English

Contract(s)/Grant(s): Proj-23030423

Report No.(s): AD-A489584; AFRL-RZ-ED-JA-2008-090; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A class of room temperature ionic liquids (RTILs) that exhibit hypergolic activity towards strong nitric acid is reported. Fast ignition of dicyanamide ionic liquids when mixed with nitric acid is contrasted with the reactivity of the ionic liquid azides, which show high reactivity with nitric acid, but do not ignite. The reactivity of other potential salt fuels is assessed here. Rapid-scan, Fourier Transform infrared (FTIR) spectroscopy of the pre-ignition phase indicates the evolution of N<sub>2</sub>O from both the dicyanamide and azide RTILs. Evidence for the evolution of CO<sub>2</sub> and isocyanic acid (HNCO) with similar temporal behavior to N<sub>2</sub>O from reaction of the dicyanamide ionic liquids with nitric acid is presented. Evolution of HN<sub>3</sub> is detected from the azides. No evolution of HCN from the dicyanamide reactions was detected. From the FTIR observations, biuret reaction tests and initial ab initio calculations, a mechanism is proposed for the formation of N<sub>2</sub>O, CO<sub>2</sub> and HNCO from the dicyanamide reactions during pre-ignition.

DTIC

*Cyanamides; Fuels; Ignition; Liquids*

**20080047602** National Taiwan Univ., Taipei, Taiwan, Province of China

**High Efficiency and Long Life Hybrid Photovoltaic Research for Space Applications**

Su, Wei-Fang; Jul 5, 2007; 12 pp.; In English

Contract(s)/Grant(s): FA4869-06-1-0075

Report No.(s): AD-A489592; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have developed a tree-like nanostructured photovoltaic device based on the polymer poly(3-hexylthiophene)(P3HT)/metal oxide hybrid materials by solution processes at low temperature. An array of large ZnO nanorods with a larger size of 50 nm in diameter and 150 nm in length are grown to act as tree trunks for efficient charge collection. Small TiO<sub>2</sub> nanorods with a size of 5 nm in diameter and 20 nm in length are incorporated to act as tree branches for facilitating charge separation and transport. The device based on the tree-like nanostructure exhibits a short circuit current density >2 mA/sq cm under A.M. 1.5 illumination, showing over seven times increase compared to that without the incorporation of TiO<sub>2</sub> nanorods. Efficient charge separation and transport in the tree-like nanostructured photovoltaic device has further been demonstrated by time-resolved photoluminescence spectroscopy and transient photocurrent measurements.

DTIC

*Photoluminescence; Photovoltaic Effect; Solar Cells; Technology Utilization; Titanium Oxides*

**20080047603** Army Engineer Research and Development Center, Vicksburg, MS USA

**Estimating Bottom Water Dissolved Oxygen in the Mississippi River Gulf Outlet and Gulf Intracoastal Waterway Resulting from Proposed Structures**

Dortch, Mark S; Martin, S K; Sep 2008; 33 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489595; ERDC-TR-08-9; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study examined the impacts on bottom dissolved oxygen (DO) within canal reaches comprising the Gulf Intracoastal Waterway (GIWW), the Mississippi River Gulf Outlet (MRGO), and the Inner Harbor Navigation Channel (IHNC) resulting from various alternatives for proposed water control structures located within this system. Due to time constraints, an analytical model of reduced form was used for the analysis. Bottom water DO for each canal study reach was predicted using a steady state, fully mixed, single reactor model. August conditions were imposed for the assessment. Monthly average, bottom flushing flow rates were obtained from hourly bottom velocities output from a three-dimensional (3D) hydrodynamic and salinity model that was applied to the system during a separate study. Likewise, monthly average surface and bottom salinities were also obtained from the 3D model output. The salinity data were used to estimate vertical eddy diffusivities, which were used in the model for DO exchange between surface and bottom water. The hydrodynamic information was provided for each study reach and for each alternative scenario. The model indicated that low DO conditions should be expected within the system for the structural alternatives being considered. The model showed that several reaches for several

scenarios will have DO less than the standard of 4.0 mg/L. The IHNC reach may present a special concern since bottom DO was predicted to be 0.0 mg/L for three alternatives that included structures placed within the GIWW.

DTIC

*Dissolved Gases; Dissolving; Estimating; Gulfs; Mississippi River (US); Oxygen; Water; Waterways*

**20080047733** NASA Johnson Space Center, Houston, TX, USA

**Control of the Diameter and Chiral Angle Distributions during Production of Single-wall Carbon Nanotubes**

Nikolaev, Pavel; Holmes, William; Sosa, Edward; Boul, Peter; Arepalli, Sivaram; Yowell, Leonard; [2009]; 37 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNJ05HI05C; SAA-AT-07-021; NNJ05H105C; Copyright; Avail.: Other Sources

Pulsed laser vaporization (PLV) synthesis of single-wall carbon nanotubes (SWCNT) on Co/Ni and Rh/Pd catalysts was explored with respect to variations in the production temperature. The nanotube type populations were determined via photoluminescence, UV-Vis-NIR absorption and Raman spectroscopy. It was found that lowered production temperature leads to smaller nanotube diameters and exceptionally narrow (n,m) type distributions, with marked preference towards large chiral angles for both catalysts. Interestingly, larger nanotube diameters tend to be associated with larger chiral angles. These results demonstrate that PLV production technique can provide at least partial control over the nanotube (n,m) populations. In addition, these results have implications for the understanding the nanotube nucleation mechanism in the laser oven. SWCNT synthesized at lower temperatures appear quite attractive as a starting material for nanotube type separation experiments.

Author (revised)

*Pulsed Lasers; Vaporizing; Carbon Nanotubes; Nanostructure Growth; Nanofabrication; Synthesis; Diameters; Chirality; Laser Ablation*

**20080047787** Klarquist and Sparkman, LLP, Portland, OR, USA

**Octahedral Molecular Sieve Sorbents and Catalysts**

Li, L., Inventor; King, D. L., Inventor; 3 Feb 06; 47 pp.; In English

Contract(s)/Grant(s): DE-AC06-76RL01830

Patent Info.: Filed Filed 3 Feb 06; US-Patent-Appl-SN-11-347 459

Report No.(s): PB2008-105643; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Octahedral molecular sieve sorbents and catalysts are disclosed, including silver hollandite and cryptomelane. These materials can be used, for example, to catalyze the oxidation of CO(sub x) (e.g., CO), NO(sub x) (e.g., NO), hydrocarbons (e.g., C(sub 3)H(sub 6)) and/or sulfur-containing compounds. The disclosed materials also may be used to catalyze other reactions, such as the reduction of NO(sub 2). In some cases, the disclosed materials are capable of sorbing certain products from the reactions they catalyze. Silver hollandite, in particular, can be used to remove a substantial portion of certain sulfur-containing compounds from a gas or liquid by catalysis and/or sorption. The gas or liquid can be, for example, natural gas or a liquid hydrocarbon.

NTIS

*Absorbents; Catalysts; Patent Applications; Sorbents*

**20080047801** Air Force Research Lab., Edwards AFB, CA USA

**Liquid Azide Salts and Their Reactions with Common Oxidizers IRFNA and N2O4 (Preprint)**

Schneider, Stefan; Rosander, Michael; Chambreau, Steven; Hawkins, Tommy; Mills, Jeffrey; Vaghjiani, Ghanshyam; Feb 19, 2008; 29 pp.; In English

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A489559; AFRL-RZ-ED-JA-2008-051; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Several imidazolium-based ionic liquid azides with saturated and unsaturated side chains were prepared and their physical and structural properties were investigated. The reactivity of these new as well as some previously reported ionic liquid azides with the strong oxidizers, N2O4 and inhibited, red-fuming-nitric acid (IRFNA), were studied.

DTIC

*Azides (Inorganic); Azides (Organic); Nitrogen Oxides; Oxidizers*

**20080047809** Air Force Research Lab., Edwards AFB, CA USA; Massachusetts Inst. of Tech., Cambridge, MA, USA  
**Designing Superoleophobic Surfaces (Postprint)**

Tuteja, Anish; Choi, Wonjae; Ma, Minglin; Rutledge, Gregory C; McKinley, Gareth H; Cohen, Robert E; Mazzella, Sarah A; Mabry, Joseph M; Dec 7, 2007; 7 pp.; In English

Contract(s)/Grant(s): FA9300-06-M-T015; FA9550-07-1-0272; NSF DMR-0303916; Proj-2303

Report No.(s): AD-A489553; AFRL-RZ-ED-JA-2007-476; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Understanding the complementary roles of surface energy and roughness on natural nonwetting surfaces has led to the development of a number of biomimetic superhydrophobic surfaces, which exhibit apparent contact angles with water greater than 150 degrees and low contact angle hysteresis. However, superoleophobic surfaces - those that display contact angles greater than 150 degrees with organic liquids having appreciably lower surface tensions than that of water - are extremely rare. Calculations suggest that creating such a surface would require a surface energy lower than that of any known material. We show how a third factor, re-entrant surface curvature, in conjunction with chemical composition and roughened texture, can be used to design surfaces that display extreme resistance to wetting from a number of liquids with low surface tension, including alkanes such as decane and octane.

DTIC

*Hydrophobicity; Interfacial Tension*

**20080047819** Air Force Research Lab., Edwards AFB, CA USA

**Nitrous Oxide Explosive Hazards**

Merrill, Claude; May 2008; 38 pp.; In English

Contract(s)/Grant(s): Proj-5026

Report No.(s): AD-A489459; AFRL-RZ-ED-TP-2008-184; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A recent incident caused us to evaluate the subject of nitrous oxide (N<sub>2</sub>O) hazards. Use of N<sub>2</sub>O for rocket propulsion seems to be a continuing interest. Accounts of serious, large system N<sub>2</sub>O accidents are mysterious since technically satisfying explanation of how the incidents occurred seems lacking. Inadequacy of technical information for serious N<sub>2</sub>O incidents indicates that safety practice understanding beyond current knowledge is needed. At a minimum, application of some safety practices used with high pressure oxygen systems, but not specified with N<sub>2</sub>O operations, may provide some safety improvements. Experimental investigation to gain recognition of large quantity N<sub>2</sub>O explosive and ignition traits may be the only way to ensure large N<sub>2</sub>O system safety. Prior hazard and monopropellant decomposition studies largely indicated that N<sub>2</sub>O was difficult to initiate into dangerous monopropellant decompositions. Based on prior studies and use of N<sub>2</sub>O for decades in dental practice without serious incidents, many people have considered use of N<sub>2</sub>O as safe. Early explosive hazard studies did not indicate a serious explosive nature for N<sub>2</sub>O. Inadequacy of historical N<sub>2</sub>O hazard study experiments was that they used too small volumes in their studies. N<sub>2</sub>O/organic mixtures.

DTIC

*Explosives; Hazards; Nitrogen Oxides; Nitrous Oxides*

**20080047841** Missouri Univ., Rolla, MO USA

**Numerical and Analytical Modeling of Laser Deposition with Preheating**

Fan, Zhiqiang; Stroble, Jacquelyn K; Ruan, Jianzhong; Sparks, Todd E; Liou, Frank; Mar 2007; 19 pp.; In English

Contract(s)/Grant(s): FA8650-04-C-5704; Proj-2865

Report No.(s): AD-A489652; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Laser deposition allows quick fabrication of fully-dense metallic components directly from CAD solid models. This work uses both numerical and analytical approaches to model the laser deposition process including actual deposition and preheating. The numerical approach is used to simulate the coupled, interactive transport phenomena during actual deposition. The numerical simulation involves laser material interaction, free surface evolution, and melt-pool dynamics. The analytical approach is used to model heat transfer during preheating. The combination of these two approaches can increase computational efficiency with most of the phenomena associated with laser deposition modeled. The simulation is applied to Ti-6Al-4V and simulation results are compared with experimental results.

DTIC

*Heating; Laser Deposition; Laser Materials; Mathematical Models; Numerical Analysis*



**20080047851** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Variability in Room Temperature Fatigue Life of Alpha+Beta Processed Ti-6Al-4V (Preprint)**

Golden, Patrick J; John, Reji; Porter, John; Oct 2008; 17 pp.; In English

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A489287; AFRL-RX-WP-TP-2008-4312; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489287>

In this program, smooth bar fatigue tests were conducted by several laboratories on the same lot of Ti-6Al-4V forged plate material. Multiple stress ratios and stress levels were tested to generate a fully populated stress-life curve. The tests, however, did not typically consist of many repeats. The approach of this work is to conduct a statistically significant number of repeated fatigue tests at a few loading conditions. A similar approach has been performed on several other turbine engine material systems often revealing a bimodal life distribution consisting of a number of low life specimens that may fail due to a separate mechanism. This paper will discuss the Ti-6Al-4V life distributions and sources of variability. Crack propagation using small crack growth data is used to predict the low life failures. Methods of modeling and predicting the life distributions will be discussed and demonstrated.

DTIC

*Aluminum Alloys; Crack Propagation; Fatigue Life; Room Temperature; Thermal Fatigue; Titanium Alloys; Vanadium Alloys; Variability*

**20080047863** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Biaxially Textured YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub> Films Deposited on Polycrystalline Flexible Yttria-Stabilized Zirconia Ceramic Substrates**

Varanasi, C V; Burke, J; Lu, R; Wu, J; Brunke, L; Chuck, L; Smith, H E; Maartense, I; Barnes, P N; Oct 2008; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-3145

Report No.(s): AD-A489065; AFRL-RZ-WP-TP-2008-2242; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489065>

Biaxially textured YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub> (YBCO) films were grown on polycrystalline flexible yttria-stabilized zirconia (YSZ) ceramic substrates (Ceraflex) buffered with MgO and LaMnO<sub>3</sub> layers. These substrates were initially coated with silica glass to obtain a smooth surface and then biaxially textured MgO buffer layers were deposited by ion beam assisted deposition (IBAD-MgO). Lanthanum manganate (LMO) cap layers and YBCO layers were then deposited by the pulsed laser ablation method. Highly textured YBCO films with a full width half maximum (FWHM) of 6.75 deg in (110) phi scans and a FWHM ~5 deg in (200) omega scans were obtained.

DTIC

*Ceramics; Polycrystals; Substrates; Thick Films; YBCO Superconductors; Yttrium Oxides; Zirconium Oxides*

**20080047864** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Thick YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub> BaSnO<sub>3</sub> Films with Enhanced Critical Current Density at High Magnetic Fields**

Varanasi, C V; Burke, J; Wang, H; Lee, J H; Barnes, P N; Oct 2008; 5 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-3145

Report No.(s): AD-A489066; AFRL-RZ-WP-TP-2008-2241; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489066>

The thickness dependence was studied for the critical current density (J<sub>c</sub>) of YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub> (YBCO) + BaSnO<sub>3</sub> (BSO) nanocomposite films. These films showed a significantly reduced decline of the J<sub>c</sub> with thickness, especially at high magnetic fields. For example, a 2-micron-thick YBCO+BSO film had a J<sub>c</sub> ~3x10<sup>5</sup> A/cm<sup>2</sup> at 5 T as compared to a typical J<sub>c</sub> of 2.4x10<sup>5</sup> A/cm<sup>2</sup> at 5 T for a 300-nm-thick YBCO film. The thick YBCO+BSO films maintained high T<sub>c</sub> (>88 K) and had a high density of continuous BSO nanocolumns that likely contributed for the observed J<sub>c</sub> enhancements.

DTIC

*Critical Current; Current Density; Magnetic Fields; Thick Films; YBCO Superconductors*

**20080047865** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Growth and Characterization of Carbon Nanotubes on Constantan (Cu-Ni-Mn Alloy) Metallic Substrates Without Adding Additional Catalysts (Postprint)**

Varanasi, C V; Bulmer, J; Brunke, L; Burke, J; Baca, J; Yost, K; Barnes, P; Oct 2008; 6 pp.; In English

Report No.(s): AD-A489089; AFRL-RZ-WP-TP-2008-2244; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489089>

In this study, metallic constantan (Cu55-Ni44-Mn1 wt %) alloy substrates were investigated as an alternate choice of substrates to grow carbon nanotubes (CNTs). No additional catalysts were used other than the as-rolled and annealed substrates to process CNTs on them. High density CNT growth was observed to take place on these substrates when suitable conditions were used in a thermal chemical vapor deposition (CVD) furnace with C<sub>2</sub>H<sub>2</sub> as the carbon precursor. Scanning electron microscopy and transmission electron microscopy on these samples indicated the presence of several micron long CNTs ranging in 20 to 100 nm in diameter. Raman spectra taken from the samples confirmed the presence of G band peaks (peak at ~1580 /cm) and D band peaks (peak at ~1320 /cm) commonly observed in CVD grown multiwall CNT samples with varying intensity ratios depending on the processing conditions.

DTIC

*Carbon Nanotubes; Catalysts; Constantan; Electron Microscopy; Manganese Alloys; Nanostructure Growth; Substrates; Vapor Deposition*

**20080047866** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Persistent Current in Coils Made Out of Second Generation High Temperature Superconductor Wire**

Levin, George A; Barnes, Paul N; Murphy, John; Brunke, Lyle; Long, J D; Horwath, John; Turgut, Zafer; Oct 2008; 5 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-3145

Report No.(s): AD-A489091; AFRL-RZ-WP-TP-2008-2243; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489091>

We report the results of an experimental study of a persistent coil made out of YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7</sub> coated conductors. The magnitude of the persistent current and the rate of decay were investigated. Two distinct modes of relaxation are evident -- one is flux creep and the other, which is much faster, is of less obvious origin. Our conclusion is that the persistent current in such a coil can be large enough and decay slowly enough so that coated conductors can be used to make persistent coils for a variety of applications.

DTIC

*Electric Current; High Temperature Superconductors; Wire; YBCO Superconductors*

**20080047869** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Compression Property Determination of a Gamma Titanium Aluminide Alloy Using Microspecimens**

Porter, W J; Uchic, M D; John, R; Barnas, N B; Sep 2008; 12 pp.; In English

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A489304; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489304>

The room temperature yield behaviors under compression of micro-specimens representing three lamellar orientations of a gamma titanium aluminide alloy were evaluated. The mechanical responses from specimens of each orientation and various diameters are compared to one another and to compression-loaded, conventionally-sized titanium aluminide specimens. The yield stress results from the micro-specimens are shown to be relatively independent of specimen diameter and similar to those of conventionally-sized compression specimens.

DTIC

*Gamma Rays; Titanium Alloys; Titanium Aluminides*

**20080047901** Hoag (Foley), LLP, Boston, MA, USA; Massachusetts Inst. of Tech., Cambridge, MA, USA

**Transition-Metal-Catalyzed Carbon-Nitrogen and Carbon-Carbon Bond-Forming Reactions**

Buchwald, S. L., Inventor; Anderson, K. W., Inventor; 9 Jan 06; 45 pp.; In English

Contract(s)/Grant(s): GM-58160

Patent Info.: Filed 9 Jan 06; US-Patent-Appl-SN-11-328 426  
Report No.(s): PB2008-105458; No Copyright; Avail.: CASI: [A03](#), Hardcopy

One aspect of the present invention relates to ligands for transition metals. A second aspect of the present invention relates to the use of catalysts comprising these ligands in various transition-metal-catalyzed carbon-heteroatom and carbon-carbon bond-forming reactions. The subject methods provide improvements in many features of the transition-metal-catalyzed reactions, including the range of suitable substrates, number of catalyst turnovers, reaction conditions, and efficiency. For example, improvements have been realized in transition metal-catalyzed: aryl amination reactions; aryl amidation reactions; Suzuki couplings; and Sonogashira couplings. In certain embodiments, the invention relates to catalysts and methods of using them that operate in aqueous solvent systems.

NTIS

*Carbon; Catalysis; Joints (Junctions); Nitrogen; Patent Applications; Transition Metals*

**20080047913** Argonne National Lab., IL, USA

### **Review and Assessment of Nanofluid Technology for Transportation and Other Applications**

Yu, W.; France, D. M.; Choi, S. U.; Routbort, J. L.; Apr. 2007; 78 pp.; In English

Contract(s)/Grant(s): DE-AC02-06CH11357

Report No.(s): DE2007-919327; ANL/ESD-07-9; No Copyright; Avail.: Department of Energy Information Bridge

This report provides a literature review on the research and development work contributing to the current status of nanofluid technology for heat transfer applications in industrial processes. Nanofluid technology is a relative new field, and as such, the supporting studies are not extensive. Specifically, the experimental results and theoretical predictions regarding the enhancement of the thermal conductivity and convective heat transfer of nanofluids relative to conventional heat transfer fluids were reviewed and assessments were made of the current status to derive future research and development directions for industrial applications. Pertinent parameters were considered individually as to the current state of knowledge. Experimental results from multiple research groups were cast into a consistent parameter, the enhancement ratio. To facilitate comparisons of data among research groups and identification of thermal property and heat transfer trends. The current state of knowledge is presented as well as areas where the data are currently inconclusive or conflicting. Heat transfer enhancement for available nanoparticles is shown to be in the 15-40% range, with a few situations resulting in orders of magnitude enhancement. The direction of future research should be to substantiate the lower range results and to continue investigations into the high enhancements. The focus of this study is primarily transportation applications. However, some attention is given to other industrial applications of nanofluid heat transfer. Also discussed are barriers to be addressed prior to commercialization of nanofluids.

NTIS

*Heat Transfer; Nanoparticles; Technology Assessment; Transportation*

**20080048056** Eltron Research, Inc., USA

### **Electrocatalytic Reduction of Carbon Dioxide to Methane**

Sammells, Anthony F.; Spiegel, Ella F.; NASA Tech Briefs, December 2008; December 2008, pp. 21; In English; See also [20080048022](#)

Report No.(s): MSC-23097-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3449>

A room-temperature electrocatalytic process that effects the overall chemical reaction  $\text{CO}_2 + 2\text{H}_2\text{O}$  yields  $\text{CH}_4 + 2\text{O}_2$  has been investigated as a means of removing carbon dioxide from air and restoring oxygen to the air. The process was originally intended for use in a spacecraft life-support system, in which the methane would be vented to outer space. The process may also have potential utility in terrestrial applications in which either or both of the methane and oxygen produced might be utilized or vented to the atmosphere. A typical cell used to implement the process includes a polymer solid-electrolyte membrane, onto which are deposited cathode and anode films. The cathode film is catalytic for electrolytic reduction of  $\text{CO}_2$  at low overpotential. The anode film is typically made of platinum. When  $\text{CO}_2$  is circulated past the cathode, water is circulated past the anode, and a suitable potential is applied, the anode half-cell reaction is  $4\text{H}_2\text{O}$  yields  $2\text{O}_2 + 8\text{H}^+ + 8\text{e}^-$ . The  $\text{H}^+$  ions travel through the membrane to the cathode, where they participate in the half-cell reaction  $\text{CO}_2 + 8\text{H}^+ + 8\text{e}^-$  yields  $\text{CH}_4 + 2\text{H}_2\text{O}$ .

Author

*Electrocatalysts; Chemical Reactions; Reduction (Chemistry); Carbon Dioxide; Methane; Reaction Kinetics; Electrochemistry*

**20080048112** Brookhaven National Lab., Upton, NY USA

**Palladium-Cobalt Particles as Oxygen-Reduction Electrocatalysts**

Adzie, R., Inventor; Huang, T., Inventor; 10 Feb 05; 12 pp.; In English

Contract(s)/Grant(s): DE-AC02-98CH10886

Patent Info.: Filed 10 Feb 05; US-Patent-Appl-SN-11-054 587

Report No.(s): PB2008-105660; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention relates to palladium-cobalt particles useful as oxygen-reducing electrocatalysts. The invention also relates to oxygen-reducing cathodes and fuel cells containing these palladium-cobalt particles. The invention additionally relates to methods for the production of electrical energy by using the palladium-cobalt particles of the invention.

NTIS

*Cobalt; Electrocatalysts; Oxygen; Palladium; Patent Applications*

**20080048168** California Inst. of Tech., Pasadena, CA, USA

**Making More-Complex Molecules Using Superthermal Atom/Molecule Collisions**

Shortt, Brian; Chutjian, Ara; Orient, Otto; NASA Tech Briefs, September 2008; September 2008, pp. 17; In English; See also

[20080048125](#); Original contains color illustrations

Report No.(s): NPO-41300; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3120>

A method of making more-complex molecules from simpler ones has emerged as a by-product of an experimental study in outer-space atom/surface collision physics. The subject of the study was the formation of CO<sub>2</sub> molecules as a result of impingement of O atoms at controlled kinetic energies upon cold surfaces onto which CO molecules had been adsorbed. In this study, the O/CO system served as a laboratory model, not only for the formation of CO<sub>2</sub> but also for the formation of other compounds through impingement of rapidly moving atoms upon molecules adsorbed on such cold interstellar surfaces as those of dust grains or comets. By contributing to the formation of increasingly complex molecules, including organic ones, this study and related other studies may eventually contribute to understanding of the origins of life.

Derived from text

*Cold Surfaces; Molecular Interactions; Cryogenics; Atomic Collisions*

**20080048210** Texas A&M Univ., College Station, TX, USA

**Kinetics of Slurry Phase Fischer-Tropsch Synthesis. Final Report for October 1, 2002 to December 31, 2006**

Bukur, D. B.; January 2007; 145 pp.; In English

Report No.(s): DE2007-907885; No Copyright; Avail.: National Technical Information Service (NTIS)

The overall objective of this project is to develop a comprehensive kinetic model for slurry-phase Fischer-Tropsch synthesis (FTS) employing iron-based catalysts. This model will be validated with experimental data obtained in a stirred-tank slurry reactor (STSR) over a wide range of process conditions. Three STSR tests of the Ruhrchemie LP 33/81 catalyst were conducted to collect data on catalyst activity and selectivity under 25 different sets of process conditions. The observed decrease in 1-olefin content and increase in 2-olefin and n-paraffin contents with the increase in conversion are consistent with a concept that 1-olefins participate in secondary reactions (e.g. 1-olefin hydrogenation, isomerization and readsorption), whereas 2-olefins and n-paraffins are formed in these reactions. Carbon number product distribution showed an increase in chain growth probability with increase in chain length. Vapor-liquid equilibrium calculations were made to check validity of the assumption that the gas and liquid phases are in equilibrium during FTS in the STSR. Calculated vapor phase compositions were in excellent agreement with experimental values from the STSR under reaction conditions. Discrepancies between the calculated and experimental values for the liquid-phase composition (for some of the experimental data) are ascribed to experimental errors in the amount of wax collected from the reactor, and the relative amounts of hydrocarbon wax and Durasyn 164 oil (start-up fluid) in the liquid samples. Kinetic parameters of four kinetic models (Lox and Froment, 1993b; Yang et al., 2003; Van der Laan and Beenackers, 1998, 1999; and an extended kinetic model of Van der Laan and Beenackers) were estimated from experimental data in the STSR tests. Two of these kinetic models (Lox and Froment, 1993b; Yang et al., 2003) can predict a complete product distribution (inorganic species and hydrocarbons), whereas the kinetic model of Van der Laan and Beenackers (1998, 1999) can be used only to fit product distribution of total olefins and n-paraffins. The kinetic model of Van der Laan and Beenackers was extended to account separately for formation of 1- and 2-olefins, as well as n-paraffins. A simplified form of the kinetic model of Lox and Froment (1993b) has only five parameters at isothermal conditions. Because of its relative simplicity, this model is well suited for initial studies where the main goal is to learn techniques for parameter estimation and statistical analysis of estimated values of model parameters. The same techniques and computer codes were used in the analysis of other kinetic models. The Levenberg-Marquardt (LM) method was employed for

minimization of the objective function and kinetic parameter estimation. Predicted reaction rates of inorganic and hydrocarbon species were not in good agreement with experimental data. All reaction rate constants and activation energies (24 parameters) of the Yang et al. (2003) model were found to be positive, but the corresponding 95% confidence intervals were large. Agreement between predicted and experimental reaction rates has been fair to good. Light hydrocarbons were predicted fairly accurately, whereas the model predictions of higher molecular weight hydrocarbons values were lower than the experimental ones.

NTIS

*Catalysts; Fischer-Tropsch Process; Iron; Kinetics; Slurries*

**20080048235** Air Products and Chemicals, Inc., Allentown, PA, USA

**Ion Transport Membrane Module and Vessel System with Directed Internal Gas Flow**

Holmes, M. J., Inventor; Ohrn, T. R., Inventor; Chen, C. M. P., Inventor; 22 Nov 05; 33 pp.; In English

Contract(s)/Grant(s): DE-FC26-97FT96052

Patent Info.: Filed Filed 22 Nov 05; US-Patent-Appl-SN-11-284 188

Report No.(s): PB2008-105847; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An ion transport membrane system comprising (a) a pressure vessel having an interior, an inlet adapted to introduce gas into the interior of the vessel, an outlet adapted to withdraw gas from the interior of the vessel, and an axis; (b) a plurality of planar ion transport membrane modules disposed in the interior of the pressure vessel and arranged in series, each membrane module comprising mixed metal oxide ceramic material and having an interior region and an exterior region; and (c) one or more gas flow control partitions disposed in the interior of the pressure vessel and adapted to change a direction of gas flow within the vessel.

NTIS

*Gas Flow; Internal Flow; Membranes; Oxygen; Patent Applications*

**20080048281** National Inst. of Standards and Technology, Gaithersburg, MD USA

**NIST Realization of the Gallium Triple Point**

Strouse, G. F.; January 2008; 6 pp.; In English

Report No.(s): PB2008-105911; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The gallium triple point (302.9166 K) instead of the gallium melting point (302.9146 K) is used at NIST in the realization of the International Temperature Scale of 1990 (ITS-90). Four different sources of gallium with purities of at least 99.999 995 wt. % were compared at NIST over the last eight years. One of these four sources was a 30 kg lot designated for use as a Standard Reference Material. Three different fixed-point cell designs were used to fabricate twelve cells from these sources. Different methods of preparation of the gallium triple point were investigated to determine the optimum realization method and to determine if different methods affect the realization temperature of the triple point. Pressure and immersion characteristics were tested to check the agreement with the ITS-90 assigned values for the effect of pressure and hydrostatic head. Comparison of the twelve cells with the previous NIST reference gallium triple-point cell (Ga-1) containing 99.999 99+ wt. % pure gallium shows that the triple-point temperatures of the twelve cells are about 0.03 mK hotter than that of Ga-1. Additionally, repeated measurements of the twelve gallium triple-point cells give a reproducibility that is equivalent to that of a similar group of water triple-point cells. The uncertainty ( $k = 2$ ) assigned to the current NIST reference gallium triple-point cells is the same as that assigned to the NIST reference water triple-point cells, i.e. 0.04 mK. This paper presents the fixed-point cells designs, fabrication method, realization technique and the uncertainty of the NIST-realized gallium triple-point temperature.

NTIS

*Gallium; Temperature Measurement; Melting Points*

**20080048283** National Inst. of Standards and Technology, Gaithersburg, MD USA

**Effects of different Methods of Preparation of Ice Mantles of Triple Point of Water Cells on the Temporal Behaviour of the Triple-Point Temperatures**

Furukawa, G. T.; Mangum, B. W.; Strouse, G. F.; January 2008; 19 pp.; In English

Report No.(s): PB2008-105912; No Copyright; Avail.: CASI: [A03](#), Hardcopy

We report results of an investigation of the temporal variation of the temperature of triple point of water (TPW) cells, in which the ice mantles were prepared by four different techniques using: (1) solid carbon dioxide, (2) an immersion cooler, (3)

liquid-nitrogen-cooled rods, and (4) liquid nitrogen (LN), first passing cold nitrogen vapours and then LN directly into the wells of the cells.

NTIS

*Ice; Water; Temperature Measurement; Thermodynamic Properties*

**20080048285** National Inst. of Standards and Technology, Gaithersburg, MD USA

**Comparisons of Some NIST Fixed-Point Cells with Similar Cells of Other Standards Laboratories**

Mangum, B. W.; Pfeiffer, E. R.; Strouse, G. F.; Valencia-Rodriguez, J.; Lin, J. H.; January 2008; 11 pp.; In English  
Report No.(s): PB2008-105913; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In this paper we present international comparisons of fixed-point cells of some of the defining fixed-point materials of the International Temperature Scale of 1990. These comparisons involved cells from seven national laboratories, although in some cases only one type of fixed-point material was compared.

NTIS

*Temperature Measurement; Fixed Points (Mathematics)*

**20080048297** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Second-Order, Unconditionally Positive, Mass-Conserving Integration Scheme for Biochemical Systems**

Bruggeman, J.; Burchard, H.; Kooi, B.; Sommeijer, B. P.; Jan. 2006; 42 pp.; In English  
Report No.(s): PB2008-105200; MAS-R0601; Copyright; Avail.: National Technical Information Service (NTIS)

Biochemical systems are bound by two mathematically-relevant restrictions. First, state variables in such systems represent non-negative quantities, such as concentrations of chemical compounds. Second, biochemical systems conserve mass and energy. Both properties must be reflected in results of an integration scheme applied to biochemical models. This paper first presents a mathematical framework for biochemical problems, which includes an exact definition of biochemical conservation: elements and energy, rather than state variable units, are conserved. We then analyze various fixed-step integration schemes, including traditional Euler-based schemes and the recently published modified Patankar schemes, and conclude that none of these deliver unconditional positivity and biochemical conservation in combination with higher-order accuracy. Finally, we present two new fixed-step integration schemes, one first-order and one second-order accurate, which do guarantee positivity and (biochemical) conservation.

NTIS

*Biochemistry; Conservation; Measure and Integration; Chemical Composition*

**20080048302** Geological Survey, Reston, VA USA

**Evaluation of Potash Grade with Gamma-ray Logs**

Nelson, P. H.; January 2007; 14 pp.; In English  
Report No.(s): PB2008-105724; USGS-OFR-2007-1292; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Potassium is an emitter of gamma-ray radiation, consequently deposits of potash can be detected and evaluated using gamma-ray logs. A method originally designed to evaluate uranium deposits in boreholes can also be applied to potash deposits. The method equates the depth-integral of a gamma-ray log to the grade-thickness product of a potash-bearing bed or series of beds. The average grade of a bed is then determined by dividing by the overall bed thickness, which can also be obtained from the gamma-ray log. The method was tested using gamma-ray logs and potash assays from boreholes near Carlsbad, New Mexico.

NTIS

*Deposits; Gamma Rays*

**20080048317** National Inst. of Standards and Technology, Gaithersburg, MD USA

**New NIST Mercury Triple-Point Cells**

Strouse, G. F.; Lippiatt, J.; January 2008; 6 pp.; In English  
Report No.(s): PB2008-105915; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Six new Hg triple-point (TP) cells (234.3156 K) were manufactured in the NIST PRT Laboratory for use in the realization of the International Temperature Scale of 1990 (ITS-90). The fixed-point cells consisted of both glass and stainless steel designs with either an 8 mm or 12 mm inner diameter reentrant well. Triple-distilled Hg with nominal purities of 99.999 999 wt.% were used to fill the cells using a vacuum distillation filling process. The certification method of the new cells included measuring melting curve plateaus, direct comparisons with the PRT Laboratory reference Hg TP cell (Hg SS-1), and

immersion profiling. The estimated amount of impurities leached out of the stainless steel crucible into the Hg sample of Hg SS-1 over 25 years was found to be 1 mg/g. This paper presents the fixed-point cell designs, fabrication method, results from the cell certification procedures, and the estimated uncertainty assigned to the Hg TP cells

NTIS

*Mercury (Metal); Temperature Scales*

**20080048342** Physikalisch-Technische Bundesanstalt, Berlin, Germany; National Physical Lab., Teddington, UK; Istituto di Metrologia G. Colonetti, Turin, Italy; Polish Academy of Sciences, Warsaw, Poland

**Special Problems When Realising the Triple Point of Hydrogen as a Defining Fixed Point of the ITS-90**

Fellmuth, B.; Head, D.; Pavese, F.; Szymrka-Grzebyk, A.; Tew, W.; January 2008; 8 pp.; In English

Report No.(s): PB2008-105916; CCT/01-22; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The two special problems, which appear when realising the triple point of hydrogen as a temperature fixed point due to the influences of the deuterium content and the catalyst, have been investigated by filling a large number of sealed triple-point cells. The cells differ with respect to the deuterium content (29 mmol D/mol H to 155 mmol D/mol H), type of catalyst (hydrous ferric oxide and gadolinium oxide), catalyst-to-liquid volume ratio (a few per cent to more than 100 per cent) and cell design. At higher catalyst-to-liquid volume ratios, the shape of the melting curve depends on the type of the catalyst, but only the melting temperature of that sample part being in direct contact with the catalyst and thus distorted is changed.

NTIS

*Hydrogen; Temperature Measurement; Temperature Scales*

**20080048343** Consiglio Nazionale delle Ricerche, Turin, Italy; National Inst. of Standards and Technology, Gaithersburg, MD USA; National Research Council of Canada, Ottawa, Ontario, Canada

**Archival and Theoretical Considerations for Isotopic Dependence in the e-H(2) Fixed Points**

Pavese, F.; Tew, W. L.; Steele, A. D.; January 2008; 6 pp.; In English

Report No.(s): PB2008-105917; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The equilibrium hydrogen (e-H<sub>2</sub>) fixed points of the International Temperature Scale of 1990 (ITS-90) are now recognized as being significantly influenced by the isotopic composition of the source gas. The text of the ITS-90 specifies only that the natural isotopic composition is to be used. The supplementary information goes further to state that the normal isotopic composition of hydrogen is 150 imol 2H per mole of 1H. However, hydrogen isotope fractionation is known to occur by a variety of mechanisms both in the natural terrestrial environment and in the synthesis of commercial gas leading to wide variations in the isotopic content. Unfortunately, there is presently no internationally accepted value for the shift of the hydrogen fixed-point temperatures with respect to variations in the 2H concentration. In fact, there were very few historical hydrogen fixed-point realizations forming the basis of the defined temperature values in the IPTS-68 and the ITS-90 which were performed using hydrogen of any known isotopic composition. It is also unlikely that any of those gas samples were of normal isotopic composition. We examine these issues for the case of the e-H<sub>2</sub> triple point (TP), and the two vapor pressure (VP) points defined near 33 kPa and 101 kPa. The archival experimental data allows predictions to be made for the shift in the TP temperature based on extrapolations of observations at large concentrations of 2H. Similarly, archival hydrogen vapor pressure measurements of pure 2H1H allow calculation of the dependence on 2H concentration in the dilute limit for ideal solutions.

NTIS

*Hydrogen; Isotopes; Temperature Measurement*

**20080048345** National Inst. of Standards and Technology, Gaithersburg, MD USA

**Evanescence Wave Cavity Ring-Down Spectroscopy: A New Platform for Thin-Film Chemical Sensors**

Pipino, A. C. R.; January 2008; 9 pp.; In English

Report No.(s): PB2008-105919; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A new optical technique is described that permits extension of cavity ring-down spectroscopy (CRDS) to surfaces, films, and liquids. As in conventional CRDS, the photon intensity decay time in a low loss optical cavity is utilized to probe optical absorption. Extension to condensed matter is achieved by employing intra-cavity total internal reflection (TIR) to generate an evanescent wave that is especially well suited for thin film chemical sensing.

NTIS

*Cavities; Evanescence; Evanescent Waves; Spectroscopy; Thin Films; Wave Dispersion*

**20080048355** Kirsch (Alan D.), Idaho Falls, ID, USA

**Electrochemical Impedance Spectroscopy System and Methods for Determining Spatial Locations of Defects**

Glenn, D. F., Inventor; Matthern, G. E., Inventor; Propp, W. A., Inventor; Glenn, A. W., Inventor; Shaw, P. G., Inventor; 16 Dec 04; 18 pp.; In English

Contract(s)/Grant(s): DE-AC07-991D13727

Patent Info.: Filed 16 Dec 04; US-Patent-Appl-SN-11-015 427

Report No.(s): PB2008-106043; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method and apparatus for determining spatial locations of defects in a material are described. The method includes providing a plurality of electrodes in contact with a material, applying a sinusoidal voltage to a select number of the electrodes at a predetermined frequency, determining gain and phase angle measurements at other of the electrodes in response to applying the sinusoidal voltage to the select number of electrodes, determining impedance values from the gain and phase angle measurements, computing an impedance spectrum for an area of the material from the determined impedance values, and comparing the computed impedance spectrum with a known impedance spectrum to identify spatial locations of defects in the material.

NTIS

*Defects; Impedance; Patent Applications; Position (Location); Spectroscopy*

**20080048550** Army Research Lab., Adelphi, MD USA

**Processing Method for Creating Ultra-Thin Lead Zirconate Titanate (PZT) Films Via Chemical Solution Deposition**

Piekarz, Richard; Polcawich, Ronald G; Dec 2008; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A490263; ARL-TN-0338; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report summarizes the effort to use modifications to a lead zirconate titanate (PZT) chemical solution process to create high performance ferroelectric, dielectric, and piezoelectric thin films with reduced film thicknesses.

DTIC

*Deposition; Lead Zirconate Titanates; Thin Films*

**20080048551** Clemson Univ., SC USA

**The Molecular Design of High-Performance Carbon Materials**

Thies, Mark C; Jun 30, 2008; 30 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0060

Report No.(s): AD-A490266; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The separation of petroleum pitch into its oligomeric fractions via dense-gas extraction (DGE), followed by the application of both new and conventional analytical techniques to those fractions, has given us unique capabilities for identifying the specific molecular structures that exist in petroleum pitches. In particular, pitch fractions containing 98% monomer or 97% dimer were isolated by DGE and characterized using MALDI, MALDI-PSD, and FD mass spectrometry (MS); as well as by H-NMR, UV-Vis, and FT-IR spectroscopy. Results indicate that the 98% monomer pitch fraction is approximately Gaussian with respect to molecular weight, with the dominant species present being methylated derivatives of the polycyclic aromatic hydrocarbons (PAH) benzofluorene, chryses, benzofluoranthene, and their isomers.

DTIC

*Carbon; Design Analysis; Molecular Weight*

**26**

**METALS AND METALLIC MATERIALS**

Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.

**20080047251** Kobe Steel Ltd., Japan

**Kobelco Technology Review, No. 27, November 2007. Feature: Technological Cooperation in the Kobe Steel Group**

Nov. 2007; 82 pp.; In English

Report No.(s): PB2009-100972; Copyright; Avail.: National Technical Information Service (NTIS)

Throughout its history of over a hundred years, Kobe Steel has been a manufacturer of a wide variety of products including materials, such as steel & aluminum, and machinery, such as industrial machines & construction machines. During its extensive history, Kobe Steel has organized an alliance of Kobe Steel Group companies, each of which has established its position in many advanced products in both the material and machinery business fields. Such advanced products include new



iron making plants, environmental equipment & facilities, electronic materials, and wholesale power. Nowadays, the value of companies is evaluated by the total business value of the group of companies as a whole, rather than by the value of an individual company.

NTIS

*Steels; Research and Development*

**20080047341** Northwestern Univ., Evanston, IL, USA

**Effects of a Tungsten Addition on the Morphological Evolution, Spatial Correlations and Temporal Evolution of a Model Ni-Al-Cr Superalloy**

Sudbrack, Chantal K.; Zieball, Tiffany D.; Seidman, David N.; Noebe, Ronald D.; Acta Materialia; January 2007; 56, pp. 448-465; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1016/j.actamat.2007.09.042>

The effect of adding 2 at.% W to a model Ni-Al-Cr superalloy on the morphological evolution, spatial correlations and temporal evolution of gamma'(L12)-precipitates at 1073 K is studied with scanning electron microscopy and atomic force microscopy. Adding W yields a larger microhardness, earlier onset of spheroidal-to-cuboidal precipitate morphological transition, larger volume fraction (from approx.20% to 30%), reduction in coarsening kinetics by one-third and a larger number density ( $N(\text{sub } v)$ ) of smaller mean radii ( $[R]$ ) precipitates. The kinetics of  $[R]$  and interfacial area per unit volume obey  $t(\text{sup } 1/3)$  and  $t(\text{sup } -1/3)$  relationships, respectively, which is consistent with coarsening driven by interfacial energy reduction. The  $N(\text{sub } v)$  power-law dependencies deviate, however, from model predictions, indicating that a stationary state is not achieved. Quantitative analyses with precipitate size distributions, pair correlation functions and edge-to-edge inter-precipitate distance distributions give insight into two-dimensional microstructural evolution, including the elastically driven transition from a uniform gamma'-distribution to one-dimensional [001]-strings to eventually clustered packs of gamma'-precipitates in the less densely packed Ni-Al-Cr alloy

Author

*Tungsten; Nickel Aluminides; Nickel Alloys; Heat Resistant Alloys; Interfacial Energy; Atomic Force Microscopy; Correlation; Microhardness*

**20080047344** Spies (Robert), Encino, CA, USA; Akron Univ., Akron, OH, USA

**Characterization of Ni<sub>19.5</sub>Ti<sub>50.5</sub>Pd<sub>25</sub>Pt<sub>5</sub> High-Temperature Shape Memory Alloy Springs and their Potential Application in Aeronautics**

Stebner, Aaron; Padula, Santo A.; Noebe, Ronald D.; March 09, 2008; 12 pp.; In English; SPIE Smart Structures/NDE, 9-13 Mar. 2008, California, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1117/12.775805>

Shape memory alloys (SMAs) have been used as actuators in many different industries since the discovery of the shape memory effect, but the use of SMAs as actuation devices in aeronautics has been limited due to the temperature constraints of commercially available materials. Consequently, work is being done at NASA's Glenn Research Center to develop new SMAs capable of being used in high temperature environments. One of the more promising high-temperature shape memory alloys (HTSMAs) is Ni<sub>19.5</sub>Ti<sub>50.5</sub>Pd<sub>25</sub>Pt<sub>5</sub>. Recent work has shown that this material is capable of being used in operating environments of up to 250 C. This material has been shown to have very useful actuation capabilities, demonstrating repeatable strain recoveries up to 2.5% in the presence of an externally applied load. Based on these findings, further work has been initiated to explore potential applications and alternative forms of this alloy, such as springs. Thus, characterization of Ni<sub>19.5</sub>Ti<sub>50.5</sub>Pd<sub>25</sub>Pt<sub>5</sub> springs, including their mechanical response and how variations in this response correlate to changes in geometric parameters, are discussed. The effects of loading history, or training, on spring behavior were also investigated. A comparison of the springs with wire actuators is made and the benefits of using one actuator form as opposed to the other discussed. These findings are used to discuss design considerations for a surge-control mechanism that could be used in the centrifugal compressor of a T-700 helicopter engine.

Author

*Shape Memory Alloys; Heat Resistant Alloys; Characterization; Actuators; Aerospace Engineering; Nickel Alloys*

**20080047347** NASA Glenn Research Center, Cleveland, OH, USA

**The Effects of Heat Treatment and Microstructure Variations on Disk Superalloy Properties at High Temperature**

Gabb, Timothy P.; Gayda, John; Telesman, Jack; Garg, Anita; September 14, 2008; 10 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 698259.02.07.03.04.01; Copyright; Avail.: CASI: [A02](#), Hardcopy

The effects of heat treatment and resulting microstructure variations on high temperature mechanical properties were

assessed for a powder metallurgy disk superalloy LSHR. Blanks were consistently supersolvus solution heat treated and quenched at two cooling rates, than aged at varying temperatures and times. Tensile, creep, and dwell fatigue crack growth tests were then performed at 704 C. Gamma' precipitate microstructures were quantified. Relationships between heat treatment-microstructure, heat treatment-mechanical properties, and microstructure-mechanical properties were assessed.

Author

*Heat Resistant Alloys; High Temperature; Microstructure; Temperature Effects; Crack Propagation; Fatigue (Materials); Powder Metallurgy*

**20080047349** NASA Glenn Research Center, Cleveland, OH, USA

#### **Durability Assessment of TiAl Alloys**

Draper, Susan L.; Lerch, Bradley A.; March 09, 2008; 12 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 599489 02.07.03.02.04.01; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047349>

The durability of TiAl is a prime concern for the implementation of TiAl into aerospace engines. Two durability issues, the effect of high temperature exposure on mechanical properties and impact resistance, have been investigated and the results are summarized in this paper. Exposure to elevated temperatures has been shown to be detrimental to the room temperature ductility of gamma alloys with the most likely mechanisms being the ingress of interstitials from the surface. Fluorine ion implantation has been shown to improve the oxidation resistance of gamma alloys, and ideally it could also improve the environmental embrittlement of high Nb content TiAl alloys. The effect of F ion implantation on the surface oxidation and embrittlement of a third generation, high Nb content TiAl alloy (Ti-45Al-5Nb-B-C) were investigated. Additionally, the ballistic impact resistance of a variety of gamma alloys, including Ti-48Al-2Cr-2Nb, Ti-47Al-2Cr-2Nb, ABB-2, ABB-23, NCG359E, 95A and Ti-45Al-5Nb-B-C was accessed. Differences in the ballistic impact properties of the various alloys will be discussed, particularly with respect to their manufacturing process, microstructure, and tensile properties.

Author

*Tensile Properties; Titanium Aluminides; Impact Resistance; Mechanical Properties; Impact Strength; Embrittlement; Temperature Effects*

**20080047352** Case Western Reserve Univ., Cleveland, OH, USA

#### **Formation of gamma(sup prime)-Ni3Al via the Peritectoid Reaction: gamma + beta (+ Al2O3)=gamma(sup prime)(+ Al2O3)**

Copeland, Evan; September 14, 2008; 9 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNC07BA13B; WBS 561581.02.08.03.15.03; Copyright; Avail.: CASI: [A02](#), Hardcopy

The activities of Al and Ni were measured using multi-cell Knudsen effusion-cell mass spectrometry (multi-cell KEMS), over the composition range 8-32 at.%Al and temperature range  $T=1400-1750$  K in the Ni-Al-O system. These measurements establish that equilibrium solidification of gamma(sup prime)-Ni3Al-containing alloys occurs by the eutectic reaction,  $L (+ Al_2O_3)=\gamma + \beta(+ Al_2O_3)$ , at  $1640 \pm 1$  K and a liquid composition of  $24.8 \pm 0.2$  at.%al (at an unknown oxygen content). The  $\{\gamma + \beta(+ Al_2O_3)\}$  phase field is stable over the temperature range 1633-1640 K, and gamma(sup prime)-Ni3Al forms via the peritectoid,  $\gamma + \beta(+ Al_2O_3)=\gamma(sup prime) (+ Al_2O_3)$ , at  $1633 \pm 1$  K. This behavior is consistent with the current Ni-Al phase diagram and a new diagram is proposed. This new Ni-Al phase diagram explains a number of unusual steady-state solidification structures reported previously and provides a much simpler reaction scheme in the vicinity of the gamma(sup prime)-Ni2Al phase field.

Author

*Nickel Aluminides; Chemical Reactions; Thermodynamic Properties; Heat Resistant Alloys*

**20080047354** NASA Glenn Research Center, Cleveland, OH, USA

#### **Comparison of the Isothermal Oxidation Behavior of As-Cast Cu-17%Cr and Cu-17%Cr-5%Al, Part 1, Oxidation Kinetics**

Raj, Sai V.; [2008]; 42 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.15.02; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047354>

The isothermal oxidation kinetics of as-cast Cu-17%Cr and Cu-17%Cr-5%Al in air were studied between 773 and 1173 K under atmospheric pressure. These observations reveal that Cu- 17%Cr-5%Al oxidizes at significantly slower rates than

Cu-17%Cr. The rate constants for the alloys were determined from generalized analyses of the data without an a priori assumption of the nature of the oxidation kinetics. Detailed analyses of the isothermal thermogravimetric weight change data revealed that Cu-17%Cr exhibited parabolic oxidation kinetics with an activation energy of 165.9 +/- 9.5 kJ/mol. In contrast, the oxidation kinetics for the Cu-17%Cr- 5%Al alloy exhibited a parabolic oxidation kinetics during the initial stages followed by a quartic relationship in the later stages of oxidation. Alternatively, the oxidation behavior of Cu-17%CR- 5%Al could be better represented by a logarithmic relationship. The parabolic rate constants and activation energy data for the two alloys are compared with literature data to gain insights on the nature of the oxidation mechanisms dominant in these alloys.

Author

*Reaction Kinetics; Atmospheric Pressure; Activation Energy; Thermogravimetry; Copper Alloys*

**20080047356** NASA Glenn Research Center, Cleveland, OH, USA

**Comparison of the Isothermal Oxidation Behavior of As-Cast Cu-17%Cr and Cu-17%Cr-5%Al Part II: Scale Microstructures**

Raj, Sai V.; [2008]; 32 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.15.02; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047356>

The isothermal oxidation kinetics of as-cast Cu-17%Cr and Cu-17%Cr-5%Al in air were studied between 773 and 1173 K under atmospheric pressure. Details of the oxidation kinetics of these alloys were discussed in Part I. This paper analyzes the microstructures of the scale and its composition in an attempt to elucidate the oxidation mechanisms in these alloys. The scales formed on Cu-17%Cr specimens oxidized between 773 and 973 K consisted of external CuO and subsurface Cu<sub>2</sub>O layers. The total thickness of these scales varied from about 10 μm at 773 K to about 450 μm at 973 K. In contrast, thin scales formed on Cu-17%Cr-5%Al alloys oxidized between 773 and 1173 K. The exact nature of these scales could not be determined by x-ray diffraction but energy dispersive spectroscopy analyses were used to construct a scale composition map. Phenomenological oxidation mechanisms are proposed for the two alloys.

Author

*Copper Alloys; Reaction Kinetics; X Ray Diffraction; Phenomenology; Microstructure; Castings; Atmospheric Pressure*

**20080047419** NASA Glenn Research Center, Cleveland, OH, USA

**Influence of Test Procedures on the Thermomechanical Properties of a 55NiTi Shape Memory Alloy**

Padula, Santo A., II; Gaydosh, Darrell J.; Noebe, Ronald D.; Bigelow, Glen S.; Garg, Anita; Lagoudas, Dimitris; Karaman, Ibrahim; Atli, Kadri C.; March 09, 2008; 11 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.15.02; Copyright; Avail.: CASI: [A03](#), Hardcopy

Over the past few decades, binary NiTi shape memory alloys have received attention due to their unique mechanical characteristics, leading to their potential use in low-temperature, solid-state actuator applications. However, prior to using these materials for such applications, the physical response of these systems to mechanical and thermal stimuli must be thoroughly understood and modeled to aid designers in developing SMA-enabled systems. Even though shape memory alloys have been around for almost five decades, very little effort has been made to standardize testing procedures. Although some standards for measuring the transformation temperatures of SMA s are available, no real standards exist for determining the various mechanical and thermomechanical properties that govern the usefulness of these unique materials. Consequently, this study involved testing a 55NiTi alloy using a variety of different test methodologies. All samples tested were taken from the same heat and batch to remove the influence of sample pedigree on the observed results. When the material was tested under constant-stress, thermal-cycle conditions, variations in the characteristic material responses were observed, depending on test methodology. The transformation strain and irreversible strain were impacted more than the transformation temperatures, which only showed an affect with regard to applied external stress. In some cases, test methodology altered the transformation strain by 0.005-0.01mm/mm, which translates into a difference in work output capability of approximately 2 J/cu cm (290 in!<sup>3</sup>/cu in). These results indicate the need for the development of testing standards so that meaningful data can be generated and successfully incorporated into viable models and hardware. The use of consistent testing procedures is also important when comparing results from one research organization to another. To this end, differences in the observed responses will be presented, contrasted and rationalized, in hopes of eventually developing standardized testing procedures for shape memory alloys.

Author

*Nickel Alloys; Titanium Alloys; Shape Memory Alloys; Thermodynamics; Actuators; Mechanical Properties; Binary Alloys*

**20080047469** NASA Glenn Research Center, Cleveland, OH, USA

**Spray Forming of NiTi and NiTiPd Shape-Memory Alloys**

Mabe, James; Ruggeri, Robert; Noebe, Ronald; Proceedings of SPIE; March 09, 2008; ISSN 0277-786X; Volume 6930; 15 pp.; In English; Industrial and Commercial Applications of Smart Structures Technologies 2008, 10 Mar. 2008, San Diego, CA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC07QA121P; N68335-04-C-0191; WBS 561581.02.08.03.15.02; Copyright; Avail.: Other Sources  
ONLINE: <http://dx.doi.org/10.1117/12.775243>

In the work to be presented, vacuum plasma spray forming has been used as a process to deposit and consolidate prealloyed NiTi and NiTiPd powders into near net shape actuators. Testing showed that excellent shape memory behavior could be developed in the deposited materials and the investigation proved that VPS forming could be a means to directly form a wide range of shape memory alloy components. The results of DSC characterization and actual actuation test results will be presented demonstrating the behavior of a Nitinol 55 alloy and a higher transition temperature NiTiPd alloy in the form of torque tube actuators that could be used in aircraft and aerospace controls.

Author

*Plasma Spraying; Forming Techniques; Nitinol Alloys; Shape Memory Alloys; Actuators; Smart Materials*

**20080047513** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Extension of Viscoplasticity Based on Overstress to Capture the Effects of Prior Aging on the Time Dependent Deformation Behavior of a High-Temperature Polymer: Experiments and Modeling**

McClung, Amber J; Oct 2008; 217 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489212; AFIT/DS/ENY/08-D15; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA489212>

The inelastic deformation behavior of PMR-15 neat resin, a high-temperature thermoset polymer, was investigated at 288 degrees C. The experimental program was designed to explore the influence of strain rate on tensile loading, unloading, and strain recovery behaviors. In addition, the effect of the prior strain rate on the relaxation response of the material, as well as on the creep behavior following strain controlled loading were examined. The experimental data were modeled with the Viscoplasticity Based on Overstress (VBO) theory. A systematic procedure for determining model parameters was developed and the model was employed to predict the response of the material under various test histories. Additionally the effects of prior aging at 288 degrees C in argon on the time (rate)-dependent behavior of the PMR-15 polymer were evaluated in a series of strain and load controlled experiments. Based on experimental results, the VBO theory was extended to capture the environmentally induced changes in the material response. Several of the VBO material parameters were expanded as functions of prior aging time. The resulting model was used to predict the high-temperature behavior of the PMR-15 polymer subjected to prior aging of various durations.

DTIC

*Capture Effect; Deformation; High Temperature; Plastics; Strain Rate; Tensile Properties; Time Dependence; Viscoplasticity*

**20080047517** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Ab-Initio Molecular Dynamics Simulations of Molten Ni-Based Superalloys (Preprint)**

Woodward, Christopher; Asta, Mark; Trinkle, Dallas R; Lill, James; Angioletti-Uberti, Stefano; Jul 2008; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-05-0089; Proj-4347

Report No.(s): AD-A489306; AFRL-RX-WP-TP-2008-4305; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489306>

In casting of single-crystal turbine blades for jet engines, the formation of solidification defects has become an increasingly important problem due to the rising levels of refractory elements in Ni-based superalloys. Refractory elements, which are beneficial for high-temperature mechanical properties, enhance density-driven convective instabilities underlying the formation of freckle defects in directional solidification. In support of an effort aimed at the development of validated mathematical criteria for predicting solidification-defect formation in superalloys, ab-initio molecular dynamics simulations have been performed to calculate volumes of Ni-Al, Ni-W, Ni-Re, Ni-Ta, Ni-Al-Re, Ni-Al-Ta, Ni-Al-W, and complex chemistries approximating RENE-N4 melts.

DTIC

*Heat Resistant Alloys; Jet Engines; Molecular Dynamics; Nickel Alloys; Simulation; Single Crystals; Turbine Blades*

**20080047676** NASA Glenn Research Center, Cleveland, OH, USA

**Enigmatic Moisture Effects on Al<sub>2</sub>O<sub>3</sub> Scale and TBC Adhesion**

Smialek, James L.; [2008]; 9 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.16.02; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047676>

Alumina scale adhesion to high temperature alloys is known to be affected primarily by sulfur segregation and reactive element additions. However adherent scales can become partially compromised by excessive strain energy and cyclic cracking. With time, exposure of such scales to moisture can lead to spontaneous interfacial decohesion, occurring while the samples are maintained at ambient conditions. Examples of this Moisture-Induced Delayed Spallation (MIDS) are presented for NiCrAl and single crystal superalloys, becoming more severe with sulfur level and cyclic exposure conditions. Similarly, delayed failure or Desk Top Spallation (DTS) results are reviewed for TBC s, culminating in the water drop failure test. Both phenomena are discussed in terms of moisture effects on bulk alumina and bulk aluminides. A mechanism is proposed based on hydrogen embrittlement and is supported by a cathodic hydrogen charging experiment. Hydroxylation of aluminum from the alloy interface appears to be the relevant basic reaction.

Author

*Aluminum Alloys; Adhesion; Sulfur; Reactivity; Moisture; Spallation; Heat Resistant Alloys*

**20080047839** Universal Energy Systems, Inc., Dayton, OH USA

**A Coupled EBSD/EDS Method to Determine the Primary- and Secondary-Alpha Textures in Titanium Alloys With Duplex Microstructures (Preprint)**

Salem, A A; Glavicic, M G; Semiatin, S L; Jul 2007; 32 pp.; In English

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A489602; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A method for separating the textures of primary alpha and secondary alpha in alpha/beta titanium alloys with a duplex microstructure was developed. Utilizing electron backscatter diffraction (EBSD) and energy-dispersive spectroscopy (EDS), the approach relies on the non-uniform partitioning of alloying elements between primary alpha and regions containing secondary-alpha lamellae and residual beta matrix phase. The method was evaluated using samples of Ti-6Al-4V for which vanadium partitions strongly to secondary alpha + beta regions. The technique thus provides a useful tool for quantifying the evolution of deformation texture in the primary alpha and transformation texture in secondary alpha formed via decomposition of the beta matrix following hot working or final heat treatment.

DTIC

*Duplexers; Microstructure; Textures; Titanium Alloys*

**20080047840** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Effect of Stress and Strain Path on Cavity Closure During Hot Working of an Alpha/Beta Titanium Alloy (Preprint)**

Nicolaou, P D; Semiatin, S L; Jul 2007; 31 pp.; In English

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A489603; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The effect of strain path and stress state on deformation and cavitation during hot working of Ti-6Al-4V was established via torsion-compression and reversed-torsion tests. Measurements of the cavity area fraction and the size of individual cavities revealed that the rate of cavity closure during the change in strain path following torsion is approximately twice as large in compression compared to reversed torsion. The observations were interpreted in the context of the effect of texture on local stress state and a micromechanical model for the consolidation of porous media. From an engineering standpoint, this work also indicated that the rate of cavity closure decreases with increasing deformation, thus suggesting that very large strains may be required to heal damage totally.

DTIC

*Cavities; Hot Working; Stress Corrosion; Stress-Strain Relationships; Titanium Alloys*

**20080047842** Missouri Univ., Rolla, MO USA

**Part Repairing Using A Hybrid Manufacturing System (Preprint)**

Ren, Lan; Eiamsa-ard, Kunayut; Ruan, Jianzhong; Liou, Frank; Mar 2007; 10 pp.; In English

Contract(s)/Grant(s): FA8650-04-C-5704; Proj-2865

Report No.(s): AD-A489653; No Copyright; Avail.: Defense Technical Information Center (DTIC)

At present, part remanufacturing technology is gaining more interest from the military and industries due to the benefits

of cost reduction as well as time and energy savings. This paper presents the research on one main component of part remanufacturing technology, which is part repairing. Traditionally, part repairing is done in the repair department using welding processes. However, the limitations of the traditional welding process are becoming more and more noticeable when accuracy and reliability are required. Part repairing strategies have been developed utilizing a hybrid manufacturing system in which the laser-aided deposition and CNC cutting processes are integrated. Part repairing software is developed in order to facilitate the users. The system and the software elevate the repairing process to the next level, in which accuracy, reliability, and efficiency can be achieved. The concept of the repairing process is presented in this paper, and verification and experimental results are also discussed.

DTIC

*Maintenance; Manufacturing; Welding*

**20080047861** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Powder Metallurgy Processing of High-Strength FeCo Alloys (Preprint)**

Turgut, Zafer; Horwath, John C; Fingers, Richard T; Sep 2008; 15 pp.; In English

Contract(s)/Grant(s): Proj-3145

Report No.(s): AD-A489020; AFRL-RZ-WP-TP-2008-2240; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489020>

Fe-Co alloys are extensively used in lamination form, but there are certain power generation applications that require Fe-Co rotors in bulk form. Experiencing only a DC magnetic field, these rotors can be as large as 0.5 meter in diameter, depending on the size of the generator. The forging of such large pieces of Fe-Co has proven to be difficult. The present study investigates powder metallurgy (PM) processing of a gas atomized FeCoNbV alloy through hot isostatic pressing (HIP) for manufacturing large size rotors with improved mechanical strength. Gas atomized FeCoNbV alloy powders with and without ball milling were HIP'ed at temperatures between 675 deg C and 800 deg C at a fixed pressure of 193 MPa for up to 6 hours. Ball milling prior to HIP improved the yield strength. A further improvement in yield strength and in ductility was obtained after a disordering heat treatment at 730 deg C followed by a rapid quench to room temperature. The optimum HIP and annealing conditions resulted in samples with yield strengths of 870 MPa. The compacts exhibited average coercivity values of 6.4 Oe and maximum permeability values of 1100.

DTIC

*Cobalt Alloys; High Strength Alloys; Hot Isostatic Pressing; Hot Pressing; Iron Alloys; Powder Metallurgy*

**20080047880** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Microstructural Conditions Contributing to Fatigue Variability in P/M Nickel-Base Superalloys (Preprint)**

Porter, III, W J; Li, K; Caton, M J; Jha, S; Bartha, B B; Larsen, J M; Sep 2008; 10 pp.; In English

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A489305; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489305>

Variability in the fatigue behavior of two common nickel-base superalloys is discussed, with emphasis given to understanding the behavior of short fatigue cracks. Rene88DT and IN100 are the materials of interest, and serve important roles in many turbine engine systems. Multiple specimens of each material were tested under low cycle fatigue (LCF) conditions at elevated temperature. Two IN100 specimens that exhibited significant difference in cycles to failure and three Rene88DT specimens having dissimilar short fatigue crack growth rates were interrogated to determine the reasons for these variations. This paper will discuss the microstructure adjacent to the initiation sites in these specimens and its role in affecting the observed disparate crack growth behavior. Additionally, an image correlation technique, used to evaluate the development of strain concentrations in a Rene88DT tensile specimen at room temperature, is described. The utility of image correlation for identifying microstructural 'hot spots' (i.e., initiation sites) in concert with LCF testing is considered.

DTIC

*Heat Resistant Alloys; Metal Fatigue; Microstructure; Nickel Alloys; Variability*

**20080047883** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Relaxation of Shot-Peened Residual Stresses Under Creep Loading (Preprint)**

Buchanan, Dennis J; John, Reji; Brockman, Robert A; Oct 2008; 36 pp.; In English

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A489314; AFRL-RX-WP-TP-2008-4330; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489314>

Shot peening is a commonly used surface treatment process that imparts compressive residual stresses into the surface of metal components. Compressive residual stresses retard initiation and growth of fatigue cracks. During the component loading history, loading, or during elevated temperature static loading, such as thermal exposure and creep. In these instances, taking full credit for compressive residual stresses would result in a methodical approach for characterizing and modeling residual stress relaxation under elevated temperature loading, near and above the monotonic yield strength of IN100. The model incorporates the dominant creep deformation mechanism, coupling between the creep and plasticity models, and effects of prior plastic strain. The initial room temperature residual stress and plastic strain profiles provide the initial conditions for relaxation predictions using the coupled creep-plasticity model. Model predictions correlate well with experimental results on shot-peened dogbone specimens subject to single cycle and creep loading conditions at elevated temperature.

DTIC

*Creep Properties; Heat Resistant Alloys; Nickel Alloys; Residual Stress; Shot Peening; Stress Relaxation*

**20080047888** Air Force Research Lab., Wright-Patterson AFB, OH USA

**The Origins of Microtexture in Duplex Ti Alloys (Preprint)**

Glavic, M G; Bartha, B B; Jha, S K; Szczepanski, C J; Jun 2008; 20 pp.; In English

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A489373; AFRL-RX-WP-TP-2008-4332; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489373>

A previously developed methodology was used to transform electron backscatter diffraction (EBSD) data for the primary and secondary alpha phases of Ti-6Al-2Sn-4Zr-6Mo (Ti-6246) to the prior beta phase. The results established that the observed microtexture in duplex alloys is a direct result of the prior beta grain orientations, and variant selection. In addition, for a homogeneous duplex microstructures, all of the secondary alpha phase and the majority of the primary alpha grains retain crystallographic coherency, according to the Burgers Relationship, with the surrounding beta-phase matrix which comprise prior beta grains. This investigation establishes that this technique to recover the prior beta grain orientations is applicable to duplex alpha/beta titanium microstructures. The crystallographic coherency of the primary and secondary alpha phase with the prior beta grain coupled with variant selection then leads to the localized microtexture observed in a wide variety of Ti alloys.

DTIC

*Backscattering; Duplexers; Electron Diffraction; Microstructure; Titanium Alloys*

**20080047908** Oak Ridge National Lab., TN USA

**Materials for Industrial Heat Recovery Systems. Task 1: Improved Materials for Operation of Recuperators for Aluminum Melting Furnaces (Final Report, April 1, 2004-March 30, 2007)**

Gorog, J. P.; Keiser, J. R.; Sarma, G. B.; Thekdi, A.; Meisner, R. A.; Sep. 30, 2007; 64 pp.; In English

Contract(s)/Grant(s): DE-FC36-04GO14035

Report No.(s): DE2007-919037; No Copyright; Avail.: National Technical Information Service (NTIS)

Production of aluminum is a very energy intensive process which is increasingly more important in the USA. This project concentrated on the materials issues associated with recovery of energy from the flue gas stream in the secondary industry where scrap and recycled metal are melted in large furnaces using gas fired burners. Recuperators are one method used to transfer heat from the flue gas to the air intended for use in the gas burners. By preheating this combustion air, less fuel has to be used to raise the gas temperature to the desired level. Recuperators have been successfully used to preheat the air, however, in many cases the metallic recuperator tubes have a relatively limited lifetime 6 to 9 months. The intent of this project was to determine the cause of the rapid tube degradation and then to recommend alternative materials or operating conditions to prolong life of the recuperator tubes.

NTIS

*Aluminum; Furnaces; Gas Streams; Heat Transfer; Melting; Regenerators; Waste Energy Utilization*

**20080048052** Miga Motor Company, Berkeley, CA, USA

**Miniature High-Force, Long-Stroke SMA Linear Actuators**

Cummin, Mark A.; Donakowski, William; Cohen, Howard; NASA Tech Briefs, December 2008; December 2008, pp. 23-24; In English; See also [20080048022](#)

Report No.(s): LEW-18267-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3456>

Improved long-stroke shape-memory-alloy (SMA) linear actuators are being developed to exert significantly higher forces and operate at higher activation temperatures than do prior SMA actuators. In these actuators, long linear strokes are achieved through the principle of displacement multiplication, according to which there are multiple stages, each intermediate stage being connected by straight SMA wire segments to the next stage so that relative motions of stages are additive toward the final stage, which is the output stage. Prior SMA actuators typically include polymer housings or shells, steel or aluminum stages, and polymer pads between successive stages of displacement-multiplication assemblies. Typical output forces of prior SMA actuators range from 10 to 20 N, and typical strokes range from 0.5 to 1.5 cm. An important disadvantage of prior SMA wire actuators is relatively low cycle speed, which is related to actuation temperature as follows: The SMA wires in prior SMA actuators are typically made of a durable nickel/titanium alloy that has a shape-memory activation temperature of 80 C. An SMA wire can be heated quickly from below to above its activation temperature to obtain a stroke in one direction, but must then be allowed to cool to somewhat below its activation temperature (typically, less than or equal to 60 C in the case of an activation temperature of 80 C) to obtain a stroke in the opposite direction (return stroke). At typical ambient temperatures, cooling times are of the order of several seconds. Cooling times thus limit cycle speeds. Wires made of SMA alloys having significantly higher activation temperatures [denoted ultra-high-temperature (UHT) SMA alloys] cool to the required lower return-stroke temperatures more rapidly, making it possible to increase cycle speeds. The present development is motivated by a need, in some applications (especially aeronautical and space-flight applications) for SMA actuators that exert higher forces, operate at greater cycle speeds, and have stronger housings that can withstand greater externally applied forces and impacts. The main novel features of the improved SMA actuators are the following: 1) The ends of the wires are anchored in compact crimps made from short steel tubes. Each wire end is inserted in a tube, the tube is flattened between planar jaws to make the tube grip the wire, the tube is compressed to a slight U-cross-section deformation to strengthen the grip, then the crimp is welded onto one of the actuator stages. The pull strength of a typical crimp is about 125 N -- comparable to the strength of the SMA wire and greater than the typical pull strengths of wire-end anchors in prior SMA actuators. Greater pull strength is one of the keys to achievement of higher actuation force; 2) For greater strength and resistance to impacts, housings are milled from aluminum instead of being made from polymers. Each housing is made from two pieces in a clamshell configuration. The pieces are anodized to reduce sliding friction; 3) Stages are made stronger (to bear greater compression loads without excessive flexing) by making them from steel sheets thicker than those used in prior SMA actuators. The stages contain recessed pockets to accommodate the crimps. Recessing the pockets helps to keep overall dimensions as small as possible; and, 4) UHT SMA wires are used to satisfy the higher-speed/higher-temperature requirement.

Author (revised)

*Shape Memory Alloys; Actuators; Mechanical Properties*

**20080048076** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Projection Method for Flows with Large Local Density Gradients. Application to Dendritic Solidification.**

Heinrich, J. C.; Sajja, U. K.; Felicelli, S. D.; Westra, D. G.; January 2008; 20 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NSF CTS-0553570; Copyright; Avail.: Other Sources

Numerical models of solidification including a mushy zone are notoriously inefficient; most of them are based on formulations that require the coupled solution of the velocity components in the momentum equation greatly restricting the range of applicability of the models. Initial attempts at modeling directional solidification in the presence of a developing mushy zone using a projection formulation encountered difficulties once solidification starts, that were traced to the inability of the method to deal with large local density differences in the vicinity of the fluid-mush interface. A modified formulation of the projection method has been developed, that maintains the coupling between the body force and the pressure gradient and is presented in this work. This formulation is shown to be robust and extremely efficient; reducing by about an order of magnitude the computational time required for the simulation of problems involving very large meshes when compared with previously published data. This, is illustrated in this workthrough its application to simulations involving aPb-Sn alloy.

Author

*Directional Solidification (Crystals); Mathematical Models; Loads (Forces); Pressure Gradients; Alloys*



**20080048081** Oak Ridge National Lab., TN USA

**Plastic Straining of Iridium Alloy Dop-26 During Cup Sizing Operations**

Ohriner, E. K.; Sabau, A. S.; Ulrich, G. B.; Sep. 2007; 25 pp.; In English

Contract(s)/Grant(s): DE-AC05-00OR22725

Report No.(s): DE2007-919455; ORNL/TM-2007/169; No Copyright; Avail.: National Technical Information Service (NTIS)

DOP-26 iridium alloy cups are used for fuel cladding for radioisotope power systems. The cups are deep drawn and recrystallized prior to final fabrication operations. This study characterizes the plastic deformation of cups during a sizing operation following the recrystallization heat treatment. The purpose of the sizing operation is to achieve the specified roundness, diameter, and radius dimensions of the cup. The operation introduces various levels of plastic strain in the cup. Plastic strain can be a cause of inhomogeneous or abnormal grain growth during subsequent exposure to elevated temperature during the service life of the fuel cladding. This is particularly true in the case of cups which have irregularities in the cup walls from the deep drawing operations. Diameter and roundness measurements were made on two cups both before and after sizing. Plastic strain levels were calculated using the ABAQUS(tm) finite element software. The calculated plastic strain levels in both cups were below 0.025, a value shown to be below the critical strain for abnormal grain growth during a simulated service exposure. The calculated maximum plastic strain was found to increase with increased applied sizing load and was not sensitive to the input value for the clearance between the cup and the sizing die. The calculated geometry of the sized cups was in good agreement with the measurements on the finished cups.

NTIS

*Heat Treatment; Iridium Alloys; Recrystallization*

**20080048252** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Long-Term Effects of Soldering By-Products on Nickel-Coated Copper Wire**

Rolin, T. D.; Hodge, R. E.; October 2008; 24 pp.; In English; Original contains color and black and white illustrations

Report No.(s): NASA/TM-2008-215577; M-1242; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080048252>

An analysis of thirty-year-old, down graded flight cables was conducted to determine the makeup of a green material on the surface of the shielded wire near soldered areas and to ascertain if the green material had corroded the nickel-coated copper wire. Two likely candidates were possible due to the handling and environments to which these cables were exposed. The flux used to solder the cables is known to contain abietic acid, a carboxylic acid found in many pine rosins used for the soldering process. The resulting material copper abietate is green in color and is formed during the application of heat during soldering operations. Copper (II) chloride, which is also green in color is known to contaminate flight parts and is corrosive. Data is presented that shows the material is copper abietate, not copper (II) chloride, and more importantly that the abietate does not aggressively attack nickel-plated copper wire.

Author

*Coatings; Copper Chlorides; Nickel; Soldering; Corrosion*

**20080048371** Purdue Univ., West Lafayette, IN, USA

**Synthesis Study: Heat Treatment and Its Effects on Rehabilitating Steel Bridges in Indiana**

Lackowski, M.; Varma, A.; Apr. 2007; 76 pp.; In English

Contract(s)/Grant(s): SPR-3025

Report No.(s): PB2009-102414; FHWA/IN/JTRP-2007/3; No Copyright; Avail.: CASI: A05, Hardcopy

The literature review of prior heat straightening research indicated that significant research has been conducted on the development of: (1) heat straightening repair techniques and their field implementation, (2) guidelines and recommendations for heat straightening repair, (3) empirical procedures for estimating plastic rotations achieved during heat straightening, (4) empirical procedures for predicting residual stresses caused by heat straightening, and (5) the effects of heat straightening on the structural properties of repaired bridges. Currently, there is a need for additional research on: (1) the fatigue performance of heat straightened beams, (2) the effects of single and multiple heat straightening on the fracture toughness and microstructure of steel beams, (3) the development of guidelines for evaluating and replacing steel beams subjected to single or multiple damage-repairs, and (4) investigating the effects of realistic heat straightening with imperfections on the properties and serviceability of steel beam bridges.

NTIS

*Bridges (Structures); Heat Treatment; Steel Structures; Steels*

**20080048481** Concurrent Technologies Corp., Johnstown, PA USA

**Advanced Metalworking Solutions for Naval Systems That Go in Harm's Way**

Jan 2008; 13 pp.; In English

Contract(s)/Grant(s): N00014-06-D-0048

Report No.(s): AD-A489915; No Copyright; Avail.: Defense Technical Information Center (DTIC)

NMC has made considerable progress executing projects that will have a significant positive impact on the Navy. For example, as a result of our HSLA-115 project, a higher-strength steel that provides improved performance and reduced weight has been approved for use and incorporated into the design of CVN 78. For the LCS Program, we developed a transportable, low-cost friction stir welding prototype that produces stiffened aluminum panels, results in lower capital and operating costs and soon will be transitioned to an LCS production facility. On another project, NMC and its team members advanced the technical maturity of LASCOR metallic sandwich panels to the point where the technology is being used to manufacture Deck Edge Safety Berms and Personnel Safety Barrier Panels for DDG 1000. LASCOR offers a lower-cost solution, higher strength relative to weight, corrosion resistance and less distortion. All of these projects encountered significant challenges. All were successful because of the dedicated people managing and supporting them. The success of these projects is directly attributable to NMC staff and their technical competence, strong work ethic, ability to build and cultivate strong teams, unwavering commitment to the customer, and flexibility in adapting and responding to change. NMC did not yield to the challenge but rather honed its game and advanced to a higher level of competition. The Navy faces a significant challenge to meet its goal of increasing the number of ships in the fleet to 313 by the year 2020. The affordability competition will be fierce, but the rewards will be great. We are confident that the people of the Navy Metalworking Center are prepared for the Navy's 21st century challenges and will continue to implement advanced metalworking solutions for naval systems that go in harm's way.

DTIC

*Cost Reduction; Metal Working*

**20080048504** Dayton Univ., OH USA

**Low-Temperature Coarsening and Plastic-Flow Behavior of an Alpha/Beta Titanium Billet Material With an Ultrafine Microstructure**

Sargent, G A; Zane, A P; Fagin, P N; Ghosh, A K; Semiatin, S L; Apr 2008; 49 pp.; In English

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A490070; AFRL-RX-WP-TP-2008-4321; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The influence of microstructure evolution on the low-temperature superplasticity of ultrafine alpha/beta titanium alloys was established. For this purpose, the static and dynamic coarsening response and plastic-flow behavior of Ti-6Al-4V with a submicrocrystalline microstructure were determined via a series of heat treatments and uniaxial compression tests at temperatures of 650, 775, and 815 degrees C at all test temperatures, static coarsening exhibited diffusion-controlled kinetics and followed a dependence on phase composition and volume fraction qualitatively similar to previous observations at 850 to 950 degrees C. Dynamic coarsening at 775 and 815 degrees C and strain rates was similar to prior higher temperature observations as well in that the kinetics were approximately on order of magnitude faster than the corresponding static behaviors. The increase in coarsening rate with superimposed deformation was attributed to the enhancement of diffusion by dislocations generated in the softer beta phase.

DTIC

*Billets; Microstructure; Plastic Flow; Superplasticity; Titanium; Titanium Alloys*

**20080048527** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Nominal Versus Local Shot-Peening Effects on Fatigue Lifetime in Ti-6Al-2Sn-4Zr-6Mo at Elevated Temperature (Preprint)**

Jha, S K; John, R; Larsen, J M; Sep 2008; 26 pp.; In English

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A490187; AFRL-RX-WP-TP-2008-4342; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A study of the elevated temperature fatigue lifetime variability in the shot-peened condition of the a+b titanium alloy, -Ti-6Al-2Sn-4Zr-6Mo, is presented. It is shown that failures separate into two distributions: (1) governed by the nominal residual stress profile, promoting subsurface crack initiation and longer lifetimes, and (2) the life-limiting behavior that is controlled by localized material-shot-peening interaction. In the residual-stress-free condition, failures occurred predominantly by surface crack initiation at the microstructural scale, on the order of 10 um, by crystallographic facet formation in one of

a few a particles and/or colonies. This mechanism was mitigated under the nominal shot-peening residual stress profile, producing failures initiating from the subsurface region by crystallographic faceting spread over a significantly larger area (equivalent diameter of about 100-200 um) than in the absence of residual stress.

DTIC

*Failure; Fatigue Life; High Temperature; Shot Peening*

## 27

### NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see *24 Composite Materials*.

**20080047288** Savannah River National Lab., Aiken, SC, USA

#### **Determination of Reportable Radionuclides for DWPF Sludge Batch 4 Macrobatches 5**

Bannochie, C.; Bibler, N.; Diprete, D.; May 30, 2008; 60 pp.; In English

Contract(s)/Grant(s): DE-AC09-96SR18500

Report No.(s): DE2008-934523; WSRC-STI-2008-00142; No Copyright; Avail.: Department of Energy Information Bridge

The Waste Acceptance Product Specifications (WAPS) 1.2 require that 'The Producer shall report the inventory of radionuclides (in Curies) that have half-lives longer than 10 years and that are, or will be, present in concentrations greater than 0.05 percent of the total inventory for each waste type indexed to the years 2015 and 3115'. As part of the strategy to meet WAPS 1.2, the Defense Waste Processing Facility (DWPF) will report for each waste type, all radionuclides (with half-lives greater than 10 years) that have concentrations greater than 0.01 percent of the total inventory from time of production through the 1100 year period from 2015 through 3115. The initial listing of radionuclides to be included is based on the design-basis glass as identified in the Waste Form Compliance Plan (WCP) and Waste Form Qualification Report (WQR). However, it is required that this list be expanded if other radionuclides with half-lives greater than 10 years are identified that may meet the greater than 0.01% criterion for Curie content. Specification 1.6 of the WAPS, International Atomic Energy Agency (IAEA) Safeguards Reporting for High Level Waste (HLW), requires that the ratio by weights of the following uranium and plutonium isotopes be reported: U-233.

NTIS

*Radioactive Isotopes; Radioactive Wastes; Sludge*

**20080047310** NASA Glenn Research Center, Cleveland, OH, USA

#### **Moisture-Induced Delamination Video of an Oxidized Thermal Barrier Coating**

Smialek, James L.; Zhu, Dongming; Cuy, Michael D.; [2008]; 8 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.16.02; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047310>

PVD TBC coatings were thermally cycled to near-failure at 1150 C. Normal failure occurred after 200-300 1-hr cycles with only moderate weight gains (0.5 mg/cm<sup>2</sup>). Delamination and buckling was often delayed until well after cooldown (desktop spallation), but could be instantly induced by the application of water drops, as shown in an accompanying video-recording. Moisture therefore plays a primary role in delayed desktop TBC failure. Hydrogen embrittlement is proposed as the underlying mechanism.

Author

*Thermal Control Coatings; Delaminating; Moisture; Hydrogen Embrittlement; Failure*

**20080047348** NASA Glenn Research Center, Cleveland, OH, USA

#### **Monitoring Delamination of Thermal Barrier Coatings by Near-Infrared and Upconversion Luminescence Imaging**

Eldridge, J. I.; Martin, R. E.; Singh, Jogender; Wolfe, Doug E.; April 28, 2008; 22 pp.; In English; ICMCTF, 30 Apr. 2008, San Diego, CA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.15.03; Copyright; Avail.: CASI: [A03](#), Hardcopy

Previous work has demonstrated that TBC delamination can be monitored by incorporating a thin luminescent sublayer that produces greatly increased luminescence intensity from delaminated regions of the TBC. Initial efforts utilized visible-wavelength luminescence from either europium or erbium doped sublayers. This approach exhibited good sensitivity to delamination of electron-beam physical-vapor-deposited (EB-PVD) TBCs, but limited sensitivity to delamination of the

more highly scattering plasma-sprayed TBCs due to stronger optical scattering and to interference by luminescence from rare-earth impurities. These difficulties have now been overcome by new strategies employing near-infrared (NIR) and upconversion luminescence imaging. NIR luminescence at 1550 nm was produced in an erbium plus ytterbium co-doped yttria-stabilized zirconia (YSZ) luminescent sublayer using 980-nm excitation. Compared to visible-wavelength luminescence, these NIR emission and excitation wavelengths are much more weakly scattered by the TBC and therefore show much improved depth-probing capabilities. In addition, two-photon upconversion luminescence excitation at 980 nm wavelength produces luminescence emission at 562 nm with near-zero fluorescence background and exceptional contrast for delamination indication. The ability to detect TBC delamination produced by Rockwell indentation and by furnace cycling is demonstrated for both EB-PVD and plasma-sprayed TBCs. The relative strengths of the NIR and upconversion luminescence methods for monitoring TBC delamination are discussed.

Author

*Thermal Control Coatings; Cycles; Delaminating; Luminescence; Imaging Techniques; Optical Properties*

**20080047412** NASA Glenn Research Center, Cleveland, OH, USA

**Crack Growth Properties of Sealing Glasses**

Salem, Jonathan A.; Tandon, R.; October 06, 2008; 12 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 510505.06.03.04.99; Copyright; Avail.: CASI: [A03](#), Hardcopy

The crack growth properties of several sealing glasses were measured using constant stress rate testing in 2% and 95% RH (relative humidity). Crack growth parameters measured in high humidity are systematically smaller (n and B) than those measured in low humidity, and velocities for dry environments are approx. 100x lower than for wet environments. The crack velocity is very sensitive to small changes in RH at low RH. Confidence intervals on parameters that were estimated from propagation of errors were comparable to those from Monte Carlo simulation.

Author

*Crack Propagation; Glass; Sealing; Humidity; Ceramics*

**20080047743** NASA Glenn Research Center, Cleveland, OH, USA

**Adhesion of Silicone Elastomer Seals for NASA's Crew Exploration Vehicle**

deGroh, Henry C., III; Miller, Sharon K. R.; Smith, Ian M.; Daniels, Christopher C.; Steinetz, Bruce M.; October 2008; 23 pp.; In English; 44th Joint Propulsion Conference and Exhibit, 21-23 Jul. 2008, Hartford, CT, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 644423.06.31.04.01.03.22

Report No.(s): NASA/TM-2008-215433; E-16598; Copyright; Avail.: CASI: [A03](#), Hardcopy

Silicone rubber seals are being considered for a number of interfaces on NASA's Crew Exploration Vehicle (CEV). Some of these joints include the docking system, hatches, and heat shield-to-back shell interface. A large diameter molded silicone seal is being developed for the Low Impact Docking System (LIDS) that forms an effective seal between the CEV and International Space Station (ISS) and other future Constellation Program spacecraft. Seals between the heat shield and back shell prevent high temperature reentry gases from leaking into the interface. Silicone rubber seals being considered for these locations have inherent adhesive tendencies that would result in excessive forces required to separate the joints if left unchecked. This paper summarizes adhesion assessments for both as-received and adhesion-mitigated seals for the docking system and the heat shield interface location. Three silicone elastomers were examined: Parker Hannifin S0899-50 and S0383-70 compounds, and Esterline ELA-SA-401 compound. For the docking system application various levels of exposure to atomic oxygen (AO) were evaluated. Moderate AO treatments did not lower the adhesive properties of S0899-50 sufficiently. However, AO pretreatments of approximately  $10^{20}$  atoms/sq cm did lower the adhesion of S0383-70 and ELA-SA-401 to acceptable levels. For the heat shield-to-back shell interface application, a fabric covering was also considered. Molding Nomex fabric into the heat shield pressure seal appreciably reduced seal adhesion for the heat shield-to-back shell interface application.

Author

*Adhesion; Silicone Rubber; Elastomers; Docking; Heat Shielding; International Space Station; Crew Exploration Vehicle; High Temperature Gases*

**20080047790** UT-Battelle, LLC, Oak Ridge, TN, USA

**Molecular Jet Growth of Carbon Nanotubes and Dense Vertically Aligned Nanotube Arrays**

Eres, G., Inventor; 21 Jan 05; 34 pp.; In English

Contract(s)/Grant(s): DE-AC05-00OR22725

Patent Info.: Filed Filed 21 Jan 05; US-Patent-Appl-SN-11-040 919

Report No.(s): PB2008-104844; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method of growing a carbon nanotube includes the step of impinging a beam of carbon-containing molecules onto a substrate to grow at least one carbon nanotube on the catalyst surface.

NTIS

*Carbon; Carbon Nanotubes; Gas Jets; Molecular Flow; Molecules; Nanostructure Growth; Nanotubes; Patent Applications*

**20080047791** Fredrikson and Byron, PA, Minneapolis, MN, USA

**Medicament Incorporation Matrix (PAT-APPL-11-387 508)**

Chudzik, S. J., Inventor; Everson, T. P., Inventor; Amos, R. A., Inventor; 23 Mar 06; 16 pp.; In English

Contract(s)/Grant(s): NIH-1 R43 AR 44758-01

Patent Info.: Filed Filed 23 Mar 06; US-Patent-Appl-SN-11-387 508

Report No.(s): PB2008-104855; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A coating composition, in both its uncrosslinked and crosslinked forms, for use in delivering a medicament from the surface of a medical device positioned in vivo. Once crosslinked, the coating composition provides a gel matrix adapted to contain the medicament in a form that permits the medicament to be released from the matrix in a prolonged, controlled, predictable and effective manner in vivo. A composition includes a polyether monomer, such as an alkoxy poly(alkylene glycol), a carboxylic acid-containing monomer, such as (meth)acrylic acid, a photoderivatized monomer, and a hydrophilic monomer such as acrylamide.

NTIS

*Patent Applications; Coatings; Crosslinking*

**20080047810** Air Force Research Lab., Edwards AFB, CA USA

**Polyhedral Oligomeric Silsesquioxane-Functionalized Perfluorocyclobutyl Aryl Ether Polymers: An Overview of the Synthesis and Properties of Polyhedral Oligomeric Silsesquioxanes (POSS) Functionalized with Perfluorocyclobutyl (PFCB) Aryl Ether Polymer Blends and Copolymers (Preprint)**

Iacono, Scott T; Budy, Stephen M; Smith, Jr, Dennis W; Mabry, Joseph M; Oct 17, 2007; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A489549; AFRL-RZ-ED-BK-2007-475; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Perfluorocyclobutyl (PFCB) aryl ether polymers are semi-fluorinated polymers that produce processable, optically transparent materials for a multitude of materials applications. Incorporating low surface energy polyhedral oligomeric silsesquioxanes (POSS) into the PFCB polymer matrix produced enhanced hydro- and oleo-phobicity. PFCB polymers functionalized with POSS nanostructures include blends, copolymers, and block copolymers. For copolymers, trifluorovinyl aryl ether (TFVE) POSS monomers were prepared in good yields using an operationally simple corner capping methodology from commercial POSS trisilanols. The surface analysis of POSS functionalized PFCB polymer blends and copolymers using microscopy and optical profilometry showed the POSS structures produced sub-micron to nano-meter roughness that contributes to enhanced water and hexadecane repellency.

DTIC

*Copolymers; Ethers; Hydrophobicity; Polymer Blends; Polymers*

**20080047881** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Correlation Between Thermodynamic and Kinetic Fragilities in Non-Polymeric Glass-Forming Liquids (Preprint)**

Senkov, Oleg N; Miracle, Daniel B; Feb 2008; 10 pp.; In English

Report No.(s): AD-A489308; AFRL-RX-WP-TP-2008-4324; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489308>

A theoretical relationship between reduced excess heat capacity of super-cooled liquid at the glass transition temperature, fragility index  $m$  and reduced glass transition temperature, was derived from fragile non-polymeric glass-forming liquids under the assumptions that the fragile behavior of these liquids is described by the Vogel-Fulcher-Tammann (VFT) equation,

the excess heat capacity of liquid is a hyperbolic function of the absolute temperature, and the VFT temperature is equal to the Kauzmann temperature.

DTIC

*Correlation; Equations; Glass; Glass Transition Temperature; Liquids; Thermodynamics*

**20080047903** Sparkman (Klarquist), LLP, Portland, OR, USA; Battelle Memorial Inst., Columbus, OH USA

**Aluminide Coatings (PAT-APPL-11-338 952)**

Henager, C. H., Inventor; Shih, Y., Inventor; Samuels, W. D., Inventor; 24 Jan 06; 12 pp.; In English

Contract(s)/Grant(s): DE-AC05-76RLO1830

Patent Info.: Filed Filed 24 Jan 06; US-Patent-Appl-SN-11-338 952

Report No.(s): PB2008-105657; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Disclosed herein are aluminide coatings. In one embodiment coatings are used as a barrier coating to protect a metal substrate, such as a steel or a superalloy, from various chemical environments, including oxidizing, reducing and/or sulfidizing conditions. In addition, the disclosed coatings can be used, for example, to prevent the substantial diffusion of various elements, such as chromium, at elevated service temperatures. Related methods for preparing protective coatings on metal substrates are also described.

NTIS

*Aluminides; Patent Applications*

**20080048110** Porter, Wright, Morris and Arthur, LLP, Columbus, OH, USA

**Perovskite Electrodes and Method of Making the Same**

Seabaugh, M. M., Inventor; Swartz, S. L., Inventor; 20 Sep 05; 31 pp.; In English

Contract(s)/Grant(s): DE-F2-02-01ER-83227

Patent Info.: Filed Filed 20 Sep 05; US-Patent-Appl-SN-11-231 340

Report No.(s): PB2008-105659; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The invention relates to perovskite oxide electrode materials in which one or more of the elements Mg, Ni, Cu, and Zn are present as minority components that enhance electrochemical performance, as well as electrode products with these compositions and methods of making the electrode materials. Such electrodes are useful in electrochemical system applications such as solid oxide fuel cells, ceramic oxygen generation systems, gas sensors, ceramic membrane reactors, and ceramic electrochemical gas separation systems.

NTIS

*Electrodes; Patent Applications; Perovskites*

**20080048117** Michigan Technological Univ., Houghton, MI, USA

**Evaluation of Methods for Characterizing Air Void Systems in Wisconsin Paving Concrete**

Sutter, L. L.; Jun. 2007; 203 pp.; In English

Contract(s)/Grant(s): WHRP-0092-03-16

Report No.(s): PB2008-105695; WHRP 07-05; No Copyright; Avail.: National Technical Information Service (NTIS)

This research investigated primarily two methods of determining the air-void system parameters of hardened concrete. The methods investigated were the use of a flat-bed scanner and the use of a CT x-ray scanner. The flat-bed scanner proved to be an effective means of performing the analysis at a relatively low cost. The CT scanner proved to be technically feasible but not ready for general implementation outside of controlled laboratory conditions. The research also investigated the freeze-thaw performance of Wisconsin paving concrete mixtures prepared with vinsol resin air-entraining admixtures (AEA) and with non-vinsol (synthetic) AEAs. The mixtures prepared with vinsol resin based AEA performed in accordance with what has been historically reported in the literature. The mixtures prepared with synthetic AEAs performed better than the vinsol based AEA when the admixtures were used in low dosages (i.e. low air content). The results indicate that mixtures prepared with synthetic AEA could possibly be prepared with lower target air contents and a satisfactory level of freeze-thaw performance could be expected.

NTIS

*Air Flow; Concretes; Entrainment; Voids*

**20080048152** Resodyn Corp., USA

**Thermal Spray Formation of Polymer Coatings**

Coquill, Scott; Galbraith, Stephen L.; Tuss, Darren L.; Ivosevic, Milan; NASA Tech Briefs, September 2008; September 2008, pp. 15; In English; See also [20080048125](#)

Report No.(s): LEW-18246-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3118>

This innovation forms a sprayable polymer film using powdered precursor materials and an in-process heating method. This device directly applies a powdered polymer onto a substrate to form an adherent, mechanically-sound, and thickness-regulated film. The process can be used to lay down both fully dense and porous, e.g., foam, coatings. This system is field-deployable and includes power distribution, heater controls, polymer constituent material bins, flow controls, material transportation functions, and a thermal spray apparatus. The only thing required for operation in the field is a power source. Because this method does not require solvents, it does not release the toxic, volatile organic compounds of previous methods. Also, the sprayed polymer material is not degraded because this method does not use hot combustion gas or hot plasma gas. This keeps the polymer from becoming rough, porous, or poorly bonded.

Author

*Sprayed Coatings; Polymers; High Temperature Plasmas; Polymeric Films*

**20080048183** California Inst. of Tech., Pasadena, CA, USA

**Capillography of Mats of Nanofibers**

Noca, Flavio; Sansom, Elijah; Zhou, Jijie; Gharib, Mory; NASA Tech Briefs, September 2008; September 2008, pp. 7; In English; See also [20080048125](#); Original contains color and black and white illustrations

Report No.(s): NPO-40980; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3081>

Capillography (from the Latin capillus, 'hair', and the Greek graphein, to write ) is a recently conceived technique for forming mats of nanofibers into useful patterns. The concept was inspired by experiments on carpetlike mats of multiwalled carbon nanotubes. Capillography may have the potential to be a less-expensive, less-time-consuming alternative to electron-beam lithography as a means of nanoscale patterning for the fabrication of small devices and instruments. In capillography, one exploits the lateral capillary forces exerted on small objects that pierce the surface of a liquid. If the small objects are identical, then the forces are always attractive. Two examples of the effects of such forces are the agglomeration of small particles floating on the surface of a pond and the drawing together of hairs of a wet paintbrush upon removal of the brush from water. Because nanoscale objects brought into contact remain stuck together indefinitely due to Van der Waals forces, patterns formed by capillography remain even upon removal of the liquid. For the experiments on the mats of carbon nanotubes, a surfactant solution capable of wetting carbon nanotubes (which are ultra-hydrophobic) was prepared. The mats were wetted with the solution, then dried. Once the mats were dry, it was found that the nanotubes had become ordered into various patterns, including nestlike indentations, trenches, and various combinations thereof. It may be possible to exploit such ordering effects through controlled wetting and drying of designated portions of mats of carbon nanotubes (and, perhaps, mats of nanofibers of other materials) to obtain patterns similar to those heretofore formed by use of electron-beam lithography. For making patterns that include nestlike indentations, it has been conjectured that it could be possible to control the nesting processes by use of electrostatic fields. Further research is needed to understand the physics of the patterning processes in order to develop capabilities to control patterns formed in capillography.

Author

*Nanofabrication; Fibers; Carbon Nanotubes*

**20080048238** Naval Air Warfare Center, Patuxent River, MD, USA; Office of the Secretary of the Navy, Washington, DC, USA

**Process for Preparing Chromium Conversion Coatings for Iron and Iron Alloys**

Matzdorf, C. A., Inventor; Nickerson, W. C., Inventor; Green, J. L., Inventor; Schwartz, A. S., Inventor; 15 Feb 05; 9 pp.; In English

Patent Info.: Filed Filed 15 Feb 05; US-Patent-Appl-SN-11-076 106

Report No.(s): PB2008-105848; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Process of coating iron alloys to improve the corrosion resistance and adhesive bonding strengths. The process comprises treating the iron or iron alloys such as steel with an acidic aqueous solution comprising, per liter of solution, from about 0.01 to 22 grams of a water soluble trivalent chromium compound, about 0.01 to 12 grams of hexafluorozirconate, at least one

tetrafluoroborate and/or hexafluorosilicate, at least one water soluble divalent zinc compound and from 0.0 to 10 grams of water soluble thickeners and/or water soluble surfactants.

NTIS

*Adhesive Bonding; Chromium; Corrosion Resistance; Iron; Iron Alloys; Patent Applications; Zirconium*

**20080048377** Wisconsin Dept. of Health and Family Services, Madison, WI, USA

**Fatality Assessment and Control Evaluation (FACE) for Wisconsin: Coating Machine Operator Electrocuted While Assisting Electrician With Circuit Breaker Wiring**

Mar. 1994; 3 pp.; In English

Report No.(s): PB2009-102449; FACE-93-WI-233; No Copyright; Avail.: CASI: [A01](#), Hardcopy

A 44-year-old male coating machine operator (the victim) was electrocuted while assisting a company electrician who was re-routing wires from one circuit breaker to another. The electrician discovered that a circuit breaker that served the coating machine was malfunctioning, and was in the process of moving the wires from the malfunctioning circuit breaker to an unused breaker located inside a panel board. The victim had removed the front panel from the adjacent panel board where the unused circuit breaker was located. Lockout/tagout procedures were not being used during this process because de-energization of the coating machine would have caused the coating solutions to cool and clog the machine parts. The electrician had run the wires from the malfunctioning circuit breaker up and over the top inside of the panel board to the adjacent open panel board. At that time, the victim asked if he should pull the wires through, and the electrician directed the victim to pull the wires. While reaching into the panel board, the victim's left arm touched an energized busbar carrying 2000 amperes, and he was electrocuted. The electrician noticed the victim lying on the floor, with his hand still in the panel board. The electrician kicked the victim's hand loose from the busbar, and called for help. Two workers in the area responded and began CPR procedures, until EMT's took over. The victim was transported to the local hospital, where he was pronounced dead. The Wisconsin FACE investigator concluded that, in order to prevent similar circumstances, employers should: (1) Ensure that only fully trained and qualified personnel are permitted to work with energized electrical sources, in accordance with OSHA requirements. (2) Develop, implement and enforce a comprehensive safety program which includes worker training in recognizing and avoiding hazards, especially electrical hazards.

NTIS

*Circuit Breakers; Coating; Wiring*

## 28

### PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power*; *20 Spacecraft Propulsion and Power*; and *44 Energy Production and Conversion*.

**20080047447** NASA Glenn Research Center, Cleveland, OH, USA

**Liquid Acquisition Device Testing with Sub-Cooled Liquid Oxygen**

Jurns, John M.; McQuillen, John B.; July 21, 2008; 11 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 095240.04.04.01.03; Copyright; Avail.: CASI: [A03](#), Hardcopy

When transferring propellant in space, it is most efficient to transfer single phase liquid from a propellant tank to an engine. In earth's gravity field or under acceleration, propellant transfer is fairly simple. However, in low gravity, withdrawing single-phase fluid becomes a challenge. A variety of propellant management devices (PMD) are used to ensure single-phase flow. One type of PMD, a liquid acquisition device (LAD) takes advantage of capillary flow and surface tension to acquire liquid. Previous experimental test programs conducted at NASA have collected LAD data for a number of cryogenic fluids, including: liquid nitrogen (LN<sub>2</sub>), liquid oxygen (LOX), liquid hydrogen (LH<sub>2</sub>), and liquid methane (LCH<sub>4</sub>). The present work reports on additional testing with sub-cooled LOX as part of NASA's continuing cryogenic LAD development program. Test results extend the range of LOX fluid conditions examined, and provide insight into factors affecting predicting LAD bubble point pressures.

Author

*Liquid Oxygen; Cryogenic Fluids; Propellant Transfer; Microgravity; Single-Phase Flow; Liquid Hydrogen; Liquid Nitrogen; Capillary Flow; Liquid Rocket Propellants*



**20080048216** Department of Energy, Washington, DC USA

**Nuclear Rocket Test Facility Decommissioning Including Controlled Explosive Demolition of a Neutron-Activated Shield Wall**

Nelson, J. G.; Simonsen, R. J.; Kruzic, M.; January 2007; 8 pp.; In English

Report No.(s): DE2007-908403; No Copyright; Avail.: Department of Energy Information Bridge

Located in Area 25 of the Nevada Test Site, the Test Cell A Facility was used in the 1960s for the testing of nuclear rocket engines, as part of the Nuclear Rocket Development Program. The facility was decontaminated and decommissioned (D&D) in 2005 using the Streamlined Approach For Environmental Restoration (SAFER) process, under the Federal Facilities Agreement and Consent Order (FFACO). Utilities and process piping were verified void of contents, hazardous materials were removed, concrete with removable contamination decontaminated, large sections mechanically demolished, and the remaining five-foot, five-inch thick radiologically-activated reinforced concrete shield wall demolished using open-air controlled explosive demolition (CED). CED of the shield wall was closely monitored and resulted in no radiological exposure or atmospheric release.

NTIS

*Concretes; Decommissioning; Neutrons; Rocket Engines; Rocket Test Facilities; Walls*

**20080048269** NASA Johnson Space Center, Houston, TX, USA

**Liquid Oxygen/Liquid Methane Test Summary of the RS-18 Lunar Ascent Engine at Simulated Altitude Conditions at NASA White Sands Test Facility**

Melcher, John C., IV; Allred, Jennifer K.; [2009]; 1 pp.; In English; 45th Joint Propulsion Conference, 2-5 Aug. 2009, Denver, CO, USA; No Copyright; Avail.: Other Sources; Abstract Only

Tests were conducted with the RS18 rocket engine using liquid oxygen (LO2) and liquid methane (LCH4) propellants under simulated altitude conditions at NASA Johnson Space Center White Sands Test Facility (WSTF). This project is part of NASA's Propulsion and Cryogenics Advanced Development (PCAD) project. 'Green' propellants, such as LO2/LCH4, offer savings in both performance and safety over equivalently sized hypergolic propellant systems in spacecraft applications such as ascent engines or service module engines. Altitude simulation was achieved using the WSTF Large Altitude Simulation System, which provided altitude conditions equivalent up to approx.120,000 ft (approx.37 km). For specific impulse calculations, engine thrust and propellant mass flow rates were measured. Propellant flow rate was measured using a coriolis-style mass-flow meter and compared with a serial turbine-style flow meter. Results showed a significant performance measurement difference during ignition startup. LO2 flow ranged from 5.9-9.5 lbm/sec (2.7-4.3 kg/sec), and LCH4 flow varied from 3.0-4.4 lbm/sec (1.4-2.0 kg/sec) during the RS-18 hot-fire test series. Thrust was measured using three load cells in parallel. Ignition was demonstrated using a gaseous oxygen/methane spark torch igniter. Data was obtained at multiple chamber pressures, and calculations were performed for specific impulse, C\* combustion efficiency, and thrust vector alignment. Test objectives for the RS-18 project are 1) conduct a shakedown of the test stand for LO2/methane lunar ascent engines, 2) obtain vacuum ignition data for the torch and pyrotechnic igniters, and 3) obtain nozzle kinetics data to anchor two-dimensional kinetics codes.

Author

*Liquid Oxygen; Liquefied Gases; Mass Flow Rate; Combustion Efficiency; Coriolis Effect; Specific Impulse; Rocket Engines*

**31**

**ENGINEERING (GENERAL)**

Includes general research topics related to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see *categories 32 through 39*.

**20080047487** Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA

**Standardized UXO Technology Demonstration Site Moguls Scoring Record Number 907 (Sky Research, Inc.)**

Fling, Rick; McClung, Christina; Burch, William; McClung, J S; Lombardo, Leonardo; McDonnell, Patrick; Aug 2008; 46 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-DTC-8-CO-160-UXO-021

Report No.(s): AD-A489030; ATC-9775; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489030>

This scoring record documents the efforts of Sky Research, Inc. to detect and discriminate inert unexploded ordnance (UXO) utilizing the YPG Standardized UXO Technology Demonstration Site Mogul. This Scoring Record was coordinated

by J. Stephen McClung and the Standardized UXO Technology Demonstration Site Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Command, and the U.S. Army Aberdeen Test Center.

DTIC

*Ammunition; Magnetometers; Portable Equipment; Scoring; Standardization*

**20080047488** Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA

**Standardized UXO Technology Demonstration Site Blind Grid Scoring Record Number 915 (Geometrics, Inc.)**

Fling, Rick; McClung, Christina; Burch, William; McClung, J S; Lombardo, Leonardo; McDonnell, Patrick; Sep 2008; 52 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-DTC-8-CO-160-UXO-021

Report No.(s): AD-A489031; ATC-9814; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489031>

This scoring record documents the efforts of Geometrics, Inc. to detect and discriminate inert unexploded ordnance (UXO) utilizing the YPG Standardized UXO Technology Demonstration Site blind grid. This scoring record was coordinated by J. Stephen McClung and the Standardized UXO Technology Demonstration Site Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Command, and the U.S. Army Aberdeen Test Center.

DTIC

*Ammunition; Scoring; Standardization*

**20080047489** Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA

**Standardized UXO Technology Demonstration Site Open Field Scoring Record Number 914 (Geocenters SAIC)**

Fling, Rick; McClung, Christina; Burch, William; McClung, J S; Lombardo, Leonardo; McDonnell, Patrick; Sep 2008; 52 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-DTC-8-CO-160-UXO-021

Report No.(s): AD-A489033; ATC-9813; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489033>

This scoring record documents the efforts of Geocenters SAIC to detect and discriminate inert unexploded ordnance (UXO) utilizing the YPG Standardized UXO Technology Demonstration Site Open Field. This Scoring Record was coordinated by J. Stephen McClung and the Standardized UXO Technology Demonstration Site Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Command, and the U.S. Army Aberdeen Test Center.

DTIC

*Ammunition; Scoring; Standardization*

**20080047490** Yokohama National Univ., Japan

**Study of Cryogenic Complex Plasma**

Ishihara, Osamu; Oct 27, 2008; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA4869-07-1-4047

Report No.(s): AD-A489035; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489035>

Overall goal is to study basic physics of a complex plasma at a room temperature as well as in a cryogenic environment and to reveal novel natures of a cryogenic complex plasma produced by a stable discharge above or in super fluid liquid helium . This final report describes research on Complex plasma, also known as dusty plasma and plasma with micron-sized dust particles in which charged dust particles interact with background plasma. A system with dust particles is characterized by low frequency oscillations, 1 to 10 Hz, and a system with plasma particles is characterized by high frequency oscillations, 0.1 to 10GHz. The interaction between two distinct systems produces novel features. Basic features of complex plasma at a room temperature have been studied by a device YCOPEX, while cryogenic complex plasma has been studied by YD-1 and YD-2. Researchers have produced discharge plasma in the vapor of liquid helium in the device YD-2 and in the helium gas cooled

by liquid helium in the device YD-1. In YD-1, cryogenic RF plasma is produced in a helium gas in a glass tube surrounded by cryogenic liquid (liquid nitrogen or liquid helium) and dust particles are introduced in the plasma. In YD-2, a cryogenic plasma is produced in the vapor of liquid helium above the super fluid liquid helium. Stable complex plasma in a cryogenic environment has been produced successfully in YD-1 as well as in YD-2. A linear device YCOPEX (Yokohama Complex Plasma Experiment, installed in the summer, of 2006) has been used to study the fundamental physics of room temperature complex plasma. Theoretical study on Coulomb clusters by dust particles revealed the CME (configuration of minimum energy) structures for elongated plasma confinement. Theoretical and simulation study on cryogenic complex plasma has revealed the diffusion process of charged dust particles produced in the vapor of liquid helium toward the surface of liquid helium.

DTIC

*Charged Particles; Cryogenics; Dust; Plasmas (Physics)*

**20080047592** Army Research Lab., Adelphi, MD USA

**Modeling of a Magnetic Flux Concentrator**

Fischer, Gregory A; Edelstein, Alan S; Mar 2004; 21 pp.; In English

Report No.(s): AD-A489532; ARL-TR-3166; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We performed magnetic modeling of a new and novel magnetic sensor from Visidyne Corp. The sensor is a high sensitivity vector field magnetometer. Such sensors have considerable potential for use as unattended ground sensors (UGS), alone or networked with other types of sensors, and to detect underground facilities. At frequencies over 10 Hz, the Visidyne sensitivity of 5pT square root Hz makes the sensor promising for UGS type applications. Below this frequency the sensor is limited by geomagnetic noise. Still higher sensitivity is desired for the detection of underground facilities.

DTIC

*Concentrators; Magnetic Flux; Magnetometers*

**20080047741** NASA Glenn Research Center, Cleveland, OH, USA

**Design of a Model Execution Framework: Repetitive Object-Oriented Simulation Environment (ROSE)**

Gray, Justin S.; Briggs, Jeffery L.; November 2008; 22 pp.; In English; 44th Joint Propulsion Conference and Exhibit, 21-23 Jul. 2008, Hartford, CT, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 599489.02.07.03.09.02

Report No.(s): NASA/TM-2008-215299; AIAA Paper-2008-4860; E-16568; No Copyright; Avail.: CASI: [A03](http://hdl.handle.net/2060/20080047741), Hardcopy ONLINE: <http://hdl.handle.net/2060/20080047741>

The ROSE framework was designed to facilitate complex system analyses. It completely divorces the model execution process from the model itself. By doing so ROSE frees the modeler to develop a library of standard modeling processes such as Design of Experiments, optimizers, parameter studies, and sensitivity studies which can then be applied to any of their available models. The ROSE framework accomplishes this by means of a well defined API and object structure. Both the API and object structure are presented here with enough detail to implement ROSE in any object-oriented language or modeling tool.

Author

*Complex Systems; Sensitivity; Object-Oriented Programming; Experiment Design*

**20080047800** Air Force Research Lab., Edwards AFB, CA USA

**Comments and Position Regarding the Proposed TB 700-2 Rewrite Dated June 2007 (Preprint)**

Schwartz, Daniel F; Jun 2008; 28 pp.; In English

Contract(s)/Grant(s): Proj-5026

Report No.(s): AD-A489560; AFRL-RZ-ED-TP-2008-234; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Members of the Department of Defense Explosive Safety Board (DDESB) and the Tri-Services Joint Hazard Classifiers (JHC) have been revising the current Department of Defense Ammunition and Explosives Hazard Classification Procedures: Joint Technical Bulletin TB 700-2/NAVSEAINST 8020.8B/TO 11A-1-47/DLAR 8220.1.1 Some of the proposed revisions to the test protocols outlined in this document, (hereafter referred to as TB 700-2) are more conservative and will be more costly to implement than the previous ones. These changes could have a profound impact on the solid rocket community involved with the research and development and manufacture of solid rocket propellants and motors; particularly, those to be shipped or placed in DoD storage facilities. The ramifications may include higher development costs and storage limitations for solid

rocket propellants and motors. This paper outlines past TB 700-2 revisions, the current TB 700-2 hazard classification requirements and protocols, changes of concern to the proposed TB 700-2 Revision Final Draft 2 and the possible ramifications to the solid rocket community.

DTIC

*Ammunition; Classifications; Explosives; Hazardous Materials; Hazards; Project Management; Protocol (Computers); Tests*

**20080047868** Office of Naval Research, Arlington, VA USA

**A Report on the Navy SBIR Program: Best Practices, Roadblocks and Recommendations for Technology Transition**

Bland, Erin; Busch, Dan; Clark, Al; Apr 2008; 133 pp.; In English

Report No.(s): AD-A489122; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489122>

Over the past few years the Armed Services Committees have shown an increased interest in the DoD doing as much as possible to transition SBIR developed technologies into products or services that support the warfighter. As part of the 2006 National Defense Authorization Act they formulated the Commercialization Pilot Program (CPP), which requests that the DoD SBIR program align itself more closely to Program Executive Offices (PEOs), platforms and warfighter needs, and improve the acceleration of SBIR technologies to the field. OSD AT&L responded to that language by requiring the Army, Air Force and Navy develop pilot programs aimed towards that goal. I thought the best way to get started was to appoint an expert, independent 'Tiger Team' to perform a comprehensive study of the Navy's best SBIR practices and worst roadblocks which impact technology transition. This report is the sum of their work, and will be a key document in providing guidance as the Navy maintains our continuous improvement philosophy for the best-in-class SBIR program. The report points out that the Navy's program is decentralized, which allows the PEOs and SYSCOMs to play a dominant role in determining SBIR topic and award allocation. PEO ownership of the Navy SBIR program is the key to our success: those with the technology needs and resources determine how to spend the SBIR investment. But, the study also found that there is substantial variation in practice and success; improvements could be gained from better sharing of best practices, standardization of repetitive tasks, and better training of SBIR firms, Navy Technical Monitors, PEOs, Fleet leaders (OPNAV) and our contracting officers. This report provides Navy management with well thought-out, defined and documented findings, recommendations and initiatives that will help guide us as we work to make the Navy SBIR program better.

DTIC

*Contract Management; Navy; Procedures; Project Management; Research Management; Technology Transfer*

**20080047991** California Inst. of Tech., Pasadena, CA, USA

**System for Measuring Flexing of a Large Spaceborne Structure**

Scharf, Daniel; Kuhnert, Andreas; Kovalik, Joseph; Hadaegh, Fred; Shaddock, Daniel; NASA Tech Briefs, October 2008; October 2008, pp. 12; In English; See also [20080047981](#)

Report No.(s): NPO-45076; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3266>

An optoelectronic metrology system is used for determining the attitude and flexing of a large spaceborne radar antenna or similar structure. The measurements are needed for accurate pointing of the antenna and correction and control of the phase of the radar signal wavefront. The system includes a dual-field-of-view star tracker; a laser ranging unit (LRU) and a position-sensitive-detector (PSD)-based camera mounted on an optical bench; and fiducial targets at various locations on the structure. The fiducial targets are illuminated in sequence by laser light coupled via optical fibers. The LRU and the PSD provide measurements of the position of each fiducial target in a reference frame attached to the optical bench. During routine operation, the star tracker utilizes one field of view and functions conventionally to determine the orientation of the optical bench. During operation in a calibration mode, the star tracker also utilizes its second field of view, which includes stars that are imaged alongside some of the fiducial targets in the PSD; in this mode, the PSD measurements are traceable to star measurements.

Author

*Optoelectronic Devices; Metrology; Flexing; Radar Antennas; Large Space Structures*

**20080047992** California Inst. of Tech., Pasadena, CA, USA

**Integrated Formation Optical Communication and Estimation System**

Scharf, Daniel; Kuhnert, Andreas; Kovalik, Joseph; Hadaegh, Fred; Shaddock, Daniel; NASA Tech Briefs, October 2008; October 2008, pp. 12; In English; See also [20080047981](#)

Report No.(s): NPO-44558; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3269>

An architecture has been designed that integrates formation estimation methodologies, precision formation sensing, and high-bandwidth formation communication into a robust, strap-on system that meets knowledge and communication requirements for the majority of planned, precision formation missions. Specifically, the integrated system supports (a) sub-millimeter metrology, (b) multiple greater than 10 Mbps communication channels over a large, 10 deg field-of-view (FOV), and (c) generalized formation estimation methodologies. The sensing sub-system consists of several absolute, metrology gauges with up to 0.1 mm precision that use amplitude-modulated lasers and a LISA-heritage phase meter. Since amplitude modulation is used, inexpensive and robust diode lasers may be used instead of complex, frequency-stabilized lasers such as for nanometer-level metrology. The metrology subsystem laser transceivers consist of a laser diode, collecting optics, and an avalanche photo diode (APD) for detecting incoming laser signals. The APD is necessary since received power is small due to the large (for optical applications) FOV. The phase meter determines the phase of the incoming amplitude modulations as measured by the APD. This phase is equivalent to time-of-flight and, therefore, distance. By placing three laser transceivers on each spacecraft, 18 clock-offset-corrupted distances are calculated. These measurements are communicated and averaged to obtain nine correct distances between the transceivers. From these correct distances, the range and bearing between spacecraft and their relative attitude are determined. Next, communication is integrated on the laser carrier through spectral separation. Metrology amplitude modulations are limited to the 45-50 MHz band, leaving 0-45 MHz for communication. Through careful design of coding scheme, error correction, and filters, six independent 10 Mbps receive channels are possible. Hence, a spacecraft can simultaneously broadcast at 10 Mbps and listen to six other spacecraft. The integrated sensing and communication architecture has been developed, as have formation estimation methodologies that allow the sensing topology to reconfigure as spacecraft maneuver. A bench-top implementation of the integrated sensing and communication architecture is in progress. The final, multiple sensing/communication systems will be tied together via formation estimation algorithms that are also undergoing further development.

Author

*Optical Communication; Metrology*

**20080048418** Technische Univ., Vienna, Austria

**How to Distribute GPS-Time Over COTS-Based LANs**

Schmid, Ulrich; Horauer, Martin; Kero, Nikolaus; Dec 1999; 17 pp.; In English

Report No.(s): AD-A489835; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489835>

This paper shows how to distribute GPS-time with micro-accuracy and below even in Ethernet-based distributed systems. Our SynUTC-approach is based upon a simple network controller-level hardware for timestamping data packets as they leave and arrive at a node, which comes in two flavors: The memory-based times-tamping method exploited by our Network Time Interface (NTI) M-Module timestamps data packets as the network controller accesses them in memory. This technique can be used for virtually any type of network and network controllers. For 10 Mb/s Ethernet, for example, our experimental evaluation revealed a time distribution accuracy down to the pus-range.

DTIC

*Global Positioning System; Local Area Networks; Networks*

**20080048531** Pennsylvania State Univ., University Park, PA USA

**iMAST Quarterly, Number 2, 2003**

Singh, Jogender; Wolfe, Douglas E; Jan 2003; 9 pp.; In English

Contract(s)/Grant(s): N00024-02-D-6604

Report No.(s): AD-A490201; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The IMAST quarterly newsletter is published by the Institute for Manufacturing and Sustainment Technologies of the Applied Research Laboratory at Penn State, University Park, PA. IMAST is sponsored by the U.S. Navy Manufacturing Technology Program, Office of Naval Research. This issue features an article on: Tailored Microstructure of Zirconia and

Hafnia-Based Thermal Barrier Coatings with Low Thermal Conductivity and High Hemispherical Reflectance by EB-PVD, as well as Institute Notes, personnel changes and calendar of events.

DTIC

*Manufacturing; Marine Technology*

**20080048533** TEMEX Time Neuchatel, Switzerland

**Rubidium Atomic Clock for Galileo**

Jeanmaire, A; Rochat, P; Emma, F; Dec 1999; 11 pp.; In English

Report No.(s): AD-A490205; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The overall performance of navigation payloads is dependent on the performance of the on-board clocks. Better stability leads directly to improved space segment autonomy and simplified ground segment operation. The European Space Agency supports the development of advanced atomic clocks in the frame of its Technology Demonstration Program and more recently under the GNSS-2 program. Two major activities are currently running with the aim fully space-qualifying a Rubidium Atomic Frequency Standard (RAFS) and a Space Hydrogen Maser (SHM). The development activity for the Rubidium clocks is driven by the following major design goals: \* Mass < 1 Kg \* Short-term Stability (100s) < 5 x 10(exp -13), flicker floor 5 x 10(exp -14) \* Volume < 1 ltr. Special emphasis has been placed on reliability for a 10-year mission. This article presents the status of the rubidium development program and focuses on the significant design goals and results obtained to date.

DTIC

*Atomic Clocks; Galileo Spacecraft; Rubidium*

**20080048535** Naval Observatory, Washington, DC USA

**Loran-C Prediction Problems**

Lukac, Carl F; Dec 1981; 12 pp.; In English

Report No.(s): AD-A490209; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Control of time and frequency at remote stations and the maintenance of a constant time scale for Loran-C chains are problems of practical importance. The stability of stations monitoring a Loran-C chain is analyzed - in particular, those stations monitoring the Northwest Pacific chain (LC/9970). Part of the analysis consists of comparing individual determinations of the quantity, U. S. Naval Observatory Master Clock (USNO MC) - LC/9970, with an averaged value and in making intercomparisons of monitored data.

DTIC

*Clocks; Frequencies; LORAN C; Navigation*

**20080048536** Department of the Air Force, Norton AFB, CA USA

**Using the Navstar Global Positioning System as a Global Timing System**

Kovach, Karl L; Dec 1981; 34 pp.; In English

Report No.(s): AD-A490212; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Navstar Global Positioning System (GPS), although primarily designed for three dimensional position and velocity determination, is uniquely capable of providing highly accurate and stable timing information to users. This capability is derived from the time delay pseudo ranging concept which forms the basis for GPS navigation. The combination of navigation and timing together in one system will make GPS the Precise Time and Time Interval (PTTI) source of choice for the foreseeable future. Only GPS can supply continuous timing data world wide, in any weather, to a dynamically moving user at a previously unsurveyed site, with submicrosecond accuracy traceable to an established reference. This paper discusses the application of Navstar GPS to the problems of PTTI dissemination. A short review of the GPS concept leads to a detailed description of the implementation of time transfer through Navstar GPS. Time is followed from the U.S. Naval Observatory (USNO) through the ground control, satellite, and receiving segments of GPS to the user's clock system. The three options by which a user's system can receive from the GPS receivers, currently under development by the DOD, are defined in detail. The electrical/digital/mechanical interface parameters along with suggested methods for their use are outlined for each option. A detailed error model is also presented for the traceability of UTG (GPS) to UTC (USNO). Although absolute accuracy of UTC (GPS) provided to a user is specified to be slightly over 100 nanoseconds rms, substantially better accuracies can be easily achieved. By understanding and working around some of the GPS error uncertainties, real time synchronization between stationary users on the same continent can be controlled to within a few nanoseconds, and absolute post processed time offset with UTC (USNO) measured within 25 nanoseconds or better.

DTIC

*Global Positioning System; Navstar Satellites; Real Time Operation; Timing Devices*

## COMMUNICATIONS AND RADAR

Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and 17 *Space Communications, Spacecraft Communications, Command and Tracking*; for search and rescue, see 03 *Air Transportation and Safety*; and 16 *Space Transportation and Safety*.

**20080047256** Federal Trade Commission, Washington, DC, USA

**Do-Not-Call Improvement Act of 2007. Report to Congress: Regarding the Accuracy of the Do Not Call Registry**

Oct. 2008; 12 pp.; In English

Report No.(s): PB2009-101887; No Copyright; Avail.: CASI: [A03](#), Hardcopy

On February 15, 2008, Congress passed the Do-Not-Call Improvement Act of 2007 (2007 DNCIA). According to the 2007 DNCIA, the Federal Trade Commission (FTC or Commission) shall periodically check telephone numbers registered on the national do-not-call registry against national or other appropriate databases and (remove) from such registry those telephone numbers that have been disconnected and reassigned. In addition, the 2007 DNCIA eliminated the automatic removal of numbers from the National Do-Not-Call Registry (National Registry or Registry) every five years. The 2007 DNCIA also mandates that, no later than nine months after the laws enactment, the Commission submit a report describing the efforts it has taken to improve the accuracy of the Registry. This Report from the Commission describes the efforts taken to ensure the accuracy of the Registry and outlines the newly implemented procedure being used to remove reassigned numbers from the Registry.

NTIS

*Congressional Reports; Teleoperators*

**20080047270** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Type Inference for COBOL Systems**

Van Deursen, A.; Moonen, L. M. F.; Sep. 1998; 16 pp.; In English

Report No.(s): PB2009-102340; SEN-R9813; Copyright; Avail.: National Technical Information Service (NTIS)

Types are a good starting point for various software reengineering tasks. Unfortunately, programs requiring reengineering most desperately are written in languages without an adequate type system (such as COBOL). To solve this problem, we propose a method of automated type inference for these languages. The main ingredients are that if variables are compared using some relational operator their types must be the same; likewise if an expression is assigned to a variable, the type of the expression must be a subtype of that of the variable. We present the formal type system and inference rules for this approach, show their effect on various real life COBOL fragments, describe the implementation of our ideas in a prototype type inference tool for COBOL, and discuss a number of applications.

NTIS

*COBOL; Inference*

**20080047285** National Security Technologies, LLC, Las Vegas, NV, USA

**Lunar Wireless Power Transfer Feasibility Study**

Freid, S.; Jun. 01, 2008; 36 pp.; In English

Contract(s)/Grant(s): DE-AC52-06NA25946

Report No.(s): DE2008-934452; DOE/NV/25946--488; No Copyright; Avail.: National Technical Information Service (NTIS)

This study examines the feasibility of a multi-kilowatt wireless radio frequency (RF) power system to transfer power between lunar base facilities. Initial analyses, show that wireless power transfer (WPT) systems can be more efficient and less expensive than traditional wired approaches for certain lunar and terrestrial applications. The study includes evaluations of the fundamental limitations of lunar WPT systems, the interrelationships of possible operational parameters, and a baseline design approach for a notional system that could be used in the near future to power remote facilities at a lunar base. Our notional system includes state-of-the-art photovoltaics (PVs), high-efficiency microwave transmitters, low-mass large-aperture high-power transmit antennas, high-efficiency large-area rectenna receiving arrays, and reconfigurable DC combining circuitry.

NTIS

*Feasibility; Wireless Communication*

**20080047319** Clarkson Univ., Potsdam, NY, USA

**Intelligent Control via Wireless Sensor Networks for Advanced Coal Combustion Systems, (Final)**

Beha, A.; Kumar, S.; Ahmadi, G.; Aug. 05, 2007; 34 pp.; In English

Contract(s)/Grant(s): DE-FG26-06NT42687

Report No.(s): DE2008-934579; No Copyright; Avail.: National Technical Information Service (NTIS)

Numerical Modeling of Solid Gas Flow, System Identification for purposes of modeling and control, and Wireless Sensor and Actor Network design were pursued as part of this project. Time series input-output data was obtained from NETL's Morgantown CFB facility courtesy of Dr. Lawrence Shadle. It was run through a nonlinear kernel estimator and nonparametric models were obtained for the system. Linear and first-order nonlinear kernels were then utilized to obtain a state-space description of the system. Neural networks were trained that performed better at capturing the plant dynamics. It is possible to use these networks to find a plant model and the inversion of this model can be used to control the system. These models allow one to compare with physics based models whose parameters can then be determined by comparing them against the available data based model. On a parallel track, Dr. Kumar designed an energy-efficient and reliable transport protocol for wireless sensor and actor networks, where the sensors could be different types of wireless sensors used in CFB based coal combustion systems and actors are more powerful wireless nodes to set up a communication network while avoiding the data congestion. Dr. Ahmadi's group studied gas solid flow in a duct. It was seen that particle concentration clearly shows a preferential distribution. The particles strongly interact with the turbulence eddies and are concentrated in narrow bands that are evolving with time.

NTIS

*Coal; Combustion; Combustion Chambers; Communication Networks; Fuel Combustion*

**20080047399** National Inst. of Standards and Technology, Gaithersburg, MD, USA

**Forensic Filtering of Cell Phone Protocols**

Delaitre, A.; Jansen, W.; Aug. 2008; 42 pp.; In English

Report No.(s): PB2009-102235; NISTIR-7516; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Phone managers are non-forensic software tools designed to carry out a range of tasks for the user, such as reading and updating the contents of a phone, using one or more of the communications protocols supported by the phone. Phone managers are sometimes used by forensic investigators to recover data from a cell phone when no suitable forensic tool is available. While precautions can be taken to preserve the integrity of data on a cell phone, inherent risks exist. Applying a forensic filter to phone manager protocol exchanges with a device is proposed as a means to reduce risk.

NTIS

*Protocol (Computers); Telephones; Accident Prevention*

**20080047475** National Inst. of Standards and Technology, Gaithersburg, MD, USA

**Cell Phone Forensic Tools: An Overview and Analysis Update**

Ayers, R.; Jansen, W.; Delaitre, A.; Moenner, L.; Mar. 2007; 165 pp.; In English

Report No.(s): PB2009-102232; NISTIR-7387; No Copyright; Avail.: CASI: [A08](#), Hardcopy

Cell phones and other handheld devices incorporating cell phone capabilities (e.g., Personal Digital Assistant (PDA) phones) are ubiquitous. Rather than just placing calls, most phones allow users to perform additional tasks, including Short Message Service (SMS) messaging, Multi-Media Messaging Service (MMS) messaging, Instant Messaging (IM), electronic mail, Web browsing, and basic Personal Information Management (PIM) applications (e.g., phone and date book). PDA phones, often referred to as smart phones, provide users with the combined capabilities of both a cell phone and a PDA. In addition to network services and basic PIM applications, one can manage more extensive appointment and contact information, review electronic documents, give a presentation, and perform other tasks. All but the most basic phones provide individuals with some ability to load additional applications, store and process personal and sensitive information independently of a desktop or notebook computer, and optionally synchronize the results at some later time. As digital technology evolves, the existing capabilities of these devices continue to improve rapidly. When cell phones or other cellular devices are involved in a crime or other incident, forensic examiners require tools that allow the proper retrieval and speedy examination of information present on the device. This report provides an overview on current tools designed for acquisition, examination, and reporting of data discovered on cellular handheld devices, and an understanding of their capabilities and limitations. It is a follow-on to NISTIR 7250 Cell Phone Forensic Tools: An Overview and Analysis, which focuses on tools that have undergone significant updates since that publication or were not covered previously.

NTIS

*Telephones; Information Management; Electronic Mail; Wireless Communication*



**20080047476** Federal Communications Commission, Washington, DC USA

**Local Telephone Competition: Status as of December 31, 2007**

Sep. 2008; 24 pp.; In English

Report No.(s): PB2009-101817; No Copyright; Avail.: National Technical Information Service (NTIS)

We present here summary statistics of the latest data on local telephone service competition in the USA as reported in the Commissions local competition and broadband data gathering program (FCC Form 477). The summary statistics provide a snapshot of local telephone service competition based on switched access lines in service and state-specific mobile telephony service subscribers as of December 31, 2007. Twice a year, all incumbent local exchange carriers (incumbent LECs) and competitive local exchange carriers (CLECs) are required to report to the Commission basic information about their local telephone service, and all facilities-based mobile telephony providers are required to provide information about their subscribers. Prior to June 2005, the FCC collected data from carriers with at least 10,000 switched access lines, or mobile telephony subscribers, in service in a particular state. Small carriers, many of whom serve rural areas with relatively small populations, were therefore underrepresented in the earlier data.

NTIS

*Competition; Telephones; Switching; Broadband*

**20080047509** Rheinisch Westfälische Technische Hochschule Aachen, Aachen, Netherlands

**Backward Drift Estimation with Application to Quality Layer Assignment in H.264/AVC Based Scalable Video Coding**

Rusert, Thomas; Ohm, Jens-Rainer; Apr 2007; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489196; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489196>

We present an approach for accurate estimation of the reconstruction distortion in SNR scalable video coding with drift. Based on a linear model of predictive video coding, we derive an algorithm to quantify spatio-temporal drift properties subject to prediction structure and motion information. This allows for low-complex estimation of the reconstruction distortion on a per-block basis. The accuracy of the distortion estimation is experimentally verified. We then utilize the method for quality layer assignment within the framework of H.264/AVC scalable video coding 'SVC', which is currently under standardization. The quality layers allow for bit stream truncation in a rate-distortion optimized sense. Compared to the quality layer assignment as implemented in the SVC test model, use of backward drift estimation allows for achieving equivalent coding efficiency with reduced complexity.

DTIC

*Coding; Video Signals*

**20080047777** Department of Homeland Security, Washington, DC, USA

**Interoperable Communications for Planned Events**

January 2008; 28 pp.; In English

Report No.(s): PB2008-105568; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This guide is intended for emergency response officials responsible for designing and executing interoperable communications plans for planned events (e.g., festivals, concerts, and sporting events) in their community. Interoperable communications plans include not only voice but also data considerations. The content presented in this guide is based on input from emergency responders, including lessons learned and best practices. To use communications equipment and systems effectively in all types of emergencies, emergency response personnel must have multi-disciplinary and multi-jurisdictional opportunities to become familiar with the equipment, practice Standard Operating Procedures (SOPs), and enhance their preparedness. Too often, communities procure communications equipment for interoperability with the intent of using it only when disaster strikes or the need arises. Technology alone, no matter how expansive or advanced, is limited in its effectiveness unless it is used regularly in day-to-day operations.

NTIS

*Emergencies; Telecommunication; Communication Equipment*

**20080047781** Federal Communications Commission, Washington, DC USA

**Universal Service Monitoring Report**

January 2007; 629 pp.; In English

Report No.(s): PB2008-105618; No Copyright; Avail.: National Technical Information Service (NTIS)

This is the eleventh report in a series of reports prepared by federal and state staff members for the Federal-State Joint

Board on Universal Service in CC Docket No. 96-45 (Universal Service Joint Board). This report is based on information available to us as of June 2007. These reports contain information designed to monitor the impact of various universal service support mechanisms, and the methods used to finance them. These mechanisms were adopted by the Federal Communications Commission (Commission), based on recommendations from the Universal Service Joint Board. These reports are part of a monitoring program created by the Commission in 1997 to replace a similar program in CC Docket No. 87-339 that resulted in a series of nineteen Monitoring Reports. The current program incorporates most of the information that was collected under the previous program, and also new materials from the reports of the administrator of the universal service support mechanisms, the Universal Service Administrative Company (USAC). To enhance our monitoring ability, we have created an open docket, which allows data, materials, comments, and studies to be submitted by any interested party at any time. The monitoring program has proven to be valuable, not only as a report on the effects of the Commission's regulatory policies, but also as a complete census of all incumbent local exchange carriers. Because smaller carriers generally are exempt from most Commission reporting requirements, the Monitoring Report incorporates data from several sources, including the National Exchange Carrier Association (NECA) and USAC.

NTIS

*Telephones; Support Systems; Telecommunication*

**20080047782** Federal Communications Commission, Washington, DC USA

**Local Telephone Competition: Status as of December 31, 2006**

Dec. 2007; 24 pp.; In English

Report No.(s): PB2008-105619; No Copyright; Avail.: National Technical Information Service (NTIS)

We present here summary statistics of the latest data on local telephone service competition in the USA as reported in the Commission's local competition and broadband data gathering program (FCC Form 477). The summary statistics provide a snapshot of local telephone service competition based on switched access lines in service and state-specific mobile telephony service subscribers as of December 31, 2006. Twice a year, all incumbent local exchange carriers (incumbent LECs) and competitive local exchange carriers (CLECs) are required to report to the Commission basic information about their local telephone service, and all facilities-based mobile telephony providers are required to provide information about their subscribers. Prior to June 2005, the FCC collected data from carriers with at least 10,000 switched access lines, or mobile telephony subscribers, in service in a particular state. Small carriers, many of whom serve rural areas with relatively small populations, were therefore underrepresented in the earlier data. With the inclusion of these carriers, the number of incumbent LEC and CLEC holding companies and unaffiliated carriers reporting local telephone service information as of December 31, 2005 tripled, and the number of reporting facilities-based mobile telephony providers doubled.

NTIS

*Competition; Telephones; Wireless Communication*

**20080047860** Air Univ., Maxwell AFB, AL USA

**Small Wars in a Big Theater: Special Operations Air Component Integration with the Joint Air Component in Theater Operations**

West, William P; Mar 2007; 94 pp.; In English

Report No.(s): AD-A489019; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489019>

In the 15 years since the formation of the U.S. Special Operations Command, the special operations forces (SOF) communities of all services have strongly emphasized the integration of their combat capabilities. However, Air Force Special Operations Forces (AFSOF) have not put this same degree of effort into the integration of combat capabilities with the rest of the U.S. Air Force. Consequently, AFSOF are experts at the joint tactical fight but are less proficient at integrating into larger conventional air operations. This deficiency is most evident when SOF air forces must work within the command and control (C2) system of theater air forces. This study addresses the issue and proposes measures to enhance the coordination between special operations air forces and conventional air forces in theater operations. The history of this issue is examined through three case studies: the 1st Air Commando Group in Operation Thursday, the Son Tay Raid, and SOF C2 in Operation Desert Storm. From these case studies, three main lessons stand out as applicable to the issues facing the SOF air component today: (1) SOF must integrate their operations into the larger set of theater operations, (2) SOF air assets should be centrally controlled by the theater SOF component, and (3) SOF cannot plan missions in a vacuum. Recommended measures are broken down into three specific areas: doctrine, personnel and training, and equipment. From an examination of these areas, the study proposes a set of nine reforms, including preventing the decentralized control of SOF airpower by forming one joint special operations air component (JSOAC) per contingency, balancing operational security with planning considerations to work

within the constraints of the conventional airpower targeting cycle, establishing doctrine for JSOAC operations similar to that of the joint special operations task force (JSOTF), and realigning the operational support squadron (OSS) to function as a garrison JSOAC.

DTIC

*Command and Control; Military Operations; Military Personnel*

**20080047893** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Enabling Multimedia Metadata Interoperability by Defining Formal Semantics of MPEG-7 Profiles**

Troncy, R.; Bailer, W.; Hausenblas, M.; Hofmair, P.; Schlatte, R.; Jul. 2006; 20 pp.; In English

Report No.(s): PB2008-105176; INS-E0606; Copyright; Avail.: National Technical Information Service (NTIS)

MPEG-7 can be used to create complex and comprehensive metadata descriptions of multimedia content. Since MPEG-7 is defined in terms of an XML schema, the semantics of its elements have no formal grounding. In addition, certain features can be described in multiple ways. MPEG-7 profiles are subsets of the standard that apply to specific application areas, which can be used to reduce this syntactic variability, but they still lack formal semantics. In this paper, we propose an approach for expressing semantics explicitly by formalizing the semantic constraints of a profile using ontologies and rules, thus enabling interoperability and automatic use for MPEG-7 based applications. We demonstrate the feasibility of the approach by implementing a validation service for a subset of the semantic constraints of the Detailed Audiovisual Profile (DAVP).

NTIS

*Interoperability; Metadata; Multimedia; Semantics*

**20080047897** National Telecommunications and Information Administration, Washington, DC USA

**Potential Interference from Broadband Over Power Line (BPL) Systems to Federal Government Radiocommunication Systems at 1.7-80 MHz. Phase 2 Study. Volume 1**

Richards, J. C.; Williams, J. V.; Oct. 2007; 124 pp.; In English

Report No.(s): PB2008-105347; NTIA-08-450-P2-V1; No Copyright; Avail.: National Technical Information Service (NTIS)

On October 14, 2004, the Federal Communications Commission (Commission or FCC) adopted a Report and Order that defined new Part 15 rules for Access Broadband over Power Line (BPL) systems. The National Telecommunications and Information Administration (NTIA) contributed to the Commissions work by providing analysis to support recommendations for refinements in the rules and measurement guidelines in comments and staff correspondence filed in response to the Commissions earlier BPL Notice of Proposed Rulemaking (NPRM). The NTIA Phase 2 study of Access BPL systems expands on its earlier Phase 1 study by providing additional modeling results and analyses to evaluate the effectiveness of the FCCs rules and measurement guidelines in minimizing the potential for harmful interference to federal radiocommunication systems under worst-case conditions. Volume 1 presents the main text and Volume 2 contains appendixes that provide additional technical supporting information that is summarized in Volume 1.

NTIS

*Broadband; Power Lines; Radio Communication; Radio Frequency Interference*

**20080047898** National Telecommunications and Information Administration, Washington, DC USA

**Potential Interference from Broadband Over Power Line (BPL) Systems to Federal Government Radiocommunication Systems at 1.7-80 MHz. Phase 2 Study. Volume 2**

Richards, J. C.; Williams, J. V.; Oct. 2007; 143 pp.; In English

Report No.(s): PB2008-105348; NTIA-08-450-P2-V2; No Copyright; Avail.: National Technical Information Service (NTIS)

On October 14, 2004, the Federal Communications Commission (Commission or FCC) adopted a Report and Order that defined new Part 15 rules for Access Broadband over Power Line (BPL) systems. The National Telecommunications and Information Administration (NTIA) contributed to the Commissions work by providing analysis to support recommendations for refinements in the rules and measurement guidelines in comments and staff correspondence filed in response to the Commissions earlier BPL Notice of Proposed Rulemaking (NPRM). The NTIA Phase 2 study of Access BPL systems expands on its earlier Phase 1 study by providing additional modeling results and analyses to evaluate the effectiveness of the FCCs rules and measurement guidelines in minimizing the potential for harmful interference to federal radiocommunication systems

under worst-case conditions. Volume 1 presents the main text and Volume 2 contains appendixes that provide additional technical supporting information that is summarized in Volume 1.

NTIS

*Broadband; Power Lines; Radio Communication; Radio Frequency Interference*

**20080047922** Institute for Telecommunication Sciences, Boulder, CO, USA

**Institute for Telecommunication Sciences Technical Progress Report, FY 2007**

Dec. 2007; 96 pp.; In English

Report No.(s): PB2008-105340; No Copyright; Avail.: National Technical Information Service (NTIS)

The Institute for Telecommunication Sciences (ITS) is the research and engineering laboratory of the National Telecommunications and Information Administration (NTIA). ITS provides technical support to NTIA in advancing telecommunications and information infrastructure development, enhancing domestic competition, improving U.S. telecommunications trade opportunities, and promoting more efficient and effective use of the radio spectrum.

NTIS

*Communication Satellites; Telecommunication*

**20080047956** Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Soesterberg, Netherlands

**Update of the Common Operations Room for DTO, JCG and C2000**

teBrake, G. M.; van'tHoff, A.; September 2008; 16 pp.; In Dutch; Original contains color illustrations

Report No.(s): TNO-DV-2008-A377; TD2008-0163; Copyright; Avail.: Other Sources

The design of the common operations room for DTO, JCG, and C2000 was updated to provide more space for working with classified materials.

Author

*Network Control; Computer Networks; Control Equipment; Facilities; Rooms; Layouts*

**20080047986** California Inst. of Tech., Pasadena, CA, USA

**Stable Calibration of Raman Lidar Water-Vapor Measurements**

Leblanc, Thierry; McDermid, Iain S.; NASA Tech Briefs, October 2008; October 2008, pp. 27-28; In English; See also [20080047981](#)

Report No.(s): NPO-45955; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3302>

A method has been devised to ensure stable, long-term calibration of Raman lidar measurements that are used to determine the altitude-dependent mixing ratio of water vapor in the upper troposphere and lower stratosphere. Because the lidar measurements yield a quantity proportional to the mixing ratio, rather than the mixing ratio itself, calibration is necessary to obtain the factor of proportionality. The present method involves the use of calibration data from two sources: (1) absolute calibration data from in situ radiosonde measurements made during occasional campaigns and (2) partial calibration data obtained by use, on a regular schedule, of a lamp that emits in a known spectrum determined in laboratory calibration measurements. In this method, data from the first radiosonde campaign are used to calculate a campaign-averaged absolute lidar calibration factor ( $t_{(sub\ 1)}$ ) and the corresponding campaign-averaged ratio ( $L_{(sub\ 1)}$ ) between lamp irradiances at the water-vapor and nitrogen wavelengths. Depending on the scenario considered, this ratio can be assumed to be either constant over a long time ( $L=L_{(sub\ 1)}$ ) or drifting slowly with time. The absolutely calibrated water-vapor mixing ratio ( $q$ ) obtained from the  $i$ th routine off-campaign lidar measurement is given by  $q_{(sub\ 1)}=P_{(sub\ 1)}/t_{(sub\ 1)}=LP_{(sub\ 1)}/P_{(sup\ prime)(sub\ 1)}$  where  $P_{(sub\ 1)}$  is water-vapor/nitrogen measurement signal ratio,  $t_{(sub\ 1)}$  is the unknown and unneeded overall efficiency ratio of the lidar receiver during the  $i$ th routine off-campaign measurement run, and  $P_{(sup\ prime)(sub\ 1)}$  is the water-vapor/nitrogen signal ratio obtained during the lamp run associated with the  $i$ th routine off-campaign measurement run. If  $L$  is assumed constant, then the lidar calibration is routinely obtained without the need for new radiosonde data. In this case, one uses  $L=L_{(sub\ 1)}=P_{(sup\ prime)(sub\ 1)}/t_{(sub\ 1)}$ , where  $P_{(sub\ 1)(sup\ prime)}$  is the water-vapor/nitrogen signal ratio obtained during the lamp run associated with the first radiosonde campaign. If  $L$  is assumed to drift slowly, then it is necessary to postpone calculation of  $a_{(sub\ 1)}$  until after a second radiosonde campaign. In this case, one obtains a new value,  $L_{(sub\ 2)}$ , from the second radiosonde campaign, and for the  $i$ th routine off-campaign measurement run, one uses an intermediate value of  $L$  obtained by simple linear time interpolation between  $L_{(sub\ 1)}$  and  $L_{(sub\ 2)}$ .

Author

*Optical Radar; Radiosondes; Calibrating; Water Vapor; Radar Measurement*

**20080048002** California Inst. of Tech., Pasadena, CA, USA

**VHF Wide-Band, Dual-Polarization Microstrip-Patch Antenna**

Huang, John; NASA Tech Briefs, October 2008; October 2008, pp. 9-10; In English; See also [20080047981](#); Original contains color illustrations

Report No.(s): NPO-41502; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3267>

The figure depicts selected aspects of a very-high-frequency (VHF) microstrip patch antenna designed and built to satisfy requirements specific to an airborne synthetic-aperture radar system for measuring the thickness of sea ice. One of the requirements is that the antenna be capable of functioning over the relatively wide frequency band of 127 to 172 MHz corresponding to a fractional bandwidth of about 30 percent relative to a nominal mid-band frequency of 149.5 MHz. Another requirement is that the antenna be capable of functioning in either or both of two orthogonal linear polarizations. In addition, the antenna is required to be as compact and lightweight as possible. In a basic design according to generally accepted microstrip-patch-antenna engineering practice, one would ordinarily use a relatively thick dielectric substrate and multiple feed probes to obtain the desired combination of wide-band and dual-polarization capabilities. However, the combination of a thick substrate and multiple feeds would give rise to higher-order electromagnetic modes, thereby undesirably contributing to cross polarization and to reduction of the isolation between feed probes. To counter these adverse effects while satisfying the requirements stated above, the design of this antenna incorporates several improvements over the basic design.

Derived from text

*Microstrip Antennas; Patch Antennas; Polarization; Dielectrics*

**20080048004** Rochester Inst. of Tech., NY, USA

**Improved Airborne System for Sensing Wildfires**

McKeown, Donald; Richardson, Michael; NASA Tech Briefs, October 2008; October 2008, pp. 7-8; In English; See also [20080047981](#); Original contains color illustrations

Report No.(s): SSC-00241; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3256>

The Wildfire Airborne Sensing Program (WASP) is engaged in a continuing effort to develop an improved airborne instrumentation system for sensing wildfires. The system could also be used for other aerial-imaging applications, including mapping and military surveillance. Unlike prior airborne fire-detection instrumentation systems, the WASP system would not be based on custom-made multispectral line scanners and associated custom-made complex optomechanical servomechanisms, sensors, readout circuitry, and packaging. Instead, the WASP system would be based on commercial off-the-shelf (COTS) equipment that would include (1) three or four electronic cameras (one for each of three or four wavelength bands) instead of a multispectral line scanner; (2) all associated drive and readout electronics; (3) a camera-pointing gimbal; (4) an inertial measurement unit (IMU) and a Global Positioning System (GPS) receiver for measuring the position, velocity, and orientation of the aircraft; and (5) a data-acquisition subsystem. It would be necessary to custom-develop an integrated sensor optical-bench assembly, a sensor-management subsystem, and software. The use of mostly COTS equipment is intended to reduce development time and cost, relative to those of prior systems.

Derived from text

*Aerial Reconnaissance; Fires; Detection; Inertial Platforms; Systems Engineering; Imaging Techniques*

**20080048018** California Inst. of Tech., Pasadena, CA, USA

**Onboard Data Processor for Change-Detection Radar Imaging**

Lou, Yunling; Muellerschoen, Ronald J.; Chien, Steve A.; Saatchi, Sasan S.; Clark, Duane; NASA Tech Briefs, October 2008; October 2008, pp. 10; In English; See also [20080047981](#); Original contains color illustrations

Report No.(s): NPO-45751; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3265>

A computer system denoted a change-detection onboard processor (CDOP) is being developed as a means of processing the digitized output of a synthetic-aperture radar (SAR) apparatus aboard an aircraft or spacecraft to generate images showing changes that have occurred in the terrain below between repeat passes of the aircraft or spacecraft over the terrain. When fully developed, the CDOP is intended to be capable of generating SAR images and/or SAR differential interferograms in nearly real time. The CDOP is expected to be especially useful for understanding some large-scale natural phenomena and/or mitigating natural hazards: For example, it could be used for near-real-time observation of surface changes caused by floods, landslides, forest fires, volcanic eruptions, earthquakes, glaciers, and sea ice movements. It could also be used to observe such

longer-term surface changes as those associated with growth of vegetation (relevant to estimation of wildfire fuel loads). The CDOP is, essentially, an interferometric SAR processor designed to operate aboard a radar platform.

Derived from text

*Onboard Data Processing; Change Detection; Radar Imagery; Synthetic Aperture Radar*

**20080048024** California Inst. of Tech., Pasadena, CA, USA

**Communication Limits Due to Photon-Detector Jitter**

Moision, Bruce E.; Farr, William H.; NASA Tech Briefs, December 2008; December 2008, pp. 14; In English; See also [20080048022](#)

Report No.(s): NPO-45809; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3424>

A theoretical and experimental study was conducted of the limit imposed by photon-detector jitter on the capacity of a pulse-position-modulated optical communication system in which the receiver operates in a photon-counting (weak-signal) regime. Photon-detector jitter is a random delay between impingement of a photon and generation of an electrical pulse by the detector. In the study, jitter statistics were computed from jitter measurements made on several photon detectors. The probability density of jitter was mathematically modeled by use of a weighted sum of Gaussian functions. Parameters of the model were adjusted to fit histograms representing the measured-jitter statistics. Likelihoods of assigning detector-output pulses to correct pulse time slots in the presence of jitter were derived and used to compute channel capacities and corresponding losses due to jitter. It was found that the loss, expressed as the ratio between the signal power needed to achieve a specified capacity in the presence of jitter and that needed to obtain the same capacity in the absence of jitter, is well approximated as a quadratic function of the standard deviation of the jitter in units of pulse-time-slot duration.

Author

*Photometers; Vibration; Optical Communication; Signal Processing*

**20080048033** California Inst. of Tech., Pasadena, CA, USA

**Ka-Band Transponder for Deep-Space Radio Science**

Dennis, Matthew S.; Mysoor, Narayan R.; Folkner, William M.; Mendoza, Ricardo; Venkatesan, Jaikrishna; NASA Tech Briefs, December 2008; December 2008, pp. 25; In English; See also [20080048022](#)

Report No.(s): NPO-46698; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3459>

A one-page document describes a Ka-band transponder being developed for use in deep-space radio science. The transponder receives in the Deep Space Network (DSN) uplink frequency band of 34.2 to 34.7 GHz, transmits in the 31.8- to 32.3 GHz DSN downlink band, and performs regenerative ranging on a DSN standard 4-MHz ranging tone subcarrier phase-modulated onto the uplink carrier signal. A primary consideration in this development is reduction in size, relative to other such transponders. The transponder design is all-analog, chosen to minimize not only the size but also the number of parts and the design time and, thus, the cost. The receiver features two stages of frequency down-conversion. The receiver locks onto the uplink carrier signal. The exciter signal for the transmitter is derived from the same source as that used to generate the first-stage local-oscillator signal. The ranging-tone subcarrier is down-converted along with the carrier to the second intermediate frequency, where the 4-MHz tone is demodulated from the composite signal and fed into a ranging-tone-tracking loop, which regenerates the tone. The regenerated tone is linearly phase-modulated onto the downlink carrier.

Author

*Transponders; Ranging; Uplinking; Intermediate Frequencies; Carrier Frequencies; Down-Converters; Phase Modulation*

**20080048080** SETA Corp., Washington, DC, USA

**Republic of Armenia: ICT Assessment**

Jul. 2000; 70 pp.; In English

Report No.(s): PB2008-104493; No Copyright; Avail.: CASI: [A04](#), Hardcopy

This Assessment has been undertaken at the request of the USAID/Armenia Mission in an effort to examine potential opportunities for USAID engagement in the Information Communications and Technologies (ICTs) arena. Over the past several years USAID/Armenia has been quite active in supporting strategic ICT-related projects that have been considered quite successful (e.g. automation within the Central Bank of Armenia, Customs Wide Area Network, etc.). This ICT

Assessment relies heavily on earlier ICT-related work carried out by USAID/Armenia as well as several external ICT-related assessments. The ICT Assessment seeks to pull many of the emerging threads together, validate and update key components reflected in these studies and activities, and ultimately put forth targeted areas of opportunity for further pursuit by USAID/Armenia in the ICT-related arena. The ICT Assessment has been built around four key areas: (1) Pipes an examination of the current state of telecommunications within Armenia, (2) Public Sector an examination of the Republic of Armenia's position and status with respect to ICTs, with specific focus on Policy, (3) Private Sector an examination of the current state of the private sector with regards to use and leveraging of ICTs, with focus on opportunities, and (4) People with a focus on identifying opportunities for leveraging ICTs within the current development portfolio of the USAID/Armenia Mission. The ICT Assessment has concluded that there are at present several constraints that limit Armenia's broader leveraging of ICTs in support of economic development. These are primarily in the areas of Internet access and legal restraints that do not support leveraging the Internet for advancing in the area of E-Commerce.

NTIS

*Armenia; Economic Development; Information Systems; Internets; Telecommunication*

**20080048118** Trex Enterprises Corp., San Diego, CA, USA

**Mobile Millimeter Wave Communication Link**

Lovberg, J., Inventor; Lilly, D., Inventor; Korevaar, E., Inventor; Chedester, R., Inventor; 12 Oct 05; 25 pp.; In English

Patent Info.: Filed 12 Oct 05; US-Patent-Appl-SN-11-249 787

Report No.(s): PB2008-105672; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A point-to-point, wireless, millimeter wave communications link between two stations at least one of which is a mobile station. A millimeter wave transmitter system operating at frequencies higher than 57 GHz with a tracking antenna producing a beam having a half-power beam width of about 2 degrees or less and a millimeter wave receiver also with a tracking antenna having a half-power beam width of about 2 degrees or less. In preferred embodiments each mobile station has a global position system (GPS) and a radio transmitter and both tracking antennas are pointed utilizing GPS information from the mobile station or stations. The GPS information preferably is transmitted via a low frequency, low data rate radio. Each millimeter wave unit is capable of transmitting and/or receiving, through the atmosphere, digital information to/from the other station at rates in excess of 155 million bits per second during normal weather conditions. In preferred embodiments actually built and tested by Applicants digital information has been transmitted at rates of 1.25 gigabits per second. Preferred communication links described here are millimeter wave links operating at frequencies of 71-73 GHz and 74-76 GHz mounted on simple two-axis gimbals. Pointing information of the required accuracy is provided by GPS receivers and standard radio links which send the GPS calculated positions to the millimeter wave systems at the opposite end of the link. In these embodiments there is no need for any complicated closed loop pointing information derived from received signal intensity or phase. On moving platforms locally generated inertial attitude information is combined with the GPS positions to control pointing of the gimballed transceivers.

NTIS

*Communication Networks; Data Links; Millimeter Waves; Mobile Communication Systems; Patent Applications; Radio Communication*

**20080048199** California Inst. of Tech., Pasadena, CA, USA

**Reducing Spaceborne-Doppler-Radar Rainfall-Velocity Error**

Tanelli, Simone; Im, Eastwood; Durden, Stephen L.; NASA Tech Briefs, September 2008; September 2008, pp. 41; In English; See also [20080048125](#)

Report No.(s): NPO-40590; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3153>

A combined frequency-time (CFT) spectral moment estimation technique has been devised for calculating rainfall velocity from measurement data acquired by a nadir-looking spaceborne Doppler weather radar system. Prior spectral moment estimation techniques used for this purpose are based partly on the assumption that the radar resolution volume is uniformly filled with rainfall. The assumption is unrealistic in general but introduces negligible error in application to airborne radar systems. However, for spaceborne systems, the combination of this assumption and inhomogeneities in rainfall [denoted non-uniform beam filling (NUBF)] can result in velocity measurement errors of several meters per second. The present CFT spectral moment estimation technique includes coherent processing of a series of Doppler spectra generated in a standard manner from data over measurement volumes that are partially overlapping in the along-track direction. Performance simulation of this technique using high-resolution data from an airborne rain-mapping radar shows that a spaceborne Ku-band

Doppler radar operating at signal-to-noise ratios greater than 10 dB can achieve root-mean-square accuracy between 0.5 and 0.6 m/s in vertical-velocity estimates.

Author

*Doppler Radar; Meteorological Radar; Rain; Velocity Measurement; Velocity Errors*

**20080048337** Raytheon Co., Canton, MA, USA

**Adaptive Array (PAT-APPL-11-042 878)**

Pauplis, B. E., Inventor; Seghezzi, E. A., Inventor; Carey, W. T., Inventor; 25 Jan 05; 22 pp.; In English

Contract(s)/Grant(s): ARMY-DASG60-98-C-0001

Patent Info.: Filed Filed 25 Jan 05; US-Patent-Appl-SN-11-042 878

Report No.(s): PB2008-104835; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An adaptive antenna array has array elements arranged in element rows and element columns and subarrays arranged in subarray rows and subarray columns, for which the subarray phase centers have non-uniform spacing. The adaptive antenna array provides good detection and tracking performance when used in a radar system, while being inexpensive and easy to manufacture. A radar system and a method of adapting a radar array both employ the above described adaptive antenna array.

NTIS

*Adaptation; Antenna Arrays; Patent Applications; Radar Antennas*

**20080048356** Aerospace Corp., El Segundo, CA, USA

**Multiple Signal Intermodulation Reduction System**

Ksienski, D. A., Inventor; MacGowan, K. S., Inventor; Osofsky, S. S., Inventor; Young, A. M., Inventor; Tam, T. T., Inventor; 15 Feb 05; 10 pp.; In English

Contract(s)/Grant(s): AF-F04701-00-C-0009

Patent Info.: Filed Filed 15 Feb 05; US-Patent-Appl-SN-11-057 979

Report No.(s): PB2008-106044; No Copyright; Avail.: CASI: [A02](#), Hardcopy

An intermodulation product reduction or cancellation amplifier received two input signals that are split in quadrature wherein the inphase outputs are summed and then amplified as an inphase signal, and the quadrature outputs are fixed-phase phase-shifted, then summed and then amplified as a quadrature signal. The inphase and quadrature signals are fed into an output hybrid for canceling intermodulation products, where the fixed-phase phase shift is +/-60.degree. for reducing 3rd order, +/-36.degree. for reducing 5th order, and +/-25.71.degree. for reducing 7th order intermodulation products, for examples, for improved signal communications of the two signals over a common antenna or link.

NTIS

*Cancellation; Intermodulation; Patent Applications; Quadratures*

**20080048368** Boeing Co., Seattle, WA, USA

**Handbook for Networked Local Area Networks in Aircraft**

Fleischman, E.; Oct. 2008; 111 pp.; In English

Report No.(s): PB2009-102154; No Copyright; Avail.: CASI: [A06](#), Hardcopy

This Handbook summarizes the results of the Federal Aviation Administration (FAA) networked local area network (LAN) study, which addresses potential safety impacts introduced by networking LANs onboard aircraft. Interconnecting previously isolated components on aircraft increases the complexity of unintended interactions between components and provides potential new access points that could be exploited to cause harm. This Handbook addresses the potential security vulnerabilities introduced by networking LANs, the safety affects of security failures, and a process for designing and certifying LANs on aircraft to ensure the safety of these new aircraft systems. This Handbook extends the current FAA safety assurance processes into airborne networked environments by leveraging the Biba Integrity Model. It builds upon existing FAA studies that articulate mechanisms to integrate RTCA/DO-178B and common criteria processes for the National Airspace System. This approach creates a safety-oriented airborne network architecture that is built upon DO-178B and ARP 4754 safety mechanisms. This Handbook discusses specific design and configuration issues upon which the civil aviation community will need to establish consistent consensus positions if the recommended architecture is to be seamlessly deployed into operational environments.

NTIS

*Handbooks; Local Area Networks*



**20080048384** Commerce Dept., Washington, DC, USA

**International Trade Administration: Although Progress Has Been Made, More Needs to Be Done to Deliver On-Line Export Information and Services. Final Inspection Report No. IPE-13213**

Mar. 2001; 79 pp.; In English

Report No.(s): PB2009-102814; No Copyright; Avail.: CASI: [A05](#), Hardcopy

The number of people using the Internet is growing at an astounding rate. In 1993, fewer than 90,000 people worldwide were estimated to be using the Internet on a regular basis, and those who did were primarily in academia or the government. By the summer of 2000, there were more than 300 million frequent on-line users, and within five years, the number is expected to pass the 1 billion mark. This exponential growth is accompanied by increasing expectations. As the public conducts more commercial transactions on-line, such as personal finance and banking, travel arrangements, and retail shopping, it also expects more on-line government-to-citizen information, transactions, and services. Technology, and the Internet specifically, are changing how the government conducts its business and how it communicates both internally and externally. In recognition of this, the Department of Commerce is planning to move from being a paper-based bureaucracy to a Digital Department, whereby it will effectively obtain, process, produce, and provide information in the medium that best meets the needs of its employees and customers. Early goals include providing electronic access to all Departmental forms, developing a Commerce Intranet site, and organizing the Commerce Internet home page so that customers can readily access information without having to understand how the Department is organized. Next steps include developing web-based internal administrative and business processes. This review examined how well the Department of Commerce is using the Internet to provide export promotion information and services to the public.

NTIS

*Commerce; Information Systems; Inspection; International Trade; Internets*

**20080048388** Social Policy Research Associates, Oakland, CA, USA

**Action Steps for Businesses: A Guide to Developing Partnerships with Faith-Based and Community Organizations (FBCOs)**

Soukamneuth, S.; Apr. 04, 2007; 35 pp.; In English

Report No.(s): PB2009-102825; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This guide, Action Steps for Businesses: A Guide to Developing Partnerships with Faith-Based and Community Organizations (FBCOs), is a practical tool for businesses that are interested in developing partnerships with FBCOs. This guide provides specific steps that businesses can take to develop and sustain successful FBCO partnerships. It contains essential information on what FBCOs look like, the value and benefits that they can bring to businesses, the services they provide to businesses and job seekers, and where they are located in the local community.

NTIS

*Commerce; Organizations*

**20080048389** Federal Communications Commission, Washington, DC, USA

**Evaluation of the Performance of prototype TV-Band White Space Devices Phase II**

Jones, S. K.; Phillips, T. W.; Van Tuyl, H. L.; Weller, R. D.; Oct. 15, 2008; 149 pp.; In English

Report No.(s): PB2009-103048; FCC/OET-08-TR-1005; No Copyright; Avail.: National Technical Information Service (NTIS)

The Federal Communications Commission's Laboratory Division has completed a second phase of its measurement studies of the spectrum sensing and transmitting capabilities of prototype TV white space devices. These devices have been developed to demonstrate capabilities that might be used in unlicensed low power radio transmitting devices that would operate on frequencies in the broadcast television bands that are unused in each local area. At this juncture, we believe that the burden of proof of concept has been met. We are satisfied that spectrum sensing in combination with geo-location and database access techniques can be used to authorize equipment today under appropriate technical standards and that issues regarding future development and approval of any additional devices, including devices relying on sensing alone, can be addressed. The Commission is conducting a rulemaking proceeding to consider authorization of new, low power transmitting devices in the television broadcast spectrum at locations where channels are not being used for TV or other authorized services (ET Docket No. 04-186). This locally unused spectrum is often referred to as TV white space. As established thus far by the Commission, white space devices (WSDs) that operate from a fixed location will be allowed into the TV spectrum simultaneous with the completion of the transition from analog to digital television broadcasting on February 17, 2009. This

action will open for use a significant amount of spectrum with very desirable propagation characteristics that has heretofore lain fallow.

NTIS

*Evaluation; Performance Tests; Prototypes; Television Systems*

**20080048391** USA Joint Forces Command, Norfolk, VA, USA; Joint Warfighting Center, Fort Monroe, VA, USA  
**Commanders's Handbook for Strategic Communication**

Sep. 01, 2008; 138 pp.; In English

Report No.(s): PB2009-103076; No Copyright; Avail.: National Technical Information Service (NTIS)

This handbook is a pre-doctrinal document on Strategic Communication (SC). It provides the fundamental principles, techniques, and procedures that are evolving in the joint community and moving toward incorporation into joint publications. This handbook serves as a bridge between the current practices in the field and their migration into doctrine. As such, the intent is to inform doctrine writers, educators, and trainers of SC for inclusion in joint doctrine, education, and training. This handbook outlines current doctrine, recognizes some best practices, and offers some techniques and procedures currently used in the field. It also addresses some techniques, procedures, and implications for further development of SC-related joint doctrine, organizations, training, materiel, leadership and education, personnel, and facilities. A hypothetical vignette progresses through the document to assist in understanding the material.

NTIS

*Handbooks; Organizations; Training Devices; Education; Procedures*

**20080048422** Naval Research Lab., Washington, DC USA

**High Altitude Relay and Router (HARR)**

Rupar, Michael A; Mereish, Raymond; Corretjer, Ivan; Vorees, Brian; Doffoh, Jonathan; Nov 20, 2008; 49 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-06-WX-20615

Report No.(s): AD-A489843; NRL/FR/5554--08-10168; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489843>

This report describes the development and test of processing and transponding payload configurations for the High Altitude Relay and Router (HARR) project. This work was performed by the U.S. Naval Research Laboratory (NRL) to support a viable long-range end-to-end mobile ad hoc wireless network in a tactical environment. HARR has the potential to provide closed network communications and other tactical capabilities between nodes separated by up to 200 miles at a reduced cost as compared to other existing technologies. HARR achieves these results by flying its payloads in untethered balloons at near-space altitudes around 20,000 m (approximately 65,000 ft), providing a relay capability over a substantial area of operation. The report describes the design and integration of the airborne and ground node systems that make up this network, and analyzes test data collected using unicast and multicast transport protocols in an IP-based environment. The field test data discussed in this report was collected at Lubbock, Texas, in June 2006. Additional followup testing was conducted through the summer and fall of 2006 at NRL in Washington, DC.

DTIC

*Communication Networks; High Altitude*

**20080048433** Maryland Univ., College Park, MD USA

**Fast Unconstrained Audio Search in Numerous Human Languages**

Olsson, J S; Wintrode, Jonathan; Lee, Matthew; Apr 2007; 5 pp.; In English

Report No.(s): AD-A489878; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489878>

We present a system to index and search conversational speech using a scoring heuristic on the expected posterior counts of phone n-grams in recognition lattices. We report significant improvements in retrieval effectiveness on five human languages over a strong 1-best baseline. The method is shown to improve the utility 'mean average precision' of the retrieved lattices? rank order and to do so with a search cost negligible compared to the fastest yet known methods for the linear scanning of phonetic lattices.

DTIC

*Languages; Speech Recognition; Voice Communication*

**20080048474** Handheld Speech LLC, Amesbury, MA USA  
**Applying a Multi-Voice Speech Recognizer to the BMIST Task**

Gadbois, Gregory J; Oct 2008; 19 pp.; In English

Contract(s)/Grant(s): W81XWH-07-1-0714

Report No.(s): AD-A489824; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Speech recognition topics are explored. An orally driven user interface to form filling was developed. Along the way, unsupervised adaptation methods, noise injection and novel enrollment/ model search methods were studied. On the strength of the discovered techniques, an application moved from a research topic to a program of record .

DTIC

*Speech Recognition; Voice Communication*

**20080048485** Naval Research Lab., Washington, DC USA

**Analysis of Analog Photonic Links Employing Multiple-Channel (Arrayed) Receivers**

McKinney, Jason D; Urick, Vincent J; Bucholtz, Frank; Villarruel, Carl; Sunderman, Christopher; Nov 7, 2008; 32 pp.; In English

Report No.(s): AD-A489932; NRL/MR/5650--08-9161; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Analog photonic links have seen increased application to military systems in recent years. While virtually all deployed systems utilize optical fiber as the transmission medium, for example in antenna remoting applications, there is increased interest in applying these links in free-space applications. For free-space systems, the received optical power may be significantly below that in fiber-based applications; this necessitates new receiver and amplification architectures to obtain the required receiver sensitivity. One solution is the use of arrayed receivers, i.e., those employing multiple receive channels (analogous to the use of phased arrays in radar systems), each with an optical amplifier to boost the received optical signal level. While analog links utilizing single-channel and balanced receivers have been thoroughly analyzed, arrayed receiver architectures have received far less attention. In this work, we provide a complete noise analysis of multiple-channel receivers employing optical amplifiers and provide experimental verification of the achievable increase in sensitivity of these architectures.

DTIC

*Data Links; Radio Receivers; Receivers*

**20080048507** Delaware Univ., Newark, DE USA

**Priorities in Stream Transmission Control Protocol (SCTP) Multistreaming**

Heinz, II, Gerard J; Jan 2003; 36 pp.; In English

Report No.(s): AD-A490104; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis introduces per-stream priorities as a method of decreasing delays of important data during periods of low bandwidth availability. We group streams into priority classes and propose a scheduling algorithm to prioritize data among these classes. Per-stream priorities are useful in applications sending different types of data, such as Instant Messaging (IM) systems. We discuss the details of present (AOL Instant Messenger) and future IM systems (using Session Initiation Protocol) and how these systems benefit from prioritized SCTP. We discuss the practical application of example applications of such a scheme are discussed. Through simulation with ns-2, we compare prioritized SCTP to non-prioritized SCTP using an application with two streams (one stream is sending high-priority sporadic data while the other stream is sending low-priority bulk data) In periods when the bulk data submission rate is greater than the available bandwidth and the transmission rate of the sporadic data is less than the link transmission rate, we demonstrate that with per-stream priorities the bulk data transfer will not affect the quality of the sporadic data transfer.

DTIC

*Data Transmission; Message Processing; Priorities; Protocol (Computers)*

## ELECTRONICS AND ELECTRICAL ENGINEERING

Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment; and microelectronics and integrated circuitry. for related information see also *60 Computer Operations and Hardware*; and *76 Solid-State Physics*. For communications equipment and devices see *32 Communications and Radar*.

**20080047324** Caterpillar, Inc., Peoria, IL, USA

### **Advanced Electric Systems and Aerodynamics for Efficiency Improvements in Heavy Duty Trucks**

Slone, L.; Birkel, J.; Oct. 31, 2007; 20 pp.; In English

Contract(s)/Grant(s): DE-FC26-04NT42189

Report No.(s): DE2008-934589; No Copyright; Avail.: National Technical Information Service (NTIS)

The Advanced Electric Systems and Aerodynamics for Efficiency Improvements in Heavy Duty Trucks program (DE-FC26-04NT42189), commonly referred to as the AES program, focused on areas that will primarily benefit fuel economy and improve heat rejection while driving over the road. The AES program objectives were to: (1) Analyze, design, build, and test a cooling system that provided a minimum of 10 percent greater heat rejection in the same frontal area with no increase in parasitic fan load. (2) Realize fuel savings with advanced power management and acceleration assist by utilizing an integrated starter/generator (ISG) and energy storage devices. (3) Quantify the effect of aerodynamic drag due to the frontal shape mandated by the area required for the cooling system.

NTIS

*Aerodynamics; Electric Motor Vehicles; Energy Conservation; Trucks*

**20080047325** Cabot Corp., Indianapolis, IN, USA

### **Development of Advanced LED Phosphors by Spray-based Processes for Solid State Lighting, (Final)**

Sep. 30, 2007; 62 pp.; In English

Contract(s)/Grant(s): DE-FC26-04NT42276

Report No.(s): DE2008-934590; No Copyright; Avail.: National Technical Information Service (NTIS)

The overarching goal of the project was to develop luminescent materials using aerosol processes for making improved LED devices for solid state lighting. In essence this means improving white light emitting phosphor based LEDs by improvement of the phosphor and phosphor layer. The structure of these types of light sources comprises of a blue or UV LED under a phosphor layer that converts the blue or UV light to a broad visible (white) light. Traditionally, this is done with a blue emitting diode combined with a blue absorbing, broadly yellow emitting phosphor such as  $Y(\text{sub } 3)\text{Al}(\text{sub } 5)\text{O}(\text{sub } 12):\text{Ce}$  (YAG). A similar result may be achieved by combining a UV emitting diode and at least three different UV absorbing phosphors: red, green, and blue emitting. These emitted colors mix to make white light. The efficiency of these LEDs is based on the combined efficiency of the LED, phosphor, and the interaction between the two. The Cabot SSL project attempted to improve the over all efficiency of the LED light source by improving the efficiency of the phosphor and the interaction between the LED light and the phosphor. Cabot's spray based process for producing phosphor powders is able to improve the brightness of the powder itself by increasing the activator (the species that emits the light) concentration without adverse quenching effects compared to conventional synthesis.

NTIS

*Illuminating; Light Emitting Diodes; Phosphors; Solid State; Sprayers*

**20080047417** NASA Glenn Research Center, Cleveland, OH, USA

### **Evaluation of Silicon-on-Insulator HTOP-01 Operational Amplifier for Wide Temperature Operation**

Patterson, Richard; Hammoud, Ahmad; Elbuluk, Malik; June 16, 2008; 9 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC06BA07B; EXCX2208D; Copyright; Avail.: CASI: [A02](#), Hardcopy

Electronics capable of operation under extreme temperatures are required in many of NASA space exploration missions. Aerospace and military applications, as well as some terrestrial industries constitute environments where electronic systems are anticipated to be exposed to extreme temperatures and wide-range thermal swings. Electronics that are able to withstand and operate efficiently in such harsh environments would simplify, if not eliminate, traditional thermal control elements and their associated structures for proper ambient operation. As a result, overall system mass would be reduced, design would be simplified, and reliability would be improved. Electronic parts that are built utilizing silicon-on-insulator (SOI) technology are known to offer better radiation-tolerance compared to their conventional silicon counterparts, provide faster switching, and consume less power. They also exhibit reduced leakage current and, thus, they are often tailored for high temperature

operation. These attributes make SOI-based devices suitable for use in harsh environments where extreme temperatures and wide thermal swings are anticipated. A new operational amplifier, based on silicon-on-insulator technology and geared for high temperature well-logging applications, was recently introduced by Honeywell Corporation. This HTOP-01 dual precision operational amplifier is a low power device, operates on a single supply, and has an internal oscillator and an external clocking option [1]. It is rated for operation from -55 C to +225 C with a maximum output current capability of 50 mA. The amplifier chip is designed as a 14-pin, hermetically-sealed device in a ceramic package. Table I shows some of the device manufacturer's specifications.

Author

*Oscillators; Temperature Control; Radiation Tolerance; Operational Amplifiers; SOI (Semiconductors); High Temperature; Military Technology; Silicon*

**20080047460** NASA Glenn Research Center, Cleveland, OH, USA

#### **A 1 GHz Oscillator-Type Active Antenna**

Jordan, Jennifer L.; Scardelletti, Maximilian; Ponchak, George E.; July 05, 2008; 4 pp.; In English; 2008 IEEE International Symposium on Antennas and Propagation, 5-12 Jul. 2008, San Diego, CA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 645836.02.07.03.03.02; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047460>

Wireless sensors are desired for monitoring aircraft engines, automotive engines, industrial machinery, and many other applications. The most important requirement of sensors is that they do not interfere with the environment that they are monitoring. Therefore, wireless sensors must be small, which demands a high level of integration. Sensors that modulate an oscillator active antenna have advantages of small size, high level of integration, and lower packaging cost. Several types of oscillator active antennas have been reported. Ip et al. demonstrated a CPW line fed patch antenna with a feedback loop [1]. No degradation in performance was noticed without a ground plane. A GaAs FET was used in an amplifier/oscillator-based active antenna [2]. An oscillator based on a Cree SiC transistor was designed and characterized in [3]. This paper reports the integration of the SiC Clapp oscillator to a slotline loop antenna.

Author

*Field Effect Transistors; Loop Antennas; Microwave Oscillators; Patch Antennas; Slot Antennas; Gallium Arsenides*

**20080047495** Massachusetts Inst. of Tech., Lexington, MA USA

#### **Robust Matched Filters for Target Detection in Hyperspectral Imaging Data**

Manolakis, D; Lockwood, R; Cooley, T; Jacobson, J; Apr 2007; 5 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0002

Report No.(s): AD-A489053; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489053>

Most detection algorithms for hyperspectral imaging applications assume a target with a perfectly known spectral signature. In practice, the target signature is either imperfectly measured (target mismatch) and/or it exhibits spectral variability. The objective of this paper is to introduce a robust matched filter that takes the uncertainty and/or variability of target signatures into account. It is shown that, if we describe this uncertainty with an ellipsoid in the spectral space, we can design a matched filter that provides a response of the same magnitude for all spectra within this ellipsoid. Thus, by changing the size of this ellipsoid, we can control the 'spectral selectivity' of the matched filter. The ability of the robust matched filter to deal effectively with target mismatch and spectral variability is demonstrated with hyperspectral imaging data from the HYDICE sensor.

DTIC

*Detection; Imagery; Imaging Techniques; Matched Filters; Target Acquisition*

**20080047600** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

#### **Hardware, Software and Data Analysis Techniques for SRAM-based Field Programmable Gate Array Circuits**

Hockenberry, Eugene B; Jun 2008; 83 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489580; AFIT/GE/ENG/08-11; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The main objective of this research is to accomplish two objectives; first, develop a robust test methodology to successfully allow researchers to isolate errors occurring in SRAM-based FPGAs and other memory devices. Second, provide a test platform capable of exercising this methodology. Several requirements were made known for this platform. The system

should be compact, versatile, flexible, and affordable. To meet these objectives, a failure analysis tree was derived such that various combinations of circuits on a test FPGA, with subsequent data analysis being accomplished on a controller FPGA board. Using the data derived from various types of adder and counter circuits, major subsystems of the FPGA could be targeted. Next, a test structure was built using a controlling FPGA board and a laptop for data reporting. The controller board provided stimuli to the device under test (DUT), accepted the data produced, and automatically analyzed the data to generate data messages. Additionally, Xilinx BlockRam modules were created to test their susceptibility to logic errors in a radiation environment. Two reliability-enhancing techniques were implemented for evaluation; triple modular redundancy (TMR) and error correction coding (ECC).

DTIC

*Circuits; Computer Programs; Computers; Field-Programmable Gate Arrays; Random Access; Random Access Memory*

**20080047657** Department of the Navy, Washington, DC USA

**A System and Method for Improving the Efficiency and Reliability of a Broadband Transistor Switch for Periodic Switching Applications**

Steinbrecher, Donald H, Inventor; Nov 3, 2008; 60 pp.; In English

Report No.(s): AD-D020385; No Copyright; Avail.: Other Sources

A driver circuit is provided for enabling a transistor collector--emitter path to be used as a broadband periodic switch. The broadband driver circuit controls the magnitude of the transistor base-emitter current in order to enable a CLOSED switch state and to simultaneously control the magnitude of the transistor base-emitter reverse-bias voltage in order to enable the OPEN-switch state. The precise control of these parameters minimizes base-charge storage and prevents reverse-breakdown failure.

DTIC

*Broadband; Patent Applications; Reliability; Switches; Switching; Transistors*

**20080047667** NASA Glenn Research Center, Cleveland, OH, USA

**A Novel Nanoionics-based Switch for Microwave Applications**

Nessel, James A.; Lee, Richard Q.; Mueller, Carl H.; Kozicki, Michael N.; Ren, Minghan; Morse, Jacki; June 15, 2008; 4 pp.; In English; 2008 International Microwave Symposium, 15-20 Jun. 2008, Atlanta, GA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 698671.01.03.41; Copyright; Avail.: CASI: [A01](#), Hardcopy

This paper reports the development and characterization of a novel switching device for use in microwave systems. The device utilizes a switching mechanism based on nanoionics, in which mobile ions within a solid electrolyte undergo an electrochemical process to form and remove a conductive metallic 'bridge' to define the change of state. The nanoionics-based switch has demonstrated an insertion loss of approx.0.5dB, isolation of >30dB, low voltage operation (1V), low power (approx. micro-W) and low energy (approx. nJ) consumption, and excellent linearity up to 6 GHz. The switch requires fewer bias operations (due to non-volatile nature) and has a simple planar geometry allowing for novel device structures and easy integration into microwave power distribution circuits.

Author

*Switches; Microwave Circuits; Microwave Equipment; Low Voltage; Insertion Loss; Solid Electrolytes*

**20080047764** Shook, Hardy and Bacon, LLP, Kansas City, MO, USA

**Method to Grow III-Nitride Materials Using No Buffer Layer**

Li, J., Inventor; 12 Apr 05; 8 pp.; In English

Contract(s)/Grant(s): DMI-0450314

Patent Info.: Filed Filed 12 Apr 05; US-Patent-Appl-SN-11-103 846

Report No.(s): PB2008-105468; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Disclosed is a method for growing nitride compound semiconductors on sapphire substrates where no low-temperature buffer layer is used. The nitride based compound semiconductor materials and devices grown by the method of the present invention have crystallinity and surface morphology at practical levels with high quality, high stability, and high yield.

NTIS

*Nitrides; Patent Applications; Semiconductors (Materials)*

**20080047766** McLeod and Moyne, PC, Okekmos, MI, USA

**Electrically Conductive Diamond Electrodes**

Swain, G., Inventor; Fischer, A., Inventor; Bennett, J., Inventor; Lowe, M., Inventor; 17 Mar 06; 28 pp.; In English

Contract(s)/Grant(s): DE-FG02 and FGO3-01ER15120

Patent Info.: Filed Filed 17 Mar 06; US-Patent-Appl-SN-11-378 109

Report No.(s): PB2008-105470; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An electrically conductive diamond electrode and process for preparation thereof is described. The electrode comprises diamond particles coated with electrically conductive doped diamond preferably by chemical vapor deposition which are held together with a binder. The electrodes are useful for oxidation reduction in gas, such as hydrogen generation by electrolysis. NTIS

*Diamonds; Electrical Resistivity; Electrodes; Patent Applications*

**20080047771** Honeywell International, Inc., Morristown, NJ, USA

**System, Circuit and Method for Off-Mode-Peak Operation of Ring Laser Gyroscopes**

Molaskey, C. T., Inventor; Thielman, L. O., Inventor; Chamberlin, D. A., Inventor; 4 Feb 05; 10 pp.; In English

Contract(s)/Grant(s): DASG60-00-C-0072

Patent Info.: Filed Filed 4 Feb 05; US-Patent-Appl-SN-11-051 950

Report No.(s): PB2008-105476; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A system, circuit and method are disclosed for operating an RLG off-mode-peak to avoid exciting undesirable transverse modes. An alternate PLC operating point can be used to bias the optical path length of the RLG to an appropriate side of an ideal integer number of wavelengths, and thus avoid exciting the undesirable transverse modes. Although this alternate PLC operating point is not perfect with respect to establishing an integer number of wavelengths, this operation provides acceptable performance of the RLG's (in particular, short length path RLG's), and acceptable margin can be established relative to variations in the PLC set points involved. For example, a PLC loop can be used to dither about this operating point as a discriminate to allow closed loop control of the path length. Also, a PSSD control architecture can be used to establish and maintain a requisite path length over relatively wide variations in operating temperature. Specifically, a small offset error can be injected into a conventional PSSD loop for an RLG, which causes the loop to converge on a pre-selected operating point that is on one side of a conventional convergence point. The magnitude and polarity characteristics of this operating point offset can be determined for each RLG, or such characteristics can be consistently used for a family of RLG's. NTIS

NTIS

*Circuits; Gyroscopes; Laser Gyroscopes; Patent Applications; Ring Lasers*

**20080047774** Lawrence Livermore National Lab., Livermore, CA USA; California Univ., Berkeley, CA, USA

**Network-Based TTL Counter (PAT-APPL-11-350 717)**

Cunningham, M. F., Inventor; Urbina, G. A., Inventor; 8 Feb 06; 8 pp.; In English

Contract(s)/Grant(s): W-7405-ENG-48

Patent Info.: Filed Filed 8 Feb 06; US-Patent-Appl-SN-11-350 717

Report No.(s): PB2008-105479; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A network-based TTL counter having integrated components for processing TTL counts from sensor input and hosting the count data over a network. The TTL counter includes one or more TTL counters, each capable of receiving sensor input and outputting TTL pulse count data; a network node server for communication with a network as a node of the network and transmitting the count data to the network; one or more micro-controllers for controlling the TTL counter(s) and the network transmission of the count data; and a power source. As such TTL counts performed by the TTL counter may be remotely monitored anywhere over a network. NTIS

NTIS

*Patent Applications; Transistors; Computer Networks*

**20080047988** United Space Alliance, Houston, TX, USA

**Tool for Inspecting Alignment of Twinaxial Connectors**

Smith, Christopher R.; NASA Tech Briefs, October 2008; October 2008, pp. 21-22; In English; See also [20080047981](#);

Original contains color illustrations

Report No.(s): MSC-23757; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3287>

A proposed tool would be used to inspect alignments of mating twinaxial-connector assemblies on interconnecting wiring

harnesses. More specifically, the tool would be used to inspect the alignment of each contact pin of each connector on one assembly with the corresponding socket in the corresponding connector on the other assembly. It is necessary to inspect the alignment because if mating of the assemblies is attempted when any pin/socket pair is misaligned beyond tolerance, the connection will not be completed and the dielectric material in the socket will be damaged (see Figure 1). Although the basic principle of the tool is applicable to almost any type of mating connector assemblies, the specific geometry of the tool must match the pin-and-socket geometry of the specific mating assemblies to be inspected. In the original application for which the tool was conceived, each of the mating assemblies contains eight twinaxial connectors; the pin diameter is 0.014 in. (.035 mm), and the maximum allowable pin/socket misalignment is 0.007 in. (.018 mm). Incomplete connections can result in loss of flight data within the functional path to the space shuttle crew cockpit displays. The tool (see Figure 2) would consist mainly of a transparent disk with alignment clocking tabs that can be fitted onto either connector assembly. Sets of circles or equivalent reference markings are affixed to the face of the tool, located at the desired positions of the mating contact pairs. An inspector would simply fit the tool onto a connector assembly, engaging the clocking tabs until the tool fits tightly. The inspector would then align one set of circles positioning a line of sight perpendicular to one contact within the connector assembly. Mis alignments would be evidenced by the tip of a pin contact straying past the inner edge of the circle. Socket contact misalignments would be evidenced by a crescent-shaped portion of the white dielectric appearing within the circle. The tool could include a variable magnifier plus an illuminator that could be configured so as not to cast shadows.

Author

*Connectors; Alignment; Joints (Junctions); Pins; Misalignment; Harnesses; Dielectrics; Tabs (Control Surfaces); Wiring*

**20080048000** California Inst. of Tech., Pasadena, CA, USA

#### **Waveguide Harmonic Generator for the SIM**

Chang, Daniel; Poberezhskiy, Ilya; Mulder, Jerry; NASA Tech Briefs, October 2008; October 2008, pp. 27; In English; See also [20080047981](#)

Report No.(s): NPO-45253; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3297>

A second-harmonic generator (SHG) serves as the source of the visible laser beam in an onboard calibration scheme for NASA's planned Space Interferometry Mission (SIM), which requires an infrared laser beam and a visible laser beam coherent with the infrared laser beam. The SHG includes quasi-phase-matched waveguides made of MgO-doped, periodically poled lithium niobate, pigtailed with polarization-maintaining optical fibers. Frequency doubling by use of such waveguides affords the required combination of coherence and sufficient conversion efficiency for the intended application. The spatial period of the poling is designed to obtain quasi-phase-matching at a nominal middle excitation wavelength of 1,319.28 nm. The SHG is designed to operate at a warm bias (ambient temperature between 20 and 25 C) that would be maintained in its cooler environment by use of electric heaters; the heater power would be adjusted to regulate the temperature precisely and thereby maintain the required precision of the spatial period. At the state of development at the time of this reporting, the SHG had been packaged and subjected to most of its planned space-qualification tests.

Author

*Harmonic Generators; Waveguides; Interferometry; Laser Beams; Electro-Optics*

**20080048017** NASA Glenn Research Center, Cleveland, OH, USA

#### **CO2 Sensors Based on Nanocrystalline SnO2 Doped with CuO**

Xu, Jennifer C.; Hunter, Gary W.; Liu, Chung Chiun; Ward, Benjamin J.; NASA Tech Briefs, October 2008; October 2008, pp. 6-7; In English; See also [20080047981](#); Original contains color illustrations

Report No.(s): LEW-18247-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3263>

Nanocrystalline tin oxide (SnO<sub>2</sub>) doped with copper oxide (CuO) has been found to be useful as an electrical-resistance sensory material for measuring the concentration of carbon dioxide in air. SnO<sub>2</sub> is an n-type semiconductor that has been widely used as a sensing material for detecting such reducing gases as carbon monoxide, some of the nitrogen oxides, and hydrocarbons. Without doping, SnO<sub>2</sub> usually does not respond to carbon dioxide and other stable gases. The discovery that the electrical resistance of CuO-doped SnO<sub>2</sub> varies significantly with the concentration of CO<sub>2</sub> creates opportunities for the development of relatively inexpensive CO<sub>2</sub> sensors for detecting fires and monitoring atmospheric conditions. This discovery could also lead to research that could alter fundamental knowledge of SnO<sub>2</sub> as a sensing material, perhaps leading to the development of SnO<sub>2</sub>-based sensing materials for measuring concentrations of oxidizing gases. Prototype CO<sub>2</sub> sensors based on CuO-doped SnO<sub>2</sub> have been fabricated by means of semiconductor-microfabrication and sol-gel nanomaterial-synthesis



batch processes that are amendable to inexpensive implementation in mass production.

Derived from text

*Carbon Dioxide; Carbon Monoxide; Copper Oxides; Fabrication; Tin Oxides; Nanocrystals*

**20080048023** NASA Glenn Research Center, Cleveland, OH, USA

#### **Update on Development of SiC Multi-Chip Power Modules**

Lostetter, Alexander; Cilio, Edgar; Mitchell, Gavin; Schupbach, Roberto; NASA Tech Briefs, December 2008; December 2008, pp. 10-11; In English; See also [20080048022](#)

Report No.(s): LEW-18341-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3421>

Progress has been made in a continuing effort to develop multi-chip power modules (SiC MCPMs). This effort at an earlier stage was reported in 'SiC Multi-Chip Power Modules as Power-System Building Blocks' (LEW-18008-1), NASA Tech Briefs, Vol. 31, No. 2 (February 2007), page 28. The following recapitulation of information from the cited prior article is prerequisite to a meaningful summary of the progress made since then: 1) SiC MCPMs are, more specifically, electronic power-supply modules containing multiple silicon carbide power integrated-circuit chips and silicon-on-insulator (SOI) control integrated-circuit chips. SiC MCPMs are being developed as building blocks of advanced expandable, reconfigurable, fault-tolerant power-supply systems. Exploiting the ability of SiC semiconductor devices to operate at temperatures, breakdown voltages, and current densities significantly greater than those of conventional Si devices, the designs of SiC MCPMs and of systems comprising multiple SiC MCPMs are expected to afford a greater degree of miniaturization through stacking of modules with reduced requirements for heat sinking; 2) The stacked SiC MCPMs in a given system can be electrically connected in series, parallel, or a series/parallel combination to increase the overall power-handling capability of the system. In addition to power connections, the modules have communication connections. The SOI controllers in the modules communicate with each other as nodes of a decentralized control network, in which no single controller exerts overall command of the system. Control functions effected via the network include synchronization of switching of power devices and rapid reconfiguration of power connections to enable the power system to continue to supply power to a load in the event of failure of one of the modules; and, 3) In addition to serving as building blocks of reliable power-supply systems, SiC MCPMs could be augmented with external control circuitry to make them perform additional power-handling functions as needed for specific applications. Because identical SiC MCPM building blocks could be utilized in such a variety of ways, the cost and difficulty of designing new, highly reliable power systems would be reduced considerably. This concludes the information from the cited prior article. The main activity since the previously reported stage of development was the design, fabrication, and testing a 120-VDC-to-28-VDC modular power-converter system composed of eight SiC MCPMs in a 4 (parallel)-by-2 (series) matrix configuration, with normally-off controllable power switches. The SiC MCPM power modules include closed-loop control subsystems and are capable of operating at high power density or high temperature. The system was tested under various configurations, load conditions, load-transient conditions, and failure-recovery conditions. Planned future work includes refinement of the demonstrated modular system concept and development of a new converter hardware topology that would enable sharing of currents without the need for communication among modules. Toward these ends, it is also planned to develop a new converter control algorithm that would provide for improved sharing of current and power under all conditions, and to implement advanced packaging concepts that would enable operation at higher power density.

Author (revised)

*Silicon Carbides; Chips (Electronics); Integrated Circuits; Modules; Semiconductor Devices; Electrical Engineering*

**20080048025** NASA Kennedy Space Center, Cocoa Beach, FL, USA; ASRC Aerospace Corp., USA

#### **TDR Using Autocorrelation and Varying-Duration Pulses**

Lucena, Angel; Mullinex, Pam; Huang, PoTien; Santiago, Josephine; Mata, Carlos; Zavala, Carlos; Lane, John; NASA Tech Briefs, December 2008; December 2008, pp. 10; In English; See also [20080048022](#)

Report No.(s): KSC-12856; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3419>

In an alternative to a prior technique of time-domain-reflectometry (TDR) in which very short excitation pulses are used, the pulses have very short rise and fall times and the pulse duration is varied continuously between a minimum and a maximum value. In both the present and prior techniques, the basic idea is to (1) measure the times between the generation of excitation pulses and the reception of reflections of the pulses as indications of the locations of one or more defects along a cable and (2) measure the amplitudes of the reflections as indication of the magnitudes of the defects. In general, an excitation pulse has a duration  $T$ . Each leading and trailing edge of an excitation pulse generates a reflection from a defect, so that a unique pair of reflections is associated with each defect. In the present alternative technique, the processing of the

measured reflection signal includes computation of the autocorrelation function  $R(\tau)$  identical with  $\int_{t-\tau}^t x(t)x(t-\tau)dt$  where  $t$  is time,  $x(t)$  is the measured reflection signal at time  $t$ , and  $\tau$  is the correlation interval. The integration is performed over a measurement time interval short enough to enable identification and location of a defect within the corresponding spatial interval along the cable. Typically, where there is a defect,  $R(\tau)$  exhibits a negative peak having maximum magnitude for  $\tau$  in the vicinity of  $T$ . This peak can be used as a means of identifying a leading-edge/trailing-edge reflection pair. For a given spatial interval, measurements are made and  $R(\tau)$  computed, as described above, for pulse durations  $T$  ranging from the minimum to the maximum value. The advantage of doing this is that the effective signal-to-noise ratio may be significantly increased over that attainable by use of a fixed pulse duration  $T$ .

Author

*Fault Detection; Electronic Equipment; Time Signals; Signal Reflection; Pulse Duration; Autocorrelation*

**20080048031** NASA Glenn Research Center, Cleveland, OH, USA

**Logic Gates Made of N-Channel JFETs and Epitaxial Resistors**

Krasowski, Michael J.; NASA Tech Briefs, December 2008; December 2008, pp. 13-14; In English; See also [20080048022](#); Original contains color illustrations

Report No.(s): LEW-18256-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3415>

Prototype logic gates made of n-channel junction field-effect transistors (JFETs) and epitaxial resistors have been demonstrated, with a view toward eventual implementation of digital logic devices and systems in silicon carbide (SiC) integrated circuits (ICs). This development is intended to exploit the inherent ability of SiC electronic devices to function at temperatures from 300 to somewhat above 500 C and withstand large doses of ionizing radiation. SiC-based digital logic devices and systems could enable operation of sensors and robots in nuclear reactors, in jet engines, near hydrothermal vents, and in other environments that are so hot or radioactive as to cause conventional silicon electronic devices to fail. At present, current needs for digital processing at high temperatures exceed SiC integrated circuit production capabilities, which do not allow for highly integrated circuits. Only single to small number component production of depletion mode n-channel JFETs and epitaxial resistors on a single substrate is possible. As a consequence, the fine matching of components is impossible, resulting in rather large direct-current parameter distributions within a group of transistors typically spanning multiples of 5 to 10. Add to this the lack of p-channel devices to complement the n-channel FETs, the lack of precise dropping diodes, and the lack of enhancement mode devices at these elevated temperatures and the use of conventional direct coupled and buffered direct coupled logic gate design techniques is impossible. The presented logic gate design is tolerant of device parameter distributions and is not hampered by the lack of complementary devices or dropping diodes. In addition to n-channel JFETs, these gates include level-shifting and load resistors (see figure). Instead of relying on precise matching of parameters among individual JFETs, these designs rely on choosing the values of these resistors and of supply potentials so as to make the circuits perform the desired functions throughout the ranges over which the parameters of the JFETs are distributed. The supply rails  $V_{DD}$  and  $V_{SS}$  and the resistors  $R$  are chosen as functions of the distribution of direct-current operating parameters of the group of transistors used.

Author

*Logic Circuits; Gates (Circuits); Semiconductor Devices; JFET; Resistors; Epitaxy; Electrical Resistivity*

**20080048032** NASA Glenn Research Center, Cleveland, OH, USA

**SiC JFET Transistor Circuit Model for Extreme Temperature Range**

Neudeck, Philip G.; NASA Tech Briefs, December 2008; December 2008, pp. 9-10; In English; See also [20080048022](#)

Report No.(s): LEW-18342-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3418>

A technique for simulating extreme-temperature operation of integrated circuits that incorporate silicon carbide (SiC) junction field-effect transistors (JFETs) has been developed. The technique involves modification of NGSPICE, which is an open-source version of the popular Simulation Program with Integrated Circuit Emphasis (SPICE) general-purpose analog-integrated-circuit-simulating software. NGSPICE in its unmodified form is used for simulating and designing circuits made from silicon-based transistors that operate at or near room temperature. Two rapid modifications of NGSPICE source code enable SiC JFETs to be simulated to 500 C using the well-known Level 1 model for silicon metal oxide semiconductor field-effect transistors (MOSFETs). First, the default value of the MOSFET surface potential must be changed. In the unmodified source code, this parameter has a value of 0.6, which corresponds to slightly more than half the bandgap of silicon. In NGSPICE modified to simulate SiC JFETs, this parameter is changed to a value of 1.6, corresponding to slightly more than half the bandgap of SiC. The second modification consists of changing the temperature dependence of MOSFET

transconductance and saturation parameters. The unmodified NGSPICE source code implements a  $T(\text{sup } -1.5)$  temperature dependence for these parameters. In order to mimic the temperature behavior of experimental SiC JFETs, a  $T(\text{sup } -1.3)$  temperature dependence must be implemented in the NGSPICE source code. Following these two simple modifications, the Level 1 MOSFET model of the NGSPICE circuit simulation program reasonably approximates the measured high-temperature behavior of experimental SiC JFETs properly operated with zero or reverse bias applied to the gate terminal. Modification of additional silicon parameters in the NGSPICE source code was not necessary to model experimental SiC JFET current-voltage performance across the entire temperature range from 25 to 500 C.

Author

*JFET; Silicon Carbides; Transistor Circuits; Integrated Circuits; Thermal Resistance; Computerized Simulation*

**20080048041** TPL, Inc., Albuquerque, NM, USA

#### **Oxide Fiber Cathode Materials for Rechargeable Lithium Cells**

Rice, Catherine E.; Welker, Mark F.; NASA Tech Briefs, December 2008; December 2008, pp. 21; In English; See also

[20080048022](#)

Report No.(s): MSC-22892-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3448>

LiCoO<sub>2</sub> and LiNiO<sub>2</sub> fibers have been investigated as alternatives to LiCoO<sub>2</sub> and LiNiO<sub>2</sub> powders used as lithium-intercalation compounds in cathodes of rechargeable lithium-ion electrochemical cells. In making such a cathode, LiCoO<sub>2</sub> or LiNiO<sub>2</sub> powder is mixed with a binder [e.g., poly(vinylidene fluoride)] and an electrically conductive additive (usually carbon) and the mixture is pressed to form a disk. The binder and conductive additive contribute weight and volume, reducing the specific energy and energy density, respectively. In contrast, LiCoO<sub>2</sub> or LiNiO<sub>2</sub> fibers can be pressed and sintered to form a cathode, without need for a binder or a conductive additive. The inter-grain contacts of the fibers are stronger and have fewer defects than do those of powder particles. These characteristics translate to increased flexibility and greater resilience on cycling and, consequently, to reduced loss of capacity from cycle to cycle. Moreover, in comparison with a powder-based cathode, a fiber-based cathode is expected to exhibit significantly greater ionic and electronic conduction along the axes of the fibers. Results of preliminary charge/discharge-cycling tests suggest that energy densities of LiCoO<sub>2</sub>- and LiNiO<sub>2</sub>-fiber cathodes are approximately double those of the corresponding powder-based cathodes.

Author

*Oxides; Cathodes; Lithium; Electrochemical Cells; Recharging*

**20080048047** California Inst. of Tech., Pasadena, CA, USA

#### **FPGA Coprocessor for Accelerated Classification of Images**

Pingree, Paula J.; Scharenbroich, Lucas J.; Werne, Thomas A.; NASA Tech Briefs, December 2008; December 2008, pp. 9;

In English; See also [20080048022](#)

Report No.(s): NPO-45961; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3417>

An effort related to that described in the preceding article focuses on developing a spaceborne processing platform for fast and accurate onboard classification of image data, a critical part of modern satellite image processing. The approach again has been to exploit the versatility of recently developed hybrid Virtex-4FX field-programmable gate array (FPGA) to run diverse science applications on embedded processors while taking advantage of the reconfigurable hardware resources of the FPGAs. In this case, the FPGA serves as a coprocessor that implements legacy C-language support-vector-machine (SVM) image-classification algorithms to detect and identify natural phenomena such as flooding, volcanic eruptions, and sea-ice break-up. The FPGA provides hardware acceleration for increased onboard processing capability than previously demonstrated in software. The original C-language program demonstrated on an imaging instrument aboard the Earth Observing-1 (EO-1) satellite implements a linear-kernel SVM algorithm for classifying parts of the images as snow, water, ice, land, or cloud or unclassified. Current onboard processors, such as on EO-1, have limited computing power, extremely limited active storage capability and are no longer considered state-of-the-art. Using commercially available software that translates C-language programs into hardware description language (HDL) files, the legacy C-language program, and two newly formulated programs for a more capable expanded-linear-kernel and a more accurate polynomial-kernel SVM algorithm, have been implemented in the Virtex-4FX FPGA. In tests, the FPGA implementations have exhibited significant speedups over conventional software implementations running on general-purpose hardware.

Author

*Field-Programmable Gate Arrays; Onboard Data Processing; Image Classification; Image Processing; Satellite Imagery*

**20080048064** Hernandez Engineering, Inc., Houston, TX, USA

**Improved Short-Circuit Protection for Power Cells in Series**

Davies, Francis; NASA Tech Briefs, December 2008; December 2008, pp. 14; In English; See also [20080048022](#)  
Report No.(s): MSC-23446-1; Copyright; Avail.: CASI: [A01](#), Hardcopy  
ONLINE: <http://www.techbriefs.com/component/content/article/3423>

A scheme for protection against short circuits has been devised for series strings of lithium electrochemical cells that contain built-in short-circuit protection devices, which go into a high-resistance, current-limiting state when heated by excessive current. If cells are simply connected in a long series string to obtain a high voltage and a short circuit occurs, whichever short-circuit protection device trips first is exposed to nearly the full string voltage, which, typically, is large enough to damage the device. Depending on the specific cell design, the damage can defeat the protective function, cause a dangerous internal short circuit in the affected cell, and/or cascade to other cells. In the present scheme, reverse diodes rated at a suitably high current are connected across short series sub-strings, the lengths of which are chosen so that when a short-circuit protection device is tripped, the voltage across it does not exceed its rated voltage. This scheme preserves the resetting properties of the protective devices. It provides for bypassing of cells that fail open and limits cell reversal, though not as well as does the more-expensive scheme of connecting a diode across every cell.

Author

*Electrochemical Cells; Short Circuits; Circuit Protection*

**20080048111** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Self-Consistent Model of Magnetospheric Electric Field, Ring Current, Plasmasphere, and Electromagnetic Ion Cyclotron Waves: Initial Results**

Khazanov, George V.; Gamayunov, K. V.; Liemohn, M. W.; Fok, M.-C.; Ridley, A. J.; January 2008; 2 pp.; In English; Copyright; Avail.: Other Sources

Electromagnetic ion cyclotron (EMIC) waves are considered to be important for the outer radiation belt relativistic electron loss, and the magnetospheric ring current (RC) ion precipitation. The effectiveness of the loss is not simply controlled by the intensity-spatial-temporal distribution of the waves, but strongly depends on wave spectral distribution. Therefore, in any modeling effort, which employs EMIC waves as an agent to heat and/or scatter the magnetospheric particles, the wave spectral distribution requires a particular care. Unfortunately, there are still very few satellite-based studies of EMIC waves, and Combination of the theoretical models and available and reliable data should be utilized in order to obtain the power spectral density of EMIC waves on global magnetospheric scale throughout the different storm phases. There is only one model currently available to simulate a spatial, temporal and spectral distribution of EMIC waves on global magnetospheric scale [Khazanov et al., 2006]. Although RC ions and EMIC waves in this model are treated self-consistently, the magnetospheric electric field is externally specified. On the other hand, electric field controls the convective patterns of both RC ions and the cold plasmaspheric plasma, being one of the most important elements controlling the wave spectral characteristics. It is why a self-consistent model of the magnetospheric electric field, RC, plasmasphere, and EMIC waves is needed. In this paper we present a further development of our self-consistent model of interacting RC ions and EMIC waves, incorporating the large scale magnetosphere-ionosphere coupling in the model. This new model treats self-consistently not only EMIC waves and RC ions, but also the magnetospheric electric field, RC, and plasmasphere. A few initial results are also presented and discussed.

Author

*Ion Cyclotron Radiation; Electromagnetic Radiation; Ring Currents; Magnetosphere-Ionosphere Coupling; Losses; Outer Radiation Belt*

**20080048114** Bozicevic, Field and Francis, LLP, Palo Alto, CA, USA; California Univ., Berkeley, CA, USA

**Organo Luminescent Semiconductor Nanocrystal Probes for Biological Applications and Process for Making and Using Such Probes (PAT-APPL-11-370 656)**

Weiss, S., Inventor; Bruchez, M., Inventor; Alivasatos, P., Inventor; 7 Mar 06; 10 pp.; In English  
Contract(s)/Grant(s): DE-AC03-SF00098  
Patent Info.: Filed Filed 7 Mar 06; US-Patent-Appl-SN-11-370 656  
Report No.(s): PB2008-105671; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A semiconductor nanocrystal compound is described capable of linking to an affinity molecule. The compound comprises (1) a semiconductor nanocrystal capable of emitting electromagnetic radiation and/or absorbing energy, and/or scattering or diffracting electromagnetic radiation--when excited by an electromagnetic radiation source or a particle beam; and (2) an affinity molecule linked to the semiconductor nanocrystal. The semiconductor nanocrystal is linked to an affinity molecule to

form a semiconductor nanocrystal probe capable of bonding with a detectable substance. Exposure of the semiconductor nanocrystal to excitation energy will excite the semiconductor nanocrystal causing the emission of electromagnetic radiation. Further described are processes for respectively: making the luminescent semiconductor nanocrystal compound; making the semiconductor nanocrystal probe; and using the probe to determine the presence of a detectable substance in a material.

NTIS

*Luminescence; Nanocrystals; Patent Applications; Semiconductors (Materials)*

**20080048123** National Inst. of Standards and Technology, Gaithersburg, MD USA

**New NIST Service for Calibrating Water Permeating Tubes**

Scace, G. E.; January 2007; 4 pp.; In English

Report No.(s): PB2008-105793; No Copyright; Avail.: CASI: [A01](#), Hardcopy

NIST is uniquely capable of substantially improving the performance of permeation tube moisture generators (PTG) by calibrating permeation tubes using NIST's trace humidity standard, the Low Frost Point Generator (LFPG). The LFPG is an extremely stable, well-characterized source of humidity whose output is based on invariant thermodynamic properties of water. The expanded uncertainty ( $k=2$ ) of the LFPG is 0.8% water vapor mole fraction. This document describes a new calibration service for water permeation tubes. The service will become available by the end of 2001.

NTIS

*Calibrating; Permeating; Water*

**20080048141** California Inst. of Tech., Pasadena, CA, USA

**Implementing a Digital Phasemeter in an FPGA**

Rao, Shanti R.; NASA Tech Briefs, September 2008; September 2008, pp. 47; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): NPO-45575; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3187>

Firmware for implementing a digital phasemeter within a field-programmable gate array (FPGA) has been devised. In the original application of this firmware, the phase that one seeks to measure is the difference between the phases of two nominally-equal-frequency heterodyne signals generated by two interferometers. In that application, zero-crossing detectors convert the heterodyne signals to trains of rectangular pulses, the two pulse trains are fed to a fringe counter (the major part of the phasemeter) controlled by a clock signal having a frequency greater than the heterodyne frequency, and the fringe counter computes a time-averaged estimate of the difference between the phases of the two pulse trains. The firmware also does the following: Causes the FPGA to compute the frequencies of the input signals; Causes the FPGA to implement an Ethernet (or equivalent) transmitter for readout of phase and frequency values; and Provides data for use in diagnosis of communication failures. The readout rate can be set, by programming, to a value between 250 Hz and 1 kHz. Network addresses can be programmed by the user.

Author

*Field-Programmable Gate Arrays; Pulse Communication; Electronics; Software Engineering*

**20080048153** California Inst. of Tech., Pasadena, CA, USA

**HEMT Amplifiers and Equipment for their On-Wafer Testing**

Fung, King man; Gaier, Todd; Samoska, Lorene; Deal, William; Radisic, Vesna; Mei, Xiaobing; Lai, Richard; NASA Tech Briefs, September 2008; September 2008, pp. 12-13; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): NPO-45022; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3082>

Power amplifiers comprising InP-based high-electron-mobility transistors (HEMTs) in coplanar-waveguide (CPW) circuits designed for operation at frequencies of hundreds of gigahertz, and a test set for onwafer measurement of their power levels have been developed. These amplifiers utilize an advanced 35-nm HEMT monolithic microwave integrated-circuit (MMIC) technology and have potential utility as local-oscillator drivers and power sources in future submillimeter-wavelength heterodyne receivers and imaging systems. The test set can reduce development time by enabling rapid output power characterization, not only of these and similar amplifiers, but also of other coplanar-waveguide power circuits, without the necessity of packaging the circuits.

Derived from text

*High Electron Mobility Transistors; Integrated Circuits; Wafers; Heterodyning; Imaging Techniques; Waveguides*

**20080048201** California Inst. of Tech., Pasadena, CA, USA

**High-Voltage, Asymmetric-Waveform Generator**

Beegle, Luther W.; Duong, Tuan A.; Duong, Vu A.; Kanik, Isik; NASA Tech Briefs, September 2008; September 2008, pp. 9; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): NPO-45665; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3093>

The shapes of waveforms generated by commercially available analytical separation devices, such as some types of mass spectrometers and differential mobility spectrometers are, in general, inadequate and result in resolution degradation in output spectra. A waveform generator was designed that would be able to circumvent these shortcomings. It is capable of generating an asymmetric waveform, having a peak amplitude as large as 2 kV and frequency of several megahertz, which can be applied to a capacitive load. In the original intended application, the capacitive load would consist of the drift plates in a differential-mobility spectrometer. The main advantage to be gained by developing the proposed generator is that the shape of the waveform is made nearly optimum for various analytical devices requiring asymmetric-waveform such as differential-mobility spectrometers. In addition, this waveform generator could easily be adjusted to modify the waveform in accordance with changed operational requirements for differential-mobility spectrometers. The capacitive nature of the load is an important consideration in the design of the proposed waveform generator. For example, the design provision for shaping the output waveform is based partly on the principle that (1) the potential (V) on a capacitor is given by  $V=q/C$ , where C is the capacitance and q is the charge stored in the capacitor; and, hence (2) the rate of increase or decrease of the potential is similarly proportional to the charging or discharging current. The proposed waveform generator would comprise four functional blocks: a sine-wave generator, a buffer, a voltage shifter, and a high-voltage switch (see Figure 1). The sine-wave generator would include a pair of operational amplifiers in a feedback configuration, the parameters of which would be chosen to obtain a sinusoidal timing signal of the desired frequency. The buffer would introduce a slight delay (approximately equal to 20 ns) but would otherwise leave the fundamental timing signal unchanged. The buffered timing signal would be fed as input to the level shifter. The output of the level shifter would serve as a timing and control signal for the high-voltage switch, causing the switch to alternately be (1) opened, allowing the capacitive load to be charged from a high-voltage DC power supply; then (2) closed to discharge the capacitive load to ground. Hence, the output waveform would closely approximate a series of exponential charging and discharging curves (see Figure 2).

Author

*Waveforms; High Voltages; Capacitance; Electronic Equipment; Test Equipment*

**20080048214** Pacific Northwest National Lab., Richland, WA, USA

**FY 2006 Infrared Photonics Final Report**

Anheier, N. C.; Allen, P. J.; Bernacki, B. E.; Ho, N.; Krishnaswami, K.; Dec. 2006; 51 pp.; In English

Contract(s)/Grant(s): DE-AC05-76RL01830

Report No.(s): DE2007-908205; PNNL-16319; No Copyright; Avail.: National Technical Information Service (NTIS)

Research done by the Infrared Photonics team at Pacific Northwest National Laboratory (PNNL) is focused on developing miniaturized integrated optics and optical fiber processing methods for mid-wave infrared (MWIR) and long-wave infrared (LWIR) sensing applications by exploiting the unique optical and material properties of chalcogenide glass. PNNL has developed thin-film deposition capabilities, direct laser writing techniques, infrared photonic device demonstration, holographic optical element design and fabrication, photonic device modeling, and advanced optical metrology all specific to chalcogenide glass. Chalcogenide infrared photonics provides a pathway to quantum cascade laser (QCL) transmitter miniaturization. The high output power, small size, and superb stability and modulation characteristics of QCLs make them amenable for integration as transmitters into ultra-sensitive, ultra-selective point sampling and remote short-range chemical sensors that are particularly useful for nuclear nonproliferation missions.

NTIS

*Chalcogenides; Infrared Radiation; Photonics*

**20080048245** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**High-Voltage Compatible, Full-Depleted CCD**

Holland, S. E., Inventor; 16 Feb 06; 22 pp.; In English

Contract(s)/Grant(s): DE-AC02-05CH11231

Patent Info.: Filed 16 Feb 06; US-Patent-Appl-SN-11-357 769

Report No.(s): PB2008-105852; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A charge coupled device for detecting electromagnetic and particle radiation is described. The device includes a

high-resistivity semiconductor substrate, buried channel regions, gate electrode circuitry, and amplifier circuitry. For good spatial resolution and high performance, especially when operated at high voltages with full or nearly full depletion of the substrate, the device can also include a guard ring positioned near channel regions, a biased channel stop, and a biased polysilicon electrode over the channel stop.

NTIS

*Charge Coupled Devices; Depletion; Detection; Electromagnetic Radiation; High Voltages; Patent Applications*

**20080048246** Chau (F.) and Associates, Woodbury, NY, USA

**Apparatus and Methods for Cooling Semiconductor Integrated Circuit Chip Packages**

Andry, P. S., Inventor; Colgan, E. G., Inventor; 30 Mar 06; 14 pp.; In English

Contract(s)/Grant(s): H98230-04-C-0920

Patent Info.: Filed Filed 30 Mar 06; US-Patent-Appl-SN-11-393 324

Report No.(s): PB2008-105853; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Apparatus and methods are provided for integrating microchannel cooling modules within high-density electronic modules (e.g., chip packages, system-on-a-package modules, etc.) comprising multiple high-performance IC chips. Electronic modules are designed such that high-performance (high power) IC chips are disposed in close proximity to the integrated cooling module (or cooling plate) for effective heat extraction. Moreover, electronic modules which comprise large surface area silicon carriers with multiple chips face mounted thereon are designed such that integrated silicon cooling modules are rigidly bonded to the back surfaces of such chips to increase the structural integrity of the silicon carriers.

NTIS

*Chips; Cooling; Electronic Modules; Electronic Packaging; Microchannels; Modules; Patent Applications; Semiconductors (Materials)*

**20080048247** Trellis Intellectual Property Law Group, PC, Palo Alto, CA, USA; California Univ., Oakland, CA, USA

**System and Method for Constructing and Operating a High Performance Piezoelectric Actuator**

Wood, R. J., Inventor; Fearing, R. S., Inventor; Hickerson, J. L., Inventor; 11 Feb 05; 24 pp.; In English

Contract(s)/Grant(s): ONR-N00014-98-1-0671

Patent Info.: Filed Filed 11 Feb 05; US-Patent-Appl-SN-11-056 497

Report No.(s): PB2008-105854; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method for fabricating a piezoelectric actuator. The method includes using a mold to place a first portion of a piezoelectric actuator in compression and to place a second portion of the piezoelectric actuator in tension. In a more specific embodiment, the method further includes selecting piezoelectric and elastic passive layer materials; choosing actuator dimensions with reference to desired actuator performance parameters; and then employing a curved mold to form a piezoelectric actuator with the desired dimensions. The piezoelectric actuator exhibits a first surface with compressive stresses caused by curing of the actuator via the curved mold.

NTIS

*Actuators; Patent Applications; Piezoelectric Actuators; Piezoelectricity*

**20080048267** NASA White Sands Test Facility, NM, USA

**Electrical Arc Ignition Testing for Constellation Program**

Sparks, Kyle; Gallus, Timothy; Smith, Sarah; [2009]; 9 pp.; In English; 12th International Symposium on Flammability and of Materials in Oxygen-Enriched Atmospheres, 7-9 Oct. 2009, Berlin, Germany; Original contains color illustrations; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080048267>

NASA Johnson Space Center (JSC) Materials and Processes Branch requested that NASA JSC White Sands Test Facility (WSTF) perform testing for the Constellation Program to evaluate the hazard of electrical arc ignition of materials that could be in close proximity to batteries. Specifically, WSTF was requested to perform wire-break electrical arc tests to determine the current threshold for ignition of generic cotton woven fabric samples with a fixed voltage of 3.7 V, a common voltage for hand-held electrical devices. The wire-break test was developed during a previous test program to evaluate the hazard of electrical arc ignition inside the Extravehicular Mobility Unit [1].

Author

*Ignition; Electric Arcs; Extravehicular Mobility Units; Electric Potential; Electric Batteries; Constellation Program*

**20080048278** Honeywell International, Inc., Morristown, NJ, USA

**Power System Providing Power to at Least One Component Including Circuit for Minimizing Effects of Power Interruptions and Method of Using Same**

Ether, R., Inventor; 8 Feb 05; 9 pp.; In English

Contract(s)/Grant(s): DOD-Z20544

Patent Info.: Filed 8 Feb 05; US-Patent-Appl-SN-11-053 389

Report No.(s): PB2008-105877; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A power system includes a power source having a power output and a signal output and is shiftable between an off state and an on state supplying a given power from the power output, the power source producing a signal on the signal output for a period of time when the power source shifts from the off state to the on state and at least one component having a power input and a signal input, at least one component shifting to a diagnostic state when power at the power input rises from below the given power level to at least the given power level and a signal is present on the signal input and shifting to a second state when power at the power input rises from below the given power level to at least the given power level and no signal is present on the signal input.

NTIS

*Circuits; Interruption; Patent Applications*

**20080048300** Fossil Consulting Services, Inc., Columbia, MD, USA

**Identifying, Quantifying and Controlling Emissions of Sulfur Hexafluoride (SF(sub 6)) from Electrical Equipment in Maryland**

Nov. 2005; 60 pp.; In English

Report No.(s): PB2008-105716; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Sulfur hexafluoride (SF<sub>6</sub>), used extensively in the electricity generation and transmission and distribution industries as an arc quenching and insulating medium in medium and high voltage switchgear, is a potent greenhouse gas. With an extremely long atmospheric lifetime (3,200 years) and chemical properties that make it, pound for pound, 22,200 times more potent as a greenhouse gas than carbon dioxide (CO<sub>2</sub>), releases of SF<sub>6</sub> to the atmosphere can have a significant impact on the total amount of greenhouse gases produced. This report provides a brief description of SF<sub>6</sub>, its properties and its use in the electricity generation and transmission and distribution industries. These industries currently use approximately 80% of the SF<sub>6</sub> produced worldwide. The report also describes the role of SF<sub>6</sub> in increasing global greenhouse gas inventories. Reduction of SF<sub>6</sub> and other man-made greenhouse gases is part of recent initiatives, including the Kyoto Protocol, to limit or reduce worldwide emissions of greenhouse gases. Although the U.S. has not signed the Kyoto Protocol the government, through the Environmental Protection Agency (EPA), is spearheading efforts to reduce SF<sub>6</sub> emissions. The voluntary SF<sub>6</sub> Emission Reduction Partnership for Electric Power Systems encourages and assists members in adopting strategies that will reduce SF<sub>6</sub> emissions.

NTIS

*Electric Equipment; Identifying; Industries; Sulfur Hexafluoride*

**20080048328** Lee and Hayes, PLLC, Spokane, WA, USA

**Methods and Apparatus for Thermal Isolation for Thermoelectric Devices**

Tanielian, M. H., Inventor; 26 Jan 05; 9 pp.; In English

Contract(s)/Grant(s): MDA972-03-2-0003

Patent Info.: Filed 26 Jan 05; US-Patent-Appl-SN-11-044 154

Report No.(s): PB2008-104822; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Methods and apparatus for improved thermal isolation for thermoelectric devices are disclosed. In one embodiment, a thermoelectric device includes a first substrate having a first conductive pad, a second substrate having a second conductive pad, and a gap formed between the first and second conductive pads. At least one of the first and second substrates includes at least one opening positioned adjacent to an outer peripheral edge of the conductive pad. The opening may comprise a trench disposed partially or entirely around the outer peripheral edge of the conductive pad. In operation, the opening inhibits heat transfer between the first and second substrates.

NTIS

*Isolation; Patent Applications; Thermoelectricity*



**20080048331** National Renewable Energy Lab., Golden, CO USA

**Low Bandgap, Monolithic, Multi-Bandgap, Optoelectronic Devices**

Wanlass, M. W., Inventor; Carapella, J. J., Inventor; 21 May 02; 35 pp.; In English

Contract(s)/Grant(s): DE-AC36-99GO10337

Patent Info.: Filed Filed 21 May 02; US-Patent-Appl-SN-10-515 243

Report No.(s): PB2008-104825; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Low-bandgap, monolithic, multi-bandgap, optoelectronic devices, including PV converters, photodetectors, and LED's, have lattice-matched (LM), double-heterostructure (DH), low-bandgap GaInAs(P) subcells including those that are lattice-mismatched (LMM) to InP, grown on an InP substrate by use of at least one graded lattice constant transition layer of InAsP positioned somewhere between the InP substrate and the LMM subcell(s). These devices are monofacial or bifacial and include monolithic, integrated, modules (MIMs) with a plurality of voltage-matched subcell circuits as well as other variations and embodiments.

NTIS

*Energy Gaps (Solid State); Optoelectronic Devices; Patent Applications; Photometers*

**20080048334** Shook, Hardy and Bacon, LLP, Kansas City, MO, USA

**Heterogeneous Integrated High Voltage DC/AC Light Emitter**

Fan, Z., Inventor; Jiang, H., Inventor; Lin, J., Inventor; 21 Jan 05; 9 pp.; In English

Contract(s)/Grant(s): N00014-02-C-0214

Patent Info.: Filed Filed 21 Jan 05; US-Patent-Appl-SN-11-040 445

Report No.(s): PB2008-104830; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A single-chip integrated LED particularly adapted for direct use with a high voltage DC or AC power sources comprises a plurality of electrically isolated LEDs on a generally transparent substrate and bonded to electrically conductive elements on a thermally conductive mount. A reflective coating may be applied to the area between LEDs.

NTIS

*Emitters; Heterogeneity; High Voltages; Inverted Converters (DC to AC); Light Emitting Diodes; Patent Applications; Semiconductor Devices*

**20080048336** Denninger (Douglas E.), Norwalk, VA, USA

**Sixsn<sub>1-x-y</sub> and Related Alloy Heterostructures Based on Si, Ge, and Sn**

Kouvetakis, J., Inventor; Bauer, M., Inventor; 14 Jun 04; 12 pp.; In English

Patent Info.: Filed Filed 14 Jun 04; US-Patent-Appl-SN-10-559 979

Report No.(s): PB2008-104831; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A novel method for synthesizing device-quality alloys and ordered phases in a Si--Ge--Sn system uses a UHV-CVD process and reactions of SnD<sub>(sub 4)</sub> with SiH<sub>(sub 3)</sub>GeH<sub>(sub 3)</sub>. Using the method, single-phase Si<sub>(sub x)</sub>Sn<sub>(sub y)</sub>Ge<sub>(sub 1-x-y)</sub> semiconductors ( $x < \text{or} = 0.25$ ,  $y < \text{or} = 0.11$ ) are grown on Si via Ge<sub>(sub 1-x)</sub>Sn<sub>(sub x)</sub> buffer layers. The Ge<sub>(sub 1-x)</sub>Sn<sub>(sub x)</sub> buffer layers facilitate heteroepitaxial growth of the Si<sub>(sub x)</sub>Sn<sub>(sub y)</sub>Ge<sub>(sub 1-x-y)</sub> films and act as compliant templates that can conform structurally and absorb the differential strain imposed by the more rigid Si and Si--Ge--Sn materials. The SiH<sub>(sub 3)</sub>GeH<sub>(sub 3)</sub> species was prepared using a new and high yield method that provided high purity semiconductor grade material.

NTIS

*Patents; Semiconductors (Materials)*

**20080048339** Pennington (Joan), Chicago, IL, USA; Chicago Univ., Chicago, IL USA

**Single Metal Nanoparticle Scattering Interferometer**

Eah, S. K., Inventor; Lin, X. M., Inventor; Wiederrecht, G., Inventor; 21 Jan 05; 11 pp.; In English

Contract(s)/Grant(s): W-31-1 09-ENG-38

Patent Info.: Filed Filed 21 Jan 05; US-Patent-Appl-SN-11-040 914

Report No.(s): PB2008-104837; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An interferometer and a method for generating scattered light interference are provided. A beam splitter is provided by a single metal nanoparticle to split an incoming excitation light. Scattered light from the single metal nanoparticle and its mirror image shows interference in both spatial and spectral domains. A mirror modifies the spatial distribution of elastic light

scattering of the single metal nanoparticle. A large spectral width of the scattered light enables a distance measurement without scanning the mirror.

NTIS

*Interferometers; Nanoparticles; Patent Applications; Scattering*

**20080048354** Trellis Intellectual Property Law Group, PC, Palo Alto, CA, USA; California Univ., Oakland, CA, USA

**High Performance Piezoelectric Actuator**

Wood, R. J., Inventor; Fearing, R. S., Inventor; Hickerson, J. I., Inventor; 11 Feb 05; 17 pp.; In English

Contract(s)/Grant(s): ONR-N00014-98-1-0671

Patent Info.: Filed Filed 11 Feb 05; US-Patent-Appl-SN-11-056 974

Report No.(s): PB2008-106042; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A high performance piezoelectric actuator. The actuator includes a piezoelectric material exhibiting a selectively tapered width sufficient to enhance actuator fracture load capabilities. A passive material is disposed on or integrated with the piezoelectric material. A drive system is connected to the piezoelectric material. The drive system is capable of selectively applying an electric field to the piezoelectric material. In specific embodiment, the piezoelectric material includes a curved piezoelectric layer exhibits a default state of compression along a surface of the piezoelectric layer.

NTIS

*Actuators; Patent Applications; Piezoelectric Actuators; Piezoelectricity*

**20080048357** Dougherty (J. Charles), Little Rock, AR, USA

**MEMS-Based Optical Communications Beam Steering Apparatus**

Chalfant, C. H., Inventor; Orlando, F. J., Inventor; Gregory, J. T., Inventor; O'Neal, C. B., Inventor; 12 Sep 05; 5 pp.; In English

Contract(s)/Grant(s): AFRL-F29601-02-C-0021

Patent Info.: Filed Filed 12 Sep 05; US-Patent-Appl-SN-11-224 473

Report No.(s): PB2008-106046; No Copyright; Avail.: CASI: [A01](#), Hardcopy

A MEMS-based optical steering apparatus for free space optical transmitters, receivers, and transceivers is disclosed. The MEMS device comprises actuators linked to an optic fiber, the actuators operable to maneuver the optical fiber in the X-Y plane at the focal point of the transmitter, receiver, or transceiver. The MEMS device may thus be used to replace gimbals for beam steering applications.

NTIS

*Beam Steering; Microelectromechanical Systems; Optical Communication; Patent Applications; Transmitter Receivers*

**20080048430** California Univ., Santa Barbara, CA USA

**S-MMICs: Sub-mm-Wave Transistors and Integrated Circuits**

Hung, Alfred; Sep 2008; 13 pp.; In English

Contract(s)/Grant(s): DAAD19-03-R-0017

Report No.(s): AD-A489869; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489869>

Transistor and power amplifier IC technology was developed under UCSB tbr the DARPA SWIFT program. SWIFT seeks to develop sub-mm-wave transistors and ICs to support 340 GHz-band imaging and radar systems. By program end, HBT power-gain cutoff frequencies were increased to 880 GHz, simultaneous with a 5 V breakdown voltage. HBT layer structure designs and process flows, and initial 340 GHz power amplifier designs developed at UCSB were transferred to Teledyne Scientific. Teledyne Scientific then fabricated both transistors and ICs under the financial support of a separate DARPA program; results at TSC include a 2 mW power amplifier at 340 GHz. Device technology development at UCSB included a number of significant accomplishments supporting the future development of sub-mm-wave transistors and integrated circuits, including all-dry-etched processes for reliable formation of ~128 nm feature size transistor emitters and ultra low resistivity contacts for the emitter and base contacts. These several features are critical in enabling transistor bandwidths to extend to the low THz regime.

DTIC

*Integrated Circuits; Power Amplifiers; Radar Equipment; Transistors*

**20080048514** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Exposing and Exploiting Internal Parallelism in MEMS-Based Storage**

Schlosser, Steven W; Schindler, Jiri; Ailamaki, Anastassia; Ganger, Gregory R; Mar 2003; 24 pp.; In English

Contract(s)/Grant(s): NSF-CCR-0113660

Report No.(s): AD-A490134; CMU-CS-03-125; No Copyright; Avail.: Defense Technical Information Center (DTIC)

MEMS-based storage has interesting access parallelism features. Specifically, subsets of a MEMStore's thousands of tips can be used in parallel, and the particular subset can be dynamically chosen. This paper describes how such access parallelism can be exposed to system software -- with minimal changes to system interfaces -- and utilized cleanly for two classes of applications. First, background tasks can utilize unused parallelism to access media locations with no impact on foreground activity. Second, two-dimensional data structures, such as dense matrices and relational database tables, can be accessed in both row order and column order with maximum efficiency. With proper table layout, unwanted portions of a table can be skipped while scanning at full speed. Using simulation, the authors explore performance features of using this device parallelism for an example application from each class.

DTIC

*Application Programming Interface; Computer Storage Devices; Data Storage; Microelectromechanical Systems; Parallel Processing (Computers)*

**20080048529** Army Tank-Automotive Research and Development Command, Warren, MI USA

**MEMS and Nanotechnology Workshop: An Emerging Army Technology**

Meitzler, Tom; Feb 8, 2007; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A490189; TARDEC-16957; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Introductory talk of the MEMS and Nanotechnology Workshop, focusing on microelectromechanical systems and Army applications.

DTIC

*Microelectromechanical Systems; Military Technology; Nanotechnology*

**20080048537** Air Force Research Lab., Rome, NY USA

**A Photonic Recirculating Delay Line for Analog-to-Digital Conversions and Other Applications**

Zmuda, Henry; Fanto, Michael; McEwen, Thomas; Pawloski, Jared; Norelli, Kristina; Mar 2008; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-AWGD

Report No.(s): AD-A490214; AFRL-RY-RS-TP-2008-9; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Experimental results for a photonic recirculating delay line for high-speed, high-resolution Analog-to-Digital Converted (ADC) and other applications is presented. The approach modifies an analog fiber optic link with a recirculating optical loop as a means to store a time-limited microwave signal so that it may be digitized by using a slower, conventional electronic ADC. Detailed analytical analysis of the dynamic range and noise figure show that under appropriate conditions the microwave signal degradation is sufficiently small so as to allow the digitization of a multi-gigahertz signal with a resolution greater than 10 effective bits. Experimental results provided support the theory.

DTIC

*Analog to Digital Converters; Circulation; Delay Lines*

**20080048577** Department of the Navy, Washington, DC USA

**Ultra Wideband Buoyant Cable Antenna Element**

Tonn, David A, Inventor; Aug 20, 2008; 13 pp.; In English

Report No.(s): AD-D020387; No Copyright; Avail.: Other Sources

The invention as disclosed is of a buoyant cable antenna for use with underwater vehicles having improved bandwidth through the use of discrete distributed loading along the antenna. The buoyant cable antenna is designed with an antenna wire that is divided into N equal length segments of length  $d/2$ . A capacitor is coupled between every other segment such that capacitors are separated by a distance  $d$ . A shunt inductor is coupled to the antenna wire between the adjoining segments not separated by a capacitor such that the shunt inductors are separated by a distance  $d$ . This antenna design provides a

substantially improved impedance bandwidth over existing prior art antennas at high frequency without increasing the physical profile of the antenna and without the use of active circuit elements.

DTIC

*Antenna Components; Antennas; Broadband; Buoyancy; Inventions; Patent Applications; Underwater Vehicles*

## 34

### FLUID MECHANICS AND THERMODYNAMICS

Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also *02 Aerodynamics*.

**20080047329** Geological Survey, Reston, VA USA; Utah State Univ., Logan, UT, USA

#### **Update on Regulation of Sand Transport in the Colorado River by Changes in the Surface Grain Size of Eddy Sandbars Over Multiyear Timescales**

Topping, D. J.; Rubin, D. M.; Schmidt, J. C.; January 2008; 32 pp.; In English

Report No.(s): PB2009-101385; USGS/SIR-2008-5042; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In settings where the transport of sand is partially or fully supply limited, changes in the upstream supply of sand are coupled to changes in the grain size of sand on the bed. In this manner, the transport of sand under the supply-limited case is grain-size regulated. Since the closure of Glen Canyon Dam in 1963, the downstream reach of the Colorado River in Marble and Grand Canyons has exhibited evidence of sand-supply limitation. Sand transport in the river is now about equally regulated by changes in the discharge of water and changes in the grain sizes of sand on the channel bed and eddy sandbars. Previous work has shown that changes in the grain size of sand on the channel bed (driven by changes in the upstream supply of sand owing to both tributary floods and high dam releases) are important in regulating sand transport over timescales of days to months. In this study, suspended-sand data are analyzed in conjunction with bed grain-size data to determine whether changes in the sand grain size on the channel bed, or changes in the sand grain size on the surface of eddy sandbars, have been more important in regulating sand transport in the postdam Colorado River over longer, multiyear timescales. The results of this study show that this combined theory- and field-based approach can be used to deduce which environments in a complicated setting are most important for regulating sediment transport. In the case of the regulated Colorado River in Marble and upper Grand Canyons, suspended-sand transport has been regulated mostly by changes in the surface grain size of eddy sandbars.

NTIS

*Colorado River (North America); Sands; Vortices*

**20080047384** Center for Mathematics and Computer Science, Amsterdam, Netherlands

#### **Spotting Structure in Complex Time Dependent Flow**

De Leeuw, W. C.; Van Liere, R.; Sep. 1998; 12 pp.; In English

Report No.(s): PB2009-102509; SEN-9823; Copyright; Avail.: National Technical Information Service (NTIS)

Analysing structure in complex time dependent flow fields is a challenging problem. Spot noise is a technique which utilizes texture for the visualization of flow fields. In this paper, two extensions of spot noise are discussed. These extensions allow spot noise to be used for very detailed analysis of time dependent flow fields. Two applications are discussed: (1) a large data set resulting from a direct numerical simulation of turbulence; and (2) a data set resulting from a global climate data.

NTIS

*Flow Distribution; Flow Visualization; Time Dependence*

**20080047420** NASA Glenn Research Center, Cleveland, OH, USA

#### **Oxidation of ZrB<sub>2</sub> SiC TaSi<sub>2</sub> Materials at Ultra High Temperatures**

Opila, E.; Smith, J.; Levine, S.; Lorincz, J.; Reigel, M.; August 05, 2008; 29 pp.; In English; Ultra-High Temperature Ceramics Conference, 5 Aug. 2008, Lake Tahoe, CA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 599489.02.07.03.02.04.01; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047420>

ZrB<sub>2</sub> - 20v% SiC - 20v% TaSi<sub>2</sub> was oxidized in stagnant air for ten minute cycles for times up to 100 minutes at 1627 C and 1927 C. The sample oxidized at 1627 C showed oxidation resistance better than that of the standard ZrB<sub>2</sub> - 20v% SiC. The sample oxidized at 1927 C, however, showed evidence of liquid phase formation and complex oxidation products. The sample exposed at 1927 C was analyzed in detail by scanning electron microprobe and wavelength dispersive spectroscopy

to understand the complex oxidation and melting reactions occurring during exposure. The as hot-pressed material shows the formation of a Zr(Ta)<sub>2</sub>B<sub>2</sub> phase in addition to the three phases in the nominal composition already noted. After oxidation, the TaSi<sub>2</sub> in the matrix was completely reacted to form Ta(Zr)C. The layered oxidation products included SiO<sub>2</sub>, ZrO<sub>2</sub>, Ta<sub>2</sub>O<sub>5</sub>, and a complex oxide containing both Zr and Ta. Likely reactions are proposed based on thermodynamic phase stability and phase morphology.

Author

*Zirconium Oxides; Silicon Dioxide; Oxidation Resistance; High Temperature; Liquid Phases; Hot Pressing; Thermodynamics*

**20080047438** NASA Glenn Research Center, Cleveland, OH, USA

**NASA Clean-Sheet Fans: Design, Build Analyze, Test, and Report**

Koch, L. Danielle; April 02, 2008; 8 pp.; In English; Quiet, Efficient Fans for Spaceflight Workshop, 2-4 Apr. 2008, Cleveland, OH, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 439906.04.01.02.03; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047438>

A suggested topic in small fan research is presented. Presentation briefly describes the scope of an effort to design, build and test a ventilation class cooling fan. Comments are included for the following categories: information (available and needed), benefits and values, concerns, variations and alternatives, and interest.

Author

*Cooling Systems; Ventilation Fans*

**20080047458** NASA Glenn Research Center, Cleveland, OH, USA

**Cold Start of a Radiator Equipped with Titanium-Water Heat Pipes**

Jaworske, Donald A.; Sanzi, James L.; Siamidis, John; July 28, 2008; 11 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 463169.04.03.05.02; Copyright; Avail.: CASI: [A03](#), Hardcopy

Radiator panels utilizing titanium-water heat pipes are being considered for lunar applications. A traditional sandwich structure is envisioned where heat pipes are embedded between two high thermal conductivity face sheets. The heat pipe evaporators are to be thermally connected to the heat source through one or more manifolds containing coolant. Initial radiator operation on the lunar surface would likely follow a cold soak where the water in the heat pipes is purposely frozen. To achieve heat pipe operation, it will be necessary to thaw the heat pipes. One option is to allow the sunlight impinging on the surface at sunrise to achieve this goal. Testing was conducted in a thermal vacuum chamber to simulate the lunar sunrise and additional modeling was conducted to identify steady-state and transient response. It was found that sunlight impinging on the radiator surface at sunrise was insufficient to solely achieve the goal of thawing the water in the heat pipes. However, starting from a frozen condition was accomplished successfully by applying power to the evaporators. Start up in this fashion was demonstrated without evaporator dryout. Concern is raised over thawing thermosyphons, vertical heat pipes operating in a gravity field, with no wick in the condenser section. This paper presents the results of the simulated cold start study and identifies future work to support radiator panels equipped with titanium-water heat pipes.

Author

*Evaporators; Heat Pipes; Titanium; Thermal Conductivity; Sandwich Structures; Heat Sources; Coolants*

**20080047672** NASA Glenn Research Center, Cleveland, OH, USA

**Jet Penetration into a Scaled Microfabricated Stirling Cycle Regenerator**

Sun, Liyong; Simon, Terrence W.; Mantell, Susan; Ibrahim, Mournir; Gedeon, David; Tew, Roy; July 28, 2008; 17 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS3-03124; WBS 138494.04.01.01; Copyright; Avail.: CASI: [A03](#), Hardcopy

The cooler and heater adjacent to the regenerator of a Stirling cycle engine have tubes or channels which form jets that pass into the regenerator while diffusing within the matrix. An inactive part of the matrix, beyond the cores of these jets, does not participate fully in the heat transfer between the flow of working fluid and the regenerator matrix material, weakening the regenerator's ability to exchange heat with the working fluid. The objective of the present program is to document this effect on the performance of the regenerator and to develop a model for generalizing the results. However, the small scales of actual Stirling regenerator matrices (on the order of tens of microns) make direct measurements of this effect very difficult. As a result, jet spreading within a regenerator matrix has not been characterized well and is poorly understood. Also, modeling is lacking experimental verification. To address this, a large-scale mockup of thirty times actual scale was constructed and

operated under conditions that are dynamically similar to the engine operation. Jet penetration with round jets and slot jets into the microfabricated regenerator geometry are then measured by conventional means. The results are compared with those from a study of spreading of round jets within woven screen regenerator for further documentation of the comparative performance of the microfabricated regenerator geometry.

Author

*Stirling Cycle; Coolers; Heat Transfer; Regenerators; Working Fluids*

**20080047727** NASA Glenn Research Center, Cleveland, OH, USA

**Failure Mechanisms and Life Prediction of Thermal and Environmental Barrier Coatings under Thermal Gradients**  
Zju, Dongming; Ghosn, Louis J.; Miller, Robert A.; January 30, 2008; 24 pp.; In English; 32nd International Conference on Advanced Ceramics and Composites, 27 Jan. - 1 Feb. 2008, Daytona Beach, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.16.03; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047727>

Ceramic thermal and environmental barrier coatings (TEBCs) will play an increasingly important role in gas turbine engines because of their ability to further raise engine temperatures. However, the issue of coating durability is of major concern under high-heat-flux conditions. In particular, the accelerated coating delamination crack growth under the engine high heat-flux conditions is not well understood. In this paper, a laser heat flux technique is used to investigate the coating delamination crack propagation under realistic temperature-stress gradients and thermal cyclic conditions. The coating delamination mechanisms are investigated under various thermal loading conditions, and are correlated with coating dynamic fatigue, sintering and interfacial adhesion test results. A coating life prediction framework may be realized by examining the crack initiation and propagation driving forces for coating failure under high-heat-flux test conditions.

Author

*Thermal Control Coatings; Ceramic Coatings; Failure Analysis; Crack Propagation; Stress Distribution; Gas Turbine Engines; Fatigue Tests*

**20080047728** NASA Glenn Research Center, Cleveland, OH, USA

**The Lattice and Thermal Radiation Conductivity of Thermal Barrier Coatings**

Zhu, Dongming; Spuckler, Charles M.; January 27, 2008; 17 pp.; In English; 32nd International Conference on Advanced Ceramics and Composites, 27 Jan. - 1 Feb. 2008, Daytona Beach, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.16.03; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047728>

The lattice and radiation conductivity of thermal barrier coatings was evaluated using a laser heat flux approach. A diffusion model has been established to correlate the apparent thermal conductivity of the coating to the lattice and radiation conductivity. The radiation conductivity component can be expressed as a function of temperature and the scattering and absorption properties of the coating material. High temperature scattering and absorption of the coating systems can also be derived based on the testing results using the modeling approach. The model prediction is found to have good agreement with experimental observations.

Author

*Thermal Control Coatings; High Temperature; Thermal Radiation; Thermal Conductivity; Lasers; Heat Flux*

**20080047729** NASA Glenn Research Center, Cleveland, OH, USA

**Advanced Low Conductivity Thermal Barrier Coatings: Performance and Future Directions (Invited paper)**

Zhu, Dongming; Miller, Robert A.; April 27, 2008; 39 pp.; In English; 35th International Conference On Metallurgical Coatings And Thin Films (ICMCTF 2008), 27 Apr. 2 May 2008, San Diego, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 877888.02.07.03.05.03; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047729>

Thermal barrier coatings will be more aggressively designed to protect gas turbine engine hot-section components in order to meet future engine higher fuel efficiency and lower emission goals. In this presentation, thermal barrier coating development considerations and performance will be emphasized. Advanced thermal barrier coatings have been developed using a multi-component defect clustering approach, and shown to have improved thermal stability and lower conductivity. The coating systems have been demonstrated for high temperature combustor applications. For thermal barrier coatings designed

for turbine airfoil applications, further improved erosion and impact resistance are crucial for engine performance and durability. Erosion resistant thermal barrier coatings are being developed, with a current emphasis on the toughness improvements using a combined rare earth- and transition metal-oxide doping approach. The performance of the toughened thermal barrier coatings has been evaluated in burner rig and laser heat-flux rig simulated engine erosion and thermal gradient environments. The results have shown that the coating composition optimizations can effectively improve the erosion and impact resistance of the coating systems, while maintaining low thermal conductivity and cyclic durability. The erosion, impact and high heat-flux damage mechanisms of the thermal barrier coatings will also be described.

Author

*Thermal Control Coatings; Corrosion Resistance; Impact Resistance; Transition Metals; Thermal Conductivity; High Temperature; Thermal Stability*

**20080047730** LibertyWorks, USA

**Rolls-Royce Low Noise Highly Variable Cycle Nozzle for Next Generation Supersonic Aircraft**

Sokhey, Jack S.; Kube-McDowell, Matthew; October 07, 2008; 18 pp.; In English; Fundamental Aeronautics Annual Meeting, 7-9 Oct. 2008, Atlanta, GA, USA; Original contains color illustrations

Contract(s)/Grant(s): NNL08AA29C; WBS 984754.02.07.03.17.04; Copyright; Avail.: CASI: [A03](#), Hardcopy

An overview of the work performed by Rolls-Royce under contract NNL08AA29C is presented. The work includes computational fluid dynamic (CFD) analysis for, and design of, a highly variable cycle exhaust model for the Supersonic project (NRA NN06ZEA001N). The CFD analysis shows that the latest design improvements to the clam shell doors have increased flow through the ejector over that achieved with previous designs.

Author

*Computational Fluid Dynamics; Low Noise; Ejectors; Supersonic Aircraft*

**20080047757** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Design by Continuous Collaboration Between Manual and Automatic Optimization**

Shahroudi, K. E.; Feb. 28, 1997; 18 pp.; In English

Report No.(s): PB2009-102242; SEN-R9701; Copyright; Avail.: National Technical Information Service (NTIS)

Numerical optimization is traditionally viewed as a machine centric activity. This view dominates the majority of numerical optimization packages today, where user interaction is normally limited to the problem definition phase or visualization of the results with little or no interaction at design or run time. Surprisingly we are surrounded by many examples of successful engineering systems which allow human interaction at run time, i.e., automobiles, aircraft, etc. In fact, Integrated Human Machine Systems (IHMS) and dedicated engineering design groups have already shown that the distribution of the intelligent function between the human and artificial agents at design time leads to a more effective utilization of their complementary capabilities. This paper discusses the implementation of a generic semi-automatic optimization concept in which the human designer continuously collaborates with a numerical agent to navigate the design space and modify it when necessary. The concept allows human interaction at various levels of automation. The potential of this approach is shown by way of three human-in-the-loop optimization examples: (1) conceptual design optimization of subsonic aircraft; (2) optimization of trajectory of a Mars rover vehicle; and (3) configuration optimization of a multi-stage rocket.

NTIS

*Systems Integration; Design Optimization*

**20080047797** Air Force Research Lab., Edwards AFB, CA USA

**Effect of a Phase Angle on Coaxial Jet Behavior Spanning Sub- to Supercritical Pressures**

Leyva, Ivett A; Rodriguez, Juan; Talley, Douglas; Sep 2008; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-2308

Report No.(s): AD-A489564; AFRL-RZ-ED-TP-2008-211; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper describes the effects of phase angle of an acoustic pressure field on a shear coaxial jet. The jet is forced with a transverse acoustic field, made up of two acoustics sources with  $p_{RMS} / p_{mean}$  up to 3.1%. The chamber pressure ranges from 1.5 to 5.0 MPa. The momentum flux ratio (MR) between the outer and inner jet varies from 0.02 to 23 and the velocity ratio from 0.25 to 23. The shear coaxial geometry is selected because of its application to liquid rocket engines. The jet was analyzed by taking high speed images and exit-plane temperature measurements. This work continues previous work where the jet was excited with one acoustic source; therefore the jet location was fixed with respect to the acoustic field. For

near-critical pressures, the cases with  $MR < 1$  and  $MR > 9$  were least sensitive to the acoustic field and phase angles. For the cases,  $MR = 1.1$  to  $4.9$  the trends of  $L/D$  qualitatively followed the  $p'$  field trends. The maximum  $L/D$  was found around the maximum value of  $p'$  and viceversa. For these data, it seems like the dark core length is more affected, in terms of its reduction, by high acoustic velocity amplitude and not high pressure amplitudes.

DTIC

*Acoustics; Phase Shift; Supercritical Pressures*

**20080048045** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Spatial and Temporal Low-Dimensional Models for Fluid Flow**

Kalb, Virginia; NASA Tech Briefs, December 2008; December 2008, pp. 25; In English; See also [20080048022](#)

Report No.(s): GSC-15130-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3462>

A document discusses work that obtains a low-dimensional model that captures both temporal and spatial flow by constructing spatial and temporal four-mode models for two classic flow problems. The models are based on the proper orthogonal decomposition at two reference Reynolds numbers. Model predictions are made at an intermediate Reynolds number and compared with direct numerical simulation results at the new Reynolds number.

Author

*Direct Numerical Simulation; Fluid Flow; Decomposition*

**20080048053** Boeing Co., Houston, TX, USA

**'Bootstrap' Configuration for Multistage Pulse-Tube Coolers**

Nguyen, Bich; Nguyen, Lauren; NASA Tech Briefs, December 2008; December 2008, pp. 24; In English; See also [20080048022](#)

Report No.(s): MSC-23500-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3455>

A bootstrap configuration has been proposed for multistage pulse-tube coolers that, for instance, provide final-stage cooling to temperatures as low as 20 K. The bootstrap configuration supplants the conventional configuration, in which customarily the warm heat exchangers of all stages reject heat at ambient temperature. In the bootstrap configuration, the warm heat exchanger, the inertance tube, and the reservoir of each stage would be thermally anchored to the cold heat exchanger of the next warmer stage. The bootstrapped configuration is superior to the conventional setup, in some cases increasing the 20 K cooler's coefficient of performance two-fold over that of an otherwise equivalent conventional layout. The increased efficiency could translate into less power consumption, less cooler mass, and/or lower cost for a given amount of cooling.

Author

*Coolers; Temperature Control; Configurations; Thermodynamics*

**20080048058** Creare, Inc., Hanover, NH, USA

**Nonventing, Regenerable, Lightweight Heat Absorber**

Izenon, Michael G.; Chen, Weibo; NASA Tech Briefs, December 2008; December 2008, pp. 23; In English; See also [20080048022](#)

Report No.(s): MSC-23914-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3454>

A lightweight, regenerable heat absorber (RHA), developed for rejecting metabolic heat from a space suit, may also be useful on Earth for short-term cooling of heavy protective garments. Unlike prior space-suit-cooling systems, a system that includes this RHA does not vent water. The closed system contains water reservoirs, tubes through which water is circulated to absorb heat, an evaporator, and an absorber/radiator. The radiator includes a solution of LiCl contained in a porous material in titanium tubes. The evaporator cools water that circulates through a liquid-cooled garment. Water vapor produced in the evaporator enters the radiator tubes where it is absorbed into the LiCl solution, releasing heat. Much of the heat of absorption is rejected to the environment via the radiator. After use, the RHA is regenerated by heating it to a temperature of 100 C for about 2 hours to drive the absorbed water back to the evaporator. A system including a prototype of the RHA was found to be capable of maintaining a temperature of 20 C while removing heat at a rate of 200 W for 6 hours.

Author

*Space Suits; Evaporators; Thermal Absorption; Cooling Systems; Lithium Chlorides; Rejection*



**20080048095** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Local Structure of Stable and Undercooled Ti-Zr-Ni Alloy Liquids; Distortion and Growth Mechanism Of Icosahedral Short-Range Order In Liquids**

Lee, G. W.; Gangopadhyay, A. K.; Hyers, R. W.; Rathz, T. J.; Rogers, J. R.; Robinson, D. S.; Goldman, A. I.; Kelton, K. F.; [2008]; 1 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

Recently, we reported direct experimental evidence for distorted and undistorted icosahedral short-range order (ISRO) in select metal and alloy liquids in stable and metastable states, based on in-situ high-energy x-ray diffraction studies of electrostatically-levitated samples. Results, showing a systematic development of ISRO from binary Ti-Zr to ternary Ti-Zr-Ni alloy liquids, are presented here. From a cluster based analysis of the derived x-ray structure factors, it is concluded that the ISRO in the binary alloys progressively becomes less distorted and the coherence length of the order becomes longer with the addition of Ni, approaching nearly perfect extended ISRO near a concentration of 21 at.% Ni. The role of chemical interactions among Ti/Zr-Ni and the atomic size on the stabilization of the ISRO are discussed.

Author

*Binary Alloys; Cluster Analysis; Metastable State; Titanium Alloys; X Ray Diffraction*

**20080048184** California Inst. of Tech., Pasadena, CA, USA

**Thermally Actuated Hydraulic Pumps**

Jones, Jack; Ross, Ronald; Chao, Yi; NASA Tech Briefs, September 2008; September 2008, pp. 22-23; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): NPO-40844; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3139>

Thermally actuated hydraulic pumps have been proposed for diverse applications in which direct electrical or mechanical actuation is undesirable and the relative slowness of thermal actuation can be tolerated. The proposed pumps would not contain any sliding (wearing) parts in their compressors and, hence, could have long operational lifetimes. The basic principle of a pump according to the proposal is to utilize the thermal expansion and contraction of a wax or other phase-change material in contact with a hydraulic fluid in a rigid chamber. Heating the chamber and its contents from below to above the melting temperature of the phase-change material would cause the material to expand significantly, thus causing a substantial increase in hydraulic pressure and/or a substantial displacement of hydraulic fluid out of the chamber. Similarly, cooling the chamber and its contents from above to below the melting temperature of the phase-change material would cause the material to contract significantly, thus causing a substantial decrease in hydraulic pressure and/or a substantial displacement of hydraulic fluid into the chamber. The displacement of the hydraulic fluid could be used to drive a piston. The figure illustrates a simple example of a hydraulic jack driven by a thermally actuated hydraulic pump. The pump chamber would be a cylinder containing encapsulated wax pellets and containing radial fins to facilitate transfer of heat to and from the wax. The plastic encapsulation would serve as an oil/wax barrier and the remaining interior space could be filled with hydraulic oil. A filter would retain the encapsulated wax particles in the pump chamber while allowing the hydraulic oil to flow into and out of the chamber. In one important class of potential applications, thermally actuated hydraulic pumps, exploiting vertical ocean temperature gradients for heating and cooling as needed, would be used to vary hydraulic pressures to control buoyancy in undersea research vessels. Heretofore, electrically actuated hydraulic pumps have been used for this purpose. By eliminating the demand for electrical energy for pumping, the use of the thermally actuated hydraulic pumps could prolong the intervals between battery charges, thus making it possible to greatly increase the durations of undersea exploratory missions.

Author

*Hydraulic Equipment; Temperature Effects; Thermal Expansion; Hydraulic Control; Hydraulic Fluids; Pumps; Compressors; Heat Transfer*

**20080048258** NASA Langley Research Center, Hampton, VA, USA

**Experimental Investigation of Project Orion Crew Exploration Vehicle Aeroheating in AEDC Tunnel 9**

Hollis, Brian R.; Horvath, Thomas J.; Berger, Karen T.; Lillard, Randolph P.; Kirk, Benjamin S.; Coblisch, Joseph J.; Norris, Joseph D.; December 2008; 168 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 644423.02.39.04.10.03

Report No.(s): NASA/TP-2008-215547; L-19359; No Copyright; Avail.: CASI: [A08](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080048258>

An investigation of the aeroheating environment of the Project Orion Crew Entry Vehicle has been performed in the Arnold Engineering Development Center Tunnel 9. The goals of this test were to measure turbulent heating augmentation levels on the heat shield and to obtain high-fidelity heating data for assessment of computational fluid dynamics methods.

Laminar and turbulent predictions were generated for all wind tunnel test conditions and comparisons were performed with the data for the purpose of helping to define uncertainty margins for the computational method. Data from both the wind tunnel test and the computational study are presented herein.

Author

*Aerodynamic Heating; Crew Exploration Vehicle; Computational Fluid Dynamics; Heat Shielding; Turbulence*

**20080048332** Schlumberger Oilfield Services, Sugar Land, TX, USA

**Cooling Apparatus and Method (PAT-APPL-10-905 954)**

Mayes, J. C., Inventor; 27 Jan 05; 12 pp.; In English

Contract(s)/Grant(s): DE-FC26-03NT41835

Patent Info.: Filed 27 Jan 05; US-Patent-Appl-SN-10-905 954

Report No.(s): PB2008-104826; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An apparatus and method provide for cooling of a system having an energy source, one or more devices that actively consume energy, and one or more devices that generate heat. The inventive apparatus comprises one or more thermoelectric coolers ('TECs') disposed in conductive engagement with at least one of the heat-generating devices, and an energy diverter disposed for diverting at least a portion of the energy from the energy source that is not consumed by the active energy-consuming devices to the TECs. In this manner, cooling is provided for the cooler-engaged heat-generating devices. In particular embodiments of the inventive apparatus, the system comprises a tool string conveyed within a borehole. In such embodiments, the one or more TECs are carried by the tool string in conductive engagement with at least one of the heat-generating devices. The tool string may, e.g., be part of a drill string conveyed within the borehole, or the tool string may be conveyed within the borehole on a wireline.

NTIS

*Coolants; Coolers; Cooling; Cooling Systems; Patent Applications; Thermoelectricity*

**20080048347** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Computational Fluid Dynamics: Science and Tool**

Koren, B.; Jan. 2006; 18 pp.; In English

Report No.(s): PB2008-106023; MAS-E0602; Copyright; Avail.: National Technical Information Service (NTIS)

The year 2003 marked the 100th anniversary of both the birth of John von Neumann and the first manned flight with a power plane. In the current paper, from a Dutch perspective, attention is paid to the great importance of both events for computational fluid dynamics in general and computational aerodynamics in particular.

NTIS

*Computational Fluid Dynamics; Education; Research and Development*

**20080048363** Air Force Research Lab., Edwards AFB, CA USA

**Preliminary Results on Coaxial Jet Spread Angles and the Effects of Variable Phase Transverse Acoustic Fields (Postprint)**

Leyva, Ivett A; Talley, Douglas; Rodriguez, Juan I; Chehroudi, Bruce; Jan 2008; 16 pp.; In English

Contract(s)/Grant(s): Proj-2308

Report No.(s): AD-A489546; AFRL-RZ-ED-TP-2007-528; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An experimental study on the jet spreading angle of N<sub>2</sub> shear coaxial jets at sub-, near-, and supercritical pressures is presented. The jet spreading angle is an important parameter which characterizes the mixing between two flows forming a shear layer. The present results are compared with previous experimental data, CFD results, and theoretical predictions. The angle measurements are made directly from at least 20 backlit images. The shear coaxial injector used here is similar to those used in cryogenic liquid rockets. The chamber pressure ranges from 1.5 to 5.0 MPa to span subcritical to supercritical pressures. The chamber to outer jet density ratio varies from 0.17-4.8 and the momentum flux ratio between the outer and the inner jet varies from 0.37 to 30. These ratios are mainly varied by changing the temperature and flow rates of the outer jet. For the ranges of conditions studied it is found that the tangent of the jet spreading angle is roughly constant and approximately 0.19 with std. dev. of 0.02. The value is lower than those predicted by different theories for planar mixing layers of variable density for gaseous flows. The second part of the paper focuses on the initial results obtained by combining two piezo-sirens which generate a transverse acoustic field to excite the coaxial jet. The resonant frequency studied is approximately 3kHz and delta P/P varies from 1-1.6%. These two acoustic sources can have an arbitrary phase between them so the position of the jet

with respect to the pressure and velocity field can be adjusted. The main parameter investigated is the length of the dark inner jet core. The initial results indicate an effect of the phase angle on the dark core length but the differences are statistically significant only in the extreme cases.

DTIC

*Acoustics; Shear Flow*

**20080048545** Engineering Research and Consulting, Inc., Edwards AFB, CA USA

**Effect of Thermal Conductivity on the Knudsen Layer at Ablative Surfaces (Postprint)**

Pekker, L; Keidar, M; Cambier, J -L; Feb 13, 2008; 7 pp.; In English

Report No.(s): AD-A490255; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper we develop an analytical model of Knudsen layer at the ablative wall taking into account the temperature gradient in the bulk gas. The region of validity of the existing models and effect of the temperature gradient on the Knudsen layer properties are calculated.

DTIC

*Ablation; Ablative Materials; Thermal Conductivity*

### 35

## INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography. For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Avionics and Aircraft Instrumentation*; and *19 Spacecraft Instrumentation and Astrionics*.

**20080047497** Naval Postgraduate School, Monterey, CA USA

**Investigating the Effects of Higher Spatial Resolution on Benthic Classification Accuracy at Midway Atoll**

Arledge, Richard K; Hatcher, Ervin B; Sep 2008; 141 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489075; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489075>

Effective monitoring of coral reefs is important for ecological and economic reasons, and satellite remote sensing has been shown to be useful for mapping and monitoring these ecosystems. This thesis will compare 2 multispectral systems and investigate the effects of increased spatial resolution on benthic classifications in the highly heterogeneous coral reef environment of Midway Atoll. It will evaluate the utility of QuickBird's increased spatial resolution compared to IKONOS imagery in the same study area at multiple scales. Previous studies (e.g., Mumby and Edwards, 2002; Capolsini et al., 2003; Wang et al., 2004; Benefield et al., 2007) comparing various satellite sensors suggest that greater spatial resolution should lead to more accurate classifications, but a direct comparison of QuickBird and IKONOS sensors has not been carried out in marine environments. Light interactions in marine environments are complex and add difficulty to spectral discrimination, producing more variable results in classification accuracy than in terrestrial environments. This research does not find any significant improvements in thematic mapping accuracy of benthic environment from QuickBird's higher spatial resolution satellite imagery. Additionally, a cost benefit analysis did not show a decisive advantage in choosing either imagery type for the application of monitoring the extent, biodiversity, and health of coral reef habitats.

DTIC

*Accuracy; Atolls; Classifications; Ocean Bottom; Remote Sensors; Spatial Resolution*

**20080047514** Naval Research Lab., Washington, DC USA

**EM61-MK2 Response of Standard Munition Items**

Nelson, H H; Bell, T; Kingdon, J; Khadr, N; Steinhurst, D A; Oct 6, 2008; 36 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W74RDV73544541

Report No.(s): AD-A489224; NRL/MR/6110--08-9155; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489224>

Target response coefficients for 13 commonly encountered UXO items were calculated from measurements made using the recently developed NRL Time-domain Electromagnetic Induction array. These response coefficients were used to predict the signals expected from an EM61-MK2, the most commonly used geophysical survey instrument for UXO, for each of these

items as a function of orientation and distance of the center of the item below the bottom coil of the sensor. A series of EM61-MK2 survey measurements were made over the object at the NRL Blossom Point Test site to confirm the predictions. These predicted EM61-MK2 signals are presented graphically with the confirming survey measurements plotted on the same axes. The minimum signal at each of the four gates available from the EM61-MK2 is tabulated for a depth corresponding to 11x the object's diameter, the de facto expectation for detectability with modern geophysical equipment, and all the results obtained electronically as a spreadsheet.

DTIC

*Depth; Magnetic Induction; Ordnance*

**20080047515** Naval Research Lab., Washington, DC USA

**The Feasibility of Nonlinear Dimensionality Reduction for the Rapid Analysis of Persistent Surveillance Data, including the Detection of IED Placement Activity**

Bucholtz, Frank; Nichols, Jonathan M; Duncan, Michael D; Smith, Leslie N; Oct 31, 2008; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489256; NRL/MR/5650--08-9146; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489256>

Our ability to analyze large, complex data sets, such as persistent surveillance data, has often far outstripped our ability to rapidly analyze that data. We have identified a class of intelligent data reduction algorithms, known collectively as Nonlinear Dimensionality Reduction (NLDR), and we believe the utilization of NLDR approaches will allow a significant performance improvement for automated data analysis systems. In this report, we review the basic elements of NLDR techniques, we discuss the advantages of these techniques over more traditional approaches such as Principal-Component Analysis (PCA), and we outline an approach for utilizing NLDR to detect activities leading to the placement of IEDs based on airborne persistent surveillance video data.

DTIC

*Detection; Explosives; Nonlinearity; Surveillance*

**20080047574** Catania Univ., Italy

**Achieving Consensus in Self-Organizing Wireless Sensor Networks: The Impact of Network Topology on Energy Consumption**

Barbarossa, Sergio; Scutari, Gesualdo; Swami, Ananthram; Apr 2007; 5 pp.; In English; Original contains color illustrations  
Contract(s)/Grant(s): N62558-05-P-0458

Report No.(s): AD-A489463; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Achieving consensus on common global parameters through totally decentralized algorithms is a topic that has attracted considerable attention in the last few years. Several algorithms have been developed, among which the most popular is the average consensus method. The main advantage of these approaches is that they do not require a fusion center. But, on the other hand, they are typically based on iterative algorithms, whose energy consumption is proportional to the time necessary to achieve consensus. This time depends on the network topology, as well as on the transmit power of each node. In this paper, we show that there exists an optimal transmit power that minimizes the overall energy consumption necessary to achieve the global estimate within a given accuracy and that this power depends on the network topology.

DTIC

*Algebra; Detectors; Energy Consumption; Topology; Wireless Communication*

**20080047691** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**A Detector for Cosmic Microwave Background Polarimetry**

Wollack, E.; Cao, N.; Chuss, D.; Hsieh, W.-T.; Moseley, S. Harvey; Stevenson, T.; U-yen, K.; July 06, 2008; 1 pp.; In English; Astronomical Polarimetry 2008 Conference, 6-11 Jul. 2008, Montreal, Canada; Copyright; Avail.: Other Sources; Abstract Only

We present preliminary design and development work on polarized detectors intended to enable Cosmic Microwave Background polarization measurements that will probe the first moments of the universe. The ultimate measurement will be challenging, requiring background-limited detectors and good control of systematic errors. Toward this end, we are integrating the beam control of HE-11 feedhorns with the sensitivity of transition-edge sensors. The coupling between these two devices is achieved via waveguide probe antennas and superconducting microstrip lines. This implementation allows band-pass filters

to be incorporated on the detector chip. We believe that a large collection of single-mode polarized detectors will eventually be required for the reliable detection of the weak polarized signature that is expected to result from gravitational waves produced by cosmic inflation. This focal plane prototype is an important step along the path to this detection, resulting in a capability that will enable various future high performance instrument concepts.

Author

*Cosmic Microwave Background Radiation; Polarimetry; Detectors; Prototypes; Research and Development*

**20080047745** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**(55)Fe X-ray Response of HgCdTe NIR Detector Arrays**

Fox, Ori; Rauscher, Bernard J.; May 15, 2008; 1 pp.; In English; SuperNova Acceleratio Probe Collaboration Meeting, 15-17 May 2008, Batavia, IL, USA; No Copyright; Avail.: Other Sources; Abstract Only

Conversion gain is a fundamental parameter in detector characteristics that is used to measure many identifying detector properties, including read noise, dark current, and quantum efficiency (QE). Charge coupling effects, such as inter-pixel capacitance, attenuate photon shot noise and result in an overestimation of conversion gain when implementing the photon transfer technique. The (55)Fe X-ray technique is a direct and simple method by which to measure the conversion gain by comparing the observed instrumental counts (ADU) to the known charge (e-) liberated by a single X-ray photon. Here we present the calibrated pair production energy for 1.7 micron HgCdTe infrared detectors.

Author

*Infrared Detectors; Charge Coupled Devices; Charge Transfer; Photons; Iron Isotopes; Radioactive Isotopes*

**20080047747** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Wide Field Camera 3: A Powerful New Imager for the Hubble Space Telescope**

Kimble, Randy; June 23, 2008; 1 pp.; In English; SPIE 2008 Conference, 23-28 Jun. 2008, Marseille, France; No Copyright; Avail.: Other Sources; Abstract Only

Wide Field Camera 3 (WFC3) is a powerful UV/visible/near-infrared camera in development for installation into the Hubble Space Telescope during upcoming Servicing Mission 4. WFC3 provides two imaging channels. The UVIS channel incorporates a 4096 x 4096 pixel CCD focal plane with sensitivity from 200 to 1000 nm. The IR channel features a 1024 x 1024 pixel HgCdTe focal plane covering 850 to 1700 nm. We report here on the design of the instrument, the performance of its flight detectors, results of the ground test and calibration program, and the plans for the Servicing Mission installation and checkout.

Author

*Cameras; Pixels; Image Resolution; Ground Tests; Calibrating; Orbital Servicing; Hubble Space Telescope*

**20080047749** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**FPGA Control System for the Automated Test of Microshutters**

Lyness, Eric; Rapchun, David A.; Moseley, S. Harvey; October 20, 2008; 1 pp.; In English; 25th Space Simulation Conference, 20-23 Oct. 2008, Annapolis, MD, USA; Copyright; Avail.: Other Sources; Abstract Only

The James Webb Space Telescope, scheduled to replace the Hubble in 2013, must simultaneously observe hundreds of faint galaxies. This requirement has led to the development of a programmable transmission mask which can be adapted to admit light with arbitrary pattern of galaxies into its spectrograph. This programmable mask will contain a large array of micro-electromechanical (MEMs) devices called MicroShutters. These microscopic shutters physically open and close like the shutter on a camera, except each shutter is microscopic in size and an array 365 by 171 is used to select the objects under spectroscopic observation at a given time, and to block the unwanted background light from other areas. NASA developed and is currently refining the exceptionally difficult process of manufacturing these shutters. This paper describes how the authors used LabVIEW FPGA and a reconfigurable I/O board to control the shutters in a test chamber and how the flexibility of the system allows us to continue to modify the control algorithms as NASA optimizes the performance of the MicroShutter arrays.

Author

*Field-Programmable Gate Arrays; Shutters; Microelectromechanical Systems; Control Systems Design; Design Optimization; Test Chambers; James Webb Space Telescope*

**20080048010** California Inst. of Tech., Pasadena, CA, USA

**Mars Image Collection Mosaic Builder**

Plesea, Lucian; Hare, Trent; NASA Tech Briefs, October 2008; October 2008, pp. 17; In English; See also [20080047981](#)  
Report No.(s): NPO-45960; Copyright; Avail.: CASI: [A01](#), Hardcopy  
ONLINE: <http://www.techbriefs.com/component/content/article/3276>

A computer program assembles images from the Mars Global Surveyor (MGS) Mars Observer Camera Narrow Angle (MOCNA) collection to generate a uniform-high-resolution, georeferenced, uncontrolled mosaic image of the Martian surface. At the time of reporting the information for this article, the mosaic covered 7 percent of the Martian surface and contained data from more than 50,000 source images acquired under various light conditions at various resolutions.

Derived from text

*Mars Surface; Applications Programs (Computers); Mosaics; Image Enhancement; Imaging Techniques*

**20080048054** California Inst. of Tech., Pasadena, CA, USA

**Heterogeneous Superconducting Low-Noise Sensing Coils**

Hahn, Inseob; Penanen, Konstantin I.; Ho Eom, Byeong; NASA Tech Briefs, December 2008; December 2008, pp. 21-22; In English; See also [20080048022](#); Original contains color illustrations  
Report No.(s): LEW-18366-1; Copyright; Avail.: CASI: [A01](#), Hardcopy  
ONLINE: <http://www.techbriefs.com/component/content/article/3451>

A heterogeneous material construction has been devised for sensing coils of superconducting quantum interference device (SQUID) magnetometers that are subject to a combination of requirements peculiar to some advanced applications, notably including low-field magnetic resonance imaging for medical diagnosis. The requirements in question are the following: The sensing coils must be large enough (in some cases having dimensions of as much as tens of centimeters) to afford adequate sensitivity; The sensing coils must be made electrically superconductive to eliminate Johnson noise (thermally induced noise proportional to electrical resistance); and Although the sensing coils must be cooled to below their superconducting- transition temperatures with sufficient cooling power to overcome moderate ambient radiative heat leakage, they must not be immersed in cryogenic liquid baths. For a given superconducting sensing coil, this combination of requirements can be satisfied by providing a sufficiently thermally conductive link between the coil and a cold source. However, the superconducting coil material is not suitable as such a link because electrically superconductive materials are typically poor thermal conductors. The heterogeneous material construction makes it possible to solve both the electrical- and thermal-conductivity problems. The basic idea is to construct the coil as a skeleton made of a highly thermally conductive material (typically, annealed copper), then coat the skeleton with an electrically superconductive alloy (typically, a lead-tin solder) [see figure]. In operation, the copper skeleton provides the required thermally conductive connection to the cold source, while the electrically superconductive coating material shields against Johnson noise that originates in the copper skeleton.

Author

*SQUID (Detectors); Low Noise; Sensors; Coils; Heterogeneity; Materials Selection*

**20080048101** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Feasibility Design Study of 8-Meter Monolithic-Mirror UV/Optical Serviceable Space Telescope**

Stahl, H. Philip; [2008]; 30 pp.; In English; Original contains color illustrations; No Copyright; Avail.: Other Sources

The planned Ares V launch vehicle with its 10 meter fairing shroud and 55,600 kg capacity to the Sun Earth L2 point enables entirely new classes of space telescopes. NASA MSFC has conducted a preliminary study that demonstrates the feasibility of launching a 6 to 8 meter class monolithic primary mirror telescope to Sun-Earth L2 using an Ares V. Specific technical areas studied included optical design; structural design/analysis including primary mirror support structure, sun shade and secondary mirror support structure; thermal analysis; launch vehicle performance and trajectory; spacecraft including structure, propulsion, GN and C, avionics, power systems and reaction wheels; mass and power budgets; and system cost. A key element of the study was extending operational life to 20 or 30 years by servicing the observatory via autonomous rendezvous and docking.

Author

*Spaceborne Telescopes; Optical Equipment; Design Analysis; Structural Design; Technology Assessment*

**20080048136** California Inst. of Tech., Pasadena, CA, USA

**Calculations for Calibration of a Mass Spectrometer**

Lee, Seungwon; NASA Tech Briefs, September 2008; September 2008, pp. 52; In English; See also [20080048125](#)  
Report No.(s): NPO-45181; Copyright; Avail.: CASI: [A01](#), Hardcopy  
ONLINE: <http://www.techbriefs.com/component/content/article/3199>

A computer program performs calculations to calibrate a quadrupole mass spectrometer in an instrumentation system for identifying trace amounts of organic chemicals in air. In the operation of the mass spectrometer, the mass-to-charge ratio (m/z) of ions being counted at a given instant of time is a function of the instantaneous value of a repeating ramp voltage waveform applied to electrodes. The count rate as a function of time can be converted to an m/z spectrum (equivalent to a mass spectrum for singly charged ions), provided that a calibration of m/z is available. The present computer program can perform the calibration in either or both of two ways: (1) Following a data-based approach, it can utilize the count-rate peaks and the times thereof measured when fed with air containing known organic compounds. (2) It can utilize a theoretical proportionality between the instantaneous m/z and the instantaneous value of an oscillating applied voltage. The program can also estimate the error of the calibration performed by the data-based approach. If calibrations are performed in both ways, then the results can be compared to obtain further estimates of errors.

Author

*Mass Spectrometers; Calibrating*

**20080048154** Columbus Technologies and Services, Inc., Pasadena, CA, USA

**MISR Instrument Data Visualization**

Nelson, David; Garay, Michael; Diner, David; Thompson, Charles; Hall, Jeffrey; Rheingans, Brian; Mazzoni, Dominic; NASA Tech Briefs, September 2008; September 2008, pp. 54-55; In English; See also [20080048125](#)  
Report No.(s): NPO-45744; Copyright; Avail.: CASI: [A01](#), Hardcopy  
ONLINE: <http://www.techbriefs.com/component/content/article/3204>

The MISR Interactive eXplorer (MINX) software functions both as a general-purpose tool to visualize Multiangle Imaging SpectroRadiometer (MISR) instrument data, and as a specialized tool to analyze properties of smoke, dust, and volcanic plumes. It includes high-level options to create map views of MISR orbit locations; scrollable, single-camera RGB (red-green-blue) images of MISR level 1B2 (L1B2) radiance data; and animations of the nine MISR camera images that provide a 3D perspective of the scenes that MISR has acquired. NASA Tech Briefs, September 2008 55 The plume height capability provides an accurate estimate of the injection height of plumes that is needed by air quality and climate modelers. MISR provides global high-quality stereo height information, and this program uses that information to perform detailed height retrievals of aerosol plumes. Users can interactively digitize smoke, dust, or volcanic plumes and automatically retrieve heights and winds, and can also archive MISR albedos and aerosol properties, as well as fire power and brightness temperatures associated with smoke plumes derived from Moderate Resolution Imaging Spectroradiometer (MODIS) data. Some of the specialized options in MINX enable the user to do other tasks. Users can display plots of top-of-atmosphere bidirectional reflectance factors (BRFs) versus camera-angle for selected pixels. Images and animations can be saved to disk in various formats. Also, users can apply a geometric registration correction to warp camera images when the standard processing correction is inadequate. It is possible to difference the images of two MISR orbits that share a path (identical ground track), as well as to construct pseudo-color images by assigning different combinations of MISR channels (angle or spectral band) to the RGB display channels. This software is an interactive application written in IDL and compiled into an IDL Virtual Machine (VM) '.sav' file.

Author

*Imaging Spectrometers; MISR (Radiometry); MODIS (Radiometry); Scientific Visualization*

**20080048236** Naval Research Lab., Washington, DC USA

**An Advanced Space Surveillance System**

Feb 8, 1961; 30 pp.; In English

Report No.(s): AD-A489586; NRL-MR-1147; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Requirements for a space surveillance system are now being generated by the various unified and specified commands. While details remain to be determined, in general it may be stated that the requirements express a need for three categories of coverage: (a) early detection, (b) coverage of low inclinations, and (c) coverage at extreme altitudes. A minimum-cost, space surveillance system which provides early orbit determination of all satellites out to nearly 30,000 nautical miles is described. The system consists of U.S. installations, to provide refined orbital data on most known satellites, and special installations, to provide data on orbital elements of new satellites and special orbits. The special installations would be located on islands

in the Pacific and Caribbean to provide extended longitude coverage and to provide equatorial coverage for both low-period and 24-hour-period orbits. The detection device described utilizes high-powered, continuous-wave transmitters, fixed antennas, a nonambiguous ranging technique, and precise determination of angles to give a good orbit (error in period approx. 0.1%) for satellites above 350 nautical miles (seen by two stations) and a less accurate orbit for satellites below that altitude seen by one station (error in period 0.1% to 1%). The proposed initial installation at Truk-Ponape and in Florida provides 30,000-mile coverage for the island installation and lower latitude coverage for the U.S. experimental installation.

DTIC

*Detection; Orbit Determination; Surveillance Radar; Space Surveillance (Spaceborne)*

**20080048242** Trellis Consulting, Hillsdale, Ontario Canada

**Speech Communication in Noise**

Dunn, Garry; May 13, 2008; 8 pp.; In English

Contract(s)/Grant(s): W7711-037898/001/TOR

Report No.(s): AD-A489126; DRDC-TORONTO-CR-2008-086; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489126>

The main objective of this Call up was to convert the library of audio tapes in DRDC Toronto's Noise Simulation Facility's (NSF) to DVD format and provide general technical help pertaining to the facility's audio system.

DTIC

*Voice Communication; Acoustics*

**20080048429** Systems Planning and Analysis, Inc., Alexandria, VA USA

**Sensor Performance Optimization Tool (SPOT)**

Richardson, James S; Jun 2008; 47 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489860; SPA-SERIAL-32539; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489860>

BACKGROUND: USCG is in the process of acquiring improved infrared (IR) sensor systems for installation on standard rotary-wing platforms. Historically, IR sensor systems have not been used for primary detection work. Question remains, 'How can these high-tech sensors be best employed to assist in obtaining initial detections on hard-to-find targets?'

DTIC

*Classifications; Detection; Infrared Detectors; Target Acquisition; Targets*

**20080048472** Army Night Vision Lab., Fort Belvoir, VA USA

**The Role of Foreign Comparative Testing Programs in Army Modernization**

Nichols, Camille; Grogan, Dan; Schmidt, Raef; Jan 2001; 11 pp.; In English

Report No.(s): AD-A487906; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This article illustrates how acquisition programs are adapting to a military industrial base that is undergoing reform-induced change. In search of the best suppliers for combat optical and sensing equipment, this program office successfully made use of foreign suppliers to develop and manufacture a new generation of equipment. The Army has embarked on a modernization program to ensure that it will continue to prevail in future conflicts. The formidable task of its implementation falls to the Army's acquisition managers, who must excel in what is indisputably a hostile environment. Already shrinking limited resources, fierce competition from other programs, and problems arising from unanticipated developments require product managers to be vigilant, creative, and innovative. Of late, a new feature has been added to the landscape to render the environment even more challenging -- the mergers and acquisitions by and of the major defense contractors. This diminishes an already limited industrial base for key components and technologies essential to win in future hostilities. In the vanguard of this modernization effort is the second-generation forward looking infrared (FLIR), charged with ensuring that our forces will 'own the night' in future conflicts. As we equip the Army's premier warfighting platforms with an unparalleled day-and-night combat capability, the program manager (PM) FLIR is facing and successfully meeting these challenges. A key element of the acquisition strategy to improve the tank and infantry vehicle and scout sights includes foreign comparative testing programs. These effective efforts have allowed us to develop sources for the most critical components, obtain funding to qualify them, and ultimately award production contracts for two of the most technologically challenging



components: the Standard Advanced Dewar Assembly II (SADA II -- the 'eye' of the FLIR, and its associated 1-W linear (OWL) drive cryogenic cooler.

DTIC

*Contractors; Coolers; Cryogenic Cooling; FLIR Detectors; Government Procurement; Infrared Instruments; Night Vision*

**20080048491** Missile Defense Agency, Washington, DC USA

**Improving Prediction of Forward-Based Radar Performance by Combining Surveillance and Track Metrics**

Libertini, Jessica; Friel, Patrick; Simkin, Daniel; Cichon, Jaclyn; Jun 12, 2008; 34 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489953; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Outline: \*Background and Problem Statement; -Ballistic Missile Defense Overview, -Role of Missile Defense System Engineering Team (MDSET), -Forward-Based Radar Description; \*Forward-Based Radar Performance Metrics; -Definitions of Metrics, -Methods of Combining Metrics; \*Examples; -Simple Two Trajectory Example, -Analysis of Notional Scenario; \*Summary.

DTIC

*Radar; Surveillance*

### 36

## LASERS AND MASERS

Includes lasing theory, laser pumping techniques, maser amplifiers, laser materials, and the assessment of laser and maser outputs. For cases where the application of the laser or maser is emphasized see also the specific category where the application is treated. For related information see also *76 Solid-State Physics*.

**20080047306** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Frequency-Tunable Pre-stabilized lasers for LISA via Stabilized Lasers for LISA via Sideband Locking**

Livas, Jeffrey; Thorpe, James Ira; Numata, K.; June 18, 2008; 17 pp.; In English; 7th International LISA Symposium, 16-20 Jun. 2008, Barcelona, Spain; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNH06CC03B; Copyright; Avail.: CASI: A03, Hardcopy

This viewgraph presentation discusses a major potential source of noise for the Laser Interferometer Space Antenna (LISA) that is the laser frequency noise and the proposed mechanism to suppress the unstabilized frequency fluctuations. These fluctuations must be suppressed by about 12 orders of magnitude to achieve a stability that is sufficient for the detection of gravitational waves. This presentation reviews present a modification to the traditional cavity locking technique that allows the laser to be locked to a cavity resonance with an adjustable frequency offset. This presentation also discusses measurements of the system stability, demonstrating that the pre-stabilization level satisfies LISA requirements and a demonstration of a phase-lock loop which utilizes the tunable sideband locking technique as a pre-stabilization stage.

CASI

*Laser Outputs; LISA (Observatory); Laser Cavities; Laser Stability; Frequency Stability; Laser Mode Locking; Electromagnetic Noise*

**20080047503** National Inst. of Standards and Technology, Gaithersburg, MD USA

**Recursive Motion Estimation of Range Image**

Gharavi, Hamid; Gao, Shaoshuai; Apr 2007; 5 pp.; In English

Report No.(s): AD-A489133; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489133>

In this paper, we present an innovative recursive motion estimation technique that can take advantage of the in-depth resolution 'range' to perform an accurate estimation of objects that have undergone 3-D translational and rotational movements. This approach iteratively aims at minimizing the error between the object in the current frame and its compensated object using estimated motion displacement from the previous range measurements. In addition, in order to use the range data on the non-rectangular grid in the Cartesian coordinate, we consider a combination of derivative filters and the transformation between the Cartesian coordinates and the sensor-centered coordinates. For sequences of moving range images we demonstrate the effectiveness of the proposed scheme.

DTIC

*Cartesian Coordinates; Displacement; Images; Laser Beams; Motion*

**20080047856** Office of Inspector General, Arlington, VA USA

**Special Inspector General for Iraq Reconstruction (SIGIR) (Highlights: July 2006 Quarterly and Semiannual Report)**

Brown, Jr, Start W; Jul 2006; 573 pp.; In English

Report No.(s): AD-A489217; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489217>

During this quarter, the U.S. reconstruction effort in Iraq achieved some important milestones: production of electricity and oil climbed above pre-war levels for the first time in over a year, with electricity output exceeding 5,000 megawatts and oil production reaching 2.5 million barrels per day. The watershed event of this year, however, occurred in May, when the first permanent, democratically-elected government of Iraq took office. Iraq's new unity government now faces many daunting tasks, including improving security, sustaining the infrastructure, and fighting corruption.

DTIC

*Electricity; Finance; International Relations; Iraq*

**20080048083** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Structure and Mixing of a Transient Flow of Helium Injected into an Established Flow of Nitrogen: Two Dimensional Measurement and Simulation**

Kulatilaka, W. D.; Bhuiyan, A. H.; Lucht, R. P.; Voytovych, D. M.; Merkle, C. L.; Hulka, James R.; Jones, Gregg W.; [2008]; 22 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNM05AB50C; NCC8-200; Copyright; Avail.: Other Sources

We discuss an experimental and numerical modeling study of transient injection and mixing in a simulated rocket chamber. Non-reacting flow experiments were conducted to provide validation data for computational fluid dynamic (CFD) models used for the calculation of time-dependent bipropellant flow structure and mixing in rocket chambers prior to ignition. Transient mixing of simulated injectant flow streams was measured in a two-dimensional, atmospheric pressure bench-scale injector and mixing chamber. The mixing chamber was designed to have two long injection slots for the fuel stream and one long slot for oxidizer injection between the fuel slots. Two different mixing chamber geometries were investigated: a baseline case and a face-cavity case where a long slot was cut into the injector face. In the experiments, nitrogen was used instead of oxygen to simulate the oxidizer flow, and helium was used instead of hydrogen to simulate the fuel flow. The nitrogen flow was seeded with nitric oxide (NO), and planar laser-induced fluorescence (PLIF) was used for quantitative, instantaneous imaging of the transient mixing of the simulated oxidizer and fuel streams. In the experiments, a steady-state flow of nitrogen is first established and then a fast-acting ball valve is used to actuate the helium injection. A Nd:YAG laser system is triggered and PLIF images are subsequently acquired at set times with respect to the helium valve actuation. The observed flow structures and extent of mixing between the two streams are compared with the results of two-dimensional simulations performed using the General Equation and Mesh Solver (GEMS) CFD code. The predicted and observed flow structures for the helium and nitrogen streams are in good qualitative agreement, and there is reasonable quantitative agreement between theory and experiment in terms of the extent of mixing between the two streams as function of time. Keywords Laser-induced fluorescence of nitric oxide Computational fluid dynamics Mixing of injected flows

Author

*Computational Fluid Dynamics; Laser Induced Fluorescence; Flow Measurement; Unsteady Flow; YAG Lasers; Neodymium Lasers; Reacting Flow*

**20080048193** Columbia Univ., USA; California Inst. of Tech., Pasadena, CA, USA

**Ultra-Stable Beacon Source for Laboratory Testing of Optical Tracking**

Aso, Yoichi; Marka, Szabolcs; Kovalik, Joseph; NASA Tech Briefs, September 2008; September 2008, pp. 33; In English;

See also [20080048125](#); Original contains color and black and white illustrations

Report No.(s): NPO-45127; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3159>

The ultra-stable beacon source (USBS) provides a laser-beam output with a very low angular jitter and can be used as an absolute angular reference to simulate a beacon in the laboratory. The laser is mounted on the top of a very short (approximately equal to 1 m) inverted pendulum (IP) with its optical axis parallel to the carbon fiber pendulum leg. The 85-cm, carbon fiber rods making up the leg are very lightweight and rigid, and are supported by a flex-joint at the bottom (see figure). The gimbal-mounted laser is a weight-adjustable load of about 1.5 kg with its center of rotation co-located with the center of percussion of the inverted pendulum. This reduces the coupling of transverse motion at the base of the pendulum to angular motion of the laser at the top. The inverted pendulum is mounted on a gimbal with its center of rotation coinciding with the pivot position of the inverted pendulum flexure joint. This reduces coupling of ground tilt at the inverted pendulum base to

motion of the laser mounted at the top. The mass of the top gimbal is adjusted to give the pendulum a very low resonant frequency (approximately equal to 10 mHz) that filters transverse seismic disturbances from the ground where the base is attached. The motion of the IP is monitored by an optical-lever sensor. The laser light is reflected by the mirror on the IP, and then is detected by a quadrant photo-detector (QPD). The position of the beam spot on the QPD corresponds to the tilt of the IP. Damping of this motion is provided by two coil and magnet pairs. The bottom gimbal mount consists of two plates. The IP is mounted on the second plate. The first plate is supported by two posts through needles and can be rotated about the axis connecting the tips of the needles. The second plate hangs from the first plate and can be rotated about the axis perpendicular to the first plate. As a result, the second plate acts as a two-axis rotation stage. Its center of rotation is located at the effective bending point of the flex-joint. The second plate is pressed against two screw actuators by the weight of the IP. The screw actuators are orthogonal to each other and are used to adjust the inclination of the second plate. The actuators are driven by stepper motors. The whole IP system is housed in a box made of Lexan plastic plates to provide isolation from air currents and temperature variations. The signals from the sensors are processed and recorded with a PC using the xPC Target realtime environment of Math- Works. The control algorithms are written using the Simulink package from The MathWorks.

Author

*Optical Tracking; Beacons; Laser Applications*

**20080048259** NASA Langley Research Center, Hampton, VA, USA

**Nonstoichiometric Laser Materials: Designer Wavelengths in Neodymium Doped Garnets**

Walsh, Brian M.; Barnes, Norman P.; July 07, 2008; 8 pp.; In English; 15th International Conference on Luminescence and Optical Spectroscopy of Condensed Matter, 7-11 Jul. 2008, Lyon, France; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 698671.01.07.02; Copyright; Avail.: Other Sources

The tunable nature of lasers provides for a wide range of applications. Most applications rely on finding available laser wavelengths to meet the needs of the research. This article presents the concept of compositional tuning, whereby the laser wavelength is designed by exploiting nonstoichiometry. For research where precise wavelengths are required, such as remote sensing, this is highly advantageous. A theoretical basis for the concept is presented and experimental results in spectroscopic measurements support the theoretical basis. Laser operation nicely demonstrates the validity of the concept of designer lasers.

Author

*Lasers; Neodymium; Tunable Lasers; Doped Crystals; Remote Sensing*

**20080048260** NASA Langley Research Center, Hampton, VA, USA

**Review of Tm and Ho Materials; Spectroscopy and Lasers**

Walsh, Brian M.; June 30, 2008; 22 pp.; In English; International Laser Physics Workshop, 30 Jun. - 4 Jul. 2008, Trondheim, Norway; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 698671.01.07.09; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080048260>

A review of Tm and Ho materials is presented, covering some fundamental aspects on the spectroscopy and laser dynamics in both single and co-doped systems. Following an introduction to 2- m lasers, applications and historical development, the physics of quasi-four level lasers, energy transfer and modeling are discussed in some detail. Recent developments in using Tm lasers to pump Ho lasers are discussed, and seen to offer some advantages over conventional Tm:Ho lasers. This article is not intended as a complete review, but as a primer for introducing concepts and a resource for further study.

Author

*Lasers; Energy Transfer; Doped Crystals; Holmium; Thulium*

## MECHANICAL ENGINEERING

Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see 63 *Cybernetics, Artificial Intelligence, and Robotics*; and 54 *Man/System Technology and Life Support*.

**20080047345** Army Research Lab., Cleveland, OH, USA

**Operational Condition and Superfinishing Effect on High-Speed Helical Gearing System Performance**

Handschuh, Robert F.; Kilmain, C.; Ehinger, R.; [2007]; 13 pp.; In English; American Helicopter Society 63rd Annual Forum, 1-3 May 2007, Virginia Beach, VA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 877868.02.07.03.01.01; Copyright; Avail.: Other Sources

An experimental effort has been conducted on an aerospace-quality helical gear train to investigate the thermal behavior of the gear system. Oil inlet temperature was varied from 160 to 250 F. Also, the test gears were run in both an as-ground condition and after isotropic superfinishing (ISF) condition. In-depth temperature measurements were made across the face width and at the axial end of the gear mesh. Supply power measurements were made at varying speeds and loads up to 5000 hp and 15000 rpm (pitch line velocity to 24000 feet per minute). Test results from the parametric studies and the superfinishing process are presented. The tests indicated that superfinishing offered no improvement in performance due to the high lubricant film thickness generated by the extremely high pitch line velocity that the majority of the tests were conducted. Increasing lubricant inlet temperature had the most dramatic effect on performance improvement.

Author

*Gears; Temperature Effects; Loads (Forces); Lubricants; Isotropy; High Speed*

**20080047360** NASA Glenn Research Center, Cleveland, OH, USA

**Identifying Bearing Rotordynamic Coefficients using an Extended Kalman Filter**

Miller, Brad A.; Howard, Samuel A.; [2008]; 31 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNC06GA20G; WBS 877868.02.07.03.01.01; Copyright; Avail.: CASI: [A03](#), Hardcopy

An Extended Kalman Filter is developed to estimate the linearized direct and indirect stiffness and damping force coefficients for bearings in rotor-dynamic applications from noisy measurements of the shaft displacement in response to imbalance and impact excitation. The bearing properties are modeled as stochastic random variables using a Gauss-Markov model. Noise terms are introduced into the system model to account for all of the estimation error, including modeling errors and uncertainties and the propagation of measurement errors into the parameter estimates. The system model contains two user-defined parameters that can be tuned to improve the filter's performance; these parameters correspond to the covariance of the system and measurement noise variables. The filter is also strongly influenced by the initial values of the states and the error covariance matrix. The filter is demonstrated using numerically simulated data for a rotor-bearing system with two identical bearings, which reduces the number of unknown linear dynamic coefficients to eight. The filter estimates for the direct damping coefficients and all four stiffness coefficients correlated well with actual values, whereas the estimates for the cross-coupled damping coefficients were the least accurate.

Author

*Shafts (Machine Elements); Rotor Dynamics; Kalman Filters; Stiffness; Parameter Identification; Random Variables; Stochastic Processes; Error Analysis*

**20080047418** NASA Glenn Research Center, Cleveland, OH, USA

**High Temperature, Permanent Magnet Biased, Fault Tolerant, Homopolar Magnetic Bearing Development**

Palazzolo, Alan; Tucker, Randall; Kenny, Andrew; Kang, Kyung-Dae; Ghandi, Varun; Liu, Jinfang; Choi, Heeju; Provenza, Andrew; June 09, 2008; 12 pp.; In English; ASME Turbo Expo 2008: Power for Land, Sea and Air, 9-13 Jun. 2008, Berlin, Germany; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC06CA04C; WBS 561581.02.08.03.15.03

Report No.(s): GT2008-50917; Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper summarizes the development of a magnetic bearing designed to operate at 1,000 F. A novel feature of this high temperature magnetic bearing is its homopolar construction which incorporates state of the art high temperature, 1,000 F, permanent magnets. A second feature is its fault tolerance capability which provides the desired control forces with over one-half of the coils failed. The construction and design methodology of the bearing is outlined and test results are shown. The agreement between a 3D finite element, magnetic field based prediction for force is shown to be in good agreement with

predictions at room and high temperature. A 5 axis test rig will be complete soon to provide a means to test the magnetic bearings at high temperature and speed.

Author

*Magnetic Bearings; Permanent Magnets; High Temperature; Fault Tolerance; Finite Element Method; Magnetic Fields*

**20080047432** Army Research Lab., Cleveland, OH, USA

**An Experimental Study of Fretting of Gear Teeth**

Krantz, Timothy L.; May 21, 2008; 24 pp.; In English; STLE 2008 Annual Meeting of the Society of Tribologists and Lubrication Engineers, 21 May 2008, Cleveland, OH, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 510505.01.03.01.08; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047432>

Experiments were conducted to study fretting of gears. The gears were made from case-carburized AISI 9310 alloy to match the material of a flight actuator gearbox of interest. The objective of the testing was to produce damage representative of that observed on flight hardware. The following correlations and observations were noted. The amplitude of dithering motion very strongly influenced the type and magnitude of damage. Sliding amounts on the order of 30% of the width of the line contact were judged to most readily produce fretting damage. There was observed an incubation period on the order of tens-of-thousands of cycles, and the incubation period was influenced by surface roughness, torque, and the motion extent. Fretting damage could be produced for any of the torques tested, and the severity of damage increased slightly with torque. Gear teeth having surface roughness of 0.7-0.8 micrometer were somewhat more resistant to fretting than were smoother surfaces.

Author

*Fretting; Transmissions (Machine Elements); Surface Roughness; Gears; Torque; Carburizing*

**20080047604** Army Engineer Research and Development Center, Vicksburg, MS USA

**GigaUnit Transplant System: A New Mechanical Tool for Transplanting Submerged Aquatic Vegetation**

Shafer, Deborah J; Sep 2008; 8 pp.; In English

Report No.(s): AD-A489596; ERDC/TN-SAV-08-2; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Submerged aquatic vegetation (SAV) performs many important ecosystem functions, including wave attenuation and sediment stabilization, water quality improvement, primary production, food web support for secondary consumers, and provision of critical nursery and refuge habitat for fisheries species (Orth et al. 2006a). Over the last few decades, there have been global declines in SAV abundance, which could have widespread deleterious effects on coastal and estuarine ecosystems (Orth et al. 2006a). U.S. Army Corps of Engineers staff have a need to understand the most effective tools available for restoring or mitigating damage to SAV. Regulatory personnel are responsible for issuing permits for activities that may impact sensitive nearshore coastal resources, including SAV. Other Corps activities, such as dredging, have the potential to negatively impact SAV, and mitigation may be required to restore damaged SAV resources. Planting SAV may also be a component of other types of Corps projects, such as beneficial uses of dredged material (Section 204) and ecosystem restoration (Section 206) projects.

DTIC

*Aquatic Plants; Transplantation; Vegetation*

**20080047738** NASA Glenn Research Center, Cleveland, OH, USA

**A Resonant Damping Study Using Piezoelectric Materials**

Min, J. B.; Duffy, K. P.; Choi, B. B.; Morrison, C. R.; Jansen, R. H.; Provenza, A. J.; April 07, 2008; 10 pp.; In English; 49th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials, 7-10 Apr. 2008, Schaumburg, IL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.15.03; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047738>

Excessive vibration of turbomachinery blades causes high cycle fatigue (HCF) problems requiring damping treatments to mitigate vibration levels. Based on the technical challenges and requirements learned from previous turbomachinery blade research, a feasibility study of resonant damping control using shunted piezoelectric patches with passive and active control techniques has been conducted on cantilever beam specimens. Test results for the passive damping circuit show that the optimum resistive shunt circuit reduces the third bending resonant vibration by almost 50%, and the optimum inductive circuit

reduces the vibration by 90%. In a separate test, active control reduced vibration by approximately 98%.

Author

*Vibration Damping; Piezoelectricity; Resonant Vibration; Turbomachinery; Bending Vibration; Active Control*

**20080048130** NASA Kennedy Space Center, Cocoa Beach, FL, USA

### **Alignment Pins for Assembling and Disassembling Structures**

Campbell, Oliver C.; NASA Tech Briefs, September 2008; September 2008, pp. 24-25; In English; See also [20080048125](#); Original contains color and black and white illustrations

Report No.(s): KSC-12785; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3127>

Simple, easy-to-use, highly effective tooling has been devised for maintaining alignment of bolt holes in mating structures during assembly and disassembly of the structures. The tooling was originally used during removal of a body flap from the space shuttle Atlantis, in which misalignments during removal of the last few bolts could cause the bolts to bind in their holes. By suitably modifying the dimensions of the tooling components, the basic design of the tooling can readily be adapted to other structures that must be maintained in alignment. The tooling includes tapered, internally threaded alignment pins designed to fit in the bolt holes in one of the mating structures, plus a draw bolt and a cup that are used to install or remove each alignment pin. In preparation for disassembly of two mating structures, external supports are provided to prevent unintended movement of the structures. During disassembly of the structures, as each bolt that joins the structures is removed, an alignment pin is installed in its place. Once all the bolts have been removed and replaced with pins, the pins maintain alignment as the structures are gently pushed or pulled apart on the supports. In assembling the two structures, one reverses the procedure described above: pins are installed in the bolt holes, the structures are pulled or pushed together on the supports, then the pins are removed and replaced with bolts. The figure depicts the tooling and its use. To install an alignment pin in a bolt hole in a structural panel, the tapered end of the pin is inserted from one side of the panel, the cup is placed over the pin on the opposite side of the panel, the draw bolt is inserted through the cup and threaded into the pin, the draw bolt is tightened to pull the pin until the pin is seated firmly in the hole, then the draw bolt and cup are removed, leaving the pin in place. To remove an alignment pin, the cup is placed over the pin on the first-mentioned side of the panel, the draw bolt is inserted through the cup and threaded into the pin, then the draw bolt is tightened to pull the pin out of the hole.

Author

*Mechanical Engineering; Pins; Alignment; Assembling*

**20080048177** Wiesen Engine, Inc., USA

### **A New, Highly Improved Two-Cycle Engine**

Wiesen, Bernard; NASA Tech Briefs, September 2008; September 2008, pp. 23-24; In English; See also [20080048125](#)

Report No.(s): LEW-18043-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3135>

The figure presents a cross-sectional view of a supercharged, variable-compression, two-cycle, internal-combustion engine that offers significant advantages over prior such engines. The improvements are embodied in a combination of design changes that contribute synergistically to improvements in performance and economy. Although the combination of design changes and the principles underlying them are complex, one of the main effects of the changes on the overall engine design is reduced (relative to prior two-cycle designs) mechanical complexity, which translates directly to reduced manufacturing cost and increased reliability. Other benefits include increases in the efficiency of both scavenging and supercharging. The improvements retain the simplicity and other advantages of two-cycle engines while affording increases in volumetric efficiency and performance across a wide range of operating conditions that, heretofore have been accessible to four-cycle engines but not to conventionally scavenged two-cycle ones, thereby increasing the range of usefulness of the two-cycle engine into all areas now dominated by the four-cycle engine. The design changes and benefits are too numerous to describe here in detail, but it is possible to summarize the major improvements: Reciprocating Shuttle Inlet Valve The entire reciprocating shuttle inlet valve and its operating gear is constructed as a single member. The shuttle valve is actuated in a lost-motion arrangement in which, at the ends of its stroke, projections on the shuttle valve come to rest against abutments at the ends of grooves in a piston skirt. This shuttle-valve design obviates the customary complex valve mechanism, actuated from an engine crankshaft or camshaft, yet it is effective with every type of two-cycle engine, from small high-speed single cylinder model engines, to large low-speed multiple cylinder engines.

Author

*Internal Combustion Engines; Engine Design; Volumetric Efficiency; Design Analysis*

**20080048188** Innovative Concepts in Engineering, LLC, Anchorage, AK, USA

**Advanced Active-Magnetic-Bearing Thrust-Measurement System**

Imlach, Joseph; Kasarda, Mary; Blumber, Eric; NASA Tech Briefs, September 2008; September 2008, pp. 21-22; In English; See also [20080048125](#)

Report No.(s): SSC-00177-1/8-1; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3138>

An advanced thrust-measurement system utilizes active magnetic bearings to both (1) levitate a floating frame in all six degrees of freedom and (2) measure the levitation forces between the floating frame and a grounded frame. This system was developed for original use in measuring the thrust exerted by a rocket engine mounted on the floating frame, but can just as well be used in other force-measurement applications. This system offers several advantages over prior thrust-measurement systems based on mechanical support by flexures and/or load cells: The system includes multiple active magnetic bearings for each degree of freedom, so that by selective use of one, some, or all of these bearings, it is possible to test a given article over a wide force range in the same fixture, eliminating the need to transfer the article to different test fixtures to obtain the benefit of full-scale accuracy of different force-measurement devices for different force ranges. Like other active magnetic bearings, the active magnetic bearings of this system include closed-loop control subsystems, through which the stiffness and damping characteristics of the magnetic bearings can be modified electronically. The design of the system minimizes or eliminates cross-axis force-measurement errors. The active magnetic bearings are configured to provide support against movement along all three orthogonal Cartesian axes, and such that the support along a given axis does not produce force along any other axis. Moreover, by eliminating the need for such mechanical connections as flexures used in prior thrust-measurement systems, magnetic levitation of the floating frame eliminates what would otherwise be major sources of cross-axis forces and the associated measurement errors. Overall, relative to prior mechanical-support thrust-measurement systems, this system offers greater versatility for adaptation to a variety of test conditions and requirements. The basic idea of most prior active-magnetic-bearing force-measurement systems is to calculate levitation forces on the basis of simple proportionalities between changes in those forces and changes in feedback-controlled currents applied to levitating electromagnetic coils. In the prior systems, the effects of gap lengths on fringing magnetic fields and the concomitant effects on magnetic forces were neglected. In the present system, the control subsystems of the active magnetic bearings are coupled with a computer-based automatic calibration system running special-purpose software wherein gap-length-dependent fringing factors are applied to current and magnetic-flux-based force equations and combined with a multipoint calibration method to obtain greater accuracy.

Author

*Magnetic Bearings; Thrust Measurement; Magnetic Flux; Mechanical Measurement; Feedback Control*

**20080048290** Multidisciplinary Center for Earthquake Engineering Research, Buffalo, NY, USA; Earthquake Protection Systems, San Francisco, CA, USA

**Experimental and Analytical Study of the XY-Friction Pendulum (XY-FP) Bearing for Bridge Applications**

Marin-Artieda, C. C.; Whittaker, A. S.; Constantinou, M. C.; Jun. 07, 2007; 284 pp.; In English

Contract(s)/Grant(s): DTFH61-98-C-00094

Report No.(s): PB2008-105191; MCEER-07-0009; No Copyright; Avail.: National Technical Information Service (NTIS)

The XY-FP Friction Pendulum (XY-FP) bearing is a modified Friction Pendulum TM (FP) bearing that consists of two perpendicular steel rails with opposing concave surfaces and a connector. The connector intends to resist tensile forces and to provide both independent sliding in the isolators principal directions and free-rotation capacity. Numerical and experimental studies on an XY-FP isolated truss-bridge model were conducted to study both the response under three-directional excitations and applications to bridges. An XY-FP isolated truss-bridge model was tested on a pair of earthquake simulators using harmonic and near-field earthquake histories. The experimental results demonstrated the effectiveness of the XY-FP bearings as an uplift-prevention isolation system. The construction detail of the small-scale connector of the XY-FP bearings and misalignment of the isolators on the test fixture did not permit fully uncoupled orthogonal responses. Numerical analyses on an XY-FP isolated bridge with different isolation periods in the principal directions subjected to near-field ground motions demonstrated the effectiveness of the XY-FP bearings to limit displacements in either the longitudinal or the transverse direction. Numerical analyses that investigated the sensitivity of the XY-FP isolation system response to differences in the bearings coefficients of friction demonstrated that bounding analysis using uniform upper and lower estimates of the coefficient of friction will generally provide conservative estimates of displacements and shear forces for isolation systems with non-uniform isolator properties.

NTIS

*Friction; Pendulums; Bearings*

**20080048291** Multidisciplinary Center for Earthquake Engineering Research, Buffalo, NY, USA

**Design Recommendations for Perforated Steel Plate Shear Walls**

Purba, R.; Bruneau, M.; Jun. 18, 2007; 208 pp.; In English

Contract(s)/Grant(s): NSF-EEC 9701471

Report No.(s): PB2008-105192; MCEER-07-0011; No Copyright; Avail.: National Technical Information Service (NTIS)

This report presents the results of finite element analytical studies, using monotonic pushover analysis, to investigate the behavior of unstiffened thin steel plate shear walls (SPSW) with openings on the infill plate. Two infill plate options, the perforated and the cutout corner SPSW, are investigated. First, a series of individual perforated strips were analyzed to develop a fundamental understanding of the behavior of a complete perforated SPSW. After generating a large number of data points and using fine mesh models, 'smooth' curves of total uniform strip elongation versus perforation ratio were obtained. Finite element models of complete perforated SPSW were developed to verify the individual strip model results and to evaluate the effects of different infill thicknesses, perforation diameters, and material idealizations. Two finite element models of cutout corner SPSW were then developed to study the effect of a relatively thick fish plate installed perpendicularly to the flat-plate reinforcement. The effects were examined in terms of global effects, such as frame deformation and shear strength of the systems, as well as local effects adjacent to the cutout corners, such as local buckling, stress distribution, and forces applied by the cutout edge reinforcement to the beam and columns. Recommendations and considerations are proposed to help design perforated and cutout corner SPSW.

NTIS

*Buildings; Metal Plates; Perforated Plates; Steels; Walls*

**20080048401** Naval Surface Warfare Center, Bethesda, MD USA

**Design of the ONR AxWJ-2 Axial Flow Water Jet Pump**

Michael, Thad J; Schroeder, Seth D; Becnel, Alan J; Nov 2008; 63 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489739; NSWCCD-50-TR-2008/066; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489739>

An axial flow water jet pump has been designed for model testing. The design is based on the requirements of a notional high speed ship. The potential flow blade method PBD-14/MTFLOW was used for the blade shaping. The Reynolds-Averaged Navier-Stokes codes CFX and Fluent were used to evaluate the designs. This model pump was specifically designed for model testing in the NSWCCD 36 Inch Water Tunnel, the Johns Hopkins University water tunnel, and the Rolls-Royce Hydrodynamic Research Centre water tunnel. Each water tunnel has unique requirements. This report describes the design of the pump, including the methods and philosophy used in the shaping of the hub, casing, rotor, and stator. A comparison of the predictions from the three methods is included. The predicted full scale pump efficiency is 92%; the predicted model scale efficiency is 90%. It is recommended that this pump be manufactured and tested at all three facilities.

DTIC

*Axial Flow Pumps; Hydraulic Jets; Hydraulic Test Tunnels; Hydrodynamics; Jet Pumps; Propellers; Pumps*

**20080048427** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Design of an Oxygen Turbopump for a Dual Expander Cycle Rocket Engine**

Strain, William S; Mar 2008; 84 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489856; AFIT/GAE/ENY/08-M26; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489856>

The design of a pump intended for use with a dual expander cycle (LOX/H<sub>2</sub>) engine is presented. This arrangement offers a number of advantages over hydrogen expander cycles; among these are the elimination of gearboxes and inter-propellant purges and seals, an extended throttling range, and higher engine operating pressures and performance. The target engine has been designed to meet the needs of Phase III of the Integrated High Payoff Rocket Propulsion Technology (IHRPT) program; thus, this pump must meet the program's reliability, maintainability, and service life goals. In addition, this pump will be driven by warm gaseous oxygen. In order to meet the needs of this engine, the pump will need to be capable of delivering 106 lbm/s (48.1 kg/s) at 4500 psi (31 MPa); this will necessitate a turbine capable of supplying at least 2215 hp (1652 kW). The pump and turbine were designed with the aid of an industry standard design program; the design methodology and justification for design choices are presented. Appropriate materials of construction and bearings for this pump are discussed.

DTIC

*Liquid Oxygen; Oxygen; Rocket Engines; Throttling; Turbine Pumps; Turbines*



**20080048528** Naval Research Lab., Washington, DC USA

**Project ARTEMIS Fatigue Test of Pressure Release Tube**

Barton, A M; Jan 11, 1961; 15 pp.; In English

Report No.(s): AD-A490188; NRL-MR-1144; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A fatigue test was run on stainless steel pressure release tubing to determine fatigue properties and stress levels caused by mechanical vibration at the resonant frequency in air. It was found that the cyclical stress level was low, on the order of 250 psi, and no fatigue problem was evident.

DTIC

*Fatigue Tests; Stainless Steels*

**38**

**QUALITY ASSURANCE AND RELIABILITY**

Includes approaches to, and methods for reliability analysis and control, quality control, inspection, maintainability, and standardization.

**20080047368** NASA Langley Research Center, Hampton, VA, USA

**Development and Evaluation of Sensor Concepts for Ageless Aerospace Vehicles: Report 4 - Phase 1 Implementation of the Concept Demonstrator**

Abbott, David; Batten, Adam; Carpenter, David; Dunlop, John; Edwards, Graeme; Farmer, Tony; Gaffney, Bruce; Hedley, Mark; Hoschke, Nigel; Isaacs, Peter; Johnson, Mark; Lewis, Chris; Murdoch, Alex; Poulton, Geoff; Price, Don; Prokopenko, Mikhail; Rees, David; Scott, Andrew; Seneviratne, Sarath; Valencia, Philip; Wang, Peter; Whitnall, Denis; November 2008; 36 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 939904.05.07; PO L-71346D

Report No.(s): NASA/CR-2008-215542; Report No. TIPP 1898; Copyright; Avail.: CASI: [A03](#), Hardcopy

This report describes the first phase of the implementation of the Concept Demonstrator. The Concept Demonstrator system is a powerful and flexible experimental test-bed platform for developing sensors, communications systems, and multi-agent based algorithms for an intelligent vehicle health monitoring system for deployment in aerospace vehicles. The Concept Demonstrator contains sensors and processing hardware distributed throughout the structure, and uses multi-agent algorithms to characterize impacts and determine an appropriate response to these impacts.

Author

*Sensors; Smart Structures; Nondestructive Tests; Aerospace Vehicles; Quality Control; Research and Development*

**39**

**STRUCTURAL MECHANICS**

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structures. For applications see *05 Aircraft Design, Testing and Performance*; and *18 Spacecraft Design, Testing and Performance*.

**20080047309** General Dynamics Advanced Information Systems, Chantilly, VA, USA

**User-defined Material Model for Thermo-mechanical Progressive Failure Analysis**

Knight, Norman F., Jr.; November 2008; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NNL07AA00B; WBS 510505.03.07.01.11

Report No.(s): NASA/CR-2008-215528; Copyright; Avail.: CASI: [A03](#), Hardcopy

Previously a user-defined material model for orthotropic bimodulus materials was developed for linear and nonlinear stress analysis of composite structures using either shell or solid finite elements within a nonlinear finite element analysis tool. Extensions of this user-defined material model to thermo-mechanical progressive failure analysis are described, and the required input data are documented. The extensions include providing for temperature-dependent material properties, archival of the elastic strains, and a thermal strain calculation for materials exhibiting a stress-free temperature.

Author

*Stress Analysis; Failure Analysis; Composite Structures; Temperature Dependence; Structural Analysis*

**20080047570** Library of Congress, Washington, DC USA

**Military Construction, Veterans Affairs, and Related Agencies: FY2009 Appropriations**

Else, Daniel H; Scott, Christine; Panangala, Sidath V; Oct 9, 2008; 39 pp.; In English

Report No.(s): AD-A489436; CRS-RL34558; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The President submitted his FY2009 appropriations request to Congress on February 4, 2008, including \$115.3 billion for programs covered in this appropriations bill: \$24.4 billion for Title I (military construction and family housing), \$90.8 billion for Title II (veterans affairs), and \$183 million for Title III (related agencies). Compared with funding thus far appropriated for FY2008 (emergency supplemental appropriations are pending), this represents increases for Title I of \$3.8 billion (18.3%), for Title II of \$3.2 billion (3.6%), and for Title III of \$16.7 million (10.1%). The overall increase in appropriations between that requested for FY2009 and enacted for FY2008 is \$7.0 billion (6.4%). The House and Senate Committees on Appropriations reported their versions of the FY2009 Military Construction, Veterans Affairs and Related Agencies appropriations bill on June 24 (H.R. 6559) and July 22 (S. 3301), 2008, respectively. The bill's legislative path is laid out in detail in the 'Fiscal Year 2009 Appropriations' section of this report. The House committee recommended appropriating \$118.7 billion in new budget authority, \$3.4 billion above the President's request. This included \$24.8 billion for Title I, \$400 million above the request and \$4.2 billion above the FY2008 enactment. The Senate committee recommended \$119.8 billion, including \$24.7 billion for Title I. The Continuing Appropriations Act appropriated \$119.6 billion, including \$25.0 billion for Title I. In the area of veterans nonmedical benefits, mandatory spending is increasing as claims for disability compensation, pension, and readjustment benefits increase due to a combination of several factors, including the aging of the veterans population and the current conflicts in Iraq and Afghanistan. In terms of medical care afforded to veterans, the Administration has included several cost-sharing proposals, including an increase in pharmacy copayments and enrollment fees for lower priority veterans.

DTIC

*Appropriations; Construction; Federal Budgets; Law (Jurisprudence)*

**20080047579** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**An Analysis of the Design-Build Delivery Approach in Air Force Military Construction**

Rosner, James W; Mar 2008; 161 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489495; AFIT/GEM/ENV/08-M16; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The design-build method for construction project delivery continues to grow in both the private and public sector. Several government agencies have observed, through experience with design-build, positive results which give 'anecdotal' credibility to design-build methods. The objective of this study is to compare the performance of the design-build delivery method with traditional design-bid-build approaches for Air Force (AF) military construction (MILCON). Data related to 835 (278 design-build, 557 traditional) MILCON projects were gathered from the Automated Civil Engineer System - Project Management Module (ACES-PM) for Fiscal Years 1996-2006. The design-build method had better performance for six of eight metrics with highly significant results for cost growth and number of modifications per million dollars. The traditional method experienced a highly significant advantage for the metrics of construction timeline and total project time. The historical analysis revealed that design-build MILCON has improved significantly for cost growth, modifications per million dollars, construction timeline, and total project time. The traditional method also improved for the cost growth and modifications per million dollars metrics. Finally, the facility type analysis revealed that the design-build method was best suited for seven of the nine facility types. This study provides empirical evidence of where the design-build delivery method provides an advantage to the traditional method for AF MILCON execution.

DTIC

*Construction; Project Management*

**20080047674** NASA Glenn Research Center, Cleveland, OH, USA

**Effect of Microstructure on Time Dependent Fatigue Crack Growth Behavior In a P/M Turbine Disk Alloy**

Telesman, Ignacy J.; Gabb, T. P.; Bonacuse, P.; Gayda, J.; September 14, 2008; 10 pp.; In English; 11th International Symposium Superalloys 2008, 14-18 Sep. 2008, Champion, PA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 698259.02.07.03.04; Copyright; Avail.: CASI: A02, Hardcopy

A study was conducted to determine the processes which govern hold time crack growth behavior in the LSHR disk P/M superalloy. Nineteen different heat treatments of this alloy were evaluated by systematically controlling the cooling rate from the supersolvus solutioning step and applying various single and double step aging treatments. The resulting hold time crack

growth rates varied by more than two orders of magnitude. It was shown that the associated stress relaxation behavior for these heat treatments was closely correlated with the crack growth behavior. As stress relaxation increased, the hold time crack growth resistance was also increased. The size of the tertiary gamma' in the general microstructure was found to be the key microstructural variable controlling both the hold time crack growth behavior and stress relaxation. No relationship between the presence of grain boundary M23C6 carbides and hold time crack growth was identified which further brings into question the importance of the grain boundary phases in determining hold time crack growth behavior. The linear elastic fracture mechanics parameter,  $K_{max}$ , is unable to account for visco-plastic redistribution of the crack tip stress field during hold times and thus is inadequate for correlating time dependent crack growth data. A novel methodology was developed which captures the intrinsic crack driving force and was able to collapse hold time crack growth data onto a single curve.

Author

*Time Dependence; Fatigue (Materials); Cracks; Heat Resistant Alloys; Fracture Strength; Stress Distribution; Powder Metallurgy; Fracture Mechanics; Microstructure*

**20080047680** NASA Glenn Research Center, Cleveland, OH, USA

**Microwave Sensor for Blade Tip Clearance and Structural Health Measurements**

Woike, Mark R.; Bencic, Timothy J.; May 05, 2008; 17 pp.; In English; 54th International Instrumentation Symposium (ISA), 5-8 May 2008, Pensacola, FL, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.13.06; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047680>

The use of microwave based sensors for the health monitoring of rotating machinery is being explored at the NASA Glenn Research Center. The microwave sensor works on the principle of sending a continuous signal towards a rotating component and measuring the reflected signal. The phase shift of the reflected signal is proportional to the distance between the sensor and the component that is being measured. This type of sensor is beneficial in that it has the ability to operate at extremely high temperatures and is unaffected by contaminants that may be present in the rotating machinery. It is intended to use these probes in the hot sections of turbine engines for closed loop turbine clearance control and structural health measurements. Background on the sensors, an overview of their calibration and preliminary results from using them to make blade tip clearance and health measurements on a large axial vane fan will be presented.

Author

*Microwave Sensors; Blade Tips; Contaminants; High Temperature; Turbine Engines; Phase Shift*

**20080047814** Office of Inspector General, Arlington, VA USA

**Improvements Needed in Reporting Status of Reconstruction Projects to Chief of Mission**

Warren, David R; Haigler, W D; Keays, Walt R; Kusman, Richard R; Nasser, Waheed; Naumann, Milton L; Needham, Nancee K; Oct 29, 2008; 33 pp.; In English

Report No.(s): AD-A489412; SIGIR-09-007; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In July 2008, the U.S. Ambassador to Iraq -- as Chief of Mission (COM) -- asked SIGIR to examine the availability of management information needed for oversight of agency reconstruction projects, particularly as it related to the Falluja wastewater treatment project. The Ambassador had become concerned after belatedly being made aware of various issues impacting the successful completion of the project. The 'American Embassy Baghdad, Organization and Staffing Report,' dated May 23, 2007, formalized a number of changes designed to improve the overall efficiency and effectiveness of organizations in support of operations in Iraq. The Coordinator for Economic Transition in Iraq (CETI) plays an important role in the new organizational alignment and reports directly to the COM. SIGIR makes two recommendations. One is for the U.S. Ambassador to establish policy and guidance to ensure uniform reporting on reconstruction projects, and the second is for CETI to establish a process to ensure that all projects, regardless of funding source or agency management, are accurately and adequately reported to the U.S. Ambassador. The Deputy COM and others concurred with the report and the Deputy stated that implementation of the recommendations has already begun.

DTIC

*Construction; Iraq; Policies*

**20080047972** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Compression Strength of Sulfur Concrete Subjected to Extreme Cold**

Grugel, Richard N.; [2008]; 1 pp.; In English; No Copyright; Avail.: Other Sources

Cubic blocks (2.54 cu cm, 1 cu inch) of sulfur concrete, having two different compositions, were cycled between liquid

nitrogen and room temperature to simulate exposure to a frigid environment with the intent of ascertaining their potential application as a construction material on, for example, the lunar surface. These, and a set of similar cubes not cycled, were subsequently subjected to compression testing at two temperatures, approx. 21 C (69.8 F) and approx. -101 C (-149.8 F). The compression strength of the non-cycled samples averaged approx. 35MPa (approx. 5076 psi) whereas the cycled samples fractured at about 7MPa (approx.1015 psi). Microscopic examination of the fracture surfaces from the cycled samples showed clear de-bonding of the sulfur from the aggregate whereas it was seen adhering in those non-cycled. It was concluded that the large discrepancy between the cycled and non-cycled samples is due to the relative thermal properties of the materials constituting the concrete.

Author

*Compressive Strength; Concretes; Sulfur; Thermodynamic Properties; Bonding*

**20080048203** Acellent Technologies, Inc., Sunnyvale, CA, USA

**Flexible Structural-Health-Monitoring Sheets**

Qing, Xinlin; Kuo, Fuo; NASA Tech Briefs, September 2008; September 2008, pp. 24; In English; See also [20080048125](#)  
Report No.(s): MFS-32510-1; Copyright; Avail.: CASI: [A01](#), Hardcopy  
ONLINE: <http://www.techbriefs.com/component/content/article/3136>

A generic design for a type of flexible structural-health-monitoring sheet with multiple sensor/actuator types and a method of manufacturing such sheets has been developed. A sheet of this type contains an array of sensing and/or actuation elements, associated wires, and any other associated circuit elements incorporated into various flexible layers on a thin, flexible substrate. The sheet can be affixed to a structure so that the array of sensing and/or actuation elements can be used to analyze the structure in accordance with structural-health-monitoring techniques. Alternatively, the sheet can be designed to be incorporated into the body of the structure, especially if the structure is made of a composite material. Customarily, structural-health monitoring is accomplished by use of sensors and actuators arrayed at various locations on a structure. In contrast, a sheet of the present type can contain an entire sensor/actuator array, making it unnecessary to install each sensor and actuator individually on or in a structure. Sensors of different types such as piezoelectric and fiber-optic can be embedded in the sheet to form a hybrid sensor network. Similarly, the traces for electric communication can be deposited on one or two layers as required, and an entirely separate layer can be employed to shield the sensor elements and traces.

Author

*Systems Health Monitoring; Sheets; Structural Engineering*

**20080048333** Virginia Univ. Patent Foundation, Charlottesville, VA, USA

**Method for Manufacture of Truss Core Sandwich Structures and Related Structures Thereof**

Ervin, K. D., Inventor; Wadley, H. N. G., Inventor; 3 Sep 03; 17 pp.; In English  
Contract(s)/Grant(s): N00014-01-1-1051  
Patent Info.: Filed Filed 3 Sep 03; US-Patent-Appl-SN-10-526 296  
Report No.(s): PB2008-104828; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An embodiment provides a method of constructing a cellular structure having nodes therein comprising: providing at least one truss layer comprised of at least one truss unit, at least one of the truss units being comprised of truss members; providing at least one panel in mechanical communication with at least one truss unit of the at least one truss layer, the mechanical communication defines contact regions wherein the at least one truss unit is coupled to the at least one panel; the nodes being defined as intersections existing among any of the truss members and the nodes also being defined by the contact regions; providing at least one node pin, at least one node pin spanning between two desired the nodes; and diffusion bonding at least one of the truss layer to the at least one panel. The bonding includes: applying heat, and applying force that results in the truss layer and the panel that are being bonded to be pressed together, the node pins provide support for the structure so as to concentrate or transmit the applied force onto the contact regions.

NTIS

*Patent Applications; Sandwich Structures; Trusses*

**20080048366** Multidisciplinary Center for Earthquake Engineering Research, Buffalo, NY, USA

**Seismic Retrofitting Manual for Highway Structures: Part 1. Bridges, and Part 2. Retaining Structures, Slopes, Tunnels, Culverts and Roadways**

Buckle, I. G.; Friedland, I. M.; Power, M.; Fishman, K.; Apr. 2008; In English  
Report No.(s): PB2009-500012; MCEER-08-SP02-CD; No Copyright; Avail.: National Technical Information Service (NTIS)

The Seismic Retrofitting Manual for Highway Structures is a major revision of the Federal Highway Administration

publication 'Seismic Retrofitting Manual for Highway Bridges', which was published in 1995 as report FHWA/RD-94-052. This edition expands the previous publication by including procedures for evaluating and retrofitting retaining structures, slopes, tunnels, culverts, and pavements, in addition to bridges. Whereas Part 1 maintains the basic format of the retrofitting process described in the 1995 report, major changes have been made to include current advances in earthquake engineering, field experience with retrofitting highway bridges, and the performance of bridges in recent earthquakes in California and elsewhere. Part 1 comprises 11 chapters and six appendices. Chapter 1 gives a completed overview of the retrofitting process, including the philosophy of performance-based retrofitting, characterization of seismic and geotechnical hazards, assignment of Seismic Retrofit Categories, and summaries of recommended screening methods, evaluation tools, and retrofit strategies. Chapter 2 and 3 describe the characterization of seismic and geotechnical hazards. Chapter 4 presents two screening and prioritization methods, with examples of each method. Chapters 5, 6, and 7 describe six evaluation methods for the detailed assessment of demand and capacity. Chapters 8, 9, 10 and 11 describe retrofitting measures for bearings, seats, columns, piers, cap beams, column-to-cap joints, abutments, and foundations. Remedial techniques for hazardous sites are also addressed. Appendices A through D provide supplementary material on conducting site-specific geotechnical investigations, the evaluation of geotechnical hazards, fragility curve theory, and the calculation of capacity/demand ratios for bridge components. Appendices E and F present two examples illustrating the application of the component capacity/demand method to multi-span concrete and steel highway bridges. Part 2 focuses on seismic vulnerability screening, evaluation and retrofitting of the following highway system components: retaining structures, slopes, tunnels, culverts, and pavements. It is the first known effort to capture, in a formal and consistent manner, the important aspects of seismic performance and retrofitting intended to improve performance of highway system structural components other than bridges.

NTIS

*Highways; Manuals; Retaining; Retrofitting; Slopes; Structural Design; Waterways*

**20080048511** Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA

**Rail Impact Testing. Test Operations Procedure (TOP)**

Sep 15, 2008; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A490124; TOP-1-2-501; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This TOP describes the procedures for conducting a rail impact test. The rail impact test is used to verify structural integrity of the test item and the adequacy of the tie-down system and tie-down procedures This TOP is intended for vehicles and equipment that will be transported by rail; to determine the effect of normal railroad car impacts that occur during rail shipment over the full life span of the test item.

DTIC

*Impact Tests; Rails; Structural Failure*

**42**

**GEOSCIENCES (GENERAL)**

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see *categories 42 through 48*.

**20080047330** Geological Survey, Reston, VA USA; Bureau of Reclamation, Washington, DC, USA

**Versatile Time-Lapse Camera System Developed by the Hawaiian Volcano Observatory for Use at Kilauea Volcano, Hawaii**

Orr, T. R.; Hoblitt, R. P.; January 2008; 16 pp.; In English

Report No.(s): PB2009-101386; USGS/SIR-2008-5117; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Volcanoes can be difficult to study up close. Because it may be days, weeks, or even years between important events, direct observation is often impractical. In addition, volcanoes are often inaccessible due to their remote location and (or) harsh environmental conditions. An eruption adds another level of complexity to what already may be a difficult and dangerous situation. For these reasons, scientists at the U.S. Geological Survey (USGS) Hawaiian Volcano Observatory (HVO) have, for years, built camera systems to act as surrogate eyes. With the recent advances in digital-camera technology, these eyes are rapidly improving. One type of photographic monitoring involves the use of near-real-time network-enabled cameras installed at permanent sites (Hoblitt and others, in press). Time-lapse camera-systems, on the other hand, provide an inexpensive, easily transportable monitoring option that offers more versatility in site location. While time-lapse systems lack near-real-time capability, they provide higher image resolution and can be rapidly deployed in areas where the use of sophisticated telemetry

required by the networked cameras systems is not practical. This report describes the latest generation (as of 2008) time-lapse camera system used by HVO for photograph acquisition in remote and hazardous sites on Kilauea Volcano.

NTIS

*Cameras; Geological Surveys; Observatories; Volcanoes*

## 43

### EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis of remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photography. For related instrumentation see *35 Instrumentation and Photography*.

**20080047406** ImageCat Ltd., Ashtead, UK; ImageCat, Inc., Long Beach, CA, USA

**MCEER Response: Collection and Preliminary Analysis of Aerial and In-Field Building Damage Information in the Aftermath of the 2007 California Wildfires**

McMillan, A.; Adams, B. J.; Ghosh, S.; Huyck, C. K.; Apr. 30, 2008; 30 pp.; In English

Contract(s)/Grant(s): EEC-9701471; SGER-0806874

Report No.(s): PB2009-102309; MCEER-08-SP03; No Copyright; Avail.: National Technical Information Service (NTIS)

This field campaign, undertaken in the aftermath of the 2007 California Wildfires, presented the research team with a unique opportunity to collect perishable damage data on neighborhood and per-building levels, focusing on affected urban environments throughout Southern California. The type of surveying undertaken is particularly useful for post-disaster damage assessment and also creates a compelling baseline dataset for examining change and recovery in the future. Further, the data collected is useful for re-insurance loss estimation, as well as research on engineering and planning more resilient communities. ImageCat responded to these events by deploying a number of aerial and ground-based surveys of the damage, using the VIEWS(Trade Name) field data collection and visualization system. This event is the first wildfire where the VIEWS(Trade Name) system has been utilized, collecting detailed aerial and ground survey data to identify and map the damage across a wide-ranging area.

NTIS

*Buildings; Damage; Damage Assessment; Earthquakes*

**20080047696** NASA Dryden Flight Research Center, Edwards, CA, USA

**Ikhana: A NASA UAS Supporting Long Duration Earth Science Missions**

Cobleigh, Brent R.; March 2007; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WU 769134.03.02.02.05

Report No.(s): NASA/TM-2007-214614; H-2688; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047696>

The NASA Ikhana unmanned aerial vehicle (UAV) is a General Atomics Aeronautical Systems Inc. (San Diego, California) MQ-9 Predator-B modified to support the conduct of Earth science missions for the NASA Science Mission Directorate and, through partnerships, other government agencies and universities. It can carry over 2000 lb of experiment payloads in the avionics bay and external pods and is capable of mission durations in excess of 24 hours at altitudes above 40,000 ft. The aircraft is remotely piloted from a mobile ground control station (GCS) that is designed to be deployable by air, land, or sea. On-board support capabilities include an instrumentation system and an Airborne Research Test System (ARTS). The Ikhana project will complete GCS development, science support systems integration, external pod integration and flight clearance, and operations crew training in early 2007. A large-area remote sensing mission is currently scheduled for Summer 2007.

Author

*Pilotless Aircraft; Earth Sciences; Support Systems; Ground Based Control; Avionics; Flight Operations; Remote Sensing*

**20080047925** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Satellite-based Assessment of Fire Impacts on Ecosystem Changes in West Africa**

Ichoku, Charles; October 27, 2008; 1 pp.; In English; 7th International Conference of the African Association for Remote Sensing of Environmental (AARSE) 2008, 27-31 Oct. 2008, Accra, Ghana; No Copyright; Avail.: Other Sources; Abstract Only

Fires burn many vegetated regions of the world to a variety of degrees and frequency depending on season. Extensive

biomass burning occurs in most parts of sub-Saharan Africa, posing great threat to ecosystem stability among other real and potential adverse impacts. In Africa, such landscape-scale fires are used for various agricultural purposes, including land clearing and hunting, although there may be a limited number of cases of fires ignited by accident or due to arson. Satellite remote sensing provides the most practical means of mapping fires, because of their sudden and aggressive nature coupled with the tremendous heat they generate. Recent advancements in satellite technology has enabled, not only the identification of fire locations, but also the measurement of fire radiative energy (FRE) release rate or power (FRP), which has been found to have a direct linear relationship with the rate of biomass combustion. A recent study based on FRP measurements from the Moderate-resolution imaging Spectro-radiometer (MODIS) sensor aboard the Terra and Aqua satellites revealed that, among all the regions of the world where fires occur, African regions rank the highest in the intensity of biomass burning per unit area of land during the peak of the burning season. In this study, we will analyze the burning patterns in West Africa during the last several years and examine the extent of their impacts on the ecosystem dynamics, using a variety of satellite data. The study introduces a unique methodology that can be used to build up the knowledge base from which decision makers can obtain scientific information in formulating policies for regulating biomass burning in the region.

Author

*Fires; Satellite Observation; Biomass Burning; Topography; MODIS (Radiometry); Imaging Techniques; Imaging Spectrometers; Ecosystems; Agriculture*

**20080047927** NASA Goddard Space Flight Center, Greenbelt, MD, USA

### **Effects of the 2006 El Nino on Tropospheric Ozone and Carbon Monoxide: Implications for Dynamics and Biomass Burning**

Chandra, S.; Ziemke, J. R.; Duncan, B. N.; Diehl, t. L.; [2008]; 32 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

We have studied the effects of the 2006 El Nino on tropospheric O<sub>3</sub> and CO at tropical and sub-tropical latitudes measured from the OMI and MLS instruments on the Aura satellite. The 2006 El Nino-induced drought allowed forest fires set to clear land to burn out of control during October and November in the Indonesian region. The effects of these fires are clearly seen in the enhancement of GO concentration measured from the MLS instrument. We have used a global model of atmospheric chemistry and transport (GMI CTM) to quantify the relative importance of biomass burning and large scale transport: in producing observed changes in tropospheric O<sub>3</sub> and CO. The model results show that during October and November both biomass burning and meteorological changes contributed almost equally to the observed increase in tropospheric O<sub>3</sub> in the Indonesian region. The biomass component was 4-6 DU but it was limited to the Indonesian region where the fires were most intense, The dynamical component was 4-8 DU but it covered a much larger area in the Indian Ocean extending from South East Asia in the north to western Australia in the south. By December 2006, the effect of biomass burning was reduced to zero and the observed changes in tropospheric O<sub>3</sub> were mostly due to dynamical effects. The model results show an increase of 2-3% in the global burden of tropospheric ozone. In comparison, the global burden of CO increased by 8-12%.

Author

*El Nino; Biomass Burning; Tropical Regions; Drought; Ozone; Atmospheric Chemistry; Atmospheric Models; Troposphere*

**20080048165** California Inst. of Tech., Pasadena, CA, USA

### **Automatic Rock Detection and Mapping from HiRISE Imagery**

Huertas, Andres; Adams, Douglas S.; Cheng, Yang; NASA Tech Briefs, September 2008; September 2008, pp. 56; In English; See also [20080048125](#)

Report No.(s): NPO-45752; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3207>

This system includes a C-code software program and a set of MATLAB software tools for statistical analysis and rock distribution mapping. The major functions include rock detection and rock detection validation. The rock detection code has been evolved into a production tool that can be used by engineers and geologists with minor training.

Derived from text

*Computer Programs; Detection; Imagery; Rocks; Image Processing; Imaging Techniques*

**20080048196** California Inst. of Tech., Pasadena, CA, USA

### **System for Continuous Delivery of MODIS Imagery to Internet Mapping Applications**

Plesea, Lucian; NASA Tech Briefs, September 2008; September 2008, pp. 57; In English; See also [20080048125](#)

Report No.(s): NPO-45778; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3206>

This software represents a complete, unsupervised processing chain that generates a continuously updating global image

of the Earth from the most recent available MODIS Level 1B scenes. The software constantly updates a global image of the Earth at 250 m per pixel.

Derived from text

*Imagery; Internets; MODIS (Radiometry); Computer Aided Mapping*

**20080048262** NASA Langley Research Center, Hampton, VA, USA

**Radiometric Modeling and Calibration of the Geostationary Imaging Fourier Transform Spectrometer (GIFTS-)  
Ground Based Measurement Experiment**

Tian, Jialin; Smith, William L.; Gazarik, Michael J.; November 17, 2008; 8 pp.; In English; SPIE Asia Pacific Remote Sensing 2008, 17-21 Nov. 2008, Noumea, New Caledonia; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 921266.04.07.07.01

Report No.(s): Paper Number 7149-13; Copyright; Avail.: CASI: [A02](#), Hardcopy

The ultimate remote sensing benefits of the high resolution Infrared radiance spectrometers will be realized with their geostationary satellite implementation in the form of imaging spectrometers. This will enable dynamic features of the atmosphere's thermodynamic fields and pollutant and greenhouse gas constituents to be observed for revolutionary improvements in weather forecasts and more accurate air quality and climate predictions. As an important step toward realizing this application objective, the Geostationary Imaging Fourier Transform Spectrometer (GIFTS) Engineering Demonstration Unit (EDU) was successfully developed under the NASA New Millennium Program, 2000-2006. The GIFTS-EDU instrument employs three focal plane arrays (FPAs), which gather measurements across the long-wave IR (LWIR), short/mid-wave IR (SMWIR), and visible spectral bands. The GIFTS calibration is achieved using internal blackbody calibration references at ambient (260 K) and hot (286 K) temperatures. In this paper, we introduce a refined calibration technique that utilizes Principle Component (PC) analysis to compensate for instrument distortions and artifacts, therefore, enhancing the absolute calibration accuracy. This method is applied to data collected during the GIFTS Ground Based Measurement (GBM) experiment, together with simultaneous observations by the accurately calibrated AERI (Atmospheric Emitted Radiance Interferometer), both simultaneously zenith viewing the sky through the same external scene mirror at ten-minute intervals throughout a cloudless day at Logan Utah on September 13, 2006. The accurately calibrated GIFTS radiances are produced using the first four PC scores in the GIFTS-AERI regression model. Temperature and moisture profiles retrieved from the PC-calibrated GIFTS radiances are verified against radiosonde measurements collected throughout the GIFTS sky measurement period. Using the GIFTS GBM calibration model, we compute the calibrated radiances from data collected during the moon tracking and viewing experiment events. From which, we derive the lunar surface temperature and emissivity associated with the moon viewing measurements.

Author

*Geosynchronous Orbits; Remote Sensing; High Resolution; Radiosondes; Greenhouse Effect; Infrared Spectrometers; Mathematical Models*

**20080048404** Army Engineer Research and Development Center, Vicksburg, MS USA

**Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region**

Sep 2008; 150 pp.; In English

Report No.(s): AD-A489744; ERDC/EL-TR-08-27; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489744>

This document is one of a series of Regional Supplements to the Corps of Engineers Wetland Delineation Manual, which provides technical guidance and procedures for identifying and delineating wetlands that may be subject to regulatory jurisdiction under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act. The development of Regional Supplements is part of a nationwide effort to address regional wetland characteristics and improve the accuracy and efficiency of wetland-delineation procedures. This supplement is applicable to the Midwest Region, which consists of all or portions of 14 states: Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, Oklahoma, South Dakota, and Wisconsin.

DTIC

*Delineation; Engineers; Hydrology; Soils; Vegetation; Wetlands*



**20080048541** Army Engineer Research and Development Center, Vicksburg, MS USA

**A GIS Based Tool for Extracting Shoreline Positions from Aerial Imagery (BeachTools) Revised**

Zarillo, Gary A; Kelley, Justin; Larson, Vickie; Sep 2008; 15 pp.; In English

Report No.(s): AD-A490237; ERDC/CHL-CHETN-IV-73; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This Coastal and Hydraulics Engineering Technical Note (CHETN) presents TM Beach Tools, an ArcView 9.1 Geographic Information System (GIS) extension designed to identify and quantitatively establish the position of shorelines and other coastal features from aerial imagery. This CHETN is a revision of the original Beach Tools extension produced in ArcView 3.2 (Hoeke et al. 2001).

DTIC

*Aerial Photography; Geographic Information Systems; Shorelines*

**44**

**ENERGY PRODUCTION AND CONVERSION**

Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power*; *20 Spacecraft Propulsion and Power*; and *28 Propellants and Fuels*.

**20080047291** NASA Johnson Space Center, Houston, TX, USA

**Groundwater Remediation and Alternate Energy at White Sands Test Facility**

Fischer, Holger; September 2008; 23 pp.; In English; NASA/C3P, 18-20 Nov. 2008, San Diego, CA, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047291>

White Sands Test Facility Core Capabilities: a) Remote Hazardous Testing of Reactive, Explosive, and Toxic Materials and Fluids; b) Hypergolic Fluids Materials and Systems Testing; c) Oxygen Materials and System Testing; d) Hypervelocity Impact Testing; e) Flight Hardware Processing; and e) Propulsion Testing. There is no impact to any drinking water well. Includes public wells and the NASA supply well. There is no public exposure. Groundwater is several hundred feet below ground. No air or surface water exposure. Plume is moving very slowly to the west. Plume Front Treatment system will stop this westward movement. NASA performs on-going monitoring. More than 200 wells and zones are routinely sampled. Approx. 850 samples are obtained monthly and analyzed for over 300 different hazardous chemicals.

Derived from text

*Surface Water; Potable Water; Ground Water; Hypervelocity Impact; Impact Tests; Reactivity; Oxygen Supply Equipment; Exposure*

**20080047294** Idaho National Lab., Idaho Falls, ID, USA

**Solar Nantenna Electromagnetic Collectors**

Novack, S. D.; Kotter, D. K.; Slafe, D.; Pinhero, P.; Aug. 01, 2008; 8 pp.; In English

Contract(s)/Grant(s): DE-AC07-99ID-13727

Report No.(s): DE2008-934544; INL/CON-08-13925; No Copyright; Avail.: Department of Energy Information Bridge

This research explores a new efficient approach for producing electricity from the abundant energy of the sun. A nanoantenna electromagnetic collector (NEC) has been designed, prototyped, and tested. Proof of concept has been validated. The device targets mid-infrared wavelengths where conventional photovoltaic (PV) solar cells do not respond but is abundant in solar energy. The initial concept of designing NEC antennas was based on scaling of radio frequency antenna theory. This approach has proven unsuccessful by many due to not fully understanding and accounting for the optical behavior of materials in the THz region. Also until recent years the nanofabrication methods were not available to fabricate the optical antenna elements. We have addressed and overcome both technology barriers. Several factors were critical in successful implementation of NEC including: (1) frequency-dependent modeling of antenna elements, (2) selection of materials with proper THz properties and (3) novel manufacturing methods that enable economical large-scale manufacturing. The work represents an important step toward the ultimate realization of a low-cost device that will collect as well as convert this radiation into electricity, which will lead to a wide spectrum, high conversion efficiency, and low cost solution to complement conventional PVs.

NTIS

*Solar Collectors; Antenna Components; Photovoltaic Cells; Energy Conversion Efficiency; Nanofabrication*

**20080047351** NASA Glenn Research Center, Cleveland, OH, USA

**Advanced Stirling Convertor (ASC) - From Technology Development to Future Flight Product**

Wong, Wayne A.; Wood, J. Gary; Wilson, Kyle; February 13, 2008; 26 pp.; In English; Space Technology and Applications International Forum, 13 Feb. 2008, Cleveland, OH, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 138494.04.01.01; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Advanced Stirling Convertor (ASC) is being developed by Sunpower, Inc. under contract to NASA's Glenn Research Center (GRC) with critical technology support tasks lead by GRC. The ASC development, funded by NASA's Science Mission Directorate, started in 2003 as one of 10 competitively awarded contracts that were to address future Radioisotope Power System (RPS) advanced power conversion needs. The ASC technology has since evolved through progressive convertor builds and successful testing to demonstrate high conversion efficiency (38 %), low mass (1.3 kg), hermetic sealing, launch vibration simulation, EMI characterization, and is undergoing extended operation. The GRC and Sunpower team recently delivered three ASC-E machines to the Department of Energy (DOE) and Lockheed Martin Space Systems Company, two units for integration onto the Advanced Stirling Radioisotope Generator Engineering Unit (ASRG EU) plus one spare. The design has recently been initiated for the ASC-E2, an evolution from the ASC-E that substitutes higher temperature materials enabling improved performance and higher reliability margins. This paper summarizes the history and status of the ASC project and discusses plans for this technology which enables RPS specific power of 8 W/kg for future NASA missions.

Author

*Stirling Cycle; Energy Conversion Efficiency; Systems Integration; Aerospace Systems*

**20080047353** NASA Glenn Research Center, Cleveland, OH, USA

**Design and Fabrication of a 5-kWe Free-Piston Stirling Power Conversion System**

Chapman, Peter A.; Walter, Thomas J.; Brandhorst, Henry W., Jr.; July 28, 2008; 7 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC06CB81C; AUSRI 07-SRI-208447-FMI; WBS 463169.04.03.04.01.03; Copyright; Avail.: CASI: [A02](#), Hardcopy

Progress in the design and fabrication of a 5-kWe free-piston Stirling power conversion system is described. A scaled-down version of the successful 12.5-kWe Component Test Power Converter (CTPC) developed under NAS3-25463, this single cylinder prototype incorporates cost effective and readily available materials (steel versus beryllium) and components (a commercial linear alternator). The design consists of a displacer suspended on internally pumped gas bearings and a power piston/alternator supported on flexures. Non-contacting clearance seals are used between internal volumes. Heat to and from the prototype is supplied via pumped liquid loops passing through shell and tube heat exchangers. The control system incorporates several novel ideas such as a pulse start capability and a piston stroke set point control strategy that provides the ability to throttle the engine to match the required output power. It also ensures stable response to various disturbances such as electrical load variations while providing useful data regarding the position of both power piston and displacer. All design and analysis activities are complete and fabrication is underway. Prototype test is planned for summer 2008 at Foster-Miller to characterize the dynamics and steady-state operation of the prototype and determine maximum power output and system efficiency. Further tests will then be performed at Auburn University to determine start-up and shutdown characteristics and assess transient response to temperature and load variations.

Author

*Stirling Cycle; Power Converters; Design Analysis; Loads (Forces); Gas Bearings; Power Efficiency*

**20080047357** NASA Glenn Research Center, Cleveland, OH, USA

**Progress in High Power Free-Piston Stirling Convertor Development**

Brandhorst, Henry W., Jr.; Kirby, Raymond L.; Chapman, Peter A.; Walter, Thomas J.; September 14, 2008; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NNC06CB81C; WBS 463169.04.03.04.01.03; Copyright; Avail.: CASI: [A02](#), Hardcopy

The U.S. Space Exploration Policy has established a vision for human exploration of the moon and Mars. One option for power for future outposts on the lunar and Martian surfaces is a nuclear reactor coupled with a free-piston Stirling convertor at a power level of 30-40 kWe. A 25 kW convertor was developed in the 1990s under the SP-100 program. This system consisted of two 12.5 kWe engines connected at their hot ends and mounted in tandem to cancel vibration. Recently, NASA began a new project with Auburn University to develop a 5 kWe, single convertor for use in such a possible lunar power system. Goals of this development program include a specific power in excess of 140 We/kg at the convertor level, lifetime in excess of five years and a control system that will safely manage the convertors in case of an emergency. Foster-Miller, Inc.

is developing the 5 kWe Stirling Convertor Assembly. The characteristics of the design along with progress in developing the system will be described.

Author

*Stirling Cycle; Nuclear Reactors; Space Power Reactors; Mars Bases; Piston Engines*

**20080047358** NASA Glenn Research Center, Cleveland, OH, USA

**Extended Operation Testing of Stirling Convertors in Support of Stirling Radioisotope Power System Development**

Lewandowski, Edward J.; Schreiber, Jeffrey G.; Wilson, Scott D.; Oriti, Salvatore M.; Cornell, Peggy; Schifer, Nicholas; July 28, 2008; 19 pp.; In English; 6th International Energy Conversion Engineering Conference, 28-30 Jul. 2008, Cleveland, OH, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 138494.04.01.01; Copyright; Avail.: CASI: [A03](#), Hardcopy

100 We class Stirling convertors began extended operation testing at NASA Glenn Research Center (GRC) in 2003 with a pair of Technology Demonstration Convertors (TDCs) operating in air. Currently, the number of convertors on extended operation test has grown to 12, including both TDCs and Advanced Stirling Convertors (ASCs) operating both in air and in thermal vacuum. Additional convertors and an electrically heated radioisotope generator will be put on test in the near future. This testing has provided data to support life and reliability estimates and the quality improvements and design changes that have been made to the convertor. The convertors operated 24/7 at the nominal amplitude and power levels. Performance data were recorded on an hourly basis. Techniques to monitor the convertors for change in internal operation included gas analysis, vibration measurements and acoustic emission measurements. This data provided a baseline for future comparison. This paper summarizes the results of over 145,000 hours of TDC testing and 40,000 hours of ASC testing and discusses trends in the data. Data shows the importance of improved materials, hermetic sealing, and quality processes in maintaining convertor performance over long life.

Author

*Stirling Cycle; Acoustic Emission; Vibration Measurement; Gas Analysis; Systems Engineering*

**20080047411** NASA Glenn Research Center, Cleveland, OH, USA

**Radioisotope Power: A Key Technology for Deep Space Exploration**

Schmidt, George; Sutliff, Tom; Dudzinski, Leonard; September 28, 2008; 17 pp.; In English; 59th International Astronautical Congress, 28 Sep. - 3 Oct. 2008, Glasgow, Scotland, UK; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047411>

A Radioisotope Power System (RPS) generates power by converting the heat released from the nuclear decay of radioactive isotopes, such as Plutonium-238 (Pu-238), into electricity. First used in space by the U.S. in 1961, these devices have enabled some of the most challenging and exciting space missions in history, including the Pioneer and Voyager probes to the outer solar system; the Apollo lunar surface experiments; the Viking landers; the Ulysses polar orbital mission about the Sun; the Galileo mission to Jupiter; the Cassini mission orbiting Saturn; and the recently launched New Horizons mission to Pluto. Radioisotopes have also served as a versatile heat source for moderating equipment thermal environments on these and many other missions, including the Mars exploration rovers, Spirit and Opportunity. The key advantage of RPS is its ability to operate continuously, independent of orientation and distance relative to the Sun. Radioisotope systems are long-lived, rugged, compact, highly reliable, and relatively insensitive to radiation and other environmental effects. As such, they are ideally suited for missions involving long-lived, autonomous operations in the extreme conditions of space and other planetary bodies. This paper reviews the history of RPS for the U.S. space program. It also describes current development of a new Stirling cycle-based generator that will greatly expand the application of nuclear-powered missions in the future.

Author

*Radioactive Isotopes; Stirling Cycle; Plutonium 238; Thermal Environments; Heat Sources; Electricity*

**20080047441** Auburn Univ., AL, USA

**The Development of a Control System for a 5 Kilowatt Free Piston Stirling Engine Convertor**

Kirby, Raymond L.; Vitale, Nick; July 28, 2008; 7 pp.; In English; Original contains color and black and white illustrations  
Contract(s)/Grant(s): NNC06CB81C; WBS 463169.04.03.04.01.03; Copyright; Avail.: CASI: [A02](#), Hardcopy

The new NASA Vision for Exploration, announced by President Bush in January 2004, proposes an ambitious program that plans to return astronauts to the moon by the 2018 time frame. A recent NASA study entitled 'Affordable Fission Surface Power Study' recommended a 40 kWe, 900 K, NaK-cooled, Stirling convertors for 2020 launch. Use of two of the nominal

5 kW convertors allows the system to be dynamically balanced. A group of four dual-convertor combinations that would yield 40 kWe can be tested to validate the viability of Stirling technology for space fission surface power systems. The work described in this paper deals specifically with the control system for the 5 kW convertor described in the preceding paragraph. This control system is responsible for maintaining piston stroke to a setpoint in the presence of various disturbances including electrical load variations. Pulse starting of the Free Piston Stirling Engine (FPSE) convertor is also an inherent part of such a control system. Finally, the ability to throttle the engine to match the required output power is discussed in terms of setpoint control. Several novel ideas have been incorporated into the piston stroke control strategy that will engender a stable response to disturbances in the presence of midpoint drift while providing useful data regarding the position of both the power piston and displacer.

Author

*Stirling Cycle; Spacecraft Power Supplies; Free-Piston Engines; Stirling Engines; Loads (Forces)*

**20080047457** Cleveland State Univ., Cleveland, OH, USA

**Microfabrication of a Segmented-Involute-Foil Regenerator, Testing in a Sunpower Stirling Convertor, and Supporting Modeling and Analysis**

Ibrahim, Mounir B.; Tew, Roy C.; Gedeon, David; Wood, Gary; McLean, Jeff; July 28, 2008; 27 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS3-03124; WBS 138494.04.01.01; Copyright; Avail.: CASI: [A03](#), Hardcopy

Under Phase II of a NASA Research Award contract, a prototype nickel segmented-involute-foil regenerator was microfabricated via LiGA and tested in the NASA/Sunpower oscillating-flow test rig. The resulting figure-of-merit was about twice that of the approx.90% porosity random-fiber material currently used in the small 50-100 W Stirling engines recently manufactured for NASA. That work was reported at the 2007 International Energy Conversion Engineering Conference in St. Louis, was also published as a NASA report, NASA/TM-2007-2149731, and has been more completely described in a recent NASA Contractor Report, NASA/CR-2007-2150062. Under a scaled-back version of the original Phase III plan, a new nickel segmented-involute- foil regenerator was microfabricated and has been tested in a Sunpower Frequency-Test-Bed (FTB) Stirling convertor. Testing in the FTB convertor produced about the same efficiency as testing with the original random-fiber regenerator. But the high thermal conductivity of the prototype nickel regenerator was responsible for a significant performance degradation. An efficiency improvement (by a 1.04 factor, according to computer predictions) could have been achieved if the regenerator been made from a low-conductivity material. Also the FTB convertor was not reoptimized to take full advantage of the microfabricated regenerator's low flow resistance; thus the efficiency would likely have been even higher had the FTB been completely reoptimized. This report discusses the regenerator microfabrication process, testing of the regenerator in the Stirling FTB convertor, and the supporting analysis. Results of the pre-test computational fluid dynamics (CFD) modeling of the effects of the regenerator-test-configuration diffusers (located at each end of the regenerator) is included. The report also includes recommendations for accomplishing further development of involute-foil regenerators from a higher-temperature material than nickel.

Author

*Energy Conversion; Thermal Conductivity; Stirling Engines; Stirling Cycle; Oscillating Flow; Energy Technology; Computational Fluid Dynamics*

**20080047598** Naval Research Lab., Washington, DC USA

**Corrosion Mechanisms in Steam Power Generation**

Bloom, M C; Fraser, W A; Krulfeld, M; Newport, G N; Jan 1960; 37 pp.; In English

Report No.(s): AD-A489575; NRL-MR-1166; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A summary of conclusions reached in a basic research program concerned with the corrosion of steel under conditions encountered in steam power generation is given and the work done during the past year is described. This work has been concerned with: (1) The effect of OH concentration and of OH/PO ratios on corrosion rates and on the buildup and breakdown of protective films at 600 deg F; (2) The effect of non-adherent corrosion products on the development of localized attack at 600 deg F and (3) The stabilization of protective films against breakdown upon exposure to air-saturated water at room temperature. The studies revealed that the data of Berl and van Taack, upon which conclusions regarding the beneficial effects of NaOH additions to boiler water have been based, do not give an adequate picture of these effects. Increasing the pH in static systems at 600 deg F increases the corrosion rate. The size of the crystallites in the protective film also increases with pH and this may account for increased stability of the high pH films in high velocity streams. Concentrated NaOH at 600 deg F causes drastic pitting similar in appearance to that reported by British workers as characteristic of failed high pressure boiler tubes. The attack of steel by concentrated Na<sub>2</sub>HPO<sub>4</sub> at 600 deg F is different in character than the attack by NaOH and it does not

cause the drastic pitting characteristic of NaOH. Some protection against this drastic pitting is obtained in solutions with mol ratios of NaOH to Na<sub>2</sub>HPC<sub>4</sub> as high as 3 to 1. Concentrated LiOH does not produce this drastic pitting. The presence of non-adherent corrosion products results in drastic localized attack in highly oxygenated static systems at 600 deg F but seems to have little effect in the absence of oxygen.

DTIC

*Corrosion; Steam*

**20080047656** Department of the Navy, Washington, DC USA

**Battery Charging Method**

Thivierge, Daniel P, Inventor; Nov 3, 2008; 36 pp.; In English

Report No.(s): AD-D020384; No Copyright; Avail.: Other Sources

A charging and equalizing method for a battery having a control computer in a charging system in communication with a plurality of module processors. Charging and equalization pauses periodically for voltage measurement by the module processors. The control computer determines when to equalize battery cells in the modules based on their open circuit voltages transmitted by the module processors. A selected group of cells in each module can be equalized. Equalization is carried out in the modules until all of the module processors indicate that equalization has been completed. Charging can then resume until charging is complete or cells reach a maximum voltage given by the control computer. In an alternative embodiment, a selected group of cells may be partially bypassed while charging to reduce the charge rate of the cell.

DTIC

*Battery Chargers; Electric Batteries; Patent Applications*

**20080047867** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Superconducting Generators for Airborne Applications and YBCO-Coated Conductors (Preprint)**

Barnes, Paul N; Levin, George A; Durkin, Edward B; Oct 2008; 6 pp.; In English

Contract(s)/Grant(s): Proj-3145

Report No.(s): AD-A489118; AFRL-RZ-WP-TP-2008-2245; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489118>

With the development of high-power applications, especially those on air platforms, power generation systems above the megawatt level will be required. Superconducting generators can address this need. Recently, several successful rotating machinery projects demonstrated the practicality and feasibility of the technology using the high temperature superconducting BSCCO wire. With progress of the newer superconducting YBCO-coated conductor to longer lengths, addition improvement can be made to these superconducting devices. This presentation will address the use of the superconducting generator from an airborne perspective and then address the benefits and some issues for the employment of YBCO coated conductors in future demonstrations.

DTIC

*Airborne Equipment; Coatings; Conductors; Electric Generators; Electric Power Plants; High Temperature Superconductors; Superconductivity; YBCO Superconductors*

**20080048048** DR Technologies, Inc., San Diego, CA, USA

**Electromagnetically Clean Solar Arrays**

Stem, Theodore G.; Kenniston, Anthony E.; NASA Tech Briefs, December 2008; December 2008, pp. 12-13; In English; See also [20080048022](#)

Report No.(s): LEW-18156-1; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3425>

The term 'electromagnetically clean solar array' ('EMCSA') refers to a panel that contains a planar array of solar photovoltaic cells and that, in comparison with a functionally equivalent solar-array panel of a type heretofore used on spacecraft, (1) exhibits less electromagnetic interferences to and from other nearby electrical and electronic equipment and (2) can be manufactured at lower cost. The reduction of electromagnetic interferences is effected through a combination of (1) electrically conductive, electrically grounded shielding and (2) reduction of areas of current loops (in order to reduce magnetic moments). The reduction of cost is effected by designing the array to be fabricated as a more nearly unitary structure, using fewer components and fewer process steps. Although EMCSAs were conceived primarily for use on spacecraft they are also potentially advantageous for terrestrial applications in which there are requirements to limit electromagnetic interference. In

a conventional solar panel of the type meant to be supplanted by an EMCSA panel, the wiring is normally located on the back side, separated from the cells, thereby giving rise to current loops having significant areas and, consequently, significant magnetic moments. Current-loop geometries are chosen in an effort to balance opposing magnetic moments to limit far-field magnetic interactions, but the relatively large distances separating current loops makes full cancellation of magnetic fields problematic. The panel is assembled from bare photovoltaic cells by means of multiple sensitive process steps that contribute significantly to cost, especially if electromagnetic cleanliness is desired. The steps include applying a cover glass and electrical-interconnect-cell (CIC) sub-assembly, connecting the CIC subassemblies into strings of series-connected cells, laying down and adhesively bonding the strings onto a panel structure that has been made in a separate multi-step process, and mounting the wiring on the back of the panel. Each step increases the potential for occurrence of latent defects, loss of process control, and attrition of components. An EMCSA panel includes an integral cover made from a transparent material. The silicone cover supplants the individual cover glasses on the cells and serves as an additional unitary structural support that offers the advantage, relative to glass, of the robust, forgiving nature of the silicone material. The cover contains pockets that hold the solar cells in place during the lamination process. The cover is coated with indium tin oxide to make its surface electrically conductive, so that it serves as a contiguous, electrically grounded shield over the entire panel surface. The cells are mounted in proximity to metallic printed wiring. The painted-wiring layer comprises metal-film traces on a sheet of Kapton (or equivalent) polyimide. The traces include contact pads on one side of the sheet for interconnecting the cells. Return leads are on the opposite side of the sheet, positioned to form the return currents substantially as mirror images of, and in proximity to, the cell sheet currents, thereby minimizing magnetic moments. The printed-wiring arrangement mimics the back-wiring arrangement of conventional solar arrays, but the current-loop areas and the resulting magnetic moments are much smaller because the return-current paths are much closer to the solar-cell sheet currents. The contact pads are prepared with solder for electrical and mechanical bonding to the cells. The pocketed cover/shield, the solar cells, the printed-wiring layer, an electrical bonding agent, a mechanical-bonding agent, a composite structural front-side face sheet, an aluminum honeycomb core, and a composite back-side face sheet are all assembled, then contact pads are soldered to the cells and the agents are cured in a single lamination process.

Author

*Photovoltaic Cells; Solar Arrays; Panels; Electromagnetic Interference; Electromagnetic Shielding*

**20080048151** California Inst. of Tech., Pasadena, CA, USA

### **Simulating the Gradually Deteriorating Performance of an RTG**

Wood, Eric G.; Ewell, Richard C.; Patel, Jagdish; Hanks, David R.; Lozano, Juan A.; Snyder, G. Jeffrey; Noon, Larry; NASA Tech Briefs, September 2008; September 2008, pp. 51-52; In English; See also [20080048125](#)

Report No.(s): NPO-45252; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3200>

Degra (now in version 3) is a computer program that simulates the performance of a radioisotope thermoelectric generator (RTG) over its lifetime. Degra is provided with a graphical user interface that is used to edit input parameters that describe the initial state of the RTG and the time-varying loads and environment to which it will be exposed. Performance is computed by modeling the flows of heat from the radioactive source and through the thermocouples, also allowing for losses, to determine the temperature drop across the thermocouples. This temperature drop is used to determine the open-circuit voltage, electrical resistance, and thermal conductance of the thermocouples. Output power can then be computed by relating the open-circuit voltage and the electrical resistance of the thermocouples to a specified time-varying load voltage. Degra accounts for the gradual deterioration of performance attributable primarily to decay of the radioactive source and secondarily to gradual deterioration of the thermoelectric material. To provide guidance to an RTG designer, given a minimum of input, Degra computes the dimensions, masses, and thermal conductances of important internal structures as well as the overall external dimensions and total mass.

Author

*Radioisotope Heat Sources; Thermoelectric Generators; Performance Tests; Degradation; Computer Programs; Computerized Simulation*

**20080048194** California Inst. of Tech., Pasadena, CA, USA

### **Transmissive Diffractive Optical Element Solar Concentrators**

Baron, Richard; Moynihan, Philip; Price, Douglas; NASA Tech Briefs, September 2008; September 2008, pp. 34; In English; See also [20080048125](#); Original contains black and white illustrations

Report No.(s): NPO-43801; Copyright; Avail.: CASI: [A01](#), Hardcopy

Solar-thermal-radiation concentrators in the form of transmissive diffractive optical elements (DOEs) have been proposed

as alternatives to mirror-type solar concentrators now in use. In comparison with functionally equivalent mirror-type solar concentrators, the transmissive, diffractive solar concentrators would weigh and cost less, and would be subject to relaxed mechanical tolerances. A DOE concentrator would be made from a thin, flat disk or membrane of a transmissive material having a suitable index of refraction. By virtue of its thinness, the DOE concentrator would have an areal mass density significantly less than that of a functionally equivalent conventional mirror. The DOE concentrator would have a relatively wide aperture--characterized by a focal-length/aperture-diameter ratio ('f number') on the order of 1. A kinoform (a surface-relief phase hologram) of high diffractive order would be microfabricated onto one face of the disk. The kinoform (see figure) would be designed to both diffract and refract incident solar radiation onto a desired focal region, without concern for forming an image of the Sun. The high diffractive order of this kinoform (in contradistinction to the low diffractive orders of some other kinoforms) would be necessary to obtain the desired f number of 1, which, in turn, would be necessary for obtaining a desired concentration ratio of 2,500 or greater. The design process of optimizing the concentration ratio of a proposed DOE solar concentrator includes computing convolutions of the optical bandwidth of the Sun with the optical transmission of the diffractive medium. Because, as in the cases of other non-imaging, light-concentrating optics, image quality is not a design requirement, the process also includes trading image quality against concentration ratio. A baseline design for one example calls for an aperture diameter of 1 m. This baseline design would be scalable to a diameter as large as 10 m, or to a smaller diameter for a laboratory test article. Initial calculations have indicated that the characteristics of the test article would be readily scalable to a full-size unit.

Author

*Solar Collectors; Solar Radiation; Thermal Radiation; Diffractive Optics; Design Analysis; Design Optimization; Prototypes*

**20080048248** Yoder (Patrick S. and Fletcher), Houston, TX, USA

**Power Control System and Method (PAT-APPL-11-061 706)**

Steigerwald, R. L., Inventor; Anderson, T. A., Inventor; 17 Feb 05; 9 pp.; In English

Contract(s)/Grant(s): DE-FC36-04GO14001

Patent Info.: Filed Filed 17 Feb 05; US-Patent-Appl-SN-11-061 706

Report No.(s): PB2008-105855; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A power system includes an energy harvesting device, a battery coupled to the energy harvesting device, and a circuit coupled to the energy harvesting device and the battery. The circuit is adapted to deliver power to a load by providing power generated by the energy harvesting device to the load without delivering excess power to the battery and to supplement the power generated by the energy harvesting device with power from the battery if the power generated by the energy harvesting device is insufficient to fully power the load. A method of operating the power system is also provided.

NTIS

*Patent Applications; Electric Generators*

**20080048329** Myers (Peacock), PC, Albuquerque, NM, USA

**Back-Contacted Solar Cells with Integral Conductive Vias and Method of Making**

Gee, J. M., Inventor; Schmit, R. R., Inventor; 27 Dec 05; 20 pp.; In English

Contract(s)/Grant(s): DE-AC04-94AL85000

Patent Info.: Filed Filed 27 Dec 05; US-Patent-Appl-SN-11-319 868

Report No.(s): PB2008-104823; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Methods of manufacturing back-contacted p-type semiconductor substrate solar cells fabricated using a gradient-driven solute transport process, such as thermomigration or electromigration, to create n-type conductive vias connecting the n-type emitter layer on the front side to n-type ohmic contacts located on the back side, and back-contacted solar cells with integral n-type conductive vias, such as made by a gradient-driven solute transport process.

NTIS

*Patent Applications; Photovoltaic Cells; Solar Cells*

**20080048330** National Renewable Energy Lab., Golden, CO USA

**Multi-Junction, Monolithic Solar Cell with Active Silicon Substrate**

Mascarenhas, A., Inventor; Seong, M. J., Inventor; 16 Aug 02; 13 pp.; In English

Contract(s)/Grant(s): DE-AC36-99GO10337

Patent Info.: Filed 16 Aug 02; US-Patent-Appl-SN-10-523 745

Report No.(s): PB2008-104824; No Copyright; Avail.: CASI: A03, Hardcopy

A monolithic multi-junction (tandem) photo-voltaic (PV) device includes one or more PV subcells epitaxially formed on a compliant silicon substrate. The compliant silicon substrate includes a base silicon layer, a conductive perovskite layer, and an oxide layer interposed between the base silicon layer and the conductive perovskite layer. A PV subcell is formed within the base silicon layer of the conductive silicon substrate. The conductive perovskite layer facilitates the conduction of charge carriers between the PV subcell formed in the compliant silicon substrate and the one or more PV subcells formed on the compliant silicon substrate.

NTIS

*Patent Applications; Silicon; Solar Cells; Substrates*

**20080048523** Michigan Univ., Dearborn, MI USA

**Intelligent Vehicle Power Management Using Machine Learning and Fuzzy Logic**

Chen, ZhiHang; Masrur, M A; Murphey, Yi L; Jun 2008; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A490158; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present our research in optimal power management for a generic vehicle power system that has multiple power sources using machine learning and fuzzy logic. A machine learning algorithm, LOPPS, has been developed to learn about optimal power source combinations with respect to minimum power loss for all possible load requests and various system power states. The results generated by the LOPPS are used to build a fuzzy power controller (FPC). FPC is integrated into a simulation program implemented by using a generic simulation software as indicated in reference [22] and is used to dynamically allocate optimal power sources during online drive. The simulation results generated by FPC show that the proposed machine learning algorithm combined with fuzzy logic is a promising technology for vehicle power management.

DTIC

*Engines; Fuzzy Systems; Machine Learning; Supplying*

**20080048530** Army Tank-Automotive Research and Development Command, Warren, MI USA

**Advanced Planning Briefing to Industry (APBI), TARDEC Ground Vehicle Power & Mobility (GVPM)**

Coutteau, Chuck; Blain, Michael; Patel, Rocky; Oct 9, 2008; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A490195; TARDEC-19266-RC; No Copyright; Avail.: Defense Technical Information Center (DTIC)

GVPM's mission is to provide technically sound and timely responses to the soldiers' current and future needs for technology and engineering expertise in ground vehicle power and mobility technologies.

DTIC

*Industries; Mobility*

**45**

**ENVIRONMENT POLLUTION**

Includes atmospheric, water, soil, noise, and thermal pollution.

**20080047272** Istituto Superiore di Sanita, Rome, Italy

**Conference. Dental Setting as it Stands with Current Procedure, Materials and Substances in Use and Related Environment (Indoor Air Quality)**

Satarsiero, A.; Jun. 14, 2008; 58 pp.; In Italian; ). Rome, Italy 14 June 2008. Abstract Book. (Conferenza. Il Presidio Odontoiatrico e Relavio Ambiente (Qualita Dee'Aria Indoor) In Relazione alle Procedure, Materiali e Sostanze in Uso in Odontoiatria. Roma, 14 Giugno 2008. Riassunt)

Report No.(s): PB2009-102377; ISTISAN-08/C4; Copyright; Avail.: National Technical Information Service (NTIS)

This book includes 25 abstracts of contributions presented during the day Conference. Programmed communications presented at the Round Tables are also included as abstracts. This Conference has a dual aim: 1) to provide a refresher and updating opportunity on dental setting as it stands with current procedures, materials and substances in use and related indoor air environment (indoor air quality) directed to dentists, physicians, chemists, biologists and others involved in dental activity; 2) to provide researchers of different disciplines the opportunity to discuss relevant topics and outline factors that may affect



the quality of the indoor air environment and measures (in terms of layout, air treatment systems, etc.) needed to prevent or reduce the chemical contamination which dentists and dental staff may be exposed to.

NTIS

*Abstracts; Air Quality; Conferences; Dentistry; Environmental Quality; Indoor Air Pollution; Italy*

**20080047281** National Security Technologies, LLC, Las Vegas, NV, USA

**Errata Sheet for the Closure Report (DOE/NV--1246) for Corrective Action Unit 543: Liquid Disposal Units, Nevada**

Jun. 20, 2008; 7 pp.; In English

Contract(s)/Grant(s): DE-AC52-06NA25946

Report No.(s): DE2008-934448; DOE/NV--1246-ERR; DOE/NV/25946--492; No Copyright; Avail.: Department of Energy Information Bridge

The Following Corrections and Clarifications Apply to: Closure Report for Corrective Action Unit 543: Liquid Disposal Units, Nevada Test Site, Nevada.

NTIS

*Closures; Radioactive Wastes; Waste Disposal*

**20080047293** Savannah River National Lab., Aiken, SC, USA

**242-16H 2H Evaporator Pot Samplin Final Report**

Krementz, D.; Cheng, W.; Jun. 11, 2008; 27 pp.; In English

Contract(s)/Grant(s): DE-AC09-96SR18500

Report No.(s): DE2008-934528; WSRC-STI-2008-00192; No Copyright; Avail.: Department of Energy Information Bridge

Due to the materials that are processed through 2H Evaporator, scale is constantly being deposited on the surfaces of the evaporator pot. In order to meet the requirements of the Nuclear Criticality Safety Analysis/Evaluation (NCSA/NCSE) for 2H Evaporator, inspections of the pot are performed to determine the extent of scaling. Once the volume of scale reaches a certain threshold, the pot must be chemically cleaned to remove the scale. Prior to cleaning the pot, samples of the scale are obtained to determine the concentration of uranium and plutonium and also to provide information to assist with pot cleaning. Savannah River National Laboratory (SRNL) was requested by Liquid Waste Organization (LWO) Engineering to obtain these samples from two locations within the evaporator. Past experience has proven the difficulty of successfully obtaining solids samples from the 2H Evaporator pot. To mitigate this risk, a total of four samplers were designed and fabricated to ensure that two samples could be obtained. Samples had previously been obtained from the cone surface directly below the vertical access riser using a custom scraping tool. This tool was fabricated and deployed successfully. A second scraper was designed to obtain sample from the nearby vertical thermowell and a third scraper was designed to obtain sample from the vertical pot wall. The newly developed scrapers both employed a pneumatically actuated elbow. The scrapers were designed to be easily attached/removed from the elbow assembly. These tools were fabricated and deployed successfully. A fourth tool was designed to obtain sample from the opposite side of the pot under the tube bundle. This tool was fabricated and tested, but the additional modifications required to make the tool field-ready could not be complete in time to meet the aggressive deployment schedule.

NTIS

*Evaporators; Radioactive Wastes*

**20080047313** Environmental Protection Agency, Washington, DC USA; National Oceanic and Atmospheric Administration, Washington, DC, USA

**Air Quality Awareness Week, Event Planning Kit**

Apr. 2007; 17 pp.; In English

Report No.(s): PB2009-102135; EPA/456/B-07/001; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Air Quality Awareness Week 2007 has been designated as April 30 May 4. This timeframe corresponds with the beginning of ozone season and makes for a great opportunity to engage your community in air quality awareness activities. Air quality awareness is more than just understanding the Air Quality Index (AQI) forecast that utilizes the color code system. Air quality awareness includes education about the air in your specific area and what associated health effects might be a concern for your community. Understanding the importance of the air quality forecasts and their direct relation to health impacts will make the difference between allowing children outside to play during Code Orange air quality days or reducing exposure by simply rescheduling an activity for a time when air quality is expected to be better. For help in planning activities in your community, EPA has developed some suggestions for engaging specific state, local, and tribal stakeholders and building partnerships with

other advocates in your area. Do not feel limited by what is listed in this kit many state and local agencies already hold great events. This kit is meant to complement those efforts and provide new ideas where possible.

NTIS

*Air Quality; Education; Kits*

**20080047390** Idaho National Lab., Idaho Falls, ID, USA

**INL Reactor Technology Complex Out-of-Service Buried Piping Hazards**

Gerstner, D. M.; May 01, 2008; 16 pp.; In English

Contract(s)/Grant(s): DE-AC07-99ID-13727

Report No.(s): DE2008-934545; INL/CON-08-13813; No Copyright; Avail.: National Technical Information Service (NTIS)

Idaho National Laboratory (INL) Reactor Technology Complex (RTC) buried piping and components are being characterized to determine if they should be managed as hazardous waste and subject to the Hazardous Waste Management Act/Resource Conservation and Recovery Act (RCRA). RTC buried piping and components involve both active piping and components from currently operating nuclear facilities, such as the Advanced Test Reactor (ATR), and inactive lines from facilities undergoing D&D activities. The issue exists as to the proper methods to analyze and control hazards associated with D&D activities on facilities collocated with existing operating nuclear facilities, or future collocated facilities being considered with the resurgent nuclear industry. During initial characterization activities, it was determined that residual radioactive material in several inactive RTC lines and components could potentially exceed hazard category (HC) 3 thresholds. In addition, concerns were raised as to how to properly isolate active nuclear facility piping and components from those inactive lines undergoing RCRA actions, and whether the operating facility safety basis could be impacted. Work was stopped, and a potential inadequacy in the safety analysis (PISA) was declared, even though no clear safety basis existed for the inactive, abandoned lines and equipment. An unreviewed safety question (USQ) and an occurrence report resulted. A HC 3 or greater Nuclear Facility/Activity for the buried piping and components was also declared in the occurrence report.

NTIS

*Hazards; Nuclear Reactors; Pipes (Tubes); Reactor Technology*

**20080047671** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Alaskan and Canadian Forest Fires Exacerbate Ozone Pollution over Houston, Texas, on 19 and 20 July 2004**

Morris, Gary A.; Hersey, Scott; Thompson, Anne M.; Pawson, Steven; Nielsen, J. Eric; Colarco, Peter R.; McMillan, W. Wallace; Stohl, Andreas; Turquety, Solene; Warner, Juying; Johnson, Bryan J.; Larko, David E.; Oltmans, Samuel J.; Witte, Jacquelyn C.; [2006]; 31 pp.; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

On Monday, 19 July and Tuesday, 20 July 2004, the air over Houston, Texas, appeared abnormally hazy. Transport model results and data from the Atmospheric Infrared Sounder (AIRS), the Moderate Resolution Imaging Spectrometer (MODIS), the Measurement of Ozone by Airbus In-service aircraft (MOZAIC) experiment, and the Total Ozone Mapping Spectrometer (TOMS) indicate that an air mass originating on 12 July 2004 over forest fires in Eastern Alaska and Western Canada arrived in Houston about one week later. Ozonesonde data from Houston on 19 and 20 July show elevated ozone at the surface (>125 ppbv) and even higher concentrations aloft (approx.150 ppbv of ozone found 2 km above the surface) as compared to more typical profiles. Integrated ozone columns from the surface to 5 km increased from 17 - 22 DU (measured in the absence of the polluted air mass) to 34 - 36 DU on 19 and 20 July. The combination of these ozonesonde observations with the satellite data and the model results implicates the biomass burning effluence originating in Alaska and Canada a week earlier in exacerbating pollution levels seen in Houston.

Author

*Air Pollution; Biomass Burning; Total Ozone Mapping Spectrometer; Ozone; MODIS (Radiometry); Ozonometry; Imaging Spectrometers; Air Masses*

**20080047704** Environmental Protection Agency, Research Triangle Park, NC USA

**Demonstration of a Scenario Approach for Technology Assessment: Transportation Sector**

Gage, C. L.; Johnson, T. L.; Wright, E. L.; Loughlin, D. H.; Shay, C. L.; Jul. 2004; 131 pp.; In English

Report No.(s): PB2009-102124; EPA/600/R-04/135; No Copyright; Avail.: National Technical Information Service (NTIS)

EPA's Office of Research and Development (ORD) is pursuing an Air Quality Assessment that will examine the potential consequences of global change on tropospheric ozone and particulate matter in the year 2050. Technological change is one of the most important drivers for the future of environmental air quality and global environmental change. The National Risk

Management Research Laboratory's Technology Assessment and Co-control Team (TACT) is pursuing a scenario-oriented approach to the assessment of future technologies and patterns of technology adoption in the transportation and electricity generation sectors. This report presents TACT's approach and highlights early results in the transportation sector. Scenarios considering advanced internal combustion engine vehicles, hybrid vehicles, and hydrogen vehicles and their associated fueling infrastructures are developed and analyzed. Preliminary emissions modeling results suggest different technology development and penetration scenarios may have greatly differing emissions consequences and, hence, differing air quality implications in the Air Quality Assessment time horizon. Future work will further develop the analysis of the transportation sector, including an assessment of the interaction between economic and technological changes, and will expand to include an analysis of the electricity generation sector.

NTIS

*Transportation; Computerized Simulation; Technology Assessment; Air Quality*

**20080047775** Forest Products Lab., Madison, WI USA

**Long-Term Effects of Elevated Carbon Dioxide Concentration on Sour Orange Wood Specific Gravity, Modulus of Elasticity, and Microfibril Angle**

Kretschmann, D.; Evans, J.; Weimann, M.; Rudie, A.; Kimball, B. A.; Sep. 2007; 11 pp.; In English

Report No.(s): PB2008-105497; FPL-RN-0307; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The carbon dioxide (CO<sub>2</sub>) concentration of Earth's atmosphere continues to rise. Plants in general are responsive to changing CO<sub>2</sub> concentrations, which suggests changes in agricultural productivity in the USA and around the world. The ability of plants to absorb CO<sub>2</sub> during photosynthesis and then store carbon in their structure or sequester it in the soil has potential for mitigating the rate of rise of atmospheric CO<sub>2</sub> concentration. Since 1987, Bruce Kimball and coworkers at the USDA Agricultural Research Service in Phoenix, Arizona, have maintained a greenhouse gas experiment using sour orange trees maintained in a CO<sub>2</sub>-enriched environment. These trees were harvested in 2005. During the final massive harvest, many different properties and characteristics of the woody biomass for these sour orange trees were studied. This report focuses only on the mechanical property evaluation of modulus of elasticity (MOE), specific gravity, and microfibril angle. In this study of CO<sub>2</sub>-exposed sour orange trees, CO<sub>2</sub> did not significantly affect specific gravity of sour orange trees. Exposure to CO<sub>2</sub> did not significantly affect MOE of sour orange trees. Exposure to CO<sub>2</sub> did, however, seem to influence microfibril angle development. Minor interactions between CO<sub>2</sub> and cardinal direction affected the MOE and were caused by experimental difference in chamber construction.

NTIS

*Carbon Dioxide; Carbon Dioxide Concentration; Citrus Trees; Density (Mass/Volume); Greenhouse Effect; Mechanical Properties; Modulus of Elasticity; Wood*

**20080047896** Naval Surface Warfare Center, Bethesda, MD, USA

**Glacier Bay Underwater Noise Interim Report**

Kipple, B.; Dec. 2002; 74 pp.; In English

Report No.(s): PB2008-105344; No Copyright; Avail.: National Technical Information Service (NTIS)

Both manmade and naturally occurring underwater noise in lower Glacier Bay was studied using over 5200 hourly noise samples obtained during 14 months between August 2000 and June 2002. The primary contributor of natural noise was wind generated surface noise, which averaged 83 dB re 1 microPa at 1 kHz and ranged from 67 to a maximum of 100 dB. Average monthly wind noise levels were not widely variable by season. Noise from rainfall was present in an average of 2.1 out of 24 samples per day and was not especially prevalent in winter versus other seasons. Rain noise levels at 16 kHz averaged 89 dB and ranged as high as 110 dB.

NTIS

*Glaciers; Noise (Sound); Rain; Sampling*

**20080047909** Westinghouse Savannah River Co., Aiken, SC, USA

**Tank Inspection NDE Results for Fiscal Year 2007 Including Waste Tanks 35, 36, 37, 38 and 15**

Elder, J. B.; Sep. 27, 2007; 61 pp.; In English

Contract(s)/Grant(s): DE-AC09-96SR18500

Report No.(s): DE2007-919042; WSRC-STI-2007-00315; No Copyright; Avail.: National Technical Information Service (NTIS)

Ultrasonic (UT) nondestructive examinations (NDE) were performed on waste storage tanks 35, 36, 37, 38 and 15 at the

Savannah River Site as a part of the In-Service Inspection (ISI) Program for High Level Waste Tanks. The inspections were performed from the annular space of the waste storage tanks. The inspections included thickness mapping and crack detection scans on specified areas of the tanks covering all present and historic interface levels and selected welds with particular emphasis on the vapor space regions. Including the tanks in this report, all of the 27 Type III tanks at SRS have been inspected in accordance with the ISI plan. Of the four Type III tanks examined this year, all had areas of reportable thickness in either the Primary or Secondary tank. All of these areas on the primary tank are attributed to fabrication artifacts. None of the four Type III tanks examined this year showed evidence of service induced thinning on the primary wall.

NTIS

*Inspection; Nondestructive Tests; Radioactive Wastes; Storage Tanks; Waste Management*

**20080047912** Pacific Northwest National Lab., Richland, WA, USA

**One-Twelfth-Scale Mixing Experiments to Characterize Double-Shell Tank Slurry Uniformity. Final Report**

Bamberger, J. A.; Liljegren, L. M.; Enderlin, C. W.; Meyer, P. A.; Greenwood, M. S.; Sep. 2007; 151 pp.; In English

Contract(s)/Grant(s): DE-AC05-76RL01830

Report No.(s): DE2007-919311; No Copyright; Avail.: Department of Energy Information Bridge

Scaled mixing experiments were conducted to address the issue of maintaining mobilized particles in a uniform suspension (the condition of concentration uniformity) using jet pumps to mix the suspension. The tests are based on the general analysis of maintaining uniformity described in Strategy Plan: A Methodology to Predict the Uniformity of Double-Shell Tank Waste Slurries on Mixing Pump Operation (Bamberger et al. 1990) and Test Plan: 1/12-Scale Scoping Experiments to Characterize Double-Shell Tank Slurry Uniformity (Bamberger and Liljegren 1994). The objectives of these 1/12-scale scoping experiments were to Determine which of the dimensionless parameters discussed in Bamberger and Liljegren (1994) affect the maximum concentration that can be suspended during jet mixer pump operation in the null-scale double-shell tanks; Develop empirical correlations to predict the nozzle velocity required for jet mixer pumps to suspend the contents of full-scale double-shell tanks; Apply the models to predict the nozzle velocity required to suspend the contents of Tank 241-AZ-101; Obtain experimental concentration data to compare with the TEMPEST(a) (Trent and Eyster 1989) computational modeling predictions to guide further code development; Analyze the effects of changing nozzle diameter on exit velocity (U0) and U0D0 (the product of the exit velocity and nozzle diameter) required to suspend the contents of a tank.

NTIS

*Radioactive Wastes; Slurries; Waste Management*

**20080047914** Argonne National Lab., IL USA; National Energy Technology Lab., Morgantown, WV, USA

**Summary of PERF Air Program Review, August 22-23, 2007, Annapolis, Maryland**

Veil, J. A.; Schmalzer, D. K.; Leath, P. P.; Sep. 2007; 22 pp.; In English

Contract(s)/Grant(s): DE-AC02-06CH11357

Report No.(s): DE2007-919335; ANL/EVS/R-07/6; No Copyright; Avail.: Department of Energy Information Bridge

For many years, the U.S. Department of Energy (DOE) has supported and sponsored various types of environmental research related to the oil and gas industry through its Office of Fossil Energy and its National Energy Technology Laboratory (NETL). In November 2005, Argonne National Laboratory (Argonne) organized and coordinated a review of DOE's water research program in conjunction with the fall 2005 meeting of the Petroleum Environmental Research Forum (PERF). PERF is a nonprofit organization created in 1986 to provide a stimulus and forum for collecting, exchanging, and analyzing research information related to the development of technology for the petroleum industry and also to provide a mechanism for establishing joint research projects in that field. Additional information on PERF can be accessed at <http://www.perf.org>. The water program review was so successful that both DOE and PERF agreed that a second program review would be useful this time on air research and issues. Argonne coordinated the air program review, which was held in Annapolis, Maryland, on August 22 and 23, 2007. This report summarizes the presentations and related discussions that were part of the air program review. The full agenda for the program review is included as Appendix A.

NTIS

*Air Pollution; Crude Oil*

**20080048039** TDA Research, Inc., Wheat Ridge, CO, USA; TDA Research, Inc., Wheat Ridge, CO, USA

**System for Removing Pollutants from Incinerator Exhaust**

Wickham, David t.; Bahr, James; Dubovik, Rita; Gebhard, Steven C.; Lind, Jeffrey; NASA Tech Briefs, December 2008; December 2008, pp. 15; In English; See also [20080048022](#)

Report No.(s): MSC-23440-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3427>

A system for removing pollutants -- primarily sulfur dioxide and mixed oxides of nitrogen (NOx) -- from incinerator exhaust has been demonstrated. The system is also designed secondarily to remove particles, hydrocarbons, and CO. The system is intended for use in an enclosed environment, for which a prior NOx-and-SO2-removal system designed for industrial settings would not be suitable.

Derived from text

*Exhaust Systems; Nitrogen Oxides; Sulfur Dioxides; Incinerators; Exhaust Gases; Combustion Chemistry; Pollution Control*

**20080048119** Environmental Protection Agency, New York, NY, USA

**Interim Final WTC Residential Confirmation Cleaning Study. Volume 1**

May 2003; 171 pp.; In English

Report No.(s): PB2008-105701; No Copyright; Avail.: CASI: [A08](#), Hardcopy

The USA Environmental Protection Agency (EPA) responded to the September 11, 2001 attack on the World Trade Center (WTC) in conjunction with the President's declaration of a national disaster. The Federal Emergency Management Agency (FEMA), the federal government office coordinating disaster response, issued mission assignments to EPA related to: cleaning dust and debris from the streets of lower Manhattan assessing the ambient environment through analysis of air and dust samples providing washing stations for decontamination of personnel and equipment involved in dust and debris removal operations, and disposing of hazardous materials found at the WTC response and recovery site. Residents of lower Manhattan expressed concerns about the safety and reliability of cleaning methods utilized to remove dust and debris from residential unit interiors and building exteriors. Traditional FEMA support programs were available; however, residents requested additional assurance. To address concerns about the extent of indoor impact of dust and debris, as well as concerns regarding fire-related particle deposition, EPA Administrator Christine Todd Whitman formed an Interagency Indoor Air Task Force. The task force included representatives from the following agencies: EPA, FEMA, the New York City Department of Health and Mental Hygiene (NYCDOHMH), the New York City Department of Environmental Protection (NYCDEP), the New York City Office of Emergency Management, the New York City Mayors Office of Environmental Coordination, the New York State Health Department, the New York State Department of Environmental Conservation, the Occupational Safety and Health Administration (OSHA), and the Agency for Toxic Substances and Disease Registry (ATSDR). The multidisciplinary, interagency group focused on issues of concern to residents and developed coordinated strategies to address the concerns.

NTIS

*Air Pollution; Cleaning; Disasters; Hazardous Materials; Pollution Control; Proving*

**20080048224** California Univ., Berkeley, CA, USA

**Quantifying Pollutant Emissions from Office Equipment Phase I Report**

Maddalena, R. L.; Destailats, H.; Hodgson, A. T.; McKone, T. E.; Perino, C.; Dec. 2006; 99 pp.; In English

Report No.(s): DE2007-918677; No Copyright; Avail.: National Technical Information Service (NTIS)

Although office equipment has been a focal point for governmental efforts to promote energy efficiency through programs such as Energy Star, little is known about the relationship between office equipment use and indoor air quality. This report provides results of the first phase (Phase I) of a study in which the primary objective is to measure emissions of organic pollutants and particulate matter from a selected set of office equipment typically used in residential and office environments. The specific aims of the overall research effort are: (1) use screening-level measurements to identify and quantify the concentrations of air pollutants of interest emitted by major categories of distributed office equipment in a controlled environment; (2) quantify the emissions of air pollutants from generally representative, individual machines within each of the major categories in a controlled chamber environment using well defined protocols; (3) characterize the effects of ageing and use on emissions for individual machines spanning several categories; (4) evaluate the importance of operational factors that can be manipulated to reduce pollutant emissions from office machines; and (5) explore the potential relationship between energy consumption and pollutant emissions for machines performing equivalent tasks. The study includes desktop computers (CPU units), computer monitors, and three categories of desktop printing devices. The printer categories are: (1) printers and multipurpose devices using color inkjet technology; (2) low- to medium output printers and multipurpose devices employing monochrome or color laser technology; and (3) high-output monochrome and color laser printers. The literature review and

screening level experiments in Phase 1 were designed to identify substances of toxicological significance for more detailed study. In addition, these screening level measurements indicate the potential relative importance of different categories of office equipment with respect to human exposures. The more detailed studies of the next phase of research (Phase II) are meant to characterize changes in emissions with time and may identify factors that can be modified to reduce emissions. These measurements may identify win-win situations in which low energy consumption machines have lower pollutant emissions. This information will be used to compare machines to determine if some are substantially better than their peers with respect to their emissions of pollutants.

NTIS

*Contaminants; Exhaust Emission; Indoor Air Pollution; Organic Compounds*

**20080048225** Southwest Research Inst., San Antonio, TX USA

**Novel Concepts for the Compression of Large Volumes of Carbon Dioxide (Final Report, October 1, 2005-September 30, 2007)**

Moore, J. J.; Nored, M. G.; Gernentz, R. S.; Brun, K.; Sep. 28, 2007; 74 pp.; In English

Contract(s)/Grant(s): DE-FC26-05NT42650

Report No.(s): DE2007-918688; No Copyright; Avail.: National Technical Information Service (NTIS)

In the effort to reduce the release of CO<sub>2</sub> greenhouse gases to the atmosphere, sequestration of CO<sub>2</sub> from Integrated Gasification Combined Cycle (IGCC) and Oxy-Fuel power plants is being pursued. This approach, however, requires significant compression power to boost the pressure to typical pipeline levels. The penalty can be as high as 8% to 12% on a typical IGCC plant. The goal of this research is to reduce this penalty through novel compression concepts and integration with existing IGCC processes. The primary objective of the study of novel CO<sub>2</sub> compression concepts is to boost the pressure of CO<sub>2</sub> to pipeline pressures with the minimal amount of energy required. Fundamental thermodynamics were studied to explore pressure rise in both liquid and gaseous states. For gaseous compression, the project investigated novel methods to compress CO<sub>2</sub> while removing the heat of compression internal to the compressor. The high-pressure ratio due to the delivery pressure of the CO<sub>2</sub> for enhanced oil recovery results in significant heat of compression. Since less energy is required to boost the pressure of a cooler gas stream, both upstream and interstage cooling is desirable. While isothermal compression has been utilized in some services, it has not been optimized for the IGCC environment.

NTIS

*Air Pollution; Carbon Dioxide; Pollution Control*

**20080048230** Carnegie-Mellon Univ., Pittsburgh, PA, USA

**Development and Application of Optimal Design Capability for Coal Gasification Systems (Final Report, October 2003-May 2007)**

Rubin, E. S.; Rao, A. B.; Berkenpas, M. B.; May 2007; 664 pp.; In English

Contract(s)/Grant(s): DE-AC21-92MC29094

Report No.(s): DE2007-918690; No Copyright; Avail.: Department of Energy Information Bridge

The basic objective of this research is to develop a model to simulate the performance and cost of oxyfuel combustion systems to capture CO<sub>2</sub> at fossil-fuel based power plants. The research also aims at identifying the key parameters that define the performance and costs of these systems, and to characterize the uncertainties and variability associated with key parameters. The final objective is to integrate the oxyfuel model into the existing IECM-CS modeling framework so as to have an analytical tool to compare various carbon management options on a consistent basis.

NTIS

*Air Pollution; Carbon Dioxide; Coal Gasification; Combustion; Fossil Fuels; Pollution Control*

**20080048233** Los Alamos National Lab., NM, USA; California Univ., Berkeley, CA, USA

**Continuous Air Monitor Filter Changeout Apparatus**

Rodgers, J. C., Inventor; 16 Feb 05; 15 pp.; In English

Contract(s)/Grant(s): DOE-W-7405-ENG-36

Patent Info.: Filed Filed 16 Feb 05; US-Patent-Appl-SN-11-059 096

Report No.(s): PB2008-105846; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An apparatus and corresponding method for automatically changing out a filter cartridge in a continuous air monitor. The apparatus includes: a first container sized to hold filter cartridge replacements; a second container sized to hold used filter cartridges; a transport insert connectively attached to the first and second containers; a shuttle block, sized to hold the filter

cartridges that is located within the transport insert; a transport driver mechanism means used to supply a motive force to move the shuttle block within the transport insert; and, a control means for operating the transport driver mechanism.

NTIS

*Air Filters; Air Pollution; Monitors; Patent Applications*

**20080048341** APTEK, Inc., Colorado Springs, CO, USA; Texas A&M Univ., College Station, TX USA

**Analysis of Covariance of Fall Migrations of Bowhead Whales in Relation to Human Activities and Environmental Factors, Alaskan Beaufort Sea: Phase 1, 1996-1998**

Manly, B. F. J.; Moulton, V. D.; Elliott, R. E.; Miller, G. W.; Richardson, W. J.; May 2007; 139 pp.; In English

Contract(s)/Grant(s): DTFH61-98-C-00075

Report No.(s): PB2008-103654; LGL-TA2799-3; No Copyright; Avail.: National Technical Information Service (NTIS)

This study develops an approach for exploratory analysis to investigate whether and how the distribution of bowhead whales (*Balaena mysticetus*) in the Alaskan Beaufort Sea during autumn is affected by human activities, while simultaneously investigating and allowing for the influences of natural environmental factors on bowhead distribution and sightability. This study is based on analysis of aerial survey, industrial activity, and environmental data from the 1996, 1997 and 1998 autumn migration seasons. It was designed as Phase I of a study initiated by the Minerals Management Service (MMS). Phase II, if it proceeds, would expand and apply the approach to incorporate data from additional years, and to address additional questions and hypotheses about influences of natural and anthropogenic factors. The results from Phase I concerning potential effects of various variables should be considered preliminary, given the exploratory nature of the analysis, the limited number of years considered, and the fact that the statistical models were not fully optimized given the preliminary nature of the work.

NTIS

*Beaufort Sea (North America); Covariance; Human Factors Engineering; Man Environment Interactions; Surveys; Whales*

**20080048365** Agency for International Development, Washington, DC, USA; Department of Agriculture, Washington, DC USA; Environmental Protection Agency, Washington, DC USA; Department of Energy, Washington, DC USA

**U.S. Government's Methane to Markets Partnership Accomplishments. Third Annual Report**

Nov. 2008; 28 pp.; In English

Report No.(s): PB2009-103809; No Copyright; Avail.: National Technical Information Service (NTIS)

In 2004, the USA joined with 13 other countries to focus global attention on the importance of methane emissions by launching the Methane to Markets Partnership. Methane to Markets is a multilateral initiative uniting public and private interests to fight climate change by advancing the recovery and use of methane as a clean energy source. By engaging public and private sector partners, this initiative brings together the technical and market expertise, financing, and technology necessary for methane capture and use project development.

NTIS

*Governments; Greenhouse Effect; International Cooperation; Market Research; Methane*

**20080048370** Purdue Univ., West Lafayette, IN, USA

**Applicability of Borman Decision Tree ITS Management Tool to Other Expressway Systems**

Soliman, A.; Jacko, R. B.; Partridge, B. K.; Jun. 2007; 39 pp.; In English

Contract(s)/Grant(s): SPR-3002

Report No.(s): PB2009-102413; FHWA/IN/JTRP-2007/9; No Copyright; Avail.: National Technical Information Service (NTIS)

An empirical model called the Traffic Air Quality Model (TAQ) was developed from meteorological and PM<sub>2.5</sub> measurements adjacent to the Borman Expressway in Northwest Indiana to estimate PM<sub>2.5</sub> road emissions. It concluded that on average a 74% improvement in air quality is expected (based on reduction of mass emitted per mile (g/mi)) when the average Borman speed range is improved from < 30 mph to >50 mph. An additional 39% (on average) improvement in the PM<sub>2.5</sub> emissions on the Borman Expressway was found when traffic flow speeds increased from 55 mi/h to 75 mi/h. The TAQ model was found to perform well when tested against measured data from I-65 at Lebanon, IN and on I-465 on the southeast side of Indianapolis. This result suggests that traffic management to reduce queues and speeds of less than 30 mph can have a profound effect (74% improvement) on the improvement of PM<sub>2.5</sub> air quality adjacent to the expressway.

NTIS

*Decision Theory; Transportation*

**20080048395** Office of Air Quality Planning and Standards, Research Triangle Park, NC USA

**Design and Criteria for Stage I Vapor Control Systems Gasoline Service Stations**

Nov. 1975; 15 pp.; In English

Report No.(s): PB2009-102643; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Transportation Control Plans (TPC's) promulgated by EPA in 1973 and 1974 include requirements for the control of gasoline vapors at service stations in some 17 Air Quality Control Regions (AQCR's) throughout the nation. In all cases, control of gasoline vapors during storage tank filling (Stage I sources) is required. In many areas, control of vehicle fueling (Stage II sources) is also required. For storage tank filling, EPA regulations prohibit the release of more than 10 percent by weight of displaced organic vapors. While Stage I vapor control systems are relatively new, there has been substantial testing which shows that compliance with prescribed limits can be accomplished at commercial service stations: Tests by oil companies, EPA, and a local control agency indicate that efficiencies greater than 90 percent are effected with simple balance systems if certain common design elements are employed and if the equipment is properly maintained and operated. Based primarily on this testing, criteria have been developed for Stage I control systems. The purpose of this document is to provide direction to operators who are required to install vapor recovery systems.

NTIS

*Air Pollution; Design Analysis; Gasoline; Pollution Control; Refueling; Vapors*

**46**

**GEOPHYSICS**

Includes Earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see *47 Meteorology and Climatology*; and *93 Space Radiation*.

**20080047235** Fried (David L.), USA

**The Up-Link Problem: Using RytovProp for Beam Propagation Calculations--Conference Proceedings (Postprint)**

Fried, David L.; Aug 1, 2008; 27 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9451-06-C-0348; Proj-5299

Report No.(s): AD-A488252; TN-249; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA488252>

RytovProp is a new approach to the task of generating a large number of random realizations manifesting some aspect(s) of the effect of turbulence on optical propagation. This method has been applied to the evaluation of Up-Link performance delivery of laser power from a simple ground transmitter to a satellite. This computational method allows the development of hundreds of thousands of statistically independent random realizations of the laser power density at the satellite in just one or two minutes on an ordinary PC.

DTIC

*Atmospheric Circulation; Conferences; Laser Beams; Satellite Communication*

**20080047471** State Univ. of New York, Buffalo, NY, USA

**Modal Analysis of Generally Damped Linear Structures Subjected to Seismic Excitations**

Song, J.; Chu, Y. L.; Liang, Z.; Lee, G. C.; Mar. 04, 2008; 228 pp.; In English

Contract(s)/Grant(s): DTFH61-98-C-00094

Report No.(s): PB2009-102311; MCEER-08-0005; No Copyright; Avail.: CASI: [A11](#), Hardcopy

Motivated by the need for a systematic approach for seismic evaluation and design of civil engineering structures with supplemental damping, a general modal analysis method, in which over-damped modes are taken into account, is developed and described in this report. This general modal analysis method deals with a unified formulation used to evaluate most structural response quantities of interest, such as displacements, velocity, inter-story drifts, story shear, damping forces and absolute accelerations etc. In addition, a novel general real-valued transformation matrix is established, which can be utilized to decouple the equations of motion of a generally damped structure in terms of real-valued modal coordinates. Non-singularity of this matrix and other properties related to this transformation, such as modal responses to initial conditions, modal energy distribution, modal effective masses and modal truncation etc., are discussed in details to explain the dynamic nature of the generally damped structural system. Furthermore, on the basis of the general modal response history analysis and the white noise input assumption as well as the theory of random vibration, two general modal combination rules for the response spectrum analysis, GCQC and GSRSS are formulated to handle non-classical damping and over-damped modes. To enable the new rules applicable to the practical earthquake engineering, a conversion procedure to construct an over-damped



mode response spectrum compatible with the given 5% standard design response spectrum is established. The adequacy of this conversion procedure is also validated. Examples are given to demonstrate the application of the modal analysis method, to assess the accuracy of the new modal combination rules, and to show that over-damped modes may develop in structures with supplemental damping which can provide significant response contributions to certain response parameters.

NTIS

*Damping; Excitation; Structural Analysis*

**20080047572** Army Cold Regions Research and Engineering Lab., Hanover, NH USA

**Overview of Seismic Noise and its Relevance to Personnel Detection**

Peck, Lindamae; Apr 2008; 29 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489457; ERDC/CRREL-TR-08-5; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Seismic noise refers to the ambient ground motion within which signals of interest are to be detected. Four categories of seismic noise identified by source-road (vehicle), train, wind, and ocean micro-seisms-are reviewed. Examples are given of the variation in seismic noise by geographic location and by season and time of day, and of a technique to characterize seismic site effects from local seismic noise. Noise impact on seismic detection of personnel is discussed, and ground motion induced by a walking person is compared with noise at a rural site when cultural activity is minimal and when a moving vehicle is present.

DTIC

*Clutter; Personnel*

**20080047932** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Image-Based Empirical Modeling of the Plasmasphere**

Adrian, Mark L.; Gallagher, D. L.; December 13, 2008; 1 pp.; In English; American Geophysical Union Conference, 13-20 Dec. 2008, San Francisco, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

A new suite of empirical models of plasmaspheric plasma based on remote, global images from the IMAGE EUV instrument is proposed for development. The purpose of these empirical models is to establish the statistical properties of the plasmasphere as a function of conditions. This suite of models will mark the first time the plasmaspheric plume is included in an empirical model. Development of these empirical plasmaspheric models will support synoptic studies (such as for wave propagation and growth, energetic particle loss through collisions and dust transport as influenced by charging) and serves as a benchmark against which physical models can be tested. The ability to know that a specific global density distribution occurs in response to specific magnetospheric and solar wind factors is a huge advantage over all previous in-situ based empirical models. The consequence of creating these new plasmaspheric models will be to provide much higher fidelity and much richer quantitative descriptions of the statistical properties of plasmaspheric plasma in the inner magnetosphere, whether that plasma is in the main body of the plasmasphere, nearby during recovery or in the plasmaspheric plume. Model products to be presented include statistical probabilities for being in the plasmasphere, near thermal He<sup>+</sup> density boundaries and the complexity of its spatial structure.

Author

*Plasmasphere; Ultraviolet Imagery; Models*

**20080048065** NASA, USA; Geological Survey, USA

**Advanced Land Imager Assessment System**

Chander, Gyanesh; Choate, Mike; Christopherson, Jon; Hollaren, Doug; Morfitt, Ron; Nelson, Jim; Nelson, Shar; Storey, James; Helder, Dennis; Ruggles, Tim; Kaita, Ed; Levy, Raviv; Ong, Lawrence; Markham, Brian; Schweiss, Robert; NASA Tech Briefs, December 2008; December 2008, pp. 27; In English; See also [20080048022](#)

Report No.(s): GSC-15185-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

The Advanced Land Imager Assessment System (ALIAS) supports radiometric and geometric image processing for the Advanced Land Imager (ALI) instrument onboard NASA's Earth Observing-1 (EO-1) satellite. ALIAS consists of two processing subsystems for radiometric and geometric processing of the ALI's multispectral imagery. The radiometric processing subsystem characterizes and corrects, where possible, radiometric qualities including: coherent, impulse; and random noise; signal-to-noise ratios (SNRs); detector operability; gain; bias; saturation levels; striping and banding; and the stability of detector performance. The geometric processing subsystem and analysis capabilities support sensor alignment calibrations, sensor chip assembly (SCA)-to-SCA alignments and band-to-band alignment; and perform geodetic accuracy

assessments, modulation transfer function (MTF) characterizations, and image-to-image characterizations. ALIAS also characterizes and corrects band-to-band registration, and performs systematic precision and terrain correction of ALI images. This system can geometrically correct, and automatically mosaic, the SCA image strips into a seamless, map-projected image. This system provides a large database, which enables bulk trending for all ALI image data and significant instrument telemetry. Bulk trending consists of two functions: Housekeeping Processing and Bulk Radiometric Processing. The Housekeeping function pulls telemetry and temperature information from the instrument housekeeping files and writes this information to a database for trending. The Bulk Radiometric Processing function writes statistical information from the dark data acquired before and after the Earth imagery and the lamp data to the database for trending. This allows for multi-scene statistical analyses.

Author

*Image Processing; Geodetic Accuracy; Terrain; Statistical Analysis; Signal to Noise Ratios; Radiometers; Modulation Transfer Function; Earth Observing System (EOS)*

**20080048082** Applied Technology Council, Redwood City, IA, USA; Multidisciplinary Center for Earthquake Engineering Research, Buffalo, NY, USA; California Univ., Berkeley, CA, USA

**Interim Testing Protocols for Determining the Seismic Performance Characteristics of Structural and Nonstructural Components**

Jun. 2007; 138 pp.; In English

Report No.(s): PB2008-104492; FEMA-461; No Copyright; Avail.: CASI: [A07](#), Hardcopy

The testing protocols provided in this document have been prepared to support the development of seismic performance assessment procedures, which when implemented will enable a better understanding of the probable performance of a building and its constituent components. The protocols are intended to serve as an interim basis for testing of building components and systems to establish their performance capability as measured by their fragility functions. Fragility functions are mathematical relationships used to assess the performance of the individual components, of systems incorporating these components, and entire buildings containing these components, when subjected to loading caused by earthquake ground shaking. A fragility function indicates the probability that a component or system will experience damage at or in excess of a specific level, given that the component or system experiences a specific level of demand. Fragilities are expressed as probability distributions, rather than deterministic relationships in order to account for the uncertainties inherent in the process of predicting damage as a function of demand.

NTIS

*Buildings; Earthquakes; Protocol (Computers); Structural Design*

**20080048220** NASA Marshall Space Flight Center, Huntsville, AL, USA

**A New Polar Magnetic Index of Geomagnetic Activity**

Lyatsky, Wladislaw; Khazanov, George V.; [2008]; 28 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAG5-11995; Copyright; Avail.: Other Sources

We used numerical integration of the particle balance equation for predicting the relativistic electron fluxes at geostationary orbit. The model includes a source and losses. Similar to some earlier prediction models, we used as input parameters only solar wind data. As the source, we used the solar wind coupling function that is a best-fit combination of solar wind parameters responsible for the generation of geomagnetic disturbances. The loss function was derived from recent finding showing an important role played by solar wind density in decaying the relativistic electrons. The relativistic electron fluxes, predicted (for one day ahead) from our model, show the high correlation with the actual electron fluxes 'measured with GOES 10 and 12 spacecraft. We tested the model for four year period from 2004 until present. The correlation coefficient between predicted and actual values of relativistic electron fluxes for whole four year period as well as for each of these four years is about 0.9. The high and stable correlation between the computed and actual electron fluxes shows that the reliable forecasting the relativistic electrons at geostationary orbit is possible.

Author

*Solar Wind; Numerical Integration; Relativistic Particles; Geosynchronous Orbits; High Energy Electrons; Magnetic Disturbances; Mathematical Models; Wind Measurement*

**20080048292** Multidisciplinary Center for Earthquake Engineering Research, Buffalo, NY, USA; California State Dept. of Transportation, Sacramento, CA, USA

**Performance of Seismic Isolation Hardware Under Service and Seismic Loading**

Constantinou, M. C.; Whittaker, A. S.; Kalpakidis, Y.; Fenz, D. M.; Warn, G. P.; Aug. 27, 2007; 472 pp.; In English  
Contract(s)/Grant(s): DTFH61-98-C-00094; CADOT-65A0174

Report No.(s): PB2008-105193; MCEER-07-0012; No Copyright; Avail.: CASI: [A20](#), Hardcopy

This report presents a comprehensive description of the current stage of knowledge on the behavior of hardware used in seismic isolation and in seismic damping systems. Particular emphasis is placed on the description of fundamental behavior under both non-seismic, service-type of loading conditions and under high-speed seismic conditions. Specific problems described and addressed in this report include the following: (a) Aging of elastomeric and sliding bearings, (b) effect of ambient temperature on the behavior of elastomeric and sliding bearings, (c) prediction and experimental verification of effects of frictional heating on the sliding bearings, (d) prediction and experimental verification of effects of hysteretic heating on the lead-rubber bearings, (e) analysis of elastomeric and sliding bearings, (f) design of elastomeric and sliding bearings based on principles of LRFD and ASD, (g) establishment of upper and lower bound values of properties of seismic isolation bearings for use in the analysis and design and (h) detailed new testing protocols for seismic isolators and dampers. The presented information may represent the basis for the development of contemporary Guide Specifications for Seismic Isolation Design. NTIS

*Isolation; Friction Factor; Temperature Effects*

**20080048293** Nevada Univ., Reno, NV, USA; Multidisciplinary Center for Earthquake Engineering Research, Buffalo, NY, USA

**Experimental Evaluation of the Seismic Performance of Hospital Piping Subassemblies**

Goodwin, E. R.; Maragakis, E. M.; Itani, A. M.; Sep. 04, 2007; 208 pp.; In English

Contract(s)/Grant(s): NSF-EEC 9701471

Report No.(s): PB2008-105194; MCEER-07-0013; No Copyright; Avail.: National Technical Information Service (NTIS)

Two piping subassemblies with identical geometries were tested in the Large Scale Structures Laboratory at the University of Nevada, Reno. The experimental piping subassembly was modeled after a typical subassembly in a California hospital. The two subassemblies differed only by their connection details. One subassembly had welded connections; the other had threaded connections. The welded and threaded subassemblies were then tested with and without seismic bracing. The braced welded subassembly was subjected to story drifts up to 4.34 percent with no damage. The braced threaded subassembly began to leak at 2.17 percent and failed at 4.34 percent. The unbraced welded subassembly was subjected to story drifts up to 4.34 percent with no damage. The unbraced threaded subassembly began to leak at 1.08 percent story drift. The welded piping subassemblies exceed the 1997 UBC requirements on drift. The threaded piping systems do not meet the 1997 UBC requirement on drift without sustaining damage.

NTIS

*Hospitals; Pipes (Tubes); Subassemblies*

**20080048516** Army Cold Regions Research and Engineering Lab., Hanover, NH USA

**Identifying Nonstationarity in the Atmospheric Surface Layer**

Andreas, Edgar L; Geiger, Cathleen A; Trevino, George; Claffey, Kerry J; Jan 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-611102T2400

Report No.(s): AD-A490146; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The atmospheric boundary layer is inherently nonstationary. quickly influences the wind speed profile. The the transition in sky conditions as cloud layers develop or dissipate rapidly forces the surface temperature just as do sunrise and sunset transitions. Monin-Obukhov similarity theory, which organizes our understanding of the atmospheric boundary layer especially the atmospheric surface layer relies on two assumptions that seem at odds with this depiction of the atmospheric boundary layer: that the atmosphere is statistically stationary and that the surface is horizontally homogeneous. Because clouds are ubiquitous, we speculate that many of the measurements of the Monin-Obukhov similarity functions that have been reported were collected in nonstationary conditions. Such violations of the premises on which Monin-Obukhov similarity rests may explain some of the scatter that still exists in these 'universal' similarity functions despite almost 50 years of measurements to quantify them. We present a method for identifying nonstationarity. Our method has three advantages: It has

a theoretical basis, it relies on accepted definitions of what constitutes nonstationarity, and it associates a probability as to whether any nonstationary period it identifies is truly nonstationary.

DTIC

*Atmospheric Circulation; Atmospheric Models; Atmospheric Stratification; Earth Surface; Identifying; Surface Layers; Surface Temperature*

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## METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

**20080047280** New Mexico State Univ., Las Cruces, NM, USA; New Mexico Inst. of Mining and Technology, Socorro, NM, USA; Sandia National Labs., Albuquerque, NM USA

### **Development and Testing of a Semi-Distributed Watershed Model: Case Studies Exploring the Impact of Climate Variability and Change in the Rio Salado**

Aragon, C. A.; Vivoni, E. R.; Oct. 2008; 156 pp.; In English

Contract(s)/Grant(s): 109469B

Report No.(s): PB2009-102255; NM-WRRI-TCR-345; No Copyright; Avail.: National Technical Information Service (NTIS)

Water supply problems in the Middle Rio Grande are increasing as New Mexico's population grows and new demands are placed on finite amounts. Policy and decision makers require tools, such as hydrologic models, to assist in the management of water resources. To exacerbate the problem, anticipated variations induced by global warming will have an uncertain impact on water resources. In this work, we develop and test a semi-distributed watershed model for simulating hydrologic conditions in semiarid river basins. The model is applied to the Rio Salado and tested at the point, regional and basin-scales using a range of different atmospheric forcings and a set of plausible climate change scenarios. The model performed well at simulating point-scale soil moisture and gave plausible results for other hydrological variables at the scale of different Hydrologic Response Units (HRU's). Reproducing historical streamflow in the Rio Salado with the model was difficult due to an underestimation of high elevation precipitation in the basin. Nevertheless, forcing the model with stochastically-generated, coarse precipitation fields showed improved results during long-term simulations. More importantly, the climate change scenarios demonstrate the usefulness of the semi-distributed watershed model as a tool for assessing hydrologic impacts of seasonal precipitation and temperature changes.

NTIS

*Climate Change; Computerized Simulation; Variability; Water; Watersheds*

**20080047326** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

### **Couplings Between Changes in the Climate System and Biogeochemistry**

Menon, S.; Denman, K. L.; Brasseur, G.; Chidthaisong, A.; Wofsy, S. C.; Oct. 01, 2007; 90 pp.; In English

Contract(s)/Grant(s): DE-AC02-05CH11231

Report No.(s): DE2008-934721; LBNL-464E; No Copyright; Avail.: National Technical Information Service (NTIS)

The Earth's climate is determined by a number of complex connected physical, chemical and biological processes occurring in the atmosphere, land and ocean. The radiative properties of the atmosphere, a major controlling factor of the Earth's climate, are strongly affected by the biophysical state of the Earth's surface and by the atmospheric abundance of a variety of trace constituents. These constituents include long-lived greenhouse gases (LLGHGs) such as carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O), as well as other radiatively active constituents such as ozone and different types of aerosol particles. The composition of the atmosphere is determined by processes such as natural and anthropogenic emissions of gases and aerosols, transport at a variety of scales, chemical and microphysical transformations, wet scavenging and surface uptake by the land and terrestrial ecosystems, and by the ocean and its ecosystems. These processes and, more generally the rates of biogeochemical cycling, are affected by climate change, and involve interactions between and within the different components of the Earth system. These interactions are generally nonlinear and may produce negative or positive feedbacks to the climate system.

NTIS

*Biochemistry; Biogeochemistry; Climate; Climate Change; Couplings*

**20080047375** Geological Survey, Reston, VA USA

**Portable Chamber Measurements of Evapotranspiration at the Amargosa Desert Research Site Near Beatty, Nye County, Nevada, 2003-06**

Garcia, C. A.; Johnson, M. J.; Andraski, B. J.; Halford, K. J.; Mayers, C. J.; January 2008; 18 pp.; In English  
Report No.(s): PB2009-101388; USGS/SIR-2008-5135; No Copyright; Avail.: National Technical Information Service (NTIS)

Portable chamber measurements of evapotranspiration (ET) were made at the U.S. Geological Survey's Amargosa Desert Research Site in southern Nevada to help quantify component- and landscape-scale contributions to ET in an arid environment. Evapotranspiration data were collected approximately every 3 months from 2003 to 2006. Chamber measurements of ET were partitioned into bare-soil evaporation and mixed-species transpiration components. The component-scale ET fluxes from native shrubs typically surpassed those from bare soil by as much as a factor of four. Component-scale ET fluxes were extrapolated to landscape-scale ET using a one-layer, multi-component canopy model. Landscape-scale ET fluxes predominantly were controlled by bare-soil evaporation. Bare soil covered 94 percent of the landscape on average and contributed about 70 percent of the landscape-scale vapor flux. Creosote bush, an evergreen shrub, accounted for about 90 percent of transpiration on average due to its dominance across the landscape (80 percent of the 6 percent shrub cover) and evergreen character.

NTIS

*Deserts; Evapotranspiration; Nevada*

**20080047405** ImageCat Ltd., Ashted, UK

**MCEER Response: Advanced Technology for Rapid Tornado Damage Assessment Following The 'Super Tuesday' Tornado Outbreak of February 2008**

McMillan, A.; Adams, B. J.; Reynolds, A.; Brown, T.; Liang, D.; Apr. 18, 2008; 22 pp.; In English  
Contract(s)/Grant(s): EEC-9701471

Report No.(s): PB2009-102307; MCEER-08-SP01; No Copyright; Avail.: National Technical Information Service (NTIS)

This field campaign, undertaken in the aftermath of the 2008 'Super Tuesday' tornadoes, presented the team with a unique opportunity to collect geographically located perishable damage data on a per-building level throughout a variety of tornado strengths and environments. This exploration marks the first tornado event where the VIEWS (Visualizing Impacts of Earthquakes with Satellites) system has been deployed to collect detailed ground survey data for identification and mapping of damage in a wide-ranging area. This use again extends the original aim of the VIEWS system and shows its flexibility for multi-hazard damage detection. VIEWS was developed by ImageCat through funding from MCEER. The ground-based deployment shows in detail the type of buildings which populate certain areas, the vegetation surroundings, the building materials that survive and other crucial aspects. In some neighborhoods, debris removal, and even rebuilding, had started to occur very soon after the tornado and prior to the arrival of ground-survey teams; it is therefore essential to collect information rapidly to assess the level of damage before this occurs. These quick response deployments occurred within 1 month of the event. It is envisioned that the data collected will form part of a larger research thrust into tornado damage assessment, wind characterization and improving community resilience.

NTIS

*Buildings; Damage Assessment; Earthquakes; Technology Assessment; Tornadoes*

**20080047477** Geological Survey, Reston, VA USA; Bureau of Reclamation, Washington, DC, USA

**Effects of Potential Future Warming on Runoff in the Yakima River Basin, Washington**

Mastin, M. C.; January 2008; 20 pp.; In English

Report No.(s): PB2009-101876; USGS/SIR-2008-5124; No Copyright; Avail.: National Technical Information Service (NTIS)

The Bureau of Reclamation has implemented a long-term planning study of potential water-storage alternatives in the Yakima River Basin, which includes planning for climate change effects on available water resources in the basin. Previously constructed watershed models for the Yakima River Basin were used to simulate changes in unregulated streamflow under two warmer climate scenarios, one representing a 1 deg C increase in the annual air temperature over current conditions (plus one scenario) and one representing a 2 deg C increase in the annual air temperature over current conditions (plus two scenario). Simulations were done for water years 1981 through 2005 and the results were compared to simulated unregulated runoff for the same period using recorded daily precipitation, and minimum and maximum air temperatures (base conditions). Precipitation was not altered for the two warmer climate change scenarios. Simulated annual runoff for the plus one and plus two scenarios decreased modestly from the base conditions, but the seasonal distribution and the general pattern of runoff

proved to be highly sensitive to temperature changes throughout the basin. Seasonally increased runoff was simulated during the late autumn and winter months for both the plus one and plus two scenarios compared to base conditions. Comparisons at six principal regulatory locations in the basin showed that the maximum percentage increases in runoff over the base conditions during December to March varied from 24 to 48 percent for the plus one scenario and 59 to 94 percent for the plus two scenario. During late spring and summer months, significantly decreased runoff was simulated at these sites for both scenarios compared to base conditions. Simulated maximum decreases in runoff occurred during June and July, and the changes ranged from -22 to -51 percent for the plus one scenario and -44 to -76 percent for the plus two scenario. Differences in total annual runoff at these sites ranged from -1.4 to -3.9 percent for the plus one scenario and from -2.5 to .8.2 percent for the plus two scenario. The percent change of the monthly mean runoff for both scenarios from the base conditions at many points in the basin will be used in a water-management model developed by the Bureau of Reclamation to assess various storage alternatives.

NTIS

*Drainage; Global Warming; River Basins*

**20080047526** Washington Univ., Seattle, WA USA

**Probabilistic Wind Speed Forecasting using Ensembles and Bayesian Model Averaging**

Slougher, J M; Gneiting, Tilmann; Raftery, Adrian E; Oct 14, 2008; 25 pp.; In English

Contract(s)/Grant(s): N00014-01-10745; DMS-0706745

Report No.(s): AD-A489374; TR-544; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489374>

Probabilistic forecasts of wind speed are becoming critical as interest grows in wind as a clean and renewable source of energy, in addition to a wide range of other uses, from aviation to recreational boating. Statistical approaches to wind forecasting offer two particular challenges: the distribution of wind speeds is highly skewed, and wind observations are reported to the nearest whole knot, a much coarser discretization than is seen in other weather quantities. The prevailing paradigm in weather forecasting is to issue deterministic forecasts based on numerical weather prediction models. Uncertainty can then be assessed through ensemble forecasts, where multiple estimates of the current state of the atmosphere are used to generate a collection of deterministic predictions. Ensemble forecasts are often uncalibrated, however, and Bayesian model averaging (BMA) is a statistical way of postprocessing these forecast ensembles to create calibrated predictive probability density functions (PDFs). It represents the predictive PDF as a weighted average of PDFs centered on the individual bias-corrected forecasts, where the weights reflect the forecasts' relative contributions to predictive skill over a training period. In this paper we extend BMA to provide probabilistic forecasts of wind speed, taking account of the skewness of the predictive distributions and the discreteness of the observations. The BMA method is applied to 48-hour ahead forecasts of maximum wind speed over the North American Pacific Northwest in 2003 using the University of Washington mesoscale ensemble, and is shown to provide calibrated and sharp probabilistic forecasts. Comparisons are made between a number of formulations that account for the discretization of the observations.

DTIC

*Bayes Theorem; Forecasting; Wind Velocity*

**20080047605** Army Engineer Research and Development Center, Vicksburg, MS USA

**Concepts for Sensor Data Fusion to Detect Vegetation Stress and Implications on Ecosystem Health Following Hurricane Katrina**

Jackson, Sam S; Raber, George T; Griffith, Jerry A; Graves, Mark R; Sep 2008; 16 pp.; In English

Report No.(s): AD-A489597; ERDC-TM-SWWRP-08-06; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Forest ecosystems, in particular forest wetlands, are very dynamic and offer many ecological benefits because of their complex floral and faunal assemblages. It is important to understand these interactions, thus improving the ability to sustain this precious resource, and as stewards, pass it on. In addition, response to various natural influences, such as severe weather events, is also a vital part of understanding ecosystem health. It is important to quantify not only the obvious, visible damage but also the ambiguous stress these systems have undergone as a result of sustained wind damage. Satellite and airborne-based remote sensing (particularly imagery) are well-established methods for monitoring and assessing large-scale forest damage and are currently used to quantify visible damage. This research establishes proof of concept techniques for fusing sensor data from multiple remote sensing platforms to better understand the requirements needed to characterize subtle damage to forest environments impacted by hurricanes, in this case Hurricane Katrina. These advanced techniques may provide an indication of such vegetation stress before becoming visibly detectable, thus essentially predicting stress induced mortality before it

occurs. This information can be used in formulating mitigation practices in riparian areas and along streams to help reduce sediment intake due to erosion from loss of vegetation, thus improving water quality.

DTIC

*Ecology; Ecosystems; Health; Hurricanes; Multisensor Fusion; Vegetation*

**20080047614** Oklahoma Univ., Norman, OK USA

**Spectral Analysis of Polarimetric Weather Radar Data With Multiple Processes in a Resolution Volume**

Bachmann, Svetlana; DeBrunner, Victor; Zrnicek, Dusan; Yearly, Mark; Apr 2007; 5 pp.; In English

Report No.(s): AD-A489669; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A new approach for the clear air velocity estimation in weather radar is presented. A combination of nonparametric with parametric spectral analyses allows us to identify and extract multiple processes caused by different scatterer types within a single radar resolution volume. An example of clear air observed using an S-band dual polarization radar is presented. Heretofore, migrating birds and wind-blown insects that are mixed within each resolution volume caused such data to be unusable for meteorological interpretation. In this paper, we construct power spectral densities of polarimetric variables. We use the polarimetric spectral densities to differentiate the scatterer types within the observed radar resolution volume. We demonstrate how our combination of non-parametric and parametric spectral analysis can be used to retrieve the true wind velocity in situations with severe contamination by biological scatterers.

DTIC

*Doppler Radar; Meteorological Radar; Polarimetry; Radar Data; Spectrum Analysis; Wind Velocity*

**20080047697** Geological Survey, Reston, VA USA; Bureau of Reclamation, Washington, DC, USA

**Development of a Precipitation-Runoff Model to Simulate Unregulated Streamflow in the Salmon Creek Basin, Okanogan County, Washington**

van Heeswijk, M.; January 2006; 46 pp.; In English

Report No.(s): PB2009-101878; USGS/SIR-2006-5274; No Copyright; Avail.: National Technical Information Service (NTIS)

Surface water has been diverted from the Salmon Creek Basin for irrigation purposes since the early 1900s, when the Bureau of Reclamation built the Okanogan Project. Spring snowmelt runoff is stored in two reservoirs, Conconully Reservoir and Salmon Lake Reservoir, and gradually released during the growing season. As a result of the out-of-basin streamflow diversions, the lower 4.3 miles of Salmon Creek typically has been a dry creek bed for almost 100 years, except during the spring snowmelt season during years of high runoff. To continue meeting the water needs of irrigators but also leave water in lower Salmon Creek for fish passage and to help restore the natural ecosystem, changes are being considered in how the Okanogan Project is operated. This report documents development of a precipitation-runoff model for the Salmon Creek Basin that can be used to simulate daily unregulated streamflows. The precipitation-runoff model is a component of a Decision Support System (DSS) that includes a water-operations model the Bureau of Reclamation plans to develop to study the water resources of the Salmon Creek Basin. The DSS will be similar to the DSS that the Bureau of Reclamation and the U.S. Geological Survey developed previously for the Yakima River Basin in central southern Washington.

NTIS

*Drainage; Hydrology Models; Water Resources*

**20080047768** Schwegman, Lundberg, Woessner and Kluth, Minneapolis, Macau

**Structure Function Monitor (PAT-APPL-11-325 635)**

McGraw, J. T., Inventor; Zimmer, P. C., Inventor; Ackermann, M. R., Inventor; 4 Jan 06; 34 pp.; In English

Contract(s)/Grant(s): DE-AC04-94AL85000

Patent Info.: Filed 4 Jan 06; US-Patent-Appl-SN-11-325 635

Report No.(s): PB2008-105473; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Methods and apparatus for a structure function monitor provide for generation of parameters characterizing a refractive medium. In an embodiment, a structure function monitor acquires images of a pupil plane and an image plane and, from these images, retrieves the phase over an aperture, unwraps the retrieved phase, and analyzes the unwrapped retrieved phase. In an embodiment, analysis yields atmospheric parameters measured at spatial scales from zero to the diameter of a telescope used to collect light from a source.

NTIS

*Monitors; Optical Properties; Patent Applications*

**20080047785** Trellis Intellectual Property Law Group, PC, Palo Alto, CA, USA

**System for Sensing Environmental Conditions**

Doolin, D. M., Inventor; Glaser, S., Inventor; Sitar, N., Inventor; Radke, J., Inventor; 16 Dec 05; 16 pp.; In English

Contract(s)/Grant(s): NSF-EAR-0121693

Patent Info.: Filed Filed 16 Dec 05; US-Patent-Appl-SN-11-303 458

Report No.(s): PB2008-105641; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A system and method for facilitating measurement of environmental conditions such as might be used in emergencies or other situational awareness applications. The method includes dispersing several networked nodes in a region, the nodes being coupled to one or more sensors, and then employing the one or more sensors to sense one or more environmental conditions and providing sensed data in response thereto. In a more specific embodiment, the region exhibits a fire, and the method further includes utilizing the sensed data to predict fire conditions, such as fire movement and temperature. A controller may be employed to selectively adjust power to one or more sensors based on predetermined priorities associated with sensed data output from the one or more sensors.

NTIS

*Detection; Meteorological Parameters; Patent Applications*

**20080047889** National Defense Univ., Washington, DC USA

**Reform of the National Security Science and Technology Enterprise**

Berry, William; Coffey, Timothy; DeYoung, Donald; Kadtko, James; Loeb, Cheryl; Oct 2008; 38 pp.; In English

Report No.(s): AD-A489377; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489377>

A strong science and technology (S&T) program has been vitally important to American national security since World War II and has to date given the USA a strategic advantage over competitors. During World War II and throughout the Cold War, highly specific and large-scale technology needs led to the concentration of national security S&T (NSST) programs in a few agencies, with little cross-agency coordination. Since the end of the Cold War, circumstances have changed greatly. Meeting new and emerging threats to national security from global climate change to the proliferation of weapons of mass destruction and global terrorism requires an effective mechanism for direction, funding, and integration of the highly fragmented and very wide range of Federally supported S&T. Science and technology underlie the elements of national power (diplomacy, intelligence, military, economics), but they are only rarely named as elements of national power, and the priorities, policies, and personnel for S&T are often neglected. Specific S&T capabilities have been particularly isolated in direct applications to traditional security capabilities, and fragmented even more in addressing the new and broad challenges to our security. Thus, the structure and integration of S&T in the Executive Branch agencies, integration of congressional S&T committees, and the roles and responsibilities of Government scientists and engineers, are key issues that must be considered when evaluating how we can significantly improve our nation's security. With the onset of World War II, President Franklin Roosevelt, convinced of the importance of S&T to winning the war effort, created the wartime Office of Scientific Research and Development (OSRD) in 1941. Led by the visionary Vannevar Bush, the goal of the OSRD was to develop a strategic enterprise for national research supporting the military.

DTIC

*Climate; Forecasting; Research and Development; Security; Technologies*

**20080047924** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Nowcasting in the GPM Era**

Hou, Arthur Y.; September 22, 2008; 1 pp.; In English; 10th Plinius Conference on Mediterranean Storms; EGU Topical Conference Series, 22-254Sep. 2008, Nicosia, Cyprus; No Copyright; Avail.: Other Sources; Abstract Only

The Global Precipitation Measurement (GPM) Mission is an international satellite mission to unify and advance global precipitation measurements from a constellation of dedicated and operational microwave sensors. The GPM concept centers on the deployment of a Core Spacecraft in a non-Sun-synchronous orbit at 65deg inclination carrying a dual-frequency precipitation radar (DPR) and a multi-frequency passive microwave radiometer (GMI) with high-frequency capabilities to serve as a precipitation physics observatory and calibration standard for the constellation radiometers. The baseline GPM constellation is envisioned to comprise conical-scanning microwave imagers (e.g., GMI, SSMIS, AMSR, MIS, MADRAS, GPM-Brazil) augmented with cross-track microwave temperature/humidity sounders (e.g., MHS, ATMS) over land. In addition to the Core Satellite, the GPM Mission will contribute a second GMI to be flown in a low-inclination (approx.40deg) non-Sun-synchronous orbit to improve near real-time monitoring of hurricanes. GPM is a science mission with integrated applications goals aimed at (1) advancing the knowledge of the global water/energy cycle variability and freshwater



availability and (2) improving weather, climate, and hydrological prediction capabilities through more accurate and frequent measurements of global precipitation. The GPM Mission is currently a partnership between NASA and the Japan Aerospace Exploration Agency (JAXA), with opportunities for additional partners in satellite constellation and ground validation activities. Within the framework of the inter-governmental Group of Earth Observations (GEO) and Global Earth Observation System of Systems (GEOSS), GPM has been identified as a cornerstone for the Precipitation Constellation (PC) being developed under the auspices of Committee of Earth Observation Satellites (CEOS). The GPM Core Observatory is scheduled for launch in 2013, followed by the launch of the GPM Low-Inclination Observatory in 2014. An overview of the GPM mission status, measurement capabilities, ground validation plans, and anticipated contributions to scientific research and societal applications with a special emphasis on nowcasting will be presented.

Author

*Precipitation Measurement; Remote Sensing; Earth Observations (From Space); Climate; Precipitation (Meteorology); Real Time Operation; Multispectral Radar*

**20080047960** NASA Goddard Space Flight Center, Greenbelt, MD, USA

### **The Long-term Middle Atmospheric Influence of Very Large Solar Proton Events**

Jackman, Charles H.; Marsh, Daniel R.; Vitt, Francis M.; Garcia, Rolando R.; Randall, Cora E.; Fleming, Eric L.; Frith, Stacey M.; [2008]; 53 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A04](#), Hardcopy

Long-term variations in ozone have been caused by both natural and humankind related processes. The humankind or anthropogenic influence on ozone originates from the chlorofluorocarbons and halons (chlorine and bromine) and has led to international regulations greatly limiting the release of these substances. Certain natural ozone influences are also important in polar regions and are caused by the impact of solar charged particles on the atmosphere. Such natural variations have been studied in order to better quantify the human influence on polar ozone. Large-scale explosions on the Sun near solar maximum lead to emissions of charged particles (mainly protons and electrons), some of which enter the Earth's magnetosphere and rain down on the polar regions. 'Solar proton events' have been used to describe these phenomena since the protons associated with these solar events sometimes create a significant atmospheric disturbance. We have used the National Center for Atmospheric Research (NCAR) Whole Atmosphere Community Climate Model (WACCM) to study the long-term (> few months) influences of solar proton events from 1963 through 2004 on stratospheric ozone and temperature. There were extremely large solar proton events in 1972, 1989, 2000, 2001, and 2003. These events caused very distinctive polar changes in layers of the Earth's atmosphere known as the stratosphere (12-50 km; -7-30 miles) and mesosphere (50-90 km; 30-55 miles). The solar protons connected with these events created hydrogen- and nitrogen-containing compounds, which led to the polar ozone destruction. The nitrogen-containing compounds, called odd nitrogen, lasted much longer than the hydrogen-containing compounds and led to long-lived stratospheric impacts. An extremely active period for these events occurred in the five-year period, 2000- 2004, and caused increases in odd nitrogen which lasted for several months after individual events. Associated stratospheric ozone decreases of >10% were calculated to last for up to five months past the largest events. However, the computed total column ozone and stratospheric temperature changes connected with the solar events were not found to be statistically significant. Thus, solar proton events do not likely contribute significantly to measured total column ozone fluctuations and stratospheric temperature changes.

Author

*Solar Activity Effects; Atmospheric Models; Charged Particles; Climate Models; Earth Magnetosphere; Hydrogen Compounds; Man Environment Interactions; Nitrogen Compounds; Solar Protons*

**20080047962** Science Systems and Applications, Inc., Lanham, MD, USA

### **Comparison of GPCP Monthly and Daily Precipitation Estimates with High-Latitude Gauge Observations**

Bolvin, David T.; Adler, Robert G.; Nelkin, Eric J.; Poutiainen, Jani; [2008]; 32 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

It is very important to know how much rain and snow falls around the world for uses that range from crop forecasting to disaster response, drought monitoring to flood forecasting, and weather analysis to climate research. Precipitation is usually measured with rain gauges, but rain gauges don't exist in areas that are sparsely populated, which tends to be a good portion of the globe. To overcome this, meteorologists use satellite data to estimate global precipitation. However, it is difficult to estimate rain and especially snow in cold climates using most current satellites. The satellite sensors are often 'confused' by a snowy or frozen surface and therefore cannot distinguish precipitation. One commonly used satellite-based precipitation data set, the Global Precipitation Climatology Project (GPCP) data, overcomes this frozen-surface problem through the innovative use of two sources of satellite data, the Television Infrared Observation Satellite Operational Vertical Sounder (TOVS) and the Atmospheric Infrared Sounder (AIRS). Though the GPCP estimates are generally considered a very reliable source of

precipitation, it has been difficult to assess the quality of these estimates in cold climates due to the lack of gauges. Recently, the Finnish Meteorological Institute (FMI) has provided a 12-year span of high-quality daily rain gauge observations, covering all of Finland, that can be used to compare with the GPCP data to determine how well the satellites estimate cold-climate precipitation. Comparison of the monthly GPCP satellite-based estimates and the FMI gauge observations shows remarkably good agreement, with the GPCP estimates being 6% lower in the amount of precipitation than the FMI observations. Furthermore, the month-to-month correlation between the GPCP and FMI is very high at 0.95 (1.0 is perfect). The daily GPCP estimates replicate the FMI daily occurrences of precipitation with a correlation of 0.55 in the summer and 0.45 in the winter. The winter result indicates the GPCP estimates have skill in 'seeing' snowfall, which is the most challenging situation. Thus, the GPCP data set successfully overcomes a current limitation in satellite meteorology, namely the estimation of cold-climate precipitation. The success of the GPCP data set bodes well for future missions, whose instrumentation is specifically designed to give even more information for addressing cold-climate precipitation.

Author

*Atmospheric Sounding; Climatology; Forecasting; Snow; Precipitation (Meteorology); Meteorology; Meteorological Satellites; Infrared Instruments; Floods*

**20080047982** California Inst. of Tech., Pasadena, CA, USA

#### **Polar Traverse Rover Instrument**

Karlsson, Henrik; Radulescu, Andreea; Behar, Alberto; Pegors, Mika; NASA Tech Briefs, October 2008; October 2008, pp. 22; In English; See also [20080047981](#)

Report No.(s): NPO-45463; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3290>

A Polar Traverse Rover (PTR) is a device designed to determine the role of Antarctica in the global climate system by determining typical paths of continental air that passes the South Pole, and by obtaining insight into the relationship between events at the Antarctic and the meteorology of sub-polar altitudes. The PTR is a 2-m-diameter ball in which an Iridium modem, with an integrated global positioning system (GPS) receiver and a commercial lithium battery pack, is suspended. The modem is attached to an aluminum plate and is surrounded by shock-absorbing plastic for protection. This core is attached to the interior walls of the shell by strings on three axis points. The unit's total weight is 10 kg, and it returns data regarding location, altitude, ground velocity, and vertical velocity. The PTR traverses the terrain solely through being blown around by the wind. The unit is much lighter than its predecessor, the Tumbleweed, and requires less wind to put it in motion and to sustain motion. The system is autonomous, requiring minimal monitoring, and enables long-range, unmanned scientific surface surveys in harsh environments.

Author

*Roving Vehicles; Autonomy; Polar Meteorology; Global Positioning System; Antarctic Regions; Position (Location); Modems*

**20080048034** California Inst. of Tech., Pasadena, CA, USA

#### **Reducing Surface Clutter in Cloud Profiling Radar Data**

Tanelli, Simone; Pak, Kyung; Durden, Stephen; Im, Eastwood; NASA Tech Briefs, December 2008; December 2008, pp. 6-7; In English; See also [20080048022](#)

Report No.(s): NPO-44873; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3414>

An algorithm has been devised to reduce ground clutter in the data products of the CloudSat Cloud Profiling Radar (CPR), which is a nadir-looking radar instrument, in orbit around the Earth, that measures power backscattered by clouds as a function of distance from the instrument. Ground clutter contaminates the CPR data in the lowest 1 km of the atmospheric profile, heretofore making it impossible to use CPR data to satisfy the scientific interest in studying clouds and light rainfall at low altitude. The algorithm is based partly on the fact that the CloudSat orbit is such that the geodetic altitude of the CPR varies continuously over a range of approximately 25 km. As the geodetic altitude changes, the radar timing parameters are changed at intervals defined by flight software in order to keep the troposphere inside a data-collection time window. However, within each interval, the surface of the Earth continuously 'scans through' (that is, it moves across) a few range bins of the data time window. For each radar profile, only few samples [one for every range-bin increment ( $\Delta r = 240$  m)] of the surface-clutter signature are available around the range bin in which the peak of surface return is observed, but samples in consecutive radar profiles are offset slightly (by amounts much less than  $\Delta r$ ) with respect to each other according to the relative change in geodetic altitude. As a consequence, in a case in which the surface area under examination is homogenous (e.g., an ocean surface), a sequence of consecutive radar profiles of the surface in that area contains samples of the surface response with range resolution  $\Delta p$  much finer than the range-bin increment ( $\Delta p \ll r$ ). Once the high-resolution surface response

has thus become available, the profile of surface clutter can be accurately estimated by use of a conventional maximum-correlation scheme: A translated and scaled version of the high-resolution surface response is fitted to the observed low-resolution profile. The translation and scaling factors that optimize the fit in a maximum-correlation sense represent (1) the true position of the surface relative to the sampled surface peak and (2) the magnitude of the surface backscatter. The performance of this algorithm has been tested on CloudSat data acquired over an ocean surface. A preliminary analysis of the test data showed a surface-clutter-rejection ratio over flat surfaces of >10 dB and a reduction of the contaminated altitude over ocean from about 1 km to about 0.5 km (over the ocean). The algorithm has been embedded in CloudSat L1B processing as of Release 04 (July 2007), and the estimated flat surface clutter is removed in L2B-GEOPROF product from the observed profile of reflectivity (see CloudSat product documentation for details and performance at <http://www.cloudsat.cira.colostate.edu/dataSpecs.php?prodid=1>).

Author

*Clutter; Noise Reduction; CloudSat; Applications Programs (Computers); Radar Data*

**20080048078** Meteorological Satellite Center, Kiyose, Japan

**Monthly Report of the Meteorological Satellite Center: July 2008**

July 2008; In English; Copyright; Avail.: Other Sources

The CD-ROM concerning the July 2008 Monthly Report of the Meteorological Satellite Center (MSC) contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the Polar Orbital Meteorological Satellites operated by NOAA. The CD-ROM contains the following observation data: Full Disk Earth's Cloud Image; Cloud Image of Japan and its vicinity; Cloud Amount; Sea Surface Temperature; Cloud Motion Wind; Water Vapor Motion Wind; Equivalent Blackbody Temperature; OLR (Out-going Longwave Radiation), Solar Radiation; Snow and Ice Index; Orbit Data; Attitude Data; VISSR Image Data Catalog (Cartridge Magnetic Tape (CMT), Micro Film); TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water; and TOVS Total Ozone Amount.

Derived from text

*Satellite Observation; Satellite Sounding; Atmospheric Sounding; Meteorological Parameters; Satellite Imagery; Japan*

**20080048079** Pan American Health Organization, Washington, DC, USA

**Hurricane Georges Reconstruction and Recovery Project in the Eastern Caribbean. Quarterly Report April-June 2001**

Jun. 2001; 5 pp.; In English

Report No.(s): PB2008-104497; No Copyright; Avail.: CASI: [A01](#), Hardcopy

This is the sixth quarterly report on the Hurricane Georges Reconstruction and Recovery Project currently underway in the countries of Antigua & Barbuda and St. Kitts & Nevis.

NTIS

*Caribbean Region; Caribbean Sea; Disasters; Hurricanes*

**20080048091** NASA Marshall Space Flight Center, Huntsville, AL, USA

**The Impact of High Resolution Sea Surface Temperatures on the Simulated Nocturnal Florida Marine Boundary Layer**

LaCasse, Katherine M.; Splitt, Michael E.; Lazarus, Steven M.; Lapenta, William M.; [2007]; 63 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

High and low resolution sea surface temperature (SST) analysis products are used to initialize the Weather Research and Forecasting (WRF) model for the month of May 2004 for short-term forecasts over Florida and surrounding waters. Initial and boundary conditions for the simulations were provided by a combination of observations, large scale model output, and analysis products. The impact of using a 1-km Moderate Resolution Imaging Spectroradiometer (MODIS) SST composite on subsequent evolution of the marine atmospheric boundary layer (MABL) is assessed through simulation comparisons and limited validation. Model results are presented for individual simulations, as well as for aggregates of easterly and westerly dominated low level flows. The simulation comparisons show that the use of MODIS SST composites result in enhanced convergence zones, earlier and more intense horizontal convective rolls, and an increase in precipitation as well as change in precipitation location. Validation of 10 m winds with buoys shows a slight improvement in wind speed. The most significant results of this study of this study are i) vertical wind stress divergence and pressure gradient accelerations across the Florida Current region vary in importance as a function of flow direction and stability and ii) the warmer Florida Current in the

MODIS product transports heat vertically and downwind of this heat source, modifying the thermal structure and the MABL wind field primarily through pressure gradient adjustments.

Author

*Sea Surface Temperature; Forecasting; High Resolution; MODIS (Radiometry); Atmospheric Boundary Layer; Marine Meteorology; Shear Stress*

**20080048093** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Electrification in Hurricanes: Implications for Water Vapor in the Tropical Tropopause Layer**

Pittman, J. V.; Chronis, T. G.; Robertson, F. R.; Miller, T. L.; [2007]; 17 pp.; In English; Original contains black and white illustrations; No Copyright; Avail.: Other Sources

This study explores the relation between lightning frequency associated with hurricanes and water vapor in the Tropical Tropopause Layer (TTL) over the Tropical Americas (Caribbean and Gulf of Mexico) during the 2005 hurricane season. The hypothesis herein is that hurricanes that exhibit increases in lightning frequency are associated with stronger updrafts that can transport more moisture into the TTL. This added moisture can potentially be transported irreversibly into the stratosphere and alter the chemical and radiative properties of this layer of the atmosphere. Several studies predict increases in hurricane intensity, particularly in the Atlantic basin, as a result of increases in sea surface temperature due to global warming. Given that climate forecasts are very sensitive to water vapor concentrations in the TTL and in the stratosphere, it is essential to understand the effect that hurricanes have on TTL moisture. In our analysis, we use a combination of ground-based and space-borne measurements. These measurements consist of cloud-to-ground lightning data from the Long Range Lightning Detection Network, GOES 12 infrared brightness temperatures, and water vapor from the Microwave Limb Sounder instrument aboard the Aura satellite obtained at 100, 147a, and 215 hPa. In general, we find a negative correlation between lightning frequency and storm intensification (i.e., minimum central pressure) with a significant storm-to-storm variability. On hurricane days, we find hydration within 5 from the center of the storm at the 215 and 147 hPa levels, and practically no perturbation to the 100 hPa water vapor field by the storms. Statistical analysis show weak but statistically significant correlations between lightning frequency and 215 hPa MLS water vapor ( $r = +0.2115$ ), 215 hPa and 147 hPa MLS water vapor ( $r = +0.2689$ ), and 147 hPa and 100 hPa MLS water vapor ( $r = -0.2936$ ). These correlations suggest that increases in lightning frequency correspond to hydration of the upper troposphere and dehydration of the 100 hPa level within the hurricane.

Author

*Brightness Temperature; Cloud-to-Ground Discharges; Electrification; Hurricanes; Sea Surface Temperature; Water Vapor*

**20080048096** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Forecasting Lightning Threat using Cloud-Resolving Model Simulations**

McCaul, Eugene W., Jr.; Goodman, Steven J.; LaCasse, Katherine M.; Cecil, Daniel J.; [2008]; 60 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NA07AANEG0284; Copyright; Avail.: Other Sources

Two new approaches are proposed and developed for making time and space dependent, quantitative short-term forecasts of lightning threat, and a blend of these approaches is devised that capitalizes on the strengths of each. The new methods are distinctive in that they are based entirely on the ice-phase hydrometeor fields generated by regional cloud-resolving numerical simulations, such as those produced by the WRF model. These methods are justified by established observational evidence linking aspects of the precipitating ice hydrometeor fields to total flash rates. The methods are straightforward and easy to implement, and offer an effective near-term alternative to the incorporation of complex and costly cloud electrification schemes into numerical models. One method is based on upward fluxes of precipitating ice hydrometeors in the mixed phase region at the -15 C level, while the second method is based on the vertically integrated amounts of ice hydrometeors in each model grid column. Each method can be calibrated by comparing domain-wide statistics of the peak values of simulated flash rate proxy fields against domain-wide peak total lightning flash rate density data from observations. Tests show that the first method is able to capture much of the temporal variability of the lightning threat, while the second method does a better job of depicting the areal coverage of the threat. Our blended solution is designed to retain most of the temporal sensitivity of the first method, while adding the improved spatial coverage of the second. Exploratory tests for selected North Alabama cases show that, because WRF can distinguish the general character of most convective events, our methods show promise as a means of generating quantitatively realistic fields of lightning threat. However, because the models tend to have more difficulty in predicting the instantaneous placement of storms, forecasts of the detailed location of the lightning threat based on single simulations can be in error. Although these model shortcomings presently limit the precision of lightning threat forecasts from individual runs of current generation models, the techniques proposed herein should continue to be applicable as newer and

more accurate physically-based model versions, physical parameterizations, initialization techniques and ensembles of forecasts become available.

Author

*Clouds (Meteorology); Forecasting; Atmospheric Models; Storms; Lightning; Predictions; Electrification*

**20080048104** Organisation of Eastern Caribbean States, Castries, Saint Lucia

**Hurricane Lenny Recovery Project in the Eastern Caribbean. Quarterly Report April-June 2001**

Jun. 2001; 4 pp.; In English

Report No.(s): PB2008-104498; No Copyright; Avail.: CASI: [A01](#), Hardcopy

This is the third quarterly report on the Hurricane Lenny SpO Activities for work in Grenada, Dominica, St. Lucia and Antigua & Barbuda.

NTIS

*Caribbean Region; Caribbean Sea; Disasters; Hurricanes*

**20080048105** Forest Service, Seattle, WA, USA

**Science Findings, Issue Seventy Four, July 2005. Fanning the Flames: Climate Change Stack Odds Against Fire Suppression**

Jul. 2005; 6 pp.; In English

Report No.(s): PB2008-104575; No Copyright; Avail.: CASI: [A02](#), Hardcopy

There is little question that global warming would increase the risk of wildfires by drying out vegetation and stirring the winds that spread fire. Until recently, however, land managers were unable to formulate appropriate responses because the spatial scales of predictions were far too coarse. Current research being done at the PNW Research Station in Portland, Oregon, has offered the first geographically specific estimate of the potential effect of climate change on wildfires in the USA. Simulations for three multicounty areas in northern California under a climate change scenario found that the number of fast-spreading fires will increase, mostly in grass and brush fuels. There will be little change in forested areas. The biggest increases in fire size and escape frequency will occur in low-population-density zones, where fire suppression is currently less intense. When these results are interpolated to cover all of the State Responsibility Areas in northern California, an additional 114 escapes per year can be anticipated, on top of the 110 expected under the current climate. Simulated climate change affected the predicted fire spread rate and intensity, resulting in a surprisingly large impact on fire outcomes. This issue is of keen interest to natural resource managers, fire protection planners, policymakers, and insurance companies.

NTIS

*Climate Change; Fires; Global Warming; Spreading*

**20080048106** Forest Service, Seattle, WA, USA

**Science Findings, Issue Seventy Five, August 2005. Climate Change and California: Potential Implications for Vegetation, Carbon, and Fire**

Aug. 2005; 6 pp.; In English

Report No.(s): PB2008-104576; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Nineteen scientists from leading research institutes in the USA collaborated to estimate how California's environment and economy would respond to global climate change. A scientist from the PNW Research Station led efforts to estimate effects on vegetation, carbon, and fire. To quantify the range of the possible effects of climate change over the next century, researchers used state-of-the-art climate change simulations coupled with a dynamic vegetation model to gauge sensitivity of natural ecosystems in California under several climate scenarios. The results suggest that climate change would have a more pervasive impact on the vegetation community diversity than would urbanization. Vegetation is estimated to migrate to higher elevations, which would result in reductions in the area covered by alpine meadows and subalpine forests. The area of commercially-important softwood tree species and the state's signature woodlands and shrublands are predicted to decline with warming. Climate change could also affect fire frequency and the area burned annually, with most of the scenarios resulting in increased fire. Finally, the simulations showed that reducing emissions of carbon dioxide over the next several decades could buffer the longer term impacts of global warming.

NTIS

*Carbon; Climate Change; Fires; Global Warming; Spreading; Vegetation*

**20080048128** HyPerspectives, Bozeman, MT, USA

**Processing LiDAR Data to Predict Natural Hazards**

Fairweather, Ian; Crabtree, Robert; Hager, Stacey; NASA Tech Briefs, September 2008; September 2008, pp. 58; In English; See also [20080048125](#)

Report No.(s): SSC-00279; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3209>

ELF-Base and ELF-Hazards (wherein 'ELF' signifies 'Extract LiDAR Features' and 'LiDAR' signifies 'light detection and ranging') are developmental software modules for processing remote-sensing LiDAR data to identify past natural hazards (principally, landslides) and predict future ones. ELF-Base processes raw LiDAR data, including LiDAR intensity data that are often ignored in other software, to create digital terrain models (DTMs) and digital feature models (DFMs) with sub-meter accuracy. ELF-Hazards fuses raw LiDAR data, data from multispectral and hyperspectral optical images, and DTMs and DFMs generated by ELF-Base to generate hazard risk maps. Advanced algorithms in these software modules include line-enhancement and edge-detection algorithms, surface-characterization algorithms, and algorithms that implement innovative data-fusion techniques. The line-extraction and edge-detection algorithms enable users to locate such features as faults and landslide headwall scarps. Also implemented in this software are improved methodologies for identification and mapping of past landslide events by use of (1) accurate, ELF-derived surface characterizations and (2) three LiDAR/optical-data-fusion techniques: post-classification data fusion, maximum-likelihood estimation modeling, and hierarchical within-class discrimination. This software is expected to enable faster, more accurate forecasting of natural hazards than has previously been possible.

Author

*Optical Radar; Computer Programs; Weather Forecasting; Remote Sensing; Data Processing; Multisensor Fusion*

**20080048288** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**A Possible Explanation for the 'Ozone Croissant'**

Stajner, Ivanka; Hayashi, Hiroo; Hitchman, Matthew H.; Rogal, Marek J.; Huesmann, Amihan S.; [2008]; 19 pp.; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

Monthly mean column ozone during southern winter and spring usually exhibits a croissant-shaped maximum near 50degS: extending from the Indian to Pacific Ocean, maximizing in October. A case study for August 2000 using a new assimilated ozone data set shows an example of transport by synoptic waves. We hypothesize that maintenance of the ozone croissant involves three primary aspects: 1) Seasonal and geographical dependence is controlled by monsoon outflow into the southern Indian Ocean. 2) Upward amplification of the Australian High (AH) often coincides with a stalling planetary wave two ridge, providing a rich source of ozone for descent down the 'ozone slide' into synoptic troughs. 3) A monsoon outflow pulse amplifies the AH and leads to an adjacent ozone-rich trough and packet of breaking Rossby waves. They disperse ozone eastward, possibly contributing to the upper tropospheric wave one maximum in the subtropical Atlantic.

Author

*Tropospheric Waves; Ozone; Monsoons; Pacific Ocean; Planetary Waves*

**20080048320** National Centers for Environmental Prediction, Silver Spring, MD USA

**Service Assessment: Tornadoes in Southern Alabama and Georgia on March 1, 2007**

Nov. 2007; 33 pp.; In English

Report No.(s): PB2008-104688; No Copyright; Avail.: National Technical Information Service (NTIS)

During the afternoon and evening of March 1, 2007, deadly tornadoes moved across southern Alabama and Georgia. In a 14-hour period beginning at 12:30 p.m. CST, 31 tornadoes occurred, resulting in 19 fatalities across the two states. Eleven of the tornadoes were classified as strong (EF2-EF3) on the new Enhanced Fujita Tornado Intensity Scale and two were classified as violent (EF4). Due to the magnitude of this event, a service assessment team was formed to examine the warning and forecast services provided to key decision makers and the public. In keeping with the NOAA goals of developing hazard-resilient communities, the team was also tasked with trying to identify possible reasons for the large loss of life during this event, in light of the overall high quality of services provided by the National Weather Service. The findings and recommendations from this assessment are offered with the goals of (1) improving the quality of warning and forecast products and services, and (2) enhancing the ability of the National Weather Service (NWS) to increase public education and awareness regarding issues associated with tornado safety. The ultimate goal is to help meet the NWS mission of saving lives and property and enhancing the national economy.

NTIS

*Alabama; Forecasting; Tornadoes*

**20080048321** National Centers for Environmental Prediction, Silver Spring, MD USA

**Houston/Galveston National Weather Service Hurricane Workshop**

January 2007; 44 pp.; In English

Report No.(s): PB2008-104689; No Copyright; Avail.: National Technical Information Service (NTIS)

The purpose of our workshop is to increase public awareness of the hurricane hazards for our area and to give citizens useful information on how to prepare for and respond to a landfalling hurricane. Each year, we focus on an important aspect of hurricane preparedness or look at lessons learned from significant events from the previous season. This year we chose to focus on being hurricane prepared from the community, to the business or institution, and to the family and individual. The speakers reflect on various aspects of overall hurricane preparedness, while the breakout sessions will provide helpful information on how to prepare and respond to such a threat in our area. Additionally, Interfaith Ministries present breakout sessions designed to meet the needs of the faith communities. Furthermore, we have a multitude of vendors in the exhibit area who can provide various products and services related to hurricane preparedness.

NTIS

*Disasters; Houston (TX); Hurricanes*

**20080048324** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**National Energy Research Scientific Computing Center**

Aug. 2007; 96 pp.; In English

Report No.(s): PB2008-104775; LBNL-63342; No Copyright; Avail.: National Technical Information Service (NTIS)

Those conclusions were based on the research of thousands of scientists worldwide, including the climate simulations created by Warren Washington and his colleagues at the National Center for Atmospheric Research (NCAR) and elsewhere using CCSM3, a climate code whose development was funded primarily by the National Science Foundation (NSF) and the Department of Energy (DOE). These simulations investigate the response of the Earth's climate to future emissions scenarios that represent different policy choices for energy use and global development. Data produced by these simulations are freely available to the research and education community via the DOE Earth System Grid. Among the recent studies based on these and other simulations are two that forecast more severe storms and more extreme weather in general.

NTIS

*Climate; Energy Technology; Simulation*

**20080048344** National Inst. of Standards and Technology, Gaithersburg, MD USA

**Determining Uncertainties of Relative Humidity, Dew/Frost-Point Temperature, and Mixing Ratio in a Humidity Standard Generator**

Huang, P. H.; January 2008; 11 pp.; In English

Report No.(s): PB2008-105918; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper presents an extension of the authors previous work on determining the uncertainty of dew/frost-point temperature to cover uncertainties of both relative humidity and mixing ratio in a two-pressure and/or two-temperature type precision humidity generators which are used by most of national standards laboratories in the world. Three analytical equations, based on the thermodynamic relations governing such generators are derived to express the expanded uncertainties of the relative humidity, dew/frost-point temperature, and mixing ratio, respectively.

NTIS

*Dew Point; Frost; Humidity; Humidity Measurement; Mixing Ratios; Temperature Ratio*

**20080048362** Government Accountability Office, Washington, DC, USA

**National Flood Insurance Program: Greater Transparency and Oversight of Wind and Flood Damage Determinations Are Needed**

Dec. 2007; 40 pp.; In English

Report No.(s): PB2008-106487; GAO-08-28; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Disputes between policyholders and insurers after the 2005 hurricane season highlight the challenges in understanding the cause and extent of damages when properties are subjected to both high winds and flooding. Questions remain over the adequacy of steps taken by the Federal Emergency Management Agency (FEMA) to ensure that claims paid by the National Flood Insurance Program (NFIP) cover only those damages caused by flooding. GAO was asked to evaluate (1) issues that arise when multiple insurance policies provide coverage for losses from a single event, (2) state regulators' oversight of loss adjusters, and (3) information that NFIP collects to assess the accuracy of damage determinations and payments. GAO

collected data from FEMA, reviewed reinspection reports and relevant policies and procedures, and interviewed state regulatory officials and others about adjuster oversight and NFIP.

NTIS

*Damage Assessment; Emergencies; Flood Damage; Floods; Hurricanes; Insurance (Contracts)*

**20080048369** Stockholm Univ., Sweden

**International Meteorological Institute in Stockholm (IMI) and Department of Meteorology, Stockholm University (MISU) Biennial Report 2005-2006**

January 2007; 99 pp.; In English

Report No.(s): PB2009-102357; No Copyright; Avail.: National Technical Information Service (NTIS)

The extensive international network in the field of atmospheric science and oceanography established at the institute has provided an excellent platform for co-operative research. This co-operation is directed to fundamental research as well as to providing scientific knowledge in the development of society on the national and international levels. The specific scientific research projects are dealt with in some detail in the following chapters. The present introduction outlines a few ongoing major international col-laborative activities.

NTIS

*Aerosols; Atmospheric Physics; Meteorology*

**20080048382** National Academy of Sciences - National Research Council, Washington, DC, USA

**Global Climate Change and Extreme Weather Events: Understanding the Contributions to Infectious Disease Emergence. Workshop Summary**

Relman, D. A.; Hamburg, M. A.; Chofness, E. R.; Mack, A.; January 2008; 302 pp.; In English

Report No.(s): PB2009-102642; Copyright; Avail.: National Technical Information Service (NTIS)

Long before the germ theory of disease was described, late in the nineteenth century, humans knew that climatic conditions influence the appearance and spread of epidemic diseases. Ancient notions about the effects of weather and climate on disease remain embedded in our collective consciousness--through expressions such as cold for rhinovirus infections; malaria, derived from the Latin for bad air; and the common complaint of feeling under the weather. Today, evidence is mounting that earth's climate is changing at a faster rate than previously appreciated, leading researchers to view the longstanding relationships between climate and disease with new urgency and from a global perspective. On December 4 and 5, 2007, the Forum on Microbial Threats hosted a public workshop in Washington, DC to consider the possible infectious disease impacts of global climate change and extreme weather events on human, animal, and plant health, as well as their expected implications for global and national security.

NTIS

*Climate Change; Climatology; Infectious Diseases*

**20080048390** Department of Homeland Security, Washington, DC, USA

**Hurricane Katrina: Wind Versus Flood Issues**

Sep. 2008; 53 pp.; In English

Report No.(s): PB2009-103057; OIG-08-97; No Copyright; Avail.: National Technical Information Service (NTIS)

This report addresses the Federal Emergency Management Agency's (FEMA) oversight of the Write-Your-Own companies performance in adjusting National Flood Insurance Program flood claims in the wake of Hurricane Katrina. We were directed in the Department of Homeland Security Appropriations Act, 2007 to determine whether damages from wind were improperly attributed to flooding. We examined relevant documentation and interviewed FEMA and insurance officials to assess the flood insurance adjustment process. This report provides Congress and FEMA with our findings and conclusions.

NTIS

*Floods; Hurricanes; Insurance (Contracts)*

**20080048486** Army Electronics Command, White Sands Missile Range, NM USA

**Boundary Layer Dust Occurrence IV Atmospheric Dust Over Selected Geographical Areas**

Hinds, B D; Hoidale, G B; Jun 1977; 92 pp.; In English

Report No.(s): AD-A489935; ECOM-DR-77-3; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This is the fourth in a series of reports designed to provide a guide to the occurrence of atmospheric dust over selected geographical areas. Tabular data on the duration and on the diurnal and monthly variations in the probability of occurrence



of blowing dust (visibility less than 11 km) and of dust storms (visibility less than 1 km) are presented for 45 stations which averaged at least 3.7 days per year (1%) with blowing dust. The 45 stations were geographically distributed as follows: Angola (2), Australia (1), China (1), Italy (1), Mali (13), Mauritania (11), Mexico (4), Niger (5), North Korea (1), Peru (2), South Korea (1), Spanish Sahara (2), and Venezuela (1). For 257 stations (in 35 countries) which averaged less than 3.7 days per year with blowing dust, tabular dust data are limited to the mean annual number of days with blowing dust and dust storms.

DTIC

*Atmospheric Attenuation; Boundary Layers; Dust*

## 48

### OCEANOGRAPHY

Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics; and marine resources. For related information see also 43 *Earth Resources and Remote Sensing*.

**20080047371** NASA Stennis Space Center, Stennis Space Center, MS, USA

#### **Coastal Marsh Monitoring for Persistent Saltwater Intrusion**

Hall, Callie M.; October 28, 2008; 26 pp.; In English; Mississippi-Alabama Bays and Bayous Symposium 2008, 28-29 Oct. 2008, Biloxi, MS, USA; Original contains color and black and white illustrations

Report No.(s): SSTI-2220-0174; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047371>

This viewgraph presentation reviews NASA's work on the project that supports the Gulf of Mexico Alliance (GOMA) Governors Action Plan to monitor the coastal wetlands for saltwater intrusion. The action items that relate to the task are: (1) Obtain information on projected relative sea level rise, subsidence, and storm vulnerability to help prioritize conservation projects, including restoration, enhancement, and acquisition, and (2) Develop and apply ecosystem models to forecast the habitat structure and succession following hurricane disturbance and changes in ecological functions and services that impact vital socio-economic aspects of coastal systems. The objectives of the program are to provide resource managers with remote sensing products that support ecosystem forecasting models requiring salinity and inundation data. Specifically, the proposed work supports the habitat-switching modules in the Coastal Louisiana Ecosystem Assessment and Restoration (CLEAR) model, which provides scientific evaluation for restoration management.

CASI

*Coasts; Ecosystems; Environment Models; Intrusion; Remote Sensing; Sea Level; Subsidence; Wetlands; Marine Environments; Coastal Water*

**20080047684** NASA Goddard Space Flight Center, Greenbelt, MD, USA

#### **Modeling Coccolithophores in the Global Oceans**

Gregg, Watson W.; Casey, Nancy W.; [2006]; 28 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

Coccolithophores are important ecological and geochemical components of the global oceans. A global three-dimensional model was used to simulate their distributions in a multi-phytoplankton community context. The realism of the simulation was supported by comparisons of model surface nutrients and total chlorophyll to in situ and satellite observations. Nitrate, silica, and dissolved iron surface distributions were positively correlated with in situ data across major oceanographic basins. Global annual departures were +18.9% for nitrate (model high), +5.4% for silica, and +45.0% for iron. Total surface chlorophyll was also positively correlated with satellite and in situ data sets across major basins. Global annual departures were -8.0% with SeaWiFS (model low), +1.1% with Aqua, and -17.1% with in situ data. Global annual primary production estimates were within 1% and 9% of estimates derived from SeaWiFS and Aqua, respectively, using a common primary production algorithm. Coccolithophore annual mean relative abundances were 2.6% lower than observations, but were positively correlated across basins. Two of the other three phytoplankton groups, diatoms and cyanobacteria, were also positively correlated with observations. Distributions of coccolithophores were dependent upon interactions and competition with the other phytoplankton groups. In this model coccolithophores had a competitive advantage over diatoms and chlorophytes by virtue of a greater ability to utilize nutrient and light at low values. However, their reduced maximum growth rates and higher sinking rates placed them at a disadvantage when nutrients and light were plentiful. In very low nutrient conditions, such as the mid-ocean gyres, coccolithophores were unable to compete with the efficient nutrient utilization capability and low sinking rate of cyanobacteria, despite their higher maximum growth rates. Comparisons of simulated coccolithophore distributions with satellite-derived estimates of calcite concentration and coccolithophore blooms showed some agreement, but also areas

of departure. Most notably, coccolithophores were nearly absent in the model in the North Pacific, but calcite estimates suggested widespread abundance in summer. In situ observations supported their existence suggesting a deficiency in the model. On the other hand, vast blooms observed in

Author

*Oceanography; Phytoplankton; Bacteria; Chlorophylls; Sea-Viewing Wide Field-of-View Sensor; Algae; In Situ Measurement; Geochemistry; Calcite*

**20080047967** Alabama Univ., Huntsville, AL, USA; NASA Marshall Space Flight Center, Huntsville, AL, USA

**The Impact of High-Resolution Sea Surface Temperatures on the Simulated Nocturnal Florida Marine Boundary Layer**

LaCasse, Katherine M.; Splitt, Michael E.; Lazarus, Steven M.; Lapenta, William M.; Monthly Weather Review; April 2008; Volume 136, Issue 4, pp. 1349-1372; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1175/2007MWR2167.1>

High- and low-resolution sea surface temperature (SST) analysis products are used to initialize the Weather Research and Forecasting (WRF) Model for May 2004 for short-term forecasts over Florida and surrounding waters. Initial and boundary conditions for the simulations were provided by a combination of observations, large-scale model output, and analysis products. The impact of using a 1-km Moderate Resolution Imaging Spectroradiometer (MODIS) SST composite on subsequent evolution of the marine atmospheric boundary layer (MABL) is assessed through simulation comparisons and limited validation. Model results are presented for individual simulations, as well as for aggregates of easterly- and westerly-dominated low-level flows. The simulation comparisons show that the use of MODIS SST composites results in enhanced convergence zones, earlier and more intense horizontal convective rolls, and an increase in precipitation as well as a change in precipitation location. Validation of 10-m winds with buoys shows a slight improvement in wind speed. The most significant results of this study are that 1) vertical wind stress divergence and pressure gradient accelerations across the Florida Current region vary in importance as a function of flow direction and stability and 2) the warmer Florida Current in the MODIS product transports heat vertically and downwind of this heat source, modifying the thermal structure and the MABL wind field primarily through pressure gradient adjustments.

Author

*Sea Surface Temperature; Nocturnal Variations; Marine Meteorology; Atmospheric Boundary Layer; Air Water Interactions*

**20080048383** Commerce Dept., Washington, DC, USA

**National Oceanic and Atmospheric Administration: Work On Electronic Charting Database Should Be Re-competed. Audit Report No. STD-13440**

Mar. 2001; 24 pp.; In English

Report No.(s): PB2009-102813; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This report presents the results of our performance audit of the cooperative research and development agreement (CRADA) between NOAA's National Ocean Service (NOS) and Maptch, Inc. The Federal Technology Transfer Act of 1986, as amended authorizes governmental agencies to enter into a CRADA with a non-federal partner to conduct specified research or development that is consistent with the missions of the agencies. Both parties exchange personnel, services, facilities, equipment, intellectual property, or other resources, but only the non-federal partner may provide funds.

NTIS

*Agreements; Charts; Data Bases*

## LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance of animals and plants in space and related environmental conditions. For specific topics in life sciences see *categories 52 through 55*.

**20080047427** NASA Glenn Research Center, Cleveland, OH, USA

**Feasibility of an Implanted, Stimulated Muscle Powered Piezoelectric Generator as a Power Source for Implanted Medical Devices**

Lewandowski, Beth E.; Kilgore, Kevin L.; Gustafson, Ken J.; [2004]; 22 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 444543.01.02.01; Copyright; Avail.: Other Sources

A piezoelectric generator that is driven by stimulated muscle and is implantable into the human body is under development for use as a self-replenishing power source for implanted electronic medical devices. The generator concept includes connecting a piezoelectric stack generator in series with a muscle tendon unit. The motor nerve is electrically activated causing muscle contraction force to strain the piezoelectric material resulting in charge generation that is stored in a load capacitor. Some of the generated charge is used to power the nerve stimulations and the excess is used to power an implanted device. The generator concept is based on the hypothesis that more electrical power can be converted from stimulated muscle contractions than is needed for the stimulations, a physiological phenomenon that to our knowledge has not previously been utilized. Such a generator is a potential solution to some of the limitations of power systems currently used with implanted devices.

Author

*Piezoelectricity; Muscular Function; Medical Equipment; Physiology; Human Body*

**20080047483** Army Engineer Research and Development Center, Vicksburg, MS USA

**Capacities of Candidate Herbaceous Plants for Phytoremediation of Soil-based TNT and RDX on Ranges**

Best, Elly P; Smith, Thomas; Hagen, Frank L; Dawson, Jeffrey O; Torrey, Alan J; Sep 2008; 97 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489006; ERDC-TR-08-8; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489006>

This report describes a study to quantify the phytoextraction and phytostabilization capacities of TNT and RDX from spiked soil in selected herbaceous species, while paying attention to storage and quality of breakdown products in vegetative plant parts. Ten plant species were included in the experiments. Dose-response experiments formed the basis for evaluating the uptake and tentative in-plant degradation of the soil-based energetics and biomass characteristics of the plants. In these experiments, plants were exposed for periods ranging from 55 to 83 days in the greenhouse, biomass and evapotranspiration characteristics were determined, and residues of explosives' parent compounds and metabolites were analyzed using HPLC techniques. Of the ten plant species tested, two grasses and four forbs were classified as TNT-tolerant. Total TNT loss from soil by processes other than plant TNT uptake ranged from 18.4 to 33.2 kg TNT/ha in grasses and forbs, respectively. Plant TNT uptake ranged from 0.2 kg/ha in grasses to close to none in forbs. Four grasses took up and metabolized TNT, and one forb showed some potential for TNT uptake and metabolism. All plant species were classified as RDX-tolerant. Total RDX loss from soil by processes other than plant RDX uptake ranged from 8.2 to 437 kg RDX/ha in grasses and forbs, respectively. Plant RDX uptake ranged from 3.4 kg/ha in grasses to 6.4 kg/ha in forbs. Four grasses and one forb metabolized RDX. Two plant species were recommended for further exploration of their phytoextraction/plant-assisted phytoremediation capacity, both species of the uptaker/degrader type. Three other species were recommended for further exploration of their phytostabilization/plant-assisted phytoremediation capacity.

DTIC

*Biodegradation; Grasses; RDX; Soils*

**20080047484** Mount Sinai School of Medicine, New York, NY USA

**Role of cdc25 Phosphatases in Human Breast Cancer**

Manfredi, James J; May 2008; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0305

Report No.(s): AD-A489010; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489010>

A summary is presented of research performed during three years of a project to determine the role of Cdc25 phosphatases

in human breast cancer. Three specific aims were pursued. The first was to determine the role of Cdc25B in breast cancer proliferation. The second aim was examining whether alternative splicing of Cdc25C contributes to human breast cancer. The final aim was to explore a potential novel breast cancer therapy involving altered expression of Cdc25C. The long term goals of this research were to validate a clear role for Cdc25B in breast tumor cell proliferation and to rigorously determine whether Cdc25C may contribute to human breast tumorigenesis in other ways besides its overexpression.

DTIC

*Breast; Cancer; Mammary Glands*

**20080047485** Virginia Univ., Charlottesville, VA USA

**Development of a Novel Tissue Engineering Strategy Towards Whole Limb Regeneration**

Laurencin, Cato T; Aug 2008; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-07-1-0579

Report No.(s): AD-A489014; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489014>

Tissue engineering has been a highly successful strategy for regenerating individual musculoskeletal tissue types and holds great potential as a strategy for whole limb regeneration. In contrast to the bottom up approach of limb regeneration that relies on blastema formation outgrowth and cell dedifferentiation as seen in amphibians and lower vertebrates tissue engineering utilizes a top down approach that integrates material science cell and molecular biology and engineering. The aim of this research program is to take full advantage of this new direction to develop novel tissue engineering strategies for regenerating whole limbs in mammalian models. The tasks we have proposed use the collective expertise and insights of the group to test the hypothesis that functional organs can be regenerated by actively integrating the individual component tissues developed via the tissue engineering approach through the administration of appropriate environmental cues for limb regeneration. Key findings of this research program include the successful formation of both microsphere based nanofiber-based and composite microsphere-nanofiber structures for bone cartilage and ligament growth factor binding to and release from scaffolds cellular evaluation of marrow-derived mesenchymal and cell-specific cells on scaffolds in vivo visualization of vascularization of composite scaffolds and in vivo biocompatibility studies of scaffolds.

DTIC

*Bioengineering; Tissue Engineering*

**20080047491** General Accounting Office, Washington, DC USA

**Defense Health Care: Additional Efforts Needed to Ensure Compliance with Personality Disorder Separation Requirements**

Williamson, Randall B; Curran, Mary Ann; Burton, Sarah; Enders, Christie; Friday, Krister; Hendrickson, Becky; Kelly, Martha R; Motley, Lisa; Vassilicos, Jason; Worth, Suzanne; Oct 2008; 40 pp.; In English

Report No.(s): AD-A489039; GAO-09-31; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489039>

At the Department of Defense (DoD), a personality disorder can render a service member unsuitable for service. GAO was required to report on personality disorder separations with regard to the following: (1) the extent to which selected military installations complied with DoD's separation requirements, and (2) how DoD ensures compliance with these requirements. GAO reviewed a sample of 312 service members' records from four installations, representing the Army, Air Force, and Marine Corps, that had the highest or second highest number of Operation Enduring Freedom or Operation Iraqi Freedom service members separated because of a personality disorder. The review is generalizable to the installations, but not to the services. GAO also reviewed 59 Navy service members' records, but this review is not generalizable to the installation or the Navy because parts of the separation process could have been completed at multiple locations. GAO recommends that DoD do the following: (1) ensure that the services' personality disorder separations comply with DoD's requirements, and (2) monitor the services' compliance. DoD concurred with GAO's first recommendation and partially concurred with the other. DoD stated that it will strengthen policy guidance for the services' compliance reporting, but stated that it is the responsibility of the services to ensure compliance.

DTIC

*Disorders; Health; Mental Health; Personality; Personnel; Personnel Management*

**20080047493** Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM USA

**Neuroimmune Effects of Inhaling Low Dose Sarin**

Sopori, Mohan L; Feb 2008; 14 pp.; In English

Contract(s)/Grant(s): W81XWH-04-C-0071

Report No.(s): AD-A489047; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489047>

The nerve gas sarin is a potent irreversible inhibitor of acetylcholine esterase that in high doses causes neurotoxicity seizures lung inflammation and death primarily from respiratory failure. Even in subclinical doses sarin suppresses the immune system and decreases serum corticosterone (CORT) levels. However the mechanism and duration these effects are not known. Our results that sarin upregulates the mRNA expression of proinflammatory cytokines in the lung which is associated with the activation of MAP kinases (ERK1/2) and the transcription factor NFkB. Sarin induced suppression of serum CORT level appear to be through its effects on the HPA axis. In addition higher doses of sarin that causes respiratory failure in animals result primarily from functional loss of central respiratory chemoreceptors. Moreover higher doses of sarin specifically damage the hippocampus and some regions of the cortex and might explain the long-term neurobehavioral problems seen in the survivors of Japanese sarin terrorism. Taken together these results suggest that will allow doses of sarin affect adaptive and innate immune responses and depress CORT and ACTH levels higher doses of sarin may cause death through loss of central respiratory chemoreceptors. Our preliminary results also suggest that exposure to high-doses of sarin (~LD50) may impair cognitive functions through injury to hippocampal and cortical neurons.

DTIC

*Chemoreceptors; Dosage; Lungs; Respiration*

**20080047499** Wyoming Univ., Laramie, WY USA

**Epidemiology of Chronic Wasting Disease: PrPres Detection, Shedding, and Environmental Contamination**

Lewis, Randolph V; Miller, Michael W; Kreeger, Terry; Wolfe, Lisa L; Aug 2008; 25 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0542

Report No.(s): AD-A489084; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489084>

Chronic wasting disease (CWD) of deer and elk is unique among the transmissible spongiform encephalopathies. Our long-term goal is to better understand the epidemiology of CWD and thus develop strategies for management and control. The specific goals of these studies are to develop sensitive assays for PrPres as a marker for infectivity and use these techniques to monitor the dynamics and modes of shedding of PrPres from orally infected mule and white-tailed deer and elk. Finally these techniques will be applied to investigating the nature of environmental contamination that may be associated with CWD transmission. Protease resistant prion protein from brains of CWD affected deer and elk (PrPres) and cellular PrPc were purified and used in a variety of detection assays. PrPres was detected using antibody-based techniques which although substantially more sensitive than any current assay still need improvement. Deer and elk have been and infected orally to determine CWD shedding in vivo. We have not identified several protein biomarkers as indicators of prion infection in urine from deer and elk. As the grant ends we have established a very large bank of various deer and elk tissues and fluids starting prior to infection and periodically throughout the infection.

DTIC

*Contamination; Diseases; Epidemiology; Infectious Diseases*

**20080047500** Army Research Inst. of Environmental Medicine, Natick, MA USA

**Cerebrovascular Responses to Incremental Exercise During Hypobaric Hypoxia: Effect of Oxygenation on Maximal Performance**

Subudhi, A W; Lorenz, M C; Fulco, C S; Roach, R C; Jan 2008; 10 pp.; In English

Report No.(s): AD-A489111; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489111>

While performing demanding physical activity for long durations, fluid and electrolyte imbalance is common in athletes, military personnel, and recreational hikers. The military and civilian communities have introduced extensive heat mitigation measures to manage heat strain and reduce the risk of serious exertional heat illnesses (EMI). These heat mitigation measures include fluid and electrolyte replacement guidelines, vigilance, and identifying high-risk individuals. Despite these measures, exercise in hot weather continues to result in preventable injuries and deaths in young healthy individuals. With existing emphasis on appropriate fluid intake during exercise for the avoidance of dehydration, heat illness, and associated performance decrements, there has been a subsequent increase in reported exertional hyponatremia (MYPO) cases related to excessive

water intake, elevated sweating rates, excessive sodium losses in sweat, and inadequate sodium intake in soldiers (I), athletes (2,3,4), and recreational hikers (5,6).

DTIC

*Brain Circulation; Cerebrum; Oxygenation; Physical Exercise; Physiological Responses*

**20080047511** Massachusetts Inst. of Tech., Cambridge, MA USA

**Spatial and Temporal Population Genetics at Deep-Sea Hydrothermal Vents Along the East Pacific Rise and Galapagos Rift**

Fusaro, Abigail J; Sep 2008; 208 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): OCE-0327261; OCE-0324232

Report No.(s): AD-A489201; MIT/WHOI-2008-10; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489201>

Ecological processes at deep-sea hydrothermal vents on fast-spreading mid-ocean ridges are punctuated by frequent physical disturbance. Larval dispersal among disjunct vent sites facilitates the persistence of sessile invertebrate species in these geologically and chemically dynamic habitats despite local extinction events. Regional population extension and rapid recolonization by the siboglinid tubeworm *Riftia pachyptila* have been well documented along the East Pacific Rise and the Galapagos Rift. To analyze spatial and temporal population genetic patterns and the processes governing them at ephemeral and disjunct habitats, a suite of 12 highly variable microsatellite DNA markers were developed for this species. Eight of these loci were used to assess the regional and within-ridge genetic structure of recent colonists and resident adults collected from nine sites in the eastern Pacific Ocean over period of three to seven years. A significant seafloor eruption during the seven-year sampling period allowed investigation into the role of local extinction in population genetic diversity at the Tica vent site at 9 deg N EPR, while collections within two and five years of an eruption that created the Rosebud vent field at 86 deg W GAR provided insights into genetic diversity input over population establishment.

DTIC

*Genetics; Marine Biology; Populations; Submarine Hydrothermal Vents*

**20080047518** Army Research Inst. of Environmental Medicine, Natick, MA USA

**Relationship Between Growth Hormone in vivo Bioactivity, the Insulin-Like Growth Factor-I System and Bone Mineral Density in Young, Physically Fit Men and Women**

Nindl, B C; Pierce, J R; Durkot, M J; Tuckow, A P; Kennett, M J; Nieves, J W; Cosman, F; Alemany, J A; Hymer, W C>; Jan 2008; 8 pp.; In English

Report No.(s): AD-A489321; M08-02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489321>

Bone mineral density (BMD) is influenced by growth factors, such as growth hormone (GH) and insulin-like growth immunoassay, since bio GH is quantified on a biological outcome. To determine if bio GH and components of the IGF-I system were associated with BMD in age-matched men (M;n-41, 19.1 +/- 0.2 year, 70 +/- 3 kg, 163 +/- 25 cm) and women (W. n-39, 18.6 +/- 0.3 year, 66 +/- 3kg, 141 +/- 15cm).

DTIC

*Bone Mineral Content; Bones; Females; Growth; Hormones; Human Beings; In Vivo Methods and Tests; Insulin; Males; Minerals; Physical Fitness; Pituitary Hormones*

**20080047519** Pacific Air Forces, Hickam AFB, HI USA

**Project CHECO Southeast Asia Report. Drug Abuse in Southeast Asia**

Garver, Richard B; Jan 1, 1975; 108 pp.; In English

Report No.(s): AD-A489326; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489326>

This CHECO Report addresses the problem of drug abuse in Southeast Asia (SEA), with emphasis on the drug situation in Thailand through the end of 1973. Many aspects of drug abuse in SEA have drastically changed since 1973, as a result of reduction in forces, discontinuance of urinalysis testing, and other variables. Nevertheless, this report not only serves as a record of drug abuse as it existed in 1973, but also provides a unique insight into the underlying causes of drug abuse -- and in this respect the value of the report is undiminished by the passage of time. Although the problem of drug abuse permeated the entire structure of American society, it did not surface as a major military problem until the latter part of 1970 when Congressional leaders expressed concern over the reported high degree of drug abuse among US military personnel in the

Republic of Vietnam. As a result of this concern, the military organized a concerted effort to eliminate the problem. This effort and the results it produced are discussed in Chapter I. Subsequent chapters deal with the drug abuse problem and its treatment in Thailand following the removal of remaining US Armed Forces from Vietnam in accordance with the January 1973 cease-fire. Chapter II explores the etiology of drug abuse, emphasizing specific contributing factors to the SEA drug abuse problem. Chapter III is concerned with the five phase drug abuse program at work in Thailand and with clinical evaluation of its effectiveness. Chapter IV is a statement of conclusions and an analysis of those conclusions with emphasis upon implications for improvement in the current drug abuse program.

DTIC

*Drugs; Military Personnel; Southeast Asia; Vietnam; Warfare*

**20080047523** Army Research Inst. of Environmental Medicine, Natick, MA USA

**Exertional Heat Illness and Hyponatremia: An Epidemiological Prospective**

Carter, III, Robert; Jan 2008; 9 pp.; In English

Report No.(s): AD-A489367; M07-39; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489367>

While performing demanding physical activity for long durations, fluid and electrolyte imbalance is common in athletes, military personnel, and recreational hikers. The military and civilian communities have introduced extensive heat mitigation measures to manage heat strain and reduce the risk of serious exertional heat illnesses (EHI). These heat mitigation measures include fluid and electrolyte replacement guidelines, vigilance, and identifying high-risk individuals. Despite these measures, exercise in hot weather continues to result in preventable injuries and deaths in young, healthy individuals. With existing emphasis on appropriate fluid intake during exercise for the avoidance of dehydration, heat illness, and associated performance decrements, there has been a subsequent increase in reported exertional hyponatremia (HYPO) cases related to excessive water intake, elevated sweating rates, excessive sodium losses in sweat, and inadequate sodium intake in soldiers (1), athletes (2,3,4), and recreational hikers (5,6). The primary purpose of this article is to systemically examine the epidemiological literature of fluid and electrolyte imbalances that occur during physical activity. The secondary purpose of this article is to examine signs and symptoms of HYPO and EHI cases from the literature (1,2,5,7Y26) and the U.S. Army Research Institute of Environmental Medicine (USARIEM) Total Army Injury and Health Outcomes Database (TAIHOD). While it is acknowledged that the populations at risk for HYPO and EHI may differ, reasonable comparisons are made by examining incidence rates to better understand relative magnitude of each condition. It has been reported that these two conditions have several overlapping clinical features, which has led to misdiagnosis in some rare cases. This article is not intended to persuade the reader of the relative importance of either condition.

DTIC

*Clinical Medicine; Epidemiology; Sicknesses*

**20080047527** Army Research Inst. of Environmental Medicine, Natick, MA USA

**Effects of Dietary Protein Content on IGF-I, Testosterone, and Body Composition during 8 Days of Severe Energy Deficit and Arduous Physical Activity**

Aleman, J A; Nindl, B C; Kellogg, M D; Tharion, W J; Young, A J; Montain, S J; May 1, 2008; 8 pp.; In English

Report No.(s): AD-A489378; M08-15; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489378>

Effects of dietary protein content on IGF-I, testosterone, and body composition during 8 days of severe energy deficit and arduous physical activity. *J. Appl Physiol* 105: 58-64, 2008. First published May 1, 2008; doi:10.1152/jappphysiol.0005.2008.-Energy restriction coupled with high energy expenditure from arduous work is associated with an altered insulin-like growth factor-I(IGF-I) system and androgens that are coincident with losses of fat-free mass. The aim of this study was to determine the effects of two levels of dietary protein content and its effects on IGF-I, androgens, and losses of fat-free mass accompanying energy deficit. We hypothesized that higher dietary protein content would attenuate the decline of anabolic hormones and, thus, prevent losses of fat-free mass. Thirty-four men [24(SD 0.3) yr, 180.1 (SD 1.1) cm, and 83.0 (SD 1.4) kg] participated in an 8 day military exercise characterized by high energy expenditure (16.5 MJ/day), low energy intake (6.5 MJ/day), and sleep deprivation (4h/24h) and were randomly divided into two dietary groups: 0.9 and 0.5 g/kg dietary protein intake.

DTIC

*Diets; Hormones; Males; Proteins; Sleep Deprivation*

**20080047530** Duke Univ., Durham, NC USA

**Stromal-Epithelial Interactions and Tamoxifen-Sensitivity: A Bench-to-Bedside Model of Chemoprevention**

Rowell, Craig; May 2008; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0467

Report No.(s): AD-A489387; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489387>

The microenvironment of the breast likely plays a critical role in changes to cytology during the development of cancer. Understanding of changes to the genetic as well as broader biochemical constituents of individual cells or cell types may have greater influence in our ability to detect and or track cancer development. It is likely that these changes are dynamic and affected by external stimuli including therapeutic regimes. This work examined changes in the methylation profile of estrogen responsive genes (estrogen receptor and progesterone receptor) as well as establishing early protocols for examination of tissue-level steroids that may function through these important receptors. Finally, we initiated studies to evaluate the role of changing environment on tissue development by isolating, culturing and differentiating adipose derived pluripotent (stem) cells from the breast tissue. The results of these studies showed that estrogen receptor methylation status does not change with respect to tamoxifen treatment. Current focus on progesterone methylation will soon determine if this is treatment has effect on this gene or not. Finally, we have demonstrated through our pilot study that changes in breast tissue level steroids are likely related to body mass index and menopausal status.

DTIC

*Cancer; Diseases; Estrogens; Genetics; Scale Models*

**20080047531** Columbia Univ., New York, NY USA

**Interactions Between Cell Cycle Control Proteins and the Androgen Receptor in Prostate Cancer**

Weinstein, I B; Lim, J T; Mar 2005; 15 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0042

Report No.(s): AD-A489391; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489391>

Cyclin Dependent Kinase 6 (CDK6) binds to and is activated by cyclin D1, and thereby enhances the transition of cells through the G1 phase of the cell cycle. We discovered that in human prostate cancer cells CDK6 binds to the androgen receptor (AR) and markedly stimulates its transcriptional activity in the presence of dihydrotestosterone (DHT). This effect of CDK6 does not require its kinase activity and is inhibited by both cyclin D1 and p16INK4a. An AR mutated at codon 877, which is found in 24% of advanced cases of prostate cancer displays exaggerated stimulation of transcriptional activity by CDK6. LNCaP prostate cancer cells engineered to overexpress CDK6 have increased expression of PSA and enhanced growth in the presence of DHT. CDK6 is present in the chromatin structure of these cells in association with the AR and the PSA gene. Furthermore, we found that primary human prostate cancers frequently displayed increased expression of CDK6. Thus, CDK6 may play an important role in the development and progression of prostate cancer.

DTIC

*Cancer; Hormones; Males; Prostate Gland; Proteins*

**20080047567** Boston VA Research Inst., Inc., MA USA

**Replicating Physiological Patterns of Activity with Prosthetic Stimulation**

Fried, Shelley; Jul 2008; 71 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-07-1-0474

Report No.(s): AD-A489407; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We want to develop more effective methods of neural stimulation in order to improve the clinical outcomes associated with retinal prosthetics. To accomplish this we are investigating the mechanism(s) by which different types of retinal neurons respond to electric stimulation. Previous studies have shown that ganglion cells the output cells of the retina can be activated directly and exclusively with short duration stimulus pulses [1; 12; 24; 42]. However the site of spike initiation in ganglion cells (e.g. the element with the lowest threshold) is not known. Here we found that the lowest thresholds occurred along the proximal axon about 40  $\mu$ m from the soma; this region of low threshold was spatially coextensive with a band of dense sodium channels also centered about 40  $\mu$ m from the soma. The sodium channel bands formed a homogeneous population for a given type of ganglion cell (e.g. alpha) but the properties of the band were different across different types (e.g. the lengths and locations varied). As expected from the differences in band properties the size and location of the low threshold regions were also different for different ganglion cell types. We also showed that axonal thresholds can be quite low - in some cases lower than those found in the proximal axon region. This raises the possibility that a small stimulating electrode can elicit widespread



neural activity. We continue to explore the mechanism underlying axonal activation with the hope of learning how to limit activation to the region around the somaiproximal axon.

DTIC

*Activity (Biology); Physiology; Prosthetic Devices; Retina; Stimulation*

**20080047571** Johns Hopkins Univ., Baltimore, MD USA

**Genomic Association Study of Ancestry-Matched African American Prostate Cancer Cases and Control**

Isaacs, William B; Apr 2008; 6 pp.; In English

Contract(s)/Grant(s): W81XWH-07-1-0122

Report No.(s): AD-A489444; No Copyright; Avail.: Defense Technical Information Center (DTIC)

African American men have the highest incidence and mortality from prostate cancer in the world. Multiple reasons have been postulated to explain these findings, although the definitive reasons for them are unknown. While both environmental and genetic factors may contribute to prostate cancer susceptibility, results from multiple studies consistently implicate a strong genetic component to this cancer. However, a specific gene that is consistently and reproducibly associated with prostate cancer risk in any population has not been identified. Association studies examining the frequency of common but specific genetic variants in study populations with and without a particular disease (i.e., case-control) is a powerful way to detect the influence of common genetic variants capable of affecting disease risk. While these types of studies are powerful, they are not without limitations, including the tendency to be confounded due to population stratification (a critical issue in admixed populations like African Americans), and the requirement for large, well-matched, and well-characterized study populations. While there has been extensive use of case control studies to identify genetic risk variants in Caucasian populations, corresponding studies in the African American prostate cancer population have been less extensive, typically being much smaller than their Caucasian counterparts, with little or no effort to address the critical issue of population stratification as a confounder. It is now quite clear that unless cases are well matched to controls in terms of genetic heterogeneity in such studies, spurious associations will and undoubtedly have been observed and reported. In this study, the author uses Ancestry Informative Markers (AIM) to match African American prostate cancer cases and controls for the purposes of performing association studies without confounding by population stratification.

DTIC

*Africa; Cancer; Chromosomes; Genetics; Genome; Males; Prostate Gland; Risk*

**20080047578** Defense Finance and Accounting Service, Inc., Kansas City, MO USA

**Process Therapy**

Kimmerly, Paul; Jun 2005; 3 pp.; In English

Report No.(s): AD-A489482; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Over a year ago, the author suffered a spinal cord injury that required surgery, an extended hospital stay, therapy, and a trip into the medical sub-culture. This article looks at process improvement and relates it to the author's experiences recovering from his injury. If an organization's process is injured, process therapists using the diagnostic and treatment tools at their disposal can help lead an organization to recovery.

DTIC

*Analogies; Computer Programming; Injuries; Organizations; Software Engineering; Spinal Cord; Therapy*

**20080047607** Army Research Inst. of Environmental Medicine, Natick, MA USA

**Physical Fitness and Body Composition After a 9-Month Deployment to Afghanistan**

Sharp, M A; Knapik, J J; Walker, L A; Burrell, L; Frykman, P N; Darakjy, S S; Lester, M E; Marin, R E; Jan 2008; 7 pp.; In English

Report No.(s): AD-A489599; M08-16; No Copyright; Avail.: Defense Technical Information Center (DTIC)

To examine change in physical fitness and body composition after a military deployment to Afghanistan. Methods: one hundred and ten infantry soldiers were measured before and after a 9-month deployment to Afghanistan for Operation Enduring Freedom. Measurements included treadmill peak oxygen uptake (peak VO<sub>2</sub>), lifting strength, medicine ball put, vertical jump, and body composition estimated via dual-energy x-ray absorptiometry (percent body fat), absolute body fat, fat-free mass, bone mineral content, and bone mineral density. Results: There were significant decreases (P<0.01) in peak VO<sub>2</sub> (-4.5%), medicine ball put(-4.9% body mass {-1.9%}), and fat-free mass{-3.5 %}, whereas percent body fat increased from 17.7% to 19.6%.

DTIC

*Afghanistan; Body Weight; Deployment; Muscles; Personnel; Physical Fitness*

**20080047609** Puerto Rico Univ., San Juan, Puerto Rico

**Breast Cancer Epidemiology in Puerto Rico**

Nazario, Cruz M; Freudenheim, Jo; Jun 30, 2008; 47 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-07-1-0329

Report No.(s): AD-A489626; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project has two mayor goals: to design and conduct a pilot case-control breast cancer study among Puerto Rican women, and to train and develop researchers in breast cancer at the University of Puerto Rico. The case-control study will enroll women ages 30-79 who are residents of the San Juan metropolitan area. Cases will be women with incident, primary, pathologically confirmed breast cancer with no history of previous cancer other than non-melanoma skin cancer; controls will be frequency-matched by age and randomly selected from female residents of the same geographical area. The study will examine adult and childhood factors in relation to risk of breast cancer in this understudied population of Puerto Rican women. The specific aims are to examine dietary risk factors in relation to breast cancer and in relation to tumor characteristics (e.g., estrogen and progesterone receptor status), lifetime weight gain, physical activity, alcohol consumption, reproductive history, birth weight, adult height, childhood diet, environmental factors, and residential history. The overall training goal is to develop a team of independent investigators with the necessary skills to develop a program of breast cancer research in Puerto Rico and to obtain funds and support for that research. This first-year report provides evidence that the development of the infrastructure for the study and the initiation of training of investigators is proceeding as expected. The establishment of mentoring relationships and communication venues also have been successful. Weekly teleconference calls, frequent e-mails, and individual telephone calls have been the usual method of communication. The first steps of the case-control study are underway (identification of key personnel and initial training in the study protocol, obtaining local IRBs and HIPAA approvals, designing the questionnaire, etc.). The first year of the award has been successful.

DTIC

*Breast; Cancer; Education; Epidemiology; Females; Mammary Glands; Puerto Rico; Risk*

**20080047611** Illinois Univ., Chicago, IL USA

**Training Program in Breast Cancer Prevention and Therapy for Undergraduate Students**

Mehta, Rajendra G; Nov 2007; 7 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0387

Report No.(s): AD-A489665; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The overall objective of this training program is to provide an opportunity for undergraduate students to spend summer to get exposure to concepts of breast cancer research. We proposed six students to be divided amongst 7-8 faculty members working closely in the area of breast cancer. During the last 3 summers we had introduced the program to the Honors college and GPPA program office. However the project was extended for one more year for the funds left over to train one student. This year we recruited Mr. McCormick for the second summer. He completed a project which will be submitted for publication. He also prepared a short report at the end of the summer and presented a 20 minute departmental seminar. He is interested in continuing to do breast cancer research if he gets an opportunity.

DTIC

*Breast; Cancer; Education; Mammary Glands; Prevention; Students; Therapy*

**20080047612** Brookhaven National Lab., Upton, NY USA

**Structural Studies on Toxins and Virulence Factors of Yersinia pestis**

Swaminathan, Subramanyan; Feb 2008; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0491

Report No.(s): AD-A489666; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this final report we present our efforts on two or three fronts. We were working on the expression purification and crystallization of complexes of YopB and YopD with other proteins like their chaperones. We have made progress in purifying YopB:YopD:SycD complex. However this is a challenging process and the amount of homologous protein is a problem. Since the expression levels of different components of the complex are different the stoichiometric ratio is a problem. We will continue to work on this project to successfully end it even though the project period has ended. If successful this will help in understanding the translocation mechanism of effector proteins.

DTIC

*Crystallography; Proteins; Toxins and Antitoxins; Virulence*

**20080047613** Louisiana State Univ., New Orleans, LA USA

**Interfering with DNA Damage Signals: Radiosensitizing Prostate Cancer using Small Peptides**

Xu, Bo; Nov 2007; 26 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0018

Report No.(s): AD-A489667; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We aimed to identify small peptides that can target critical DNA damage responsive pathways in order to develop novel therapeutic agents that can sensitize prostate cancer cells to radiotherapy. Critical DNA damage pathways determining cellular radiosensitivity is mediated by ATM and its phosphorylation of downstream targets including Structural Maintenance of Chromosomal protein one (SMC1) and Nijmegen Breakage Syndrome protein 1 (NBS1). We have demonstrated that small fusion peptides containing SMC1 phosphorylation sequences can inhibit ATM activity. We have characterized the inhibitory effect of the THM-SMC1 peptide on cellular responses to radiation and found the peptide can abolish radiation induced S-phase checkpoint and decrease prostate tumor cell clonogenic survival. During the last performance period we have studied the molecular mechanisms of SMC1 peptide-induced radiosensitization. We have also identified a novel inhibitory peptide containing the NBS1 C-terminal conserved sequence. The NBS1 inhibitory peptides (NIP) can increase prostate cancer cellular radiosensitivity. Future directions include in vivo evaluation of the fusion peptides as powerful radiosensitizers in prostate cancer xenograft models.

DTIC

*Cancer; Damage; Deoxyribonucleic Acid; Peptides; Prostate Gland; Proteins; Radiation Therapy*

**20080047616** Burnham Inst., La Jolla, CA USA

**Targeting Therapy Resistant Tumor Vessels**

Ruoslahti, Erkki; Aug 2008; 106 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0482

Report No.(s): AD-A489674; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Anti-angiogenic therapy appears to eliminate immature blood vessels. This paradoxically leads to improvement of tumor blood supply, as the structure and function of mature tumor blood vessels, not specific for anti-angiogenic effect, is normalized. This is a serious limitation to the anti-angiogenic therapy. The goal of this project is to specifically distinguish these 'normalized' therapy resistant vessels in breast cancer from those sensitive to anti-angiogenic treatment. To achieve this, we have developed tumor models for vascular normalization and are using in vivo phage display and isolation of peptides that specifically home to normalized tumor vessels resistant to anti-angiogenic therapy. The results obtained in this study will enable specific targeting and thus treatment of breast cancer vessels not responding to standard anti-angiogenic therapy.

DTIC

*Blood Vessels; Breast; Cancer; Mammary Glands; Therapy; Tumors*

**20080047862** Air Force Research Lab., Edwards AFB, CA USA

**Facile Synthesis of Hydrophobic Fluoroalkyl Functionalized Silsesquioxane Nanostructures (Postprint)**

Iacono, Scott T; Smith, Dennis W; Vij, Ashwani; Grabow, Wade; Mabry, Joseph M; Jan 2007; 4 pp.; In English

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A489054; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489054>

New fluorinated polyhedral oligomeric silsesquioxane (F-POSS) structures possessing a high degree of hydrophobicity have been prepared via facile corner-capping methodology.

DTIC

*Hydrophobicity; Nanostructures (Devices)*

**20080047884** RAND Corp., Santa Monica, CA USA

**Review and Evaluation of the VA Enrollee Health Care Projection Model**

Harris, Katherine M; Galasso, James P; Eibner, Christine; Jan 2008; 121 pp.; In English

Contract(s)/Grant(s): W74V8H-06-C-0002

Report No.(s): AD-A489316; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489316>

The Veterans Health Care Eligibility Reform Act of 1996 significantly expanded the mission of the VA. The reform act vastly increased the types of services offered to VA patients and extended medical coverage to all veterans through a

priority-based enrollment system. The VA now operates the largest integrated health care system in the United State. In 2007, the VA had 78 million enrollees, served 5.5 million patients, and had a total operating budget of 37.3 billion.

DTIC

*Health; Management Systems; Medical Services; Military Operations*

**20080048202** California Inst. of Tech., Pasadena, CA, USA

**Purifying Nucleic Acids from Samples of Extremely Low Biomass**

La Duc, Myron; Osman, Shariff; Venkateswaran, Kasthuri; NASA Tech Briefs, September 2008; September 2008, pp. 27; In English; See also [20080048125](#)

Report No.(s): NPO-45740; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3140>

A new method is able to circumvent the bias to which one commercial DNA extraction method falls prey with regard to the lysing of certain types of microbial cells, resulting in a truncated spectrum of microbial diversity. By prefacing the protocol with glass-bead-beating agitation (mechanically lysing a much more encompassing array of cell types and spores), the resulting microbial diversity detection is greatly enhanced. In preliminary studies, a commercially available automated DNA extraction method is effective at delivering total DNA yield, but only the non-hardy members of the bacterial bisque were represented in clone libraries, suggesting that this method was ineffective at lysing the hardier cell types. To circumvent such a bias in cells, yet another extraction method was devised. In this technique, samples are first subjected to a stringent bead-beating step, and then are processed via standard protocols. Prior to being loaded into extraction vials, samples are placed in micro-centrifuge bead tubes containing 50 micro-L of commercially produced lysis solution. After inverting several times, tubes are agitated at maximum speed for two minutes. Following agitation, tubes are centrifuged at 10,000 x g for one minute. At this time, the aqueous volumes are removed from the bead tubes and are loaded into extraction vials to be further processed via extraction regime. The new method couples two independent methodologies in such a way as to yield the highest concentration of PCR-amplifiable DNA with consistent and reproducible results and with the most accurate and encompassing report of species richness.

Author

*Deoxyribonucleic Acid; Extraction; Genetic Engineering; Purification*

**20080048241** California Univ., Davis, CA USA

**Novel Targeted Immunotherapy for CML Blast Cells**

Kumaresan, Pappanaicken R; Jun 2008; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-07-1-0456

Report No.(s): AD-A489007; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489007>

An emerging problem in chronic phase CML is molecular persistence. It is mainly due to the quiescent stem cell population that are completely insensitive to Imatinib therapy. We have developed a novel immunotherapy against CML. We have screened One-Bead-One-Compound (OBOC) combinatorial libraries and identified cyclic peptide ligands that bind to CML cancer cells. These ligands will then be ligated to the N-termini of the engineered Fc fragment of human immunoglobulin in a site-specific manner. We hypothesize that these cancer targeting ligand-Fc fragment conjugate (we call it 'ligand-body') will bind to CML cells via the peptide or peptidomimetic ligand domain and the Fc immunoglobulin domain will be used to harness the anti-cancer innate immunity against CML cells in vivo. The innate immune system includes immune effector cells such as NK cells, NKT cells, macrophages, and leukocytes and the complement system. As mentioned in Aim 1 and Aim 2 we have modified the Fc domain for specific N-terminal ligation and produced modified protein for ligand-body production. In the second year functional characterization for the ligand-body will be performed.

DTIC

*Immunology; Cells (Biology)*

**20080048308** NASA Johnson Space Center, Houston, TX, USA

**Human Factors Interface with Systems Engineering for NASA Human Spaceflights**

Wong, Douglas T.; [2009]; 13 pp.; In English; Human Systems Integration Symposium, 17 - 19 Mar. 2009, Virginia, USA;

No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080048308>

This paper summarizes the past and present successes of the Habitability and Human Factors Branch (HHFB) at NASA

Johnson Space Center's Space Life Sciences Directorate (SLSD) in including the Human-As-A-System (HAAS) model in many NASA programs and what steps to be taken to integrate the Human-Centered Design Philosophy (HCDP) into NASA's Systems Engineering (SE) process. The HAAS model stresses systems are ultimately designed for the humans; the humans should therefore be considered as a system within the systems. Therefore, the model places strong emphasis on human factors engineering. Since 1987, the HHFB has been engaging with many major NASA programs with much success. The HHFB helped create the NASA Standard 3000 (a human factors engineering practice guide) and the Human Systems Integration Requirements document. These efforts resulted in the HAAS model being included in many NASA programs. As an example, the HAAS model has been successfully introduced into the programmatic and systems engineering structures of the International Space Station Program (ISSP). Success in the ISSP caused other NASA programs to recognize the importance of the HAAS concept. Also due to this success, the HHFB helped update NASA's Systems Engineering Handbook in December 2007 to include HAAS as a recommended practice. Nonetheless, the HAAS model has yet to become an integral part of the NASA SE process. Besides continuing in integrating HAAS into current and future NASA programs, the HHFB will investigate incorporating the Human-Centered Design Philosophy (HCDP) into the NASA SE Handbook. The HCDP goes further than the HAAS model by emphasizing a holistic and iterative human-centered systems design concept.

Author

*Habitability; Human Factors Engineering; Systems Integration; Systems Engineering; Life Sciences*

**20080048398** Northwestern Univ., Evanston, IL USA

**Surface Enhanced Raman Spectroscopy for Monitoring Lactate and Glucose**

Glucksberg, Matthew; Walsh, Joseph; Duyn, Richard Van; Jul 2006; 12 pp.; In English; Original contains color illustrations  
Contract(s)/Grant(s): W81XWH-04-1-0630

Report No.(s): AD-A489709; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489709>

The development of a robust, portable, and simple biomedical device for the monitoring of glucose, lactate and other metabolites of interest is of great practical importance to routine treatment of diabetes and to the evaluation of individuals under high-stress situations, e.g. warfighters and astronauts. Raman spectroscopy is a powerful analytical tool that permits the unambiguous identification of molecules based on their unique vibrational modes. This spectral fingerprinting of molecules is well suited to multi-analyte detection without cumbersome sample preparation or separation. The Surface Enhanced Raman Scattering (SERS) phenomenon increases by up to a trillion fold the Raman signal from molecules near gold and silver nanoscale materials. We have shown that the incorporation of chemically tailored coatings on SERS active surfaces may serve as a partitioning layer, selectively concentrating the molecules of interest near the surface, thus simultaneously increasing target signal and decreasing the noise signal from interferants even with very low power (~1mW) lasers. We have successfully developed and tested these SERS active substrates in vitro and in vivo in the subcutaneous space of a rat. Work continues in rat models of hyperglycemia and hypodactatemia.

DTIC

*Glucose; Hyperglycemia; Lactates; Metabolic Diseases; Metabolites; Raman Spectra; Raman Spectroscopy*

**20080048402** Army Research Inst. of Environmental Medicine, Natick, MA USA

**Obesity and Obstructive Sleep Apnea: Or is it OSA and Obesity?**

Carter, R; Watenpugh, D E; Jan 2008; 8 pp.; In English

Report No.(s): AD-A489742; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489742>

Obstructive sleep apnea (OSA) consists of repetitive choking spells due to sleep-induced reduction of upper airway muscle tone. Millions of adults and children live unaware of this condition, which can have a profound affect on their health and quality of life. Obesity, gender, genetic, and hormonal factors mediate risk for OSA and interact in a multifaceted manner in the pathogenesis of this disease. Obesity is the most established and primary risk factor given that body mass index, visceral fat, and neck circumference are major predictors in the clinical expression of OSA. Many studies have and their sequelae with shown weight loss or gain significantly impacts OSA severity. More recently, accumulating evidence indicates OSA promotes weight gain, obesity, and type II diabetes in a variety of ways, such that obesity and OSA form multiple interleaved vicious cycles. Thus, creative strategies to increase physical activity, improve diet, and otherwise facilitate weight management become particularly vital given the epidemics of obesity and OSA in the USA. In this regard, the American College of Sports Medicine recently launched the Exercise is Medicine (initiative exerciseismedicine.org). In the future, medications may

emerge to treat obesity, OSA, and their sequelae with minimal side effects. However, there are effective ways to approach these problems now without waiting for 'the magic pill'

DTIC

*Epidemiology; Health; Hormones; Obesity; Pathogenesis; Respiratory System; Risk; Sleep; Sleep Deprivation*

**20080048406** Utah Univ., Salt Lake City, UT USA

**In Silico Genome Mismatch Scanning to Map Breast Cancer Genes in Extended Pedigrees**

Thomas, Alun; Jul 1, 2008; 56 pp.; In English

Contract(s)/Grant(s): W81XWH-07-1-0483

Report No.(s): AD-A489763; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489763>

This project aims to map breast cancer genes using dense single nucleotide polymorphism arrays in large extended pedigrees. Data has been collected using a 1,000,000 SNP genotype assay for 25 women affected by breast cancer in three high risk Utah pedigrees. Preliminary analysis of control data has been performed and significant progress has been made on the problem of modeling linkage disequilibrium between genetic loci at the density and scale required by this project. Programs to perform the modeling and analysis have been written and tested. Two papers describing the methodological developments have been published and a third describing initial analyses of control data is in preparation. The project is proceeding as planned and we expect to carry out the remainder in good time.

DTIC

*Breast; Cancer; Genes; Genetics; Genome; Mammary Glands; Nucleotides; Oncogenes; Polymorphism*

**20080048407** North Carolina State Univ., Raleigh, NC USA

**Human Metabolism and Interactions of Deployment-Related Chemicals**

Hodgson, Ernest; Brimfield, Alan A; Goldstein, Joyce E; Rose, Randy L; Wallace, Andrew D; Aug 2008; 310 pp.; In English

Contract(s)/Grant(s): DAMD17-00-2-0008

Report No.(s): AD-A489766; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489766>

Methods were developed for the investigation of the in vitro metabolism of deployment-related chemicals in humans. These studies utilized recombinant human enzymes, human liver cell fractions and isolated human hepatocytes. The metabolism of chlorpyrifos, DEET, permethrin, pyridostigmine bromide, sulfur mustard, naphthalene and nonane as well as a number of their metabolites and related chemicals was investigated. For the most part these were the first investigations of the metabolism of these chemicals in humans. Metabolic interactions, including inhibition of the metabolism of xenobiotics and endogenous metabolites such as testosterone and estradio were also examined. The potency of organophosphorus chemicals such as chlorpyrifos in the inhibition CYP-dependent monooxygenase reactions was, in many cases, dramatic and a cause for concern as was the ability of chlorpyrifos oxon to inhibit permethrin metabolism. The potential for interactions based on induction and on a combination of induction and cytotoxicity were demonstrated in the case of pyrethroids, DEET and chlorpyrifos in experiments utilizing human hepatocytes. Interactions involving JP-8 jet fuel components such as nonane and naphthalene were of interest because of the expected exposure scenarios and since the fuel itself appeared to function both as an inhibitor and as an inducer in human in vitro experiments. Preliminary genotyping experiments were conducted on two small sample sets of DNA from veterans of the first Gulf War. All of the above permitted a number of conclusions concerning human health risk analysis and possible populations and individuals at increased risk from chemical exposure. A number of recommendations were made concerning risk analysis specific to military needs and to research activities that should have a high priority in that regard.

DTIC

*Deployment; Enzymes; Metabolism; Metabolites*

**20080048408** Texas Univ., Houston, TX USA

**PROSPECT (Profiling of Resistance Patterns & Oncogenic Signaling Pathways in Evaluation of Cancers of the Thorax and Therapeutic Target Identification)**

Hong, Waun K; Stewart, David J; Jun 1, 2008; 73 pp.; In English

Contract(s)/Grant(s): W81XWH-07-1-0306

Report No.(s): AD-A489768; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489768>

We will develop a high throughput therapeutic-target focused (TTF) profiling platform and will combine this with tumor

genome wide mRNA profiling and with serum or plasma profiling of phosphopeptides and DNA. We will use these molecular profiles to help define how various molecular factors alone and in combination relate to resistance to therapy, to prognosis, and to metastatic patterns at relapse. Using tumor and blood samples from non-small cell lung cancer (NSCLC) patients as well as NSCLC cell lines with defined chemotherapy resistance patterns, we will examine how molecular profiles may confer resistance and will identify new, potential therapeutic targets. The PROSPECT approach will be novel in that we will assess tumors from NSCLC patients undergoing surgical resection after having received neoadjuvant therapy as a model of resistance. Tumor surviving neoadjuvant therapy would be expected to be enriched for resistant cells. We will define what combinations of targeted therapies are most effective against resistant cell lines with similar molecular profiles, and this will drive later clinical trials (beyond the scope of this Program). Similar studies will be conducted in patients with mesotheliomas undergoing surgical resection of tumor after neoadjuvant therapy with the new Src inhibitor dasatinib.

DTIC

*Cancer; Carcinogens; Lungs; Targets; Therapy; Thorax; Tumors*

**20080048409** Texas Univ., Galveston, TX USA

**The Role of the Sonic Hedgehog Pathway for Prostate Cancer Progression**

Xie, Jingwu; Feb 2008; 115 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0286

Report No.(s): AD-A489769; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489769>

Prostate cancer is a predominant cancer in men in the US, with an annual incidence of 170,000. Only a minority of the tumor progress rapidly into advanced cancer. Thus, identification of the signaling pathways involved in prostate cancer progression is essential for designing strategies to combat prostate cancer. Based on our preliminary data, we hypothesize that Su(Fu) gene is a novel tumor suppressor gene for human prostate cancer. In this study, we determine that activation of the sonic hedgehog pathway is high in advanced prostate cancer. Several tumors with activated hedgehog signaling lack expression of Su(Fu). Our studies have also extended to other types of tumors including lung and liver cancers. We further determine the mechanisms by which Su(Fu) exerts its tumor suppressing effects using cell lines. Similarly, we have shown that there are several mechanisms of regulating Gli transcriptional factor in addition to Su(Fu). Furthermore, we show that constitutive activation of hedgehog signaling alone in the prostate is not sufficient to drive tumor 3-6 month mice. These studies reveal that hedgehog signaling is a major pathway altered in prostate cancer and it functions mainly in tumor progression, not in tumor initiation.

DTIC

*Cancer; Genes; Liver; Prostate Gland*

**20080048410** Duke Univ., Durham, NC USA

**Computer Aided Detection of Breast Masses in Digital Tomosynthesis**

Singh, Swatee; Lo, Joseph; Jun 2008; 131 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0293

Report No.(s): AD-A489770; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489770>

The purpose of this study was to investigate feasibility of computer-aided detection of masses and calcification clusters in breast tomosynthesis images and obtain reliable estimates of sensitivity and false positive rate on an independent test set. Automatic mass and calcification detection algorithms developed for film and digital mammography images were applied without any adaptation or retraining to tomosynthesis projection images. Test set contained 36 patients including 16 patients with 20 known malignant lesions, 4 of which were missed by the radiologists in conventional mammography images and found only in retrospect in tomosynthesis. Median filter was applied to tomosynthesis projection images. Detection algorithm yielded 80% sensitivity and 5.3 false positives per breast for calcification and mass detection algorithms combined. Out of 4 masses missed by radiologists in conventional mammography images, 2 were found by the mass detection algorithm in tomosynthesis images.

DTIC

*Breast; Cancer; Computer Techniques; Mammary Glands; Pattern Recognition; Tomography*

**20080048411** California Univ., San Francisco, CA USA

**Microenvironmental Regulation of Mammary Carcinogenesis**

Coussens, Lisa M; Jun 2008; 153 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0416

Report No.(s): AD-A489771; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489771>

Chronic inflammation is now regarded as a promoting force for cancer development. We have previously demonstrated that inhibition of leukocyte migration and/or leukocyte-derived protease activities during squamous carcinogenesis significantly decrease tumor incidence; thus, supporting the contention that inflammation can be targeted pharmacologically to affect cancer outcome. Using the MMTV-PymT mouse model of mammary carcinogenesis, we now demonstrate that mammary carcinogenesis is similarly susceptible to immuno-modulation as genetic deletion of CD4+ T lymphocytes and/or a leukocyte cysteine protease (cathepsin C), significantly diminishes pulmonary metastasis formation. Utilizing a 3D organotypic culture system with primary cells, we have revealed that activated CD4+ T cells alter the mammary microenvironment in such a way that mammary epithelial cell migration into matrix is favored. Moreover, the paracrine mechanisms whereby T cells mediate these effects are in part due to M2-activation of macrophages in an IL-4-dependent manner. Together, these studies provide insight into the role adaptive immune cells play in regulating myeloid cell behavior and how leukocyte proteases together regulate cancer development, and will reveal novel mechanisms with which to target tumor cells with anti-cancer therapeutics and/or image inflammation associated with breast cancer development.

DTIC

*Breast; Cancer; Carcinogens; Enzymes; Mammary Glands; Peptides*

**20080048415** Duke Univ., Durham, NC USA

**Image Processing and Computer Aided Diagnosis in Computed Tomography of the Breast**

Xia, Jessie Q; Oct 2007; 235 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0278

Report No.(s): AD-A489806; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489806>

Dedicated breast CT imaging is a novel breast imaging modality, which may improve lesion detection with a comparable radiation dose to conventional mammography. However, due to its cone beam geometry, breast CT suffers from image degradation due to scatter radiation. Moreover, the breast CT images divide the dose of mammography among hundreds of projection views, resulting in considerable quantum noise. It is therefore desirable to reduce scatter and noise in the reconstructed breast volume without loss of spatial resolution. Several new image-processing techniques were developed based on the unique physical properties of this modality. Using images obtained on a full field digital mammography system, the Gaussian noise model demonstrated effective scatter removal. A PDE technique taking into the account the non-uniform distribution of the noise in the projection image after the preprocessing step provides excellent denoised data with sharp edges. Applying a denoising technique before reconstruction provides better images than after reconstruction. The preliminary ROC study showed that with a fixed size lesion in real anatomical backgrounds, PDE-denoised images had higher detectability, higher CNR and better qualitative appearance. These promising new techniques for noise and scatter compensation pave the way for future implementations of dedicated breast CT.

DTIC

*Breast; Computer Techniques; Diagnosis; Image Processing; Mammary Glands; Tomography*

**20080048417** National Marrow Donor Program, Minneapolis, MN USA

**Technical Report of the National Marrow Donor Program**

Setterholm, Michelle; Nov 17, 2008; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-08-1-0058

Report No.(s): AD-A489833; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489833>

Contingency Preparedness: Collect information from transplant centers, build awareness of the Transplant Center Contingency Planning Committee and educate the transplant community about the critical importance of establishing a nationwide contingency response plan. Rapid Identification of Matched Donors: Increase operational efficiencies that accelerate the search process and increase patient access are key to preparedness in a contingency event. Immunogenetic Studies: Increase understanding of the immunologic factors important in HSC transplantation. Clinical Research in



Transplanation: Create a platform that facilities multicenter collaboration and data management.

DTIC

*Bone Marrow; Emergencies; Management Methods; Stem Cells*

**20080048426** Childrens Research Inst., Columbus, OH USA

**The Role of Drosophila Merlin in the Control of Mitosis Exit and Development**

Chang, Long-Sheng; Jul 2008; 154 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0509

Report No.(s): AD-A489855; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489855>

To better understand the mechanism by which Merlin functions as a tumor suppressor, we have confirmed that Drosophila Merlin plays important roles in the control of mitosis exit and in the determination of dorsal/ventral compartment border during wing imaginal disc development. We show that the Merlin protein is dynamically redistributed during meiosis and demonstrate, for the first time, Merlin immunoreactivity in mitochondria. Also, we have found that Merlin colocalizes with Wingless morphogen in the cells at the dorsal/ventral compartment border of the wing imaginal disc. Merlin inactivation may alter the determination/maintenance of Wingless stripe expression. Cells lacking Merlin possess greater ability to overcome vein restriction. In addition, we provide evidence for potential genetic interactions between Merlin and the proteins involved in vesicular trafficking, including Porcupine, Shbire, and Lap. By analyzing the evolution, diversity, and overall distribution of Merlin among different taxa, we demonstrate a monophyletic origin of the Merlin proteins with their root in the early metazoa. The overall similarity among the primary and secondary structures of all merlin proteins and the conservation of several functionally important residues suggest a universal role for merlin in a wide range of metazoa. Furthermore, we show that the AKT pathway is frequently activated in NF2- tumor cells. We have tested two novel compounds, OSU03012 and (S)-HDAC-42, which inhibit AKT phosphorylation, and found that these drugs effectively inhibit the growth of vestibular schwannoma cells. These findings set the stage for a phase I clinical trial on VS in the future.

DTIC

*Drosophila; Mitosis; Mutations; Proteins*

**20080048431** Lemoyne-Owen, Memphis, TN USA

**Asthma Education and Intervention Program: Partnership for Asthma Trigger-Free Homes (PATH)**

Golden, Cheryl; Aug 2008; 186 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-07-1-0469

Report No.(s): AD-A489872; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489872>

Cheryl Golden Ph.D. of LeMoyne Owen College (LOC) and Sue Greco Sc.D. of Abt Associates Inc. (Abt) are the co-Principal Investigators for the Partnership for Asthma Trigger-Free Homes. The PATH study's goal is reducing the asthma disease burden on low-income housing residents by means of a peer-based education program. Although asthma is a complicated multifactorial disease with both genetic and environmental components reducing levels of certain indoor asthma triggers can reduce the disease symptoms and severity. Indoor asthma triggers include allergens (dust mite cockroach cat dog rodent) environmental tobacco smoke (ETS) pesticides and molds. The Project Coordinator will train participants (parents or guardians over 18 years old) recruited from the Memphis Housing Authority and the Memphis Health Center about asthma in general and indoor asthma triggers in particular. Moreover participants will learn about behaviors they can adopt or modify to reduce indoor asthma triggers. The training will be reinforced by Community Peer Educators (CPE's) - students from LeMoyne-Owen College and resident presidents of four MHA housing developments. (After the successful implementation of this program in public and low-income housing PATH may be transferred to a military setting if additional funding is procured.)

DTIC

*Actuators; Asthma; Education; Pesticides*

**20080048432** Social Sectors Development Strategies, Inc., Boston, MA USA

**Risk Factors for Discharge from the Army with a Permanent Disability**

Bell, Nicole S; Jul 2008; 182 pp.; In English

Contract(s)/Grant(s): W81XWH-06-2-0028

Report No.(s): AD-A489876; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489876>

This report outlines progress made during the second year of the 'Risk Factors for Discharge from the Army with a

Permanent Disability' research project. Scope: The overall goal of this project is to describe disability, including temporal trends in disability rates and the profile of those who experience disability, and to uncover the underlying factors contributing to disability among US Army soldiers in order to inform the development of targeted and cost-efficient disability reduction strategies. Major Findings to date: Musculoskeletal disability is increasing more rapidly than other types of disability, particularly among females, soldiers between the ages of 21-35, white soldiers, of lower to mid-level enlisted ranks with relatively short service tenure, and by soldiers without a college education. Lighter physically-demanding jobs have higher unadjusted rates of any-cause hospitalizations whereas heavier physically-demanding occupations have higher injury-specific hospitalization rates. Preliminary evidence suggests gender interactions such that men in physically demanding jobs are at increased risk for injury-related hospitalizations and for on-duty accidents resulting in hospitalizations; women in heavy demand jobs are not at increased risk for injury but are at increased risk for 'all-cause' hospitalizations. There are also demographic and occupational exposure differences in risk for being discharged with a mental health disability.

DTIC

*Disabilities; Epidemiology; Physiological Effects; Risk*

**20080048434** Dartmouth Coll., Hanover, NH USA

**Combined Contrast-Enhanced MRI and Fluorescence Molecular Tomography for Breast Tumor Imaging**

Davis, Scott C; Mar 2009; 75 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0367

Report No.(s): AD-A489879; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489879>

A unique fluorescence molecular tomography system which couples fluorescence data acquisition into the bore of a clinical MRI to image the spatial distribution of fluorescence activity in tissue volumes has been developed and characterized. Signal-to-noise and system sensitivity to fluorophore concentration have been studied extensively. In homogeneous 70 mm diameter cylindrical phantoms, the system shows a linear response to fluorophore concentration down to 1 nM and is sensitive down to 10 pM. Images in realistic phantoms simulating breast tissue reveal the importance of the complimentary MRI information, especially in cases where the tumor to normal tissue fluorophore uptake is less than perfect. Reconstructing images using tissue morphology information from simultaneously acquired MRI images recover tumor regions down to contrasts of 1.5 to 1 while images reconstructed without the MR information show no tumor specificity even at contrasts above 6 to 1.

DTIC

*Breast; Cancer; Fluorescence; Imaging Techniques; Magnetic Resonance; Mammary Glands; Spatial Distribution; Tomography; Tumors*

**20080048475** Connecticut Univ., Farmington, CT USA

**Improving Soldier Recovery from Catastrophic Bone Injuries: Developing an Animal Model for Standardizing the Bone Reparative Potential of Emerging Progenitor Cell Therapies**

Rowe, David W; Adams, Douglas; Shin, Dong-Guk; Kuhn, Lisa; Wei, Mei; Lieberman, Jay; Aug 2008; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-07-2-0085

Report No.(s): AD-A489829; No Copyright; Avail.: Defense Technical Information Center (DTIC)

During the first year of this award, we have demonstrated that mice carrying transgenic GFP reporters that reflect the level of osteoblast differentiation and the host/donor origin of these cells provides a rapid, highly informative and ultimately quantitative interpretation of a transplantation experiment of skeletal stem cells into a critical size bone defect. The calvarial defect model has been the primary platform to test a number of donor cell preparations and scaffold formulations. A combination of neonatal calvarial progenitors and a commercial scaffold achieves complete healing of the lesion occurs within in 3-4 months. Using this combination as a reference standard, we have begun to examine clinically relevant tissue sources and scaffolds with improved biomechanical properties that would be more appropriate for a long bone defect. To better understand the cellular basis of a long bone defect, we have utilized the GFP reporters in the closed tibial fracture. The surprise finding is the extent of activity of early vascular and skeletal progenitors that initiates well away from the fracture site and grows forward to form the callus. In the coming year we will apply the information learned from the calvarial defect to a non-union extension of the tibial fracture model.

DTIC

*Animal Models; Blood Cells; Bones; Fractures (Materials); Injuries; Proteins; Therapy*

**20080048482** Indiana Univ., Indianapolis, IN USA

**Selenium Potentiates Chemotherapeutic Selectivity: Improving Efficacy and Reducing Toxicity**

Fischer, Joshua L; Apr 2008; 48 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0504

Report No.(s): AD-A489923; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In mice, selenium in the form of seleno-L-methionine was reported to have two effects 1) to enhance efficacy of cancer therapeutics against cancer cells; and 2) to protect bone marrow and gut epithelium from dose-limiting toxicity. We are exploring the mechanism whereby selenium can have differential effects on cancer cells versus normal cells. A key genetic alteration in cancer is p53 mutation. About 70% of all human cancers are mutant i.e. defective in p53, while bone marrow and other normal tissues are functional for p53. P53 is known to protect normal cells by a DNA repair mechanism. Cancer cells lack the DNA repair mechanism and are predicted to be sensitive to chemotherapy. A DNA repair protein that is controlled by p53 is Xpc. Thus, wildtype, p53<sup>-/-</sup>, or xpc<sup>-/-</sup> mice were used to test the hypothesis that 1) selenium evoked a DNA repair and protective response in wildtype cells including bone marrow; and 2) DNA repair was defective in cells deleted for p53 or xpc genes and these cells including cancer cells would not be protected.

DTIC

*Bone Marrow; Chemotherapy; Deoxyribonucleic Acid; Selenium; Sensitivity; Toxicity*

**20080048483** Group Health Cooperative of Puget Sound, Seattle, WA USA

**A Population-Based Randomized Trial to Assess the Effects of Short-Term Cessation of Hormone Replacement Therapy on Mammography Assessments and Breast Density**

Buist, Diana S; Newton, Katherine; Reed, Susan; Jun 2008; 9 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0447

Report No.(s): AD-A489927; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This randomized controlled trial was designed to test whether short-term (1-2 months) hormone replacement therapy (HRT) cessation will sufficiently lower breast density to decrease the proportion of women who receive a recommendation for additional evaluation following a screening mammogram, and to examine whether there is a trend in decreased recall by duration of HRT cessation. The study was conducted at Group Health, a managed health care organization with an organized breast cancer screening program. We sought to recruit 1,500 women to be randomized to one of three HRT arms: 1) cessation two months before the screening mammogram, 2) cessation one month before, and 3) continued HRT use. We measured breast density using a computer-assisted method and mammography recall rates from an expert radiologist review of the mammograms; both readers were blinded to HRT status. Recruitment started 11/2004 and ran through 9/30/2007, we contacted 5,861 potentially eligible women. Among those, we consented, enrolled and randomized 1704 (29.1%) women. Of the remaining 4,157 (70.9%); 977 (16.7%) were ineligible, we were unable to contact 179 (3.1%) and 2 (<0.1%) have an unknown reason.

DTIC

*Breast; Cancer; Hormones; Mammary Glands; Populations; Replacing; Therapy*

**20080048490** National Marrow Donor Program, Minneapolis, MN USA

**National Marrow Donor Program**

Setterholm, Michelle; Nov 17, 2008; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-06-1-0704

Report No.(s): AD-A489944; No Copyright; Avail.: Defense Technical Information Center (DTIC)

1. Contingency Preparedness: Collect information from transplant centers, build awareness of the Transplant Center Contingency Planning Committee and educate the transplant community about the critical importance of establishing a nationwide contingency response plan. 2. Rapid Identification of Matched Donors : Increase operational efficiencies that accelerate the search process and increase patient access are key to preparedness in a contingency event. pa 3. Immunogenetic Studies: Increase understanding of the immunologic factors important in HSC transplantation. 4. Clinical Research in Transplantation: Create a platform that facilitates multicenter collaboration and data management.

DTIC

*Bone Marrow; Emergencies*

**20080048497** California Univ., San Francisco, CA USA

**Enhancing Hormonal Therapy for Breast Cancer by Combination with a Well-Known Approved Pharmaceutical with Little Toxicity**

Kushner, Peter; Jul 2008; 21 pp.; In English

Contract(s)/Grant(s): W81XWH-07-1-0501

Report No.(s): AD-A490015; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The beneficial effects of hormonal therapy with antiestrogens or aromatase inhibitors for estrogen receptor (ER) positive metastatic breast cancer are limited by the phenomenon of hormonal resistance. We have found that valproic acid (VPA), a pharmaceutical long used as an anti-convulsant and recently found to have anti-tumor action possibly because it is a histone deacetylase inhibitor, enhances the action of antiestrogens and aromatase inhibitors on breast cancer cells. Our specific hypothesis is that VPA, will enhance the effectiveness and duration of hormonal therapy of human breast cancer xenografts growing in mice and with few side effects. Thus VPA would be an immediate candidate as an agent to enhance the effectiveness of hormonal therapy in humans. In the first few months of this award we have begun to investigate the ability of VPA to enhance the actions of tamoxifen or letrozole on human breast cancer xenografts growing on nude mice. We have also begun planning a human clinical trial of the ability of VPA to enhance tamoxifen action during a two week treatment after biopsy and prior to surgery.

DTIC

*Breast; Cancer; Estrogens; Mammary Glands; Pharmacology; Therapy; Toxicity*

**20080048498** Princeton Univ., NJ USA

**Using High Throughput Screens to Identify Lead Compounds for Alzheimer's Disease Therapeutics**

Chen, Jermont; Nov 2008; 140 pp.; In English; Original contains color illustrations

Report No.(s): AD-A490036; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Alzheimer's disease (AD) is the leading cause for dementia affecting over 4.6 million people in the USA. The current FDA approved drugs only provide temporary relief from memory loss symptoms, without treating the underlying root cause of the disease. The amyloid cascade hypothesis suggests that aggregation of the amyloid beta (AB) peptide into a neurotoxic oligomer initiates the disease. Small molecule compounds have been reported to inhibit AB peptide aggregation, as well as rescue AB induced toxicity. Screens to identify compounds are necessary to increase the chance of developing a therapeutic that prevents AB aggregation and the associated disease. Chapter 1 reviews the possible mechanism for Alzheimer's disease and discusses methods to prevent the disease. Chapter 2 presents results from an E coli based GFP fusion anti-aggregation screen. A library of 65,000 compounds was screened, and potential hits were characterized for aggregation inhibition as well as for the ability to rescue toxicity of the AB peptide. Improvements to the screen are also discussed. Chapter 3 presents the results from a screen designed to identify compounds that bind to the AB peptide. Small molecule microarrays (SMM) were used to identify compounds that bind to AB. Compounds that bind have the potential of becoming aggregation inhibitors. Over 20,000 compounds were screened, and several hits from the screen are shown to rescue AB induced toxicity.

DTIC

*Diseases; Lead Compounds; Therapy*

**20080048540** Library of Congress, Washington, DC USA

**Increases in Tricare Costs: Background and Options for Congress**

Jansen, Don J; Oct 23, 2008; 7 pp.; In English

Report No.(s): AD-A490231; CRS-RS22402; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In its FY2007, FY2008, and FY2009 budget submissions, the Department of Defense (DOD) proposed increases in Tricare enrollment fees, deductibles, and pharmacy co-payments for retired beneficiaries not yet eligible for Medicare. These actions were justified by DOD as necessary to constrain the growth of health care spending as an increasing proportion of the overall defense budget in the next decade. Congress has passed legislation each year to prohibit the proposed fee increases. In passing the FY2009 National Defense Authorization Act (P.L. 110-417), however, Congress included measures establishing demonstration projects intended to find ways to contain costs through increased use of preventive care services by TRICARE beneficiaries. The scope of these measures are limited. Defense health care spending will likely remain an issue for the DOD in the next Administration, and Congress can anticipate being asked to consider new proposals to constrain costs. This report will be updated as necessary.

DTIC

*Costs; Federal Budgets; Management Systems; Medical Services*

**20080048544** California Univ., San Francisco, CA USA

**A Novel Mouse Model for Genetic Validation of Therapeutic Targets in Breast Cancer**

Evans, Gerardi; Jun 2007; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0508

Report No.(s): AD-A490247; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Our proposal focused on developing a versatile and generic technology platform that allows direct evaluation of the roles played by specific genes (and their products) in the genesis, progression and maintenance of breast cancer. We have constructed genetically modified mice in which c-myc or E2f3 have been modified so as to incorporate a reversible Tet or Lac regulatable switch. This will allow us to switch off (and on) individual target gene and determine what role that gene plays in mammary carcinoma. In effect, we can model the efficacy, specificity and side effects of a drug designed to target that gene's function, either alone or in combination with existing therapies. To date we have generated the targeting constructs for these mice, tested the switchability of the construct in vitro, identified correctly targeted ES cells and generated chimeric mice. Once the targeted mutant mouse lines are reestablished we will combine them with established models of breast carcinogenesis, which will allow us to evaluate their separate and combined roles in driving breast cancer progression, in the maintenance of established tumors, and as therapeutic targets.

DTIC

*Breast; Cancer; Carcinogens; Genetics; Mammary Glands; Mice; Targets; Therapy; Tumors*

**20080048546** Army Research Inst. of Environmental Medicine, Natick, MA USA

**Real-time Monitoring of our Warfighters Health State: The Good, The Bad, and The Ugly**

Freund, Beau; Apr 5, 2008; 29 pp.; In English; Original contains color illustrations

Report No.(s): AD-A490257; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An overview of current and future technology and the challenges associated to real-time health monitoring of warfighters.

DTIC

*Armed Forces (United States); Combat; Detectors; Health; Real Time Operation*

**20080048547** Army Research Inst. of Environmental Medicine, Natick, MA USA

**SPARNET - Spartan Data Network for Real-Time Physiological Status Monitoring**

Hoyt, Reed W; Apr 5, 2008; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A490258; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of SPARNET is to develop a state-of-the-art wireless squad and personal area network that enable existing physio-sensors, algorithms, and interfaces to form real-time medical and situational awareness products for foot Soldiers. SPARNET uses network monitoring of physiology and geolocation to: minimize casualties and improve casualty management, improve mission planning and risk management, and increase mission training opportunities.

DTIC

*Biotelemetry; Communication Networks; Computer Networks; Physiology; Real Time Operation*

**20080048548** British Columbia Univ., Vancouver, British Columbia Canada

**Phase I/II Study of Combination Neoadjuvant Hormone Therapy and Weekly OGX-011 (Clusterin Antisense Oligonucleotide) Prior to Radical Prostatectomy in Patients with Localized Prostate Cancer**

Chi, Kim N; Aug 2008; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0226

Report No.(s): AD-A490260; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The clusterin gene encodes a cytoprotective chaperone protein that promotes cell survival. Clusterin is expressed in a variety of cancers including prostate, increases in response to apoptotic stimuli, and confers a resistant phenotype. OGX-011 is a 2nd generation antisense complementary to clusterin mRNA that inhibits expression of clusterin in xenograft models and thereby increases sensitivity to therapy. To evaluate OGX-011 as a potential treatment in humans, we have undertaken this Phase I/II study to evaluate the clinical, pathologic and biologic effects of OGX-011, in combination with neoadjuvant hormone therapy (NHT) in patients with prostate cancer and high risk features prior to radical prostatectomy. The primary objective of the phase I study was to determine phase II dose based on target regulation effect and the phase II primary objective was to assess the effects on pathologic complete response. 25 patients were enrolled to 6 cohorts with doses of OGX-011 up to 640mg delivered. Toxicity was limited to grade 1/2, including fevers, rigors, fatigue and transient AST and ALT elevations and no dose-limiting toxicities. Plasma PK analysis showed dose proportional increases in AUC and Cmax

with a t<sub>1/2</sub> of approximately 2h. Prostate tissue concentrations of OGX-011 increased with dose, and tissue concentrations associated with preclinical effect could be achieved. Dose dependent decreases in prostate cancer cell clusterin expression were observed by QRT-PCR and immunohistochemistry (IHC). At 640mg dosing, clusterin mRNA was decreased to a mean of 8% (SD=4%) compared with lower dose levels and historical controls as assessed by QRT-PCR on laser captured microdissected cancer cells. By IHC, mean % cancer cells staining 0 intensity for clusterin protein at 640mg dosing was 54% (SD=24%). Dose-dependent changes in serum clusterin were also apparent.

DTIC

*Cancer; Hormones; Patients; Prostate Gland; Radicals; Therapy*

**20080048549** California Univ., Los Angeles, CA USA

**Increasing Adherence to Follow-up of Breast Abnormalities in Low-Income Korean American Women: A Randomized Controlled Trial**

Maxwell, Annette; Sep 1, 2008; 17 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0676

Report No.(s): AD-A490261; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this study is to design and test an intervention to assist Korean American women who have been identified with a potential breast abnormality through the Breast Cancer Early Detection Program (BCEDP) and who have missed their first follow-up appointment (at-risk women). The intervention takes place in the form of peer navigation which includes reminder phone calls or home visits by a trained peer counselor to explain the importance of follow-up procedures, emotional support, help with transportation to follow-up appointments, translations, organizing care for children or grandchildren during medical appointments, and other assistance to overcome barriers to follow-up identified during the initial phase of the study. Major Findings: A total of 137 eligible Korean American women have consented to participate in the study. Preliminary analyses of the follow-up surveys suggest that our intervention is effective in increasing adherence to follow-up of breast abnormalities in low-income Korean American who are screened through BCEDP. Complete follow-up is reported by 68% of the women in the control group and 93% of the women in the intervention group. This difference is statistically significant (Fisher's exact test, p<.0007). We will have to assess if chart reviews confirm these self-report findings.

DTIC

*Abnormalities; Breast; Cancer; Income; Korea; Mammary Glands*

**20080048552** California Univ., San Francisco, CA USA

**Targeting MRS-Defined Dominant Intraprostatic Lesions with Inverse-Planned High Dose Rate Brachytherapy**

Pouliot, Jean; Hsu, I-Chow; Kurhanewicz, John; Noworelski, Sue; Jun 1, 2008; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0262

Report No.(s): AD-A490267; No Copyright; Avail.: Defense Technical Information Center (DTIC)

During the last 16 month period from 26 JAN 2007 to 25 MAY 2008, we have obtained the UCSF CHR re-confirmation. We have commissioned a new imaging fusion and planning system to facilitate the registration of MRI/MRS images with planning CT images. We have also published our results on the class solution for the boost of DIL defined by MRI/MRSI, as well as for the sparing of organs at risk including bladder, rectum, urethra and penile bulb. Patient's enrollment has been initiated.

DTIC

*Dosage; Imaging Techniques; Lesions; Magnetic Resonance; Risk*

## 52

### AEROSPACE MEDICINE

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments, see *53 Behavioral Sciences*. For the effects of space on animals and plants see *51 Life Sciences*.

**20080047367** NASA Johnson Space Center, Houston, TX, USA

**A Review of the Military Medical Support to NASA**

Chandler, Michael R.; Stepaniak, Philip; Linde, Marty; [2009]; 2 pp.; In English; No Copyright; Avail.: Other Sources

The National Aeronautics and Space Act of 1958 authorized NASA to use the assets and resources of the Department of

Defense (DoD), with their consent. To implement the DoD support for NASA, a charter for a new DoD organization was developed in 1958. Included in this charter was the ability of this organization to work outside of the normal military chain-of-command so they could work issues and coordinate efficiently. On the NASA side, this organization provided them a one-stop-shop to request support from the DoD. The Charter was implemented through a Secretary of Defense Memorandum that established the DoD office. The Memorandum and Charter established the areas of support from the military to NASA. Both the Memorandum and Charter have been updated over the last 50 years and the name of the office has changed, (the acronym DDMS remained until recently) but the tasking has remained relatively constant. The areas of support include: Rescue/Recovery of Astronauts, Landing Site Support, Medical Operations, Public Affairs, Contingency Communications, Airlift/Sealift and Salvage, Ferry Operations and Other Services as requested.

Derived from text

*Defense Program; Resources; Cooperation; Medical Services*

**20080047428** NASA Glenn Research Center, Cleveland, OH, USA

**Risk Assessment of Bone Fracture During Space Exploration Missions to the Moon and Mars**

Lewandowski, Beth E.; Myers, Jerry G.; Nelson, Emily S.; Griffin, Devon; February 26, 2008; 26 pp.; In English; Space Systems Engineering and Risk Management Symposium, 27-29 Feb. 2008, Los Angeles, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 444543.01.02.01; Copyright; Avail.: CASI: [A03](#), Hardcopy

The possibility of a traumatic bone fracture in space is a concern due to the observed decrease in astronaut bone mineral density (BMD) during spaceflight and because of the physical demands of the mission. The Bone Fracture Risk Module (BFxRM) was developed to quantify the probability of fracture at the femoral neck and lumbar spine during space exploration missions. The BFxRM is scenario-based, providing predictions for specific activities or events during a particular space mission. The key elements of the BFxRM are the mission parameters, the biomechanical loading models, the bone loss and fracture models and the incidence rate of the activity or event. Uncertainties in the model parameters arise due to variations within the population and unknowns associated with the effects of the space environment. Consequently, parameter distributions were used in Monte Carlo simulations to obtain an estimate of fracture probability under real mission scenarios. The model predicts an increase in the probability of fracture as the mission length increases and fracture is more likely in the higher gravitational field of Mars than on the moon. The resulting probability predictions and sensitivity analyses of the BFxRM can be used as an engineering tool for mission operation and resource planning in order to mitigate the risk of bone fracture in space.

Author

*Risk Assessment; Bone Demineralization; Fracturing; Sensitivity Analysis; Aerospace Environments*

**20080047663** NASA Langley Research Center, Hampton, VA, USA

**MCNPX Cosmic Ray Shielding Calculations with the NORMAN Phantom Model**

James, Michael R.; Durkee, Joe W.; McKinney, Gregg; Singleterry Robert; November 08, 2008; 2 pp.; In English; 2008 American Nuclear Society's Winter Meeting: Detecting Radiation in Our Radioactive World Workshop For Educators, 8 Nov. 2008, Reno, NV, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 651549.02.07.06; Copyright; Avail.: CASI: [A01](#), Hardcopy

The USA is planning manned lunar and interplanetary missions in the coming years. Shielding from cosmic rays is a critical aspect of manned spaceflight. These ventures will present exposure issues involving the interplanetary Galactic Cosmic Ray (GCR) environment. GCRs are comprised primarily of protons (approx.84.5%) and alpha-particles (approx.14.7%), while the remainder is comprised of massive, highly energetic nuclei. The National Aeronautics and Space Administration (NASA) Langley Research Center (LaRC) has commissioned a joint study with Los Alamos National Laboratory (LANL) to investigate the interaction of the GCR environment with humans using high-fidelity, state-of-the-art computer simulations. The simulations involve shielding and dose calculations in order to assess radiation effects in various organs. The simulations are being conducted using high-resolution voxel-phantom models and the MCNPX[1] Monte Carlo radiation-transport code. Recent advances in MCNPX physics packages now enable simulated transport over 2200 types of ions of widely varying energies in large, intricate geometries. We report here initial results obtained using a GCR spectrum and a NORMAN[3] phantom.

Author

*Radiation Effects; Galactic Cosmic Rays; Exposure; Manned Space Flight; Radiation Transport; Shielding; Alpha Particles*

**20080047725** NASA Johnson Space Center, Houston, TX, USA

**Assessment of Nutrient Stability in Space Foods**

Zwart, S. R.; Perchonok, M.; Braby, L. A.; Kloeris, V. A.; Smith, S. M.; [2009]; 1 pp.; In English; Human Research Program Investigators' Workshop, 2-4 Feb. 2009, League City, TX, USA; Copyright; Avail.: Other Sources; Abstract Only

Maintaining an intact nutrient supply in the food system flown on spacecraft is a critical issue for mission success and crew health and safety. Early polar expeditions and exploration expeditions by sailing vessels have taught us that a deficiency, or excess, of even a single vitamin in the food supply can be catastrophic. Evidence from ground-based research indicates that some vitamins are destroyed and fatty acids are oxidized (and therefore rendered dangerous or useless) by different types of radiation and by conditions of long-term storage. We hypothesize that radiation and long-term storage in the space-flight environment will affect the stability of vitamins, amino acids, and fatty acids in the space food system. The research objectives of our ongoing stability studies are to determine the stability of water- and fat-soluble vitamins, fatty acids, and amino acids in the space food supply before and after space flight on the International Space Station (ISS). Foods were analyzed after 2 weeks (a flight control), 11, 19, and 28 months of flight. Along with the space-flown foods, ground-based controls matched for time, light, and temperature are analyzed. The flight studies complement planned ground-based studies of the effects of radiation on vitamins, amino acids, and fatty acids. Flight studies are needed because a model based on ground-based data cannot predict all of the effects of the space-flight environment. Flight studies provide a more accurate test system to determine the effects on these nutrients of the temperature, and radiation conditions in the space-flight environment. Ground studies are required to evaluate longer missions and higher radiation levels expected outside low-Earth orbit. In addition to providing information about nutrient stability in space, the results of these studies will help NASA determine if a need exists to develop special packaging that can ensure stability of foods and nutrients in space, or if further studies of nutrient metabolism or nutrient requirements are needed.

Author

*Vitamins; Spacecrews; Aerospace Medicine; Aerospace Environments; Metabolism; Radiation Effects; Fatty Acids; Amino Acids*

**20080047726** NASA Johnson Space Center, Houston, TX, USA

**Vitamin D: Spaceflight, Antarctic, and JSC**

Smith, Scott M.; Locke, J.; Zwart, S. R.; [2009]; 1 pp.; In English; Human Research Program Investigators' Workshop, 2-4 Feb. 2009, League City, TX, USA; Copyright; Avail.: Other Sources; Abstract Only

Obtaining vitamin D is critical for space travelers because they lack ultraviolet light exposure and have an insufficient dietary supply of vitamin D. Despite the provision of vitamin D supplements to International Space Station (ISS) crewmembers, vitamin D status is consistently lower after flight than before flight, and in several crewmembers has decreased to levels considered clinically significant. Vitamin D has long been known to play a role in calcium metabolism, and more recently its non-calcitropic functions have been recognized. According to the results of several recent studies, functionally relevant measures indicate that the lower limit of serum 25-hydroxyvitamin D (a marker of vitamin D status) should be raised from the current 25 nmol/L to 80 nmol/L. The sub-optimal pre- and postflight vitamin D status is an issue that needs to be addressed, to allow NASA to better define the appropriate amount of supplemental vitamin D to serve as a countermeasure against vitamin D deficiency in astronaut crews. This is very important for long-duration crewmembers, and is critical for exploration-class missions. Ground-based models with limited sunlight exposure could be valuable for evaluating vitamin D supplementation efficacy. One such model is subjects spending the winter in Antarctica, where UV-B radiation levels are zero during the winter. Data from a study of such subjects will enable us to provide long-duration space flight crewmembers with evidence-based recommendations for vitamin D supplementation to achieve optimal vitamin D status before, during, and after flight. We report here results from a vitamin D supplementation study conducted in 2007 in Antarctica at McMurdo Station, and plans for a study to be implemented over the course of 2009. Additionally, in 2008, a study was initiated (and is ongoing) to assess efficacy and safety of supplementing with 2000 IU daily, 10,000 IU weekly, or 50,000 IU weekly for a month and then monthly after that. The data from these studies will enable us to provide space crews with evidence-based recommendations for vitamin D supplementation. The findings also have implications for other persons with limited UV light exposure, including polar workers and the elderly.

Author

*Calciferol; Vitamins; Flight Crews; Age Factor; Space Flight; Ultraviolet Radiation; International Space Station; Calcium Metabolism; Diets*



**20080048090** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Modeling the Uncertainty in the Radiation Quality Factor as an Ito Diffusion Process**

Barghouty, A. F.; [2007]; 9 pp.; In English; No Copyright; Avail.: Other Sources

Radiation protection strategies for deep-space missions rely on accurate and robust estimates of exposure dose and corresponding risk to crew health, systems functions, and mission safety in general. Simulation and modeling of deep-space radiation exposure's dose and risk are, to various degrees, made difficult by the inherent complexity and variability in characterizing the radiation environment, its passage and interaction with matter, as well as its biological effects. One of the more important contributors to the overall uncertainty in dose or risk assessment is empirical variability in the radiation quality factor, which is typically used to differentiate such effects. This paper is a first attempt at treating such variability in the context of a stochastic dynamic (Ito) process. It is shown here that with some restrictions the system can be modeled as a standard Ornstein-Uhlenbeck process. Based on this description, a measure of the modeled variability vs. inherent uncertainty in the quality factor is suggested and demonstrated.

Author

*Aerospace Medicine; Radiation Protection; Exposure; Radiation Dosage; Risk Assessment; Deep Space; Biological Effects*

**20080048257** NASA Johnson Space Center, Houston, TX, USA

**Monitoring Bone Health after Spaceflight: Data Mining to Support an Epidemiological Analysis of Age-related Bone Loss in Astronauts**

Baker, K. S.; Amin, S.; Sibonga, Jean D.; [2009]; 1 pp.; In English; Human Research Program Investigators' Workshop, 2-4 Feb, 2009, League City, TX, USA; Copyright; Avail.: CASI: [A01](#), Hardcopy

Through the epidemiological analysis of bone data, HRP is seeking evidence as to whether the prolonged exposure to microgravity of low earth orbit predisposes crewmembers to an earlier onset of osteoporosis. While this collaborative Epidemiological Project may be currently limited by the number of ISS persons providing relevant spaceflight medical data, a positive note is that it compares medical data of astronauts to data of an age-matched (not elderly) population that is followed longitudinally with similar technologies. The inclusion of data from non-ISS and non-NASA crewmembers is also being pursued. The ultimate goal of this study is to provide critical information for NASA to understand the impact of low physical or minimal weight-bearing activity on the aging process as well as to direct its development of countermeasures and rehabilitation programs to influence skeletal recovery. However, in order to optimize these results NASA needs to better define the requirements for long term monitoring and encourage both active and retired astronauts to contribute to a legacy of data that will define human health risks in space.

Author

*Data Mining; Musculoskeletal System; Aerospace Medicine; Age Factor; Bone Demineralization; Osteoporosis*

**20080048268** NASA Johnson Space Center, Houston, TX, USA

**Respiratory Toxicity of Lunar Highland Dust**

James, John T.; Lam, Chiu-wing; Wallace, William T.; [2009]; 1 pp.; In English; International Conference on Environmental Systems of Materials in Oxygen-Enriched Atmospheres, 13-16 Jul. 2009, Savannah, GA, USA; Copyright; Avail.: Other Sources; Abstract Only

Lunar dust exposures occurred during the Apollo missions while the crew was on the lunar surface and especially when microgravity conditions were attained during rendezvous in lunar orbit. Crews reported that the dust was irritating to the eyes and in some cases respiratory symptoms were elicited. NASA's vision for lunar exploration includes stays of 6 months on the lunar surface hence the health effects of periodic exposure to lunar dust need to be assessed. NASA has performed this assessment with a series of in vitro and in vivo tests on authentic lunar dust. Our approach is to 'calibrate' the intrinsic toxicity of lunar dust by comparison to a nontoxic dust (TiO<sub>2</sub>) and a highly toxic dust (quartz) using intratracheal instillation of the dusts in mice. A battery of indices of toxicity is assessed at various time points after the instillations. Cultures of selected cells are exposed to test dusts to assess the adverse effects on the cells. Finally, chemical systems are used to assess the nature of the reactivity of various dusts and to determine the persistence of reactivity under various environmental conditions that are relevant to a space habitat. Similar systems are used to assess the dissolution of the dust. From these studies we will be able to set a defensible inhalation exposure standard for aged dust and predict whether we need a separate standard for reactive dust. Presently-available data suggest that aged lunar highland dust is slightly toxic, that it can adversely affect cultured cells, and that the surface reactivity induced by grinding the dust persists for a few hours after activation.

Author

*Lunar Dust; Toxicity; Chemical Composition; In Vitro Methods and Tests; Habitats; Respiration; Lunar Surface; In Vivo Methods and Tests; Health*

**20080048284** NASA Johnson Space Center, Houston, TX, USA

**Nutritional Status Assessment (SMO 016E)**

Smith, S. M.; Zwart, S. R.; Heer, M.; Ericson, K.; Coburn, S. P.; Booth, S. A.; Jones, J. A.; Lupton, J.; [2009]; 1 pp.; In English; Human Research Program Investigators' Workshop, 2-4 Feb. 2009, League City, TX, USA; Copyright; Avail.:

Other Sources; Abstract Only

Until 2006, it was not been possible to assess nutritional status of crewmembers on the ISS during flight because blood and urine could not be collected during ISS missions. Postflight observations of alterations in status of several nutrients are troubling, and we require the ability to monitor the status of these nutrients during flight to determine if there is a specific impetus or timeframe for these changes. In addition to the monitoring of crew nutritional status during flight, in-flight sample collection would allow better assessment of countermeasure effectiveness. Collecting samples during flight is one of the objectives of SMO 016E, and it is also designed to expand the current medical requirement for nutritional assessment (MR016L) to include additional normative markers for assessing crew health and countermeasure effectiveness. Additional markers of bone metabolism will be measured to better monitor bone health and the effectiveness of countermeasures to prevent bone resorption. New markers of oxidative damage will be measured to better assess the type of oxidative insults that occur during space flight. The array of nutritional assessment variables will be expanded to include ones that will allow us to better understand changes in folate, vitamin K, and vitamin B6 status, as well as risk factors for cardiovascular and oxidative damage during and after flight. Stress hormones and hormones that affect bone and muscle metabolism will also be measured. Measuring these additional variables will allow us to better monitor the health of crewmembers and make more accurate recommendations for their rehabilitation. Several nutritional assessment variables are altered at landing, but it is not known how long these changes persist. We extended the original protocol to include an additional postflight blood and urine sample collection 30 days after landing. Data are being collected before, during, and after flight. These data will provide a complete survey of how nutritional status and related systems are affected by space flight. Analyzing the data will help us to define nutritional requirements for long-duration missions. This expanded set of measurements will also aid in the identification of nutritional countermeasures to counteract, for example, the deleterious effects of microgravity on bone and muscle and the effects of space radiation.

Author

*Nutritional Requirements; Spacecrews; Surveys; Vitamins; Extraterrestrial Radiation; Hormones; Health; Muscles; Aerospace Medicine*

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**MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT**

Includes human factors engineering, bionics, man-machine systems, life support, space suits and protective clothing. For related information see also *16 Space Transportation and Safety* and *52 Aerospace Medicine*.

**20080047241** Brookhaven National Lab., Upton, NY USA

**Human Factors Engineering Program Review Model**

O'Hara, J M; Higgins, J C; Persensky, J J; Lewis, P M; Bongarra, J P; Feb 2004; 117 pp.; In English

Report No.(s): AD-A488603; NUREG-0711-REV-2; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This document is used by the staff of the Nuclear Regulatory Commission to review the human factors engineering (HFE) programs of applicants for construction permits, operating licenses, standard design certifications, combined operating licenses, and for license amendments. The purpose of these reviews is to verify that accepted HFE practices and guidelines are incorporated into the applicant's HFE program. The review methodology provides a basis for performing reviews that address the twelve elements of an HFE program: HFE Program Management, Operating Experience Review; Functional Requirements Analysis and Function Allocation, Task Analysis, Staffing, Human Reliability Analysis, Human-System Interface Design, Procedure Development, Training Program Development, Human Factors Verification and Validation, Design Implementation, and Human Performance Monitoring. Each review element is divided into four sections: Background, Objective, Applicant Submittals, and Review Criteria. References to sources of additional information are also provided for each element.

DTIC

*Human Factors Engineering; Human Performance; Systems Engineering; Construction; Project Management*

**20080047300** National Inst. for Occupational Safety and Health, Washington, DC, USA  
**Health Hazard Evaluation Report, HETA-2003-0268-3065, Tower Automotive, Bluffton, OH, August 2008. Assessment of Physical Hazards at an Automobile Parts Manufacturing Facility**

Achutan, C.; Driscoll, R.; Habes, D.; Tubbs, R. L.; Aug. 2008; 36 pp.; In English

Report No.(s): PB2009-102097; HETA-2003-0268-3065; No Copyright; Avail.: National Technical Information Service (NTIS)

On May 19, 2003, NIOSH received a union request to conduct an HHE at Tower Automotive in Bluffton, Ohio. The request stated that employees were subjected to highly repetitive work, loud metal stamping noise, and excessive heat in the painting department. The management referred to their employees as colleagues, so this term is used in this report. During an initial site visit (August 21, 2003), NIOSH investigators reviewed documentation of past industrial hygiene and noise sampling and summaries of audiometric testing conducted at the facility, conducted noise sampling, performed an ergonomic evaluation of jobs that were in operation during our visit, and conducted confidential colleague interviews. During a follow-up site visit (September 13-16, 2004), personal exposure to heat stress and heat strain was assessed in the paint department. Area monitors indicated that the temperature in the paint area was significantly higher than in a comparison area (cafeteria). Six colleagues provided 13 heat strain measures. Of the personal heat strain measures (core body temperature, heart rate, and skin temperature) collected in the paint department (fork lift operators, loaders and unloaders), six measures exceeded the ACGIH core body temperature lower limit (100.4 deg F), and one exceeded its upper limit (101.3 DGF). The average heart rate measures were 55-115 beats per minute, and the average skin temperatures ranged from 86 deg F to 98 deg F. Nine measures showed signs of dehydration, of which three reached or exceeded the 1.5% guideline for adequate hydration. The ergonomic evaluation found that the 70247 press job presented an occupational hazard; relocation of the bin or other measures to reduce the amount of shoulder abduction and wrist flexion to retrieve parts should be a high priority for the company. Noise levels in the facility were between 85 and 100 dBA. Colleagues were observed wearing hearing protectors consistently and properly. Normal hearing declined from 2002 to 2003. On one of the cut-saw machines, the built-in LEV was not working. Metal shavings were observed all over the work area. During the confidential interviews, colleagues cited musculoskeletal injuries, heat stress from working in the paint department, and dust exposures as main concerns. NIOSH investigators recommend that colleagues working in the paint department rest during the rest portion of the work/rest regiment, and not be assigned any duties during this time. Also, for colleagues performing the 70247 job, the amount of shoulder abduction and wrist flexion to retrieve parts should be reduced. One way to achieve this is by relocating the bin holding parts associated with this job. In the cut-saw area, make sure that the LEV systems function properly, and keep work areas clean.

NTIS

*Automobiles; Hazards; Health; Industrial Plants; Industries; Musculoskeletal System; Safety; Towers*

**20080047303** National Inst. for Occupational Safety and Health, Washington, DC, USA  
**Health Hazard Evaluation Report, HETA-2007-0127-3068, FUNKe Fired Arts (Formerly Know as Annie's Mud Pie Shop), Cincinnati, OH, August 2008. Evaluation of Exposures at a Pottery Shop**

Chen, L.; Ramsey, J.; Brueck, S.; Aug. 2008; 40 pp.; In English

Report No.(s): PB2009-102098; HETA-2007-0127-3068; No Copyright; Avail.: CASI: [A03](#), Hardcopy

On February 2, 2007, NIOSH received a management request for an HHE at FUNKe Fired Arts, previously known as Annie's Mud Pie Shop, in Cincinnati, Ohio. Although no health symptoms were reported, management was concerned about the potential for employees long-term exposure to a variety of substances while performing duties at the pottery shop. Exposures of concern included silica from the clay mixing process, elements from mixing dry materials used in the glazes, and VOCs and gases during kiln firing. Because management requires the use of respirators during clay and glaze mixing, they also requested information on proper respirator use and maintenance. On March 21, 2007, NIOSH investigators held an opening conference and toured the facility to review work processes. On April 11, 12, and May 24, 2007, NIOSH investigators collected eight 8-hour PBZ samples and six area air samples for respirable particulates and silica. Six separate PBZ samples were taken while employees performed specific dust-generating tasks. Wipe sampling for elements was conducted throughout the facility. An ergonomic evaluation of the work processes was performed. During the firing of the kilns, area air samples were taken for elements, NO<sub>2</sub>, SO<sub>2</sub>, CO, CO<sub>2</sub>, and VOCs. CO readings were also taken during forklift activities. None of the PBZ or area air samples exceeded the OSHA PELs or NIOSH RELs for any of the compounds measured, although one employee's exposure for silica was at the NIOSH REL of 0.05 mg/m<sup>3</sup>. Tasks that created the highest concentrations of respirable silica and particulates included moving bags of raw materials to and from storage and mixing clay. Short-term concentrations of silica were high, reaching 2.0 mg/m<sup>3</sup> over 96 minutes of sampling. This exceeded ACGIH's excursion limit of 5 times the TWA TLV. VOCs, NO<sub>2</sub>, and SO<sub>2</sub> concentrations were not detected above the MDC during the kiln-firing process. Although PBZ samples of CO were not taken during the use of the forklift, real-time area CO measurements taken

at breathing zone level in the storage room peaked at 204 ppm, exceeding the NIOSH ceiling limit of 200 ppm. Due to the silica content of the clay and the potential for silica exposures to exceed OELs, we recommend using engineering controls to reduce employee exposures. This includes installing LEV in areas where high dust-generating activities take place and improving general building ventilation to allow adequate intake of outdoor air, mixing of indoor air, and dilution of potential airborne contaminants. Engineering controls are the preferred method over respirator use to reduce exposures to workplace contaminants. However, respirators should be used, and a formal respiratory protection program should be implemented until exposures can be reduced below the NIOSH REL and ACGIH excursion limit for silica. We also recommend establishing a health and safety training program for employees on appropriate equipment use and hazards. We further recommend that employees and students practice good hygiene in the workplace. Regular preventive maintenance for the forklift should be performed, eventually transitioning to a low or no emission forklift, and loading dock doors should be kept open while using the forklift to prevent the build-up of CO.

NTIS

*Ceramics; Dust; Exposure; Hazards; Health; Industries; Mud; Silicon Dioxide*

**20080047304** National Inst. for Occupational Safety and Health, Washington, DC, USA  
**Health Hazard Evaluation Report, HETA-2007-0263-3069, Superior Industries International, Inc., Pittsburg, KS, July 2008. Report on Respiratory and Dermal Conditions Among Machine Shop Workers**  
Cummings, K. J.; Boylstein, R. J.; Cox-Ganser, J.; Jul. 2008; 60 pp.; In English  
Report No.(s): PB2009-102099; HETA-2007-0263-3069; No Copyright; Avail.: National Technical Information Service (NTIS)

On May 25, 2007, the National Institute for Occupational Safety and Health (NIOSH) received a confidential Health Hazard Evaluation (HHE) request from workers at the Superior Industries International, Inc. facility in Pittsburg, Kansas. Workers reported recurrent pneumonias, asthma, and other respiratory symptoms as well as rashes and skin irritation that they related to the metalworking fluid (MWF), or coolant, used in the facility's machine shop. Exposure to MWF is associated with respiratory conditions, including asthma, bronchitis, and hypersensitivity pneumonitis, as well as with dermatitis (NIOSH 1998). NIOSH has established a Recommended Exposure Limit (REL) for MWF in the air of 0.4 mg/m<sup>3</sup> (thoracic particulate mass), as a time-weighted average (TWA) for up to 10 hours. This level corresponds to 0.5 mg/m<sup>3</sup> for total particulate mass. NIOSH investigators conducted telephone interviews with workers, treating physicians, company management and safety officials, and the director of the company's referral occupational health clinic. They reviewed medical records and environmental monitoring conducted by the company. They also conducted microbiological tests on samples of MWF collected from the machine shop. The investigators found that workers' symptoms and diagnoses were consistent with those associated with exposure to MWF. Workers in the machine shop reported not receiving training on the health hazards of MWF and not being provided respiratory protection; furthermore, they are not in a medical surveillance program. Operations are enclosed, but ventilation is limited to general exhaust and workers handling the automobile wheels have skin contact with MWF. Environmental monitoring conducted by the company showed MWF air levels above the NIOSH REL, but no or low growth of bacteria and fungi in the MWF. Analyses of MWF by NIOSH confirmed the minimal microbial growth, but did demonstrate the presence of mycobacterial DNA and fungal products. NIOSH recommends that management provide training on MWF to exposed workers, conduct environmental monitoring that includes personal sampling, implement local ventilation, provide personal protective equipment including respirators and gloves, and establish a medical surveillance program aimed at early identification of MWF-related respiratory and dermal conditions.

NTIS

*Exposure; Hazards; Health; Industries; Metal Working; Personnel; Skin (Anatomy)*

**20080047446** NASA Glenn Research Center, Cleveland, OH, USA  
**Cutting Edge Technologies Presentation: An Overview of Developing Sensor Technology Directions and Possible Barriers to New Technology Implementation**  
Hunter, Gary W.; November 2007; 32 pp.; In English; Breath Analysis Summit 2007, 1-3 Nov. 2007, Cleveland, OH, USA; Original contains color and black and white illustrations  
Contract(s)/Grant(s): WBS 444543.01.02.01; No Copyright; Avail.: CASI: A03, Hardcopy  
ONLINE: <http://hdl.handle.net/2060/20080047446>

The aerospace industry requires the development of a range of chemical sensor technologies for such applications as leak detection, emission monitoring, fuel leak detection, environmental monitoring, and fire detection. A range of chemical sensors are being developed based on micromachining and microfabrication technology to fabricate microsensors with minimal size, weight, and power consumption; and the use of nanomaterials and structures to develop sensors with improved stability

combined with higher sensitivity, However, individual sensors are limited in the amount of information that they can provide in environments that contain multiple chemical species. Thus, sensor arrays are being developed to address detection needs in such multi-species environments. These technologies and technical approaches have direct relevance to breath monitoring for clinical applications. This presentation gives an overview of developing cutting-edge sensor technology and possible barriers to new technology implementation. This includes lessons learned from previous microsensor development, recent work in development of a breath monitoring system, and future directions in the implementation of cutting edge sensor technology.

Author

*Environmental Monitoring; Aerospace Industry; Energy Consumption; Lessons Learned; Micromachining*

**20080047496** Michigan State Univ., East Lansing, MI USA

**Face Detection and Modeling for Recognition**

Hsu, Rein-Lien; Jan 2002; 199 pp.; In English

Report No.(s): AD-A489062; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489062>

Face recognition has received substantial attention from researchers in biometrics, computer vision, pattern recognition, and cognitive psychology communities because of the increased attention being devoted to security, man-machine communication, content-based image retrieval, and image/video coding. We have proposed two automated recognition paradigms to advance face recognition technology. Three major tasks involved in face recognition systems are: (i) face detection, (ii) face modeling, and (iii) face matching. We have developed a face detection algorithm for color images in the presence of various lighting conditions as well as complex backgrounds. Our detection method first corrects the color bias by a lighting compensation technique that automatically estimates the parameters of reference white for color correction. We overcame the difficulty of detecting the low-luma and high-luma skin tones by applying a nonlinear transformation to the Y CbCr color space. Our method generates face candidates based on the spatial arrangement of detected skin patches. We constructed eye, mouth, and face boundary maps to verify each face candidate. Experimental results demonstrate successful detection of faces with different sizes, color, position, scale, orientation, 3D pose, and expression in several photo collections. 3D human face models augment the appearance-based face recognition approaches to assist face recognition under the illumination and head pose variations. For the two proposed recognition paradigms, we have designed two methods for modeling human faces based on (i) a generic 3D face model and an individual's facial measurements of shape and texture captured in the frontal view, and (ii) alignment of a semantic face graph, derived from a generic 3D face model, onto a frontal face image.

DTIC

*Biometrics; Detection*

**20080047698** Michigan Univ., Ann Arbor, MI, USA

**Diver Education Series: Respiration and the Diver**

Somers, L. H.; January 1986; 8 pp.; In English

Contract(s)/Grant(s): NOAA-NA85AA-D-SG045

Report No.(s): PB2009-101929; MICHU-SG-86-509; No Copyright; Avail.: CASI: A02, Hardcopy

This document reviews the fundamental concepts of respiration and the diver, Hyperventilation Syndrome, Hyperpnea-Exhaustion Syndrome, and overexertion and exhaustion while diving.

NTIS

*Diving (Underwater); Education; Respiration*

**20080047717** NASA Johnson Space Center, Houston, TX, USA

**Cascade Distillation Subsystem Development: Progress Toward a Distillation Comparison Test**

Callahan, M. R.; Lubman, A.; Pickering, Karen D.; [2009]; 1 pp.; In English; 39th International Conference on Environmental Systems, 12-16 Jul. 2009, Savannah, GA, USA

Contract(s)/Grant(s): 439906.04.02.04; Copyright; Avail.: Other Sources; Abstract Only

Recovery of potable water from wastewater is essential for the success of long-duration manned missions to the Moon and Mars. Honeywell International and a team from NASA Johnson Space Center (JSC) are developing a wastewater processing subsystem that is based on centrifugal vacuum distillation. The wastewater processor, referred to as the Cascade Distillation Subsystem (CDS), utilizes an innovative and efficient multistage thermodynamic process to produce purified

water. The rotary centrifugal design of the system also provides gas/liquid phase separation and liquid transport under microgravity conditions. A five-stage subsystem unit has been designed, built, delivered and integrated into the NASA JSC Advanced Water Recovery Systems Development Facility for performance testing. A major test objective of the project is to demonstrate the advancement of the CDS technology from the breadboard level to a subsystem level unit. An initial round of CDS performance testing was completed in fiscal year (FY) 2008. Based on FY08 testing, the system is now in development to support an Exploration Life Support (ELS) Project distillation comparison test expected to begin in early 2009. As part of the project objectives planned for FY09, the system will be reconfigured to support the ELS comparison test. The CDS will then be challenged with a series of human-generated waste streams representative of those anticipated for a lunar outpost. This paper provides a description of the CDS technology, a status of the current project activities, and data on the system's performance to date.

Author

*Waste Water; Water Reclamation; Potable Water; Life Support Systems; Manned Space Flight; Distillation*

**20080047718** NASA Johnson Space Center, Houston, TX, USA

**Flexible Foam Protection Materials for Portable Life Support System Packaging Study**

Tang, Henry H.; Dillon, Paul A.; Thomas, Gretchen A.; [2009]; 2 pp.; In English; 39th International Conference on Environmental System, 12-16 Jul. 2009, Savannah, GA, USA

Contract(s)/Grant(s): NNJ05HI05C; 903184.04.02.01.02; Copyright; Avail.: Other Sources; Abstract Only

This paper discusses the phase I effort in evaluating and selecting a light weight impact protection material for the Constellation Space Suit Element (CSSE) Portable Life Support System (PLSS) conceptual packaging study. A light weight material capable of holding and protecting the components inside the PLSS is required to demonstrate the viability of the flexible PLSS packaging concept. The material needs to distribute, dissipate, and absorb the impact energy of the PLSS falling on the lunar surface. It must also be robust to consistently perform over several Extravehicular Activity (EVA) missions in the extreme lunar thermal vacuum environment. This paper documents the performance requirements for selecting a foam protection material, and the methodologies for evaluating some commercial off-the-shelf (COTS) foam material candidates. It also presents the mechanical properties and impact drop tests results of the foam material candidates. The results of this study suggest that a foam based flexible protection system is a viable solution for PLSS packaging. However, additional works are needed to optimize COTS foam or to develop a composite foam system that will meet all the performance requirements for the CSSE PLSS flexible packaging.

Author

*Space Suits; Portable Life Support Systems; Foams; Impact Tests; Thermal Environments; Packaging*

**20080047720** NASA Johnson Space Center, Houston, TX, USA

**Wautersia: The Contingency Water Container Bacterial Contamination Investigation**

Shkedi, Brienne; Labuda, Laura; Bruce, Rebekah; [2009]; 1 pp.; In English; International Conference on Environmental Systems, 12-16 Jul. 2009, Savannah, GA, USA; No Copyright; Avail.: Other Sources; Abstract Only

The Orbiter delivers water to the International Space Station (ISS) in Contingency Water Containers (CWCs) on each flight to the ISS. These CWCs are routinely sampled during each mission to verify the quality of the delivered water. Of the 5 samples returned on STS118/ 13A.1 in August 2007, two exhibited microbial growth exceeding potable water acceptability limits and historical data by orders of magnitude. The microbe was identified as Wautersia species and an investigation was launched to find the source of the contamination. Since then, samples collected on subsequent flights indicated additional CWCs had the same bacteria, as well as several on-orbit systems. An investigation was launched to try to find and address the source of the bacterial contamination. This paper will discuss how Wautersia was found, what Wautersia is, the investigation, and resolution.

Author

*Potable Water; Contamination; Bacteria; Microorganisms; International Space Station*

**20080047722** NASA Johnson Space Center, Houston, TX, USA

**ALSSAT Development Status**

Yeh, H. Y. Jannivine; Brown, Cheryl B.; Jeng, Frank F.; Anderson, Molly; Ewert, Michael K.; [2009]; 1 pp.; In English; International Conference on Environmental Systems, 12-16 Jul. 2009, Savannah, GA, USA; Copyright; Avail.: Other Sources; Abstract Only

The development of the Advanced Life Support (ALS) Sizing Analysis Tool (ALSSAT) using Microsoft(Registered

TradeMark) Excel was initiated by the Crew and Thermal Systems Division (CTSD) of Johnson Space Center (JSC) in 1997 to support the ALS and Exploration Offices in Environmental Control and Life Support System (ECLSS) design and studies. It aids the user in performing detailed sizing of the ECLSS for different combinations of the Exploration Life support (ELS) regenerative system technologies. This analysis tool will assist the user in performing ECLSS preliminary design and trade studies as well as system optimization efficiently and economically. The latest ALSSAT related publication in ICES 2004 detailed ALSSAT's development status including the completion of all six ELS Subsystems (ELSS), namely, the Air Management Subsystem, the Biomass Subsystem, the Food Management Subsystem, the Solid Waste Management Subsystem, the Water Management Subsystem, and the Thermal Control Subsystem and two external interfaces, including the Extravehicular Activity and the Human Accommodations. Since 2004, many more regenerative technologies in the ELSS were implemented into ALSSAT. ALSSAT has also been used for the ELS Research and Technology Development Metric Calculation for FY02 thru FY06. It was also used to conduct the Lunar Outpost Metric calculation for FY08 and was integrated as part of a Habitat Model developed at Langley Research Center to support the Constellation program. This paper will give an update on the analysis tool's current development status as well as present the analytical results of one of the trade studies that was performed.

Author

*Life Support Systems; Temperature Control; Extravehicular Activity; Control Systems Design; Biomass; Waste Management; Water Management*

**20080047724** NASA Johnson Space Center, Houston, TX, USA

**RFID in Space: Exploring the Feasibility and Performance of Gen 2 Tags as a Means of Tracking Equipment, Supplies, and Consumable Products in Cargo Transport Bags onboard a Space Vehicle or Habitat**

Jones, Erick C.; Richards, Casey; Herstein, Kelli; Franca, Rodrigo; Yagoda, Evan L.; Vasquez, Reuben; October 31, 2008; 166 pp.; In English; RFID in Space - Gen 2 Tag Study, 10 Oct. 2008, Houston, TX, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A08](#), Hardcopy

Current inventory management techniques for consumables and supplies aboard space vehicles are burdensome and time consuming. Inventory of food, clothing, and supplies are taken periodically by manually scanning the barcodes on each item. The inaccuracy of reading barcodes and the excessive amount of time it takes for the astronauts to perform this function would be better spent doing scientific experiments. Therefore, there is a need for an alternative method of inventory control by NASA astronauts. Radio Frequency Identification (RFID) is an automatic data capture technology that has potential to create a more effective and user-friendly inventory management system (IMS). In this paper we introduce a Design for Six Sigma Research (DFSS-R) methodology that allows for reliability testing of RFID systems. The research methodology uses a modified sequential design of experiments process to test and evaluate the quality of commercially available RFID technology. The results from the experimentation are compared to the requirements provided by NASA to evaluate the feasibility of using passive Generation 2 RFID technology to improve inventory control aboard crew exploration vehicles.

Author

*Inventory Controls; Inventory Management; Bags; Cargo; Consumables (Spacecraft); Habitats; Radio Frequencies; Inventories*

**20080047736** NASA Johnson Space Center, Houston, TX, USA

**Status of Constellation Pressure Garment Development**

Ross, Amy; Aitchison, Lindsay; Daniel, Brian; [2009]; 1 pp.; In English; International Conference on Environmental Systems, 12 Jul. 2009, Savannah, GA, USA

Contract(s)/Grant(s): 731384.06.04.31.04.02; No Copyright; Avail.: Other Sources; Abstract Only

The Constellation Program requires the development of a space suit system to meet new requirements for launch, entry, and abort crew survival functions, microgravity intravehicular and extravehicular activities, and lunar surface exploration. This paper summarizes recent work and the current status of the NASA Constellation Space Suit Element Pressure Garment and Crew Survival Subsystem (PG/CS). The emphasis of the work by the PGS/CS team has been in the areas of feasibility studies toward PGS/CS architecture definition, risk mitigation, and requirements development. Included are results from component level engineering studies, testing in the Orion Vehicle and Orion seat mockups, microgravity testing on the Reduced Gravity Aircraft, occupant protection sled testing, analyses and studies, and their implications on Constellation PG/CS subsystem.

Author

*Constellation Program; Extravehicular Activity; Space Suits; Spacecrews; Lunar Surface; Intravehicular Activity; Microgravity*

**20080047740** NASA Johnson Space Center, Houston, TX, USA

**Lunar Portable Life Support System Heat Rejection Study**

Conger, Bruce; Sompayrac, Robert G.; Trevino, Luis A.; Bue, Grant C.; [2009]; 1 pp.; In English; 39th International Conference on Environmental, 12-16 Jul. 2009, Savannah, GA, USA

Contract(s)/Grant(s): 903184.04.02.02.02; Copyright; Avail.: Other Sources; Abstract Only

Performing extravehicular activity (EVA) at various locations of the lunar surface presents thermal challenges that exceed those experienced in space flight to date. The lunar Portable Life Support System (PLSS) cooling unit must maintain thermal conditions within the space suit and reject heat loads generated by the crewmember and the PLSS equipment. The amount of cooling required varies based on the lunar location and terrain due to the heat transferred between the suit and its surroundings. A study has been completed which investigated the resources required to provide cooling under various lunar conditions, assuming three different thermal technology categories: 1. Spacesuit Water Membrane Evaporator (SWME) 2. Subcooled Phase Change Material (SPCM) 3. Radiators with and without heat pumps Results from the study are presented that show mass and power impacts on the cooling system as a function of the location and terrain on the lunar surface. Resources (cooling equipment mass and consumables) are greater at the equator and inside sunlit craters due to the additional heat loads on the cooling system. While radiator and SPCM technologies require minimal consumables, they come with carry-weight penalties and have limitations. A wider investigation is recommended to determine if these penalties and limitations are offset by the savings in consumables.

Author

*Portable Life Support Systems; Cooling Systems; Space Suits; Heat Pumps; Lunar Surface; Consumables (Spacecraft); Evaporators*

**20080047823** Air Force Research Lab., Mesa, AZ USA

**Using Observer Ratings to Assess Situation Awareness**

Bell, Herbert H; Lyon, Don R; Jan 2000; 19 pp.; In English

Contract(s)/Grant(s): Proj-1123

Report No.(s): AD-A489528; AFRL-RH-AZ-BC-2000-0001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This chapter reviews the development and use of observational measures to assess situation awareness among fighter pilots. The chapter begins with a general description of air combat and situation awareness. The next two sections summarize the general approach and the results of this effort. The chapter concludes with a discussion of the advantages and disadvantages with this approach and some general comments on the problems involved in measuring concepts that are as ill-defined as situation awareness (SA).

DTIC

*Human Factors Engineering; Pilots; Ratings; Situational Awareness; Warfare*

**20080047895** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Vocabularies for Description of Accessibility Issues in Multimodal User Interfaces**

Obrenovic, Z.; Troncy, R.; Hardman, L.; Jan. 2007; 16 pp.; In English

Report No.(s): PB2008-105180; INS-E0702; Copyright; Avail.: National Technical Information Service (NTIS)

In previous work, we proposed a unified approach for describing multimodal human-computer interaction and interaction constraints in terms of sensual, motor, perceptual and cognitive functions of users. In this paper, we extend this work by providing formalized vocabularies that express human functionalities and anatomical structures required by specific modalities. The central theme of our approach is to connect these modality representations with descriptions of user, device and environmental constraints that influence the interaction. These descriptions can then be used in a reasoning framework that will exploit formal connections among interaction modalities and constraints. The focus of this paper is on specifying a comprehensive vocabulary of necessary concepts. Within the context of an interaction framework, we describe a number of examples that use this formalized knowledge.

NTIS

*Multiple Access; Human-Computer Interface*



**20080047981** NASA, Washington, DC, USA

**NASA Tech Briefs, October 2008**

October 2008; 40 pp.; In English; See also 20080047982 - 20080048021; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Topics covered include: Control Architecture for Robotic Agent Command and Sensing; Algorithm for Wavefront Sensing Using an Extended Scene; CO<sub>2</sub> Sensors Based on Nanocrystalline SnO<sub>2</sub> Doped with CuO; Improved Airborne System for Sensing Wildfires; VHF Wide-Band, Dual-Polarization Microstrip-Patch Antenna; Onboard Data Processor for Change-Detection Radar Imaging; Using LDPC Code Constraints to Aid Recovery of Symbol Timing; System for Measuring Flexing of a Large Spaceborne Structure; Integrated Formation Optical Communication and Estimation System; Making Superconducting Welds between Superconducting Wires; Method for Thermal Spraying of Coatings Using Resonant-Pulsed Combustion; Coating Reduces Ice Adhesion; Hybrid Multififoil Aerogel Thermal Insulation; SHINE Virtual Machine Model for In-flight Updates of Critical Mission Software; Mars Image Collection Mosaic Builder; Providing Internet Access to High-Resolution Mars Images; Providing Internet Access to High-Resolution Lunar Images; Expressions Module for the Satellite Orbit Analysis Program Virtual Satellite; Small-Body Extensions for the Satellite Orbit Analysis Program (SOAP); Scripting Module for the Satellite Orbit Analysis Program (SOAP); XML-Based SHINE Knowledge Base Interchange Language; Core Technical Capability Laboratory Management System; MRO SOW Daily Script; Tool for Inspecting Alignment of Twinaxial Connectors; An ATP System for Deep-Space Optical Communication; Polar Traverse Rover Instrument; Expert System Control of Plant Growth in an Enclosed Space; Detecting Phycocyanin-Pigmented Microbes in Reflected Light; DMAC and NMP as Electrolyte Additives for Li-Ion Cells; Mass Spectrometer Containing Multiple Fixed Collectors; Waveguide Harmonic Generator for the SIM; Whispering Gallery Mode Resonator with Orthogonally Reconfigurable Filter Function; Stable Calibration of Raman Lidar Water-Vapor Measurements; Bimaterial Thermal Compensators for WGM Resonators; Root Source Analysis/ValuStream[Trade Mark] - A Methodology for Identifying and Managing Risks; Ensemble: an Architecture for Mission-Operations Software; Object Recognition Using Feature-and Color-Based Methods; On-Orbit Multi-Field Wavefront Control with a Kalman Filter; and The Interplanetary Overlay Networking Protocol Accelerator.

Author

*Aerogels; Binary Systems (Materials); Change Detection; Doped Crystals; Expert Systems; Imaging Techniques; Kalman Filters; Microorganisms; NASA Programs*

**20080047987** Bowling Green State Univ., OH, USA

**Detecting Phycocyanin-Pigmented Microbes in Reflected Light**

Vincent, Robert K.; NASA Tech Briefs, October 2008; October 2008, pp. 24; In English; See also [20080047981](#); Original contains color illustrations

Report No.(s): LEW-18202-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3291>

A recently invented method of measuring concentrations of phycocyanin-pigmented algae and bacteria in water is based on measurement of the spectrum of reflected sunlight. When present in sufficiently high concentrations, phycocyanin-pigmented microorganisms can be hazardous to the health of humans who use, and of animals that depend on, an affected body of water. The present method is intended to satisfy a need for a rapid, convenient means of detecting hazardous concentrations of phycocyanin-pigmented microorganisms. Rapid detection will speed up the issuance of public health warnings and performance of corrective actions. The method involves the measurement of light reflected from a body of water in at least two, but preferably five wavelength bands. In one version of the method, the five wavelength bands are bands 1, 3, 4, 5, and 7 of the Thematic Mapper (TM) multispectral imaging instrument aboard the Landsat-7 satellite (see table). In principle, other wavelength bands indicative of phycocyanin could be used alternatively or in addition to these five. Moreover, although the method was originally intended specifically for processing Landsat-7 TM data, it is equally applicable to processing of data from other satellite-borne instruments or from airborne, hand-held, buoy-mounted, tower-mounted, or otherwise mounted instruments that measure radiances of light reflected from water in the wavelength bands of interest.

Author

*Imaging Techniques; Detection; Radiance; Microorganisms; Bacteria; Algae; Thematic Mappers (Landsat); Satellite-Borne Instruments; Public Health*

**20080047995** California Inst. of Tech., Pasadena, CA, USA

**DMAC and NMP as Electrolyte Additives for Li-Ion Cells**

Smart, Marshall; Bugga, Ratnakumar; Lucht, Brett; NASA Tech Briefs, October 2008; October 2008, pp. 25; In English; See also [20080047981](#); Original contains color illustrations

Report No.(s): NPO-44805; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3294>

Dimethyl acetamide (DMAC) and N-methyl pyrrolidinone (NMP) have been found to be useful as high-temperature-resilience-enhancing additives to a baseline electrolyte used in rechargeable lithium-ion electrochemical cells. The baseline electrolyte, which was previously formulated to improve low-temperature performance, comprises LiPF<sub>6</sub> dissolved at a concentration of 1.0 M in a mixture comprising equal volume proportions of ethylene carbonate, diethyl carbonate, and dimethyl carbonate. This and other electrolytes comprising lithium salts dissolved in mixtures of esters (including alkyl carbonates) have been studied in continuing research directed toward extending the lower limits of operating temperatures and, more recently, enhancing the high-temperature resilience of such cells. This research at earlier stages, and the underlying physical and chemical principles, were reported in numerous previous NASA Tech Briefs articles. Although these electrolytes provide excellent performance at low temperatures (typically as low as -40 C), when the affected Li-ion cells are subjected to high temperatures during storage and cycling, there occur irreversible losses of capacity accompanied by power fade and deterioration of low-temperature performance. The term 'high-temperature resilience' signifies, loosely, the ability of a cell to resist such deterioration, retaining as much as possible of its initial charge/discharge capacity during operation or during storage in the fully charged condition at high temperature. For the purposes of the present development, a temperature is considered to be high if it equals or exceeds the upper limit (typically, 30 C) of the operating-temperature range for which the cells in question are generally designed.

Author

*Additives; Methyl Compounds; Electrolytes; Lithium; Ethyl Compounds; Electrochemical Cells; Metal Ions*

**20080047996** Monitor Instruments Co., LLC, Cheswick, PA, USA

**Mass Spectrometer Containing Multiple Fixed Collectors**

Moskala, Robert; Celo, Alan; Voss, Guenter; Shaffer, Tom; NASA Tech Briefs, October 2008; October 2008, pp. 26; In English; See also [20080047981](#); Original contains color illustrations

Report No.(s): KSC-12793/936; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3295>

A miniature mass spectrometer that incorporates features not typically found in prior mass spectrometers is undergoing development. This mass spectrometer is designed to simultaneously measure the relative concentrations of five gases (H<sub>2</sub>, He, N<sub>2</sub>, O<sub>2</sub>, and Ar) in air, over the relative-concentration range from 10(exp -6) to 1, during a sampling time as short as 1 second. It is intended to serve as a prototype of a product line of easy-to-use, portable, lightweight, highspeed, relatively inexpensive instruments for measuring concentrations of multiple chemical species in such diverse applications as detecting explosive or toxic chemicals in air, monitoring and controlling industrial processes, measuring concentrations of deliberately introduced isotopes in medical and biological investigations, and general environmental monitoring. The heart of this mass spectrometer is an integral combination of a circular cycloidal mass analyzer, multiple fixed ion collectors, and two mass-selective ion sources. By circular cycloidal mass analyzer is meant an analyzer that includes (1) two concentric circular cylindrical electrodes for applying a radial electric field and (2) a magnet arranged to impose a magnetic flux aligned predominantly along the cylindrical axis, so that ions, once accelerated into the annulus between the electrodes, move along circular cycloidal trajectories. As in other mass analyzers, trajectory of each ion is determined by its mass-to-charge ratio, and so ions of different species can be collected simultaneously by collectors (Faraday cups) at different locations intersected by the corresponding trajectories (see figure). Unlike in other mass analyzers, the installation of additional collectors to detect additional species does not necessitate increasing the overall size of the analyzer assembly.

Author

*Hydrogen; Helium; Nitrogen; Oxygen; Argon; Mass Spectrometers; Gas Composition; Toxicity; Ion Sources; Air Quality*

**20080047997** NASA Glenn Research Center, Cleveland, OH, USA

**Method for Thermal Spraying of Coatings Using Resonant-Pulsed Combustion**

Paxson, Daniel E.; NASA Tech Briefs, October 2008; October 2008, pp. 13-14; In English; See also [20080047981](#); Original contains color illustrations

Report No.(s): LEW-18221-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3271>

A method has been devised for high-volume, high-velocity surface deposition of protective metallic coatings on otherwise

vulnerable surfaces. Thermal spraying is used whereby the material to be deposited is heated to the melting point by passing through a flame. Rather than the usual method of deposition from the jet formed from the combustion products, this innovation uses non-steady combustion (i.e. high-frequency, periodic, confined bursts), which generates not only higher temperatures and heat transfer rates, but exceedingly high impingement velocities an order of magnitude higher than conventional thermal systems. Higher impingement rates make for better adhesion. The high heat transfer rates developed here allow the deposition material to be introduced, not as an expensive powder with high surface-area-to-volume, but in convenient rod form, which is also easier and simpler to feed into the system. The nonsteady, resonant combustion process is self-aspirating and requires no external actuation or control and no high-pressure supply of fuel or air. The innovation has been demonstrated using a commercially available resonant combustor shown in the figure. Fuel is naturally aspirated from the tank through the lower Tygon tube and into the pulsejet. Air for starting is ported through the upper Tygon tube line. Once operation commences, this air is no longer needed as additional air is naturally aspirated through the inlet. A spark plug on the device is needed for starting, but the process carries on automatically as the operational device is resonant and reignites itself with each 220-Hz pulse.

Author

*Protective Coatings; Combustion Products; Heat Transfer; High Pressure; Powder (Particles); Pulsejet Engines; Adhesion; Melting Points*

**20080047998** California Inst. of Tech., Pasadena, CA, USA

#### **Providing Internet Access to High-Resolution Lunar Images**

Plesea, Lucian; NASA Tech Briefs, October 2008; October 2008, pp. 17-18; In English; See also [20080047981](#)

Report No.(s): NPO-45951; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3278>

The OnMoon server is a computer program that provides Internet access to high-resolution Lunar images, maps, and elevation data, all suitable for use in geographical information system (GIS) software for generating images, maps, and computational models of the Moon. The OnMoon server implements the Open Geospatial Consortium (OGC) Web Map Service (WMS) server protocol and supports Moon-specific extensions. Unlike other Internet map servers that provide Lunar data using an Earth coordinate system, the OnMoon server supports encoding of data in Moon-specific coordinate systems. The OnMoon server offers access to most of the available high-resolution Lunar image and elevation data. This server can generate image and map files in the tagged image file format (TIFF) or the Joint Photographic Experts Group (JPEG), 8- or 16-bit Portable Network Graphics (PNG), or Keyhole Markup Language (KML) format. Image control is provided by use of the OGC Style Layer Descriptor (SLD) protocol. Full-precision spectral arithmetic processing is also available, by use of a custom SLD extension. This server can dynamically add shaded relief based on the Lunar elevation to any image layer. This server also implements tiled WMS protocol and super-overlay KML for high-performance client application programs.

Author

*Lunar Maps; Computer Programs; High Resolution; Photographs; Coordinates; Document Markup Languages; Internets*

**20080048008** NASA Kennedy Space Center, Cocoa Beach, FL, USA

#### **Coating Reduces Ice Adhesion**

Smith, Trent; Prince, Michael; DwWeese, Charles; Curtis, Leslie; NASA Tech Briefs, October 2008; October 2008, pp. 15; In English; See also [20080047981](#)

Report No.(s): KSC-13100/1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3272>

The Shuttle Ice Liberation Coating (SILC) has been developed to reduce the adhesion of ice to surfaces on the space shuttle. SILC, when coated on a surface (foam, metal, epoxy primer, polymer surfaces), will reduce the adhesion of ice by as much as 90 percent as compared to the corresponding uncoated surface. This innovation is a durable coating that can withstand several cycles of ice growth and removal without loss of anti-adhesion properties. SILC is made of a binder composed of varying weight percents of siloxane(s), ethyl alcohol, ethyl sulfate, isopropyl alcohol, and of fine-particle polytetrafluoroethylene (PTFE). The combination of these components produces a coating with significantly improved weathering characteristics over the siloxane system alone. In some cases, the coating will delay ice formation and can reduce the amount of ice formed. SILC is not an ice prevention coating, but the very high water contact angle (greater than 140°) causes water to readily run off the surface. This coating was designed for use at temperatures near -170 F (-112 C). Ice adhesion tests performed at temperatures from -170 to 20 F (-112 to -7 C) show that SILC is a very effective ice release coating. SILC can be left as applied (opaque) or buffed off until the surface appears clear. Energy dispersive spectroscopy (EDS) and x-ray photoelectron spectroscopy (XPS) data show that the coating is still present after buffing to transparency. This

means SILC can be used to prevent ice adhesion even when coating windows or other objects, or items that require transmission of optical light. Car windshields are kept cleaner and SILC effectively mitigates rain and snow under driving conditions.

Author

*Siloxanes; Ethyl Alcohol; Sulfates; Isopropyl Alcohol; Polytetrafluoroethylene; Ice Prevention; Adhesion Tests; Surface Properties*

**20080048009** California Inst. of Tech., Pasadena, CA, USA

### **Making Superconducting Welds between Superconducting Wires**

Penanen, Konstantin I.; Eom, Byeong Ho; NASA Tech Briefs, October 2008; October 2008, pp. 13; In English; See also [20080047981](#); Original contains color illustrations

Report No.(s): NPO-45931; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3270>

A technique for making superconducting joints between wires made of dissimilar superconducting metals has been devised. The technique is especially suitable for fabrication of superconducting circuits needed to support persistent electric currents in electromagnets in diverse cryogenic applications. Examples of such electromagnets include those in nuclear magnetic resonance (NMR) and magnetic resonance imaging (MRI) systems and in superconducting quantum interference devices (SQUIDS). Sometimes, it is desirable to fabricate different parts of a persistent-current-supporting superconducting loop from different metals. For example, a sensory coil in a SQUID might be made of Pb, a Pb/Sn alloy, or a Cu wire plated with Pb/Sn, while the connections to the sensory coil might be made via Nb or Nb/Ti wires. Conventional wire-bonding techniques, including resistance spot welding and pressed contact, are not workable because of large differences between the hardnesses and melting temperatures of the different metals. The present technique is not subject to this limitation. The present technique involves the use (1) of a cheap, miniature, easy-to-operate, capacitor-discharging welding apparatus that has an Nb or Nb/Ti tip and operates with a continuous local flow of gaseous helium and (2) preparation of a joint in a special spark-discharge welding geometry. In a typical application, a piece of Nb foil about 25  $\mu$ m thick is rolled to form a tube, into which is inserted a wire that one seeks to weld to the tube (see figure). The tube can be slightly crimped for mechanical stability. Then a spark weld is made by use of the aforementioned apparatus with energy and time settings chosen to melt a small section of the niobium foil. The energy setting corresponds to the setting of a voltage to which the capacitor is charged. In an experiment, the technique was used to weld an Nb foil to a copper wire coated with a Pb/Sn soft solder, which is superconducting. The joint was evaluated as part of a persistent-current circuit having an inductance of 1 mH. A current was induced in a loop, and no attenuation of the current after a time interval 1,000 s was discernible in a measurement having a fractional accuracy of  $10(\exp -4)$ : This observation supports the conclusion that the weld had an electrical resistance  $<10(\exp -10)$   $\Omega$ .

Author

*Bonding; Superconductivity; Welded Joints; Wire; Nuclear Magnetic Resonance; Electric Potential; Metal Foils; Continuum Flow; Electric Current*

**20080048011** Hammers Co., Greenbelt, MD, USA

### **Virtual Satellite**

Hammers, Stephan R.; NASA Tech Briefs, October 2008; October 2008, pp. 18; In English; See also [20080047981](#)

Report No.(s): GSC-14824-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3280>

Virtual Satellite (VirtualSat) is a computer program that creates an environment that facilitates the development, verification, and validation of flight software for a single spacecraft or for multiple spacecraft flying in formation. In this environment, enhanced functionality and autonomy of navigation, guidance, and control systems of a spacecraft are provided by a virtual satellite that is, a computational model that simulates the dynamic behavior of the spacecraft. Within this environment, it is possible to execute any associated software, the development of which could benefit from knowledge of, and possible interaction (typically, exchange of data) with, the virtual satellite. Examples of associated software include programs for simulating spacecraft power and thermal- management systems. This environment is independent of the flight hardware that will eventually host the flight software, making it possible to develop the software simultaneously with, or even before, the hardware is delivered. Optionally, by use of interfaces included in VirtualSat, hardware can be used instead of

simulated. The flight software, coded in the C or C++ programming language, is compilable and loadable into VirtualSat without any special modifications. Thus, VirtualSat can serve as a relatively inexpensive software test-bed for development test, integration, and post-launch maintenance of spacecraft flight software.

Author

*Applications Programs (Computers); Flight Control; Spacecraft Guidance; Formation Flying; Computer Programs; Dynamic Characteristics; Guidance (Motion); Navigation*

**20080048014** Geological Survey, USA

**Providing Internet Access to High-Resolution Mars Images**

Plesea, Lucian; NASA Tech Briefs, October 2008; October 2008, pp. 39; In English; See also [20080047981](#)

Report No.(s): NPO-45959; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3277>

The OnMars server is a computer program that provides Internet access to high-resolution Mars images, maps, and elevation data, all suitable for use in geographical information system (GIS) software for generating images, maps, and computational models of Mars. The OnMars server is an implementation of the Open Geospatial Consortium (OGC) Web Map Service (WMS) server. Unlike other Mars Internet map servers that provide Martian data using an Earth coordinate system, the OnMars WMS server supports encoding of data in Mars-specific coordinate systems. The OnMars server offers access to most of the available high-resolution Martian image and elevation data, including an 8-meter-per-pixel uncontrolled mosaic of most of the Mars Global Surveyor (MGS) Mars Observer Camera Narrow Angle (MOCNA) image collection, which is not available elsewhere. This server can generate image and map files in the tagged image file format (TIFF), Joint Photographic Experts Group (JPEG), 8- or 16-bit Portable Network Graphics (PNG), or Keyhole Markup Language (KML) format. Image control is provided by use of the OGC Style Layer Descriptor (SLD) protocol. The OnMars server also implements tiled WMS protocol and super-overlay KML for high-performance client application programs.

Author

*Document Markup Languages; Planetary Mapping; Mars Surface; Computer Programs; Mars Global Surveyor; Photographs; Coordinates; High Resolution; Internets*

**20080048015** NASA Stennis Space Center, Stennis Space Center, MS, USA

**Expert System Control of Plant Growth in an Enclosed Space**

May, George; Lanoue, Mark; Bathel, Matthew; Ryan, Robert E.; NASA Tech Briefs, October 2008; October 2008, pp. 23; In English; See also [20080047981](#); Original contains color illustrations

Report No.(s): SSC-00258; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3292>

The Expert System is an enclosed, controlled environment for growing plants, which incorporates a computerized, knowledge-based software program that is designed to capture the knowledge, experience, and problem-solving skills of one or more human experts in a particular discipline. The Expert System is trained to analyze crop/plant status, to monitor the condition of the plants and the environment, and to adjust operational parameters to optimize the plant-growth process. This system is intended to provide a way to remotely control plant growth with little or no human intervention. More specifically, the term control implies an autonomous method for detecting plant states such as health (biomass) or stress and then for recommending and implementing cultivation and/or remediation to optimize plant growth and to minimize consumption of energy and nutrients. Because of difficulties associated with delivering energy and nutrients remotely, a key feature of this Expert System is its ability to minimize this effort and to achieve optimum growth while taking into account the diverse range of environmental considerations that exist in an enclosed environment. The plant-growth environment for the Expert System could be made from a variety of structures, including a greenhouse, an underground cavern, or another enclosed chamber. Imaging equipment positioned within or around the chamber provides spatially distributed crop/plant-growth information. Sensors mounted in the chamber provide data and information pertaining to environmental conditions that could affect plant development. Lamps in the growth environment structure supply illumination, and other additional equipment in the chamber supplies essential nutrients and chemicals.

Author

*Expert Systems; Vegetation Growth; Crop Growth; Knowledge Based Systems; Farm Crops; Cultivation; Imaging Techniques; Biomass*

**20080048044** Creare, Inc., Hanover, NH, USA

**Deployable Crew Quarters**

Izenon, Michael G.; Chen, Weibo; NASA Tech Briefs, December 2008; December 2008, pp. 23; In English; See also [20080048022](#)

Report No.(s): MSC-23132-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3453>

The deployable crew quarters (DCQ) have been designed for the International Space Station (ISS). Each DCQ would be a relatively inexpensive, deployable boxlike structure that is designed to fit in a rack bay. It is to be occupied by one crewmember to provide privacy and sleeping functions for the crew. A DCQ comprises mostly hard panels, made of a lightweight honeycomb or matrix/fiber material, attached to each other by cloth hinges. Both faces of each panel are covered with a layer of Nomex cloth and noise-suppression material to provide noise isolation from ISS. On Earth, the unit is folded flat and attached to a rigid pallet for transport to the ISS. On the ISS, crewmembers unfold the unit and install it in place, attaching it to ISS structural members by use of soft cords (which also help to isolate noise and vibration). A few hard pieces of equipment (principally, a ventilator and a smoke detector) are shipped separately and installed in the DCQ unit by use of a system of holes, slots, and quarter-turn fasteners. Full-scale tests showed that the time required to install a DCQ unit amounts to tens of minutes. The basic DCQ design could be adapted to terrestrial applications to satisfy requirements for rapid deployable emergency shelters that would be lightweight, portable, and quickly erected. The Temporary Early Sleep Station (TeSS) currently on-orbit is a spin-off of the DCQ.

Author

*Spacecraft Cabins; Honeycomb Structures; Crews; International Space Station; Structural Members; Matrix Materials*

**20080048125** NASA, Washington, DC, USA

**NASA Tech Briefs, September 2008**

September 2008; 68 pp.; In English; See also 20080048126 - 20080048207; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A04](#), Hardcopy

Topics covered include: Nanotip Carpets as Antireflection Surfaces; Nano-Engineered Catalysts for Direct Methanol Fuel Cells; Capillography of Mats of Nanofibers; Directed Growth of Carbon Nanotubes Across Gaps; High-Voltage, Asymmetric-Waveform Generator; Magic-T Junction Using Microstrip/Slotline Transitions; On-Wafer Measurement of a Silicon-Based CMOS VCO at 324 GHz; Group-III Nitride Field Emitters; HEMT Amplifiers and Equipment for their On-Wafer Testing; Thermal Spray Formation of Polymer Coatings; Improved Gas Filling and Sealing of an HC-PCF; Making More-Complex Molecules Using Superthermal Atom/Molecule Collisions; Nematic Cells for Digital Light Deflection; Improved Silica Aerogel Composite Materials; Microgravity, Mesh-Crawling Legged Robots; Advanced Active-Magnetic-Bearing Thrust-Measurement System; Thermally Actuated Hydraulic Pumps; A New, Highly Improved Two-Cycle Engine; Flexible Structural-Health-Monitoring Sheets; Alignment Pins for Assembling and Disassembling Structures; Purifying Nucleic Acids from Samples of Extremely Low Biomass; Adjustable-Viewing-Angle Endoscopic Tool for Skull Base and Brain Surgery; UV-Resistant Non-Spore-Forming Bacteria From Spacecraft-Assembly Facilities; Hard-X-Ray/Soft-Gamma-Ray Imaging Sensor Assembly for Astronomy; Simplified Modeling of Oxidation of Hydrocarbons; Near-Field Spectroscopy with Nanoparticles Deposited by AFM; Light Collimator and Monitor for a Spectroradiometer; Hyperspectral Fluorescence and Reflectance Imaging Instrument; Improving the Optical Quality Factor of the WGM Resonator; Ultra-Stable Beacon Source for Laboratory Testing of Optical Tracking; Transmissive Diffractive Optical Element Solar Concentrators; Delaying Trains of Short Light Pulses in WGM Resonators; Toward Better Modeling of Supercritical Turbulent Mixing; JPEG 2000 Encoding with Perceptual Distortion Control; Intelligent Integrated Health Management for a System of Systems; Delay Banking for Managing Air Traffic; and Spline-Based Smoothing of Airfoil Curvatures.

Author

*Aerogels; Antireflection Coatings; Biomass; Carbon Nanotubes; Composite Materials; Electrocatalysts; Gamma Rays; High Electron Mobility Transistors; Nanostructure Growth; Molecular Interactions*

**20080048126** California Inst. of Tech., Pasadena, CA, USA

**Simplified Modeling of Oxidation of Hydrocarbons**

Bellan, Josette; Harstad, Kenneth; NASA Tech Briefs, September 2008; September 2008, pp. 29-30; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): NPO-44750; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3144>

A method of simplified computational modeling of oxidation of hydrocarbons is undergoing development. This is one of

several developments needed to enable accurate computational simulation of turbulent, chemically reacting flows. At present, accurate computational simulation of such flows is difficult or impossible in most cases because (1) the numbers of grid points needed for adequate spatial resolution of turbulent flows in realistically complex geometries are beyond the capabilities of typical supercomputers now in use and (2) the combustion of typical hydrocarbons proceeds through decomposition into hundreds of molecular species interacting through thousands of reactions. Hence, the combination of detailed reaction-rate models with the fundamental flow equations yields flow models that are computationally prohibitive. Hence, further, a reduction of at least an order of magnitude in the dimension of reaction kinetics is one of the prerequisites for feasibility of computational simulation of turbulent, chemically reacting flows. In the present method of simplified modeling, all molecular species involved in the oxidation of hydrocarbons are classified as either light or heavy; heavy molecules are those having 3 or more carbon atoms. The light molecules are not subject to meaningful decomposition, and the heavy molecules are considered to decompose into only 13 specified constituent radicals, a few of which are listed in the table. One constructs a reduced-order model, suitable for use in estimating the release of heat and the evolution of temperature in combustion, from a base comprising the 13 constituent radicals plus a total of 26 other species that include the light molecules and related light free radicals. Then rather than following all possible species through their reaction coordinates, one follows only the reduced set of reaction coordinates of the base. The behavior of the base was examined in test computational simulations of the combustion of heptane in a stirred reactor at various initial pressures ranging from 0.1 to 6 MPa. Most of the simulations were performed for stoichiometric mixtures; some were performed for fuel/oxygen mole ratios of 1/2 and 2.

Author

*Hydrocarbons; Oxidation; Mathematical Models; Turbulent Flow; Reaction Kinetics; Reacting Flow; Molecular Gases*

**20080048134** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Flow Solver for Incompressible 2-D Drive Cavity**

Kalb, Virginia L.; NASA Tech Briefs, September 2008; September 2008, pp. 45; In English; See also [20080048125](#)

Report No.(s): GSC-15107-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3181>

This software solves the Navier-Stokes equations for the incompressible driven cavity flow problem. The code uses second-order finite differencing on a staggered grid using the Chorin projection method. The resulting intermediate Poisson equation is efficiently solved using the fast Fourier transform. Time stepping is done using fourth-order Runge-Kutta for stability at high Reynolds numbers. Features include check-pointing, periodic field snapshots, ongoing reporting of kinetic energy and changes between time steps, time histories at selected points, and optional streakline generation.

Author

*Flow Visualization; Incompressible Flow; Finite Difference Theory; Cavity Flow; Navier-Stokes Equation*

**20080048140** California Inst. of Tech., Pasadena, CA, USA

**Post-Flight Estimation of Motion of Space Structures: Part 2**

Brugarolas, Paul; Breckenridge, William; NASA Tech Briefs, September 2008; September 2008, pp. 48; In English; See also [20080048125](#)

Report No.(s): NPO-45074; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: [http://www.techbriefs.com/index2.php?option=com\\_content&task=emailform&id=3](http://www.techbriefs.com/index2.php?option=com_content&task=emailform&id=3)

A computer program related to the one described in the immediately preceding article estimates the relative position of two space structures that are hinged to each other. The input to the program consists of time-series data on distances, measured by two range finders at different positions on one structure, to a corner-cube retroreflector on the other structure. Given a Cartesian (x,y,z) coordinate system and the known x coordinate of the retroreflector relative to the y,z plane that contains the range finders, the program estimates the y and z coordinates of the retroreflector. The estimation process involves solving for the y,z coordinates of the intersection between (1) the y,z plane that contains the retroreflector and (2) spheres, centered on the range finders, having radii equal to the measured distances. In general, there are two such solutions and the program chooses the one consistent with the design of the structures. The program implements a Kalman filter. The output of the program is a time series of estimates of the relative position of the structures.

Author

*Large Space Structures; Estimating; Computer Programs; Position Indicators; Retroreflectors*

**20080048143** California Inst. of Tech., Pasadena, CA, USA

**Near-Field Spectroscopy with Nanoparticles Deposited by AFM**

Anderson, Mark S.; NASA Tech Briefs, September 2008; September 2008, pp. 30-31; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): NPO-44033; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3143>

An alternative approach to apertureless near-field optical spectroscopy involving an atomic-force microscope (AFM) entails less complexity of equipment than does a prior approach. The alternative approach has been demonstrated to be applicable to apertureless near-field optical spectroscopy of the type using an AFM and surface enhanced Raman scattering (SERS), and is expected to be equally applicable in cases in which infrared or fluorescence spectroscopy is used. Apertureless near-field optical spectroscopy is a means of performing spatially resolved analyses of chemical compositions of surface regions of nanostructured materials. In apertureless near-field spectroscopy, it is common practice to utilize nanostructured probe tips or nanoparticles (usually of gold) having shapes and dimensions chosen to exploit plasmon resonances so as to increase spectroscopic-signal strengths. To implement the particular prior approach to which the present approach is an alternative, it is necessary to integrate a Raman spectrometer with an AFM and to utilize a special SERS-active probe tip. The resulting instrumentation system is complex, and the tasks of designing and constructing the system and using the system to acquire spectro-chemical information from nanometer-scale regions on a surface are correspondingly demanding.

Author

*Chemical Analysis; Infrared Spectroscopy; Surface Properties; Raman Spectra; Plasmons; Atoms; Near Fields; Nanoparticles*

**20080048144** NASA Ames Research Center, Moffett Field, CA, USA

**Light Collimator and Monitor for a Spectroradiometer**

Gore, Warren; NASA Tech Briefs, September 2008; September 2008, pp. 31; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): ARC-15714-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3147>

A system that comprises optical and electronic subsystems has been developed as an infrastructure for a spectroradiometer that measures time-dependent spectral radiance of the daylight sky, in a narrow field of view (having angular width of the order of 1°) centered on the zenith, in several spectral bands in the wavelength range from 0.3 to 2.2 μm. This system is used in conjunction with two commercially available monolithic spectrometers: a silicon-based one for wavelengths from 0.3 to 1.1 μm and a gallium arsenide-based one for wavelengths from 1.05 to 2.2 μm (see figure). The role of this system is to collect the light from the affected region of the sky, collimate the light, deliver the collimated light to the monolithic spectrometers, and process the electronic outputs of the spectrometers

Author

*Collimators; Gallium Arsenides; Spectral Bands; Spectroradiometers; Time Dependence; Field of View*

**20080048145** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Magic-T Junction using Microstrip/Slotline Transitions**

U-yen, Kongpop; Wollack, Edward J.; Doiron, Terence; NASA Tech Briefs, September 2008; September 2008, pp. 9-10; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): GSC-15470-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3095>

An improved broadband planar magic-T junction that incorporates microstrip/slotline transitions has been developed. In comparison with a prior broadband magic-T junction incorporating microstrip/slotline transitions, this junction offers superior broadband performance. In addition, because this junction is geometrically simpler and its performance is less affected by fabrication tolerances, the benefits of the improved design can be realized at lower fabrication cost. There are potential uses for junctions like this one in commercial microwave communication receivers, radar and polarimeter systems, and industrial microwave instrumentation. A magic-T junction is a four-port waveguide junction consisting of a combination of an H-type and an E-type junction. An E-type junction is so named because it includes a junction arm that extends from a main waveguide in the same direction as that of the electric (E) field in the waveguide. An H-type junction is so named because it includes a junction arm parallel to the magnetic (H) field in a main waveguide. A magic-T junction includes two input ports (here labeled I and 2, respectively) and two output ports (here labeled E and H, respectively). In an ideal case, (1) a magic-T junction is lossless, (2) the input signals add (that is, they combine in phase with each other) at port H, and (3) the input signals subtract



(that is, they combine in opposite phase) at port E. The prior junction over which the present junction is an improvement affords in-phase-combining characterized by a broadband frequency response, and features a small slotline area to minimize in-band loss. However, with respect to isolation between ports 1 and 2 and return loss at port E, it exhibits narrowband frequency responses. In addition, its performance is sensitive to misalignment of microstrip and slotline components: this sensitivity is attributable to a limited number of quarter-wavelength ( $\lambda/4$ ) transmission-line sections for matching impedances among all four ports, and to strong parasitic couplings at the microstrip/slotline T junction, where four microstrip lines and a slotline are combined. The present improved broadband magic-T junction (see figure) includes a microstrip ring structure and two microstrip- to-slotline transitions. One of the microstrip/slotline transitions is a small T junction between the ring and a slotline; the other microstrip/slotline transition effects coupling between the slotline and port E. The smallness of the T junction and the use of minimum-size slotline terminations help to minimize radiation loss. An impedance-transformation network that includes multiple quarter-wavelength sections is used to increase the operating bandwidth and minimize the parasitic coupling around the microstrip/slotline T junction. As a result, the improved junction has greater bandwidth and lower phase imbalance at the sum and difference ports than did the prior junction.

Author

*Broadband; Couplings; Impedance Matching; Microstrip Transmission Lines; Microwave Equipment; Radio Receivers; Telecommunication; Magic Tees*

**20080048170** Houston Univ., TX, USA

### **Group-III Nitride Field Emitters**

Bensaoula, Abdelhak; Berishev, Igor; NASA Tech Briefs, September 2008; September 2008, pp. 11-12; In English; See also [20080048125](#)

Report No.(s): MFS-32514-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3094>

Field-emission devices (cold cathodes) having low electron affinities can be fabricated through lattice-mismatched epitaxial growth of nitrides of elements from group III of the periodic table. Field emission of electrons from solid surfaces is typically utilized in vacuum microelectronic devices, including some display devices. The present field-emission devices and the method of fabricating them were developed to satisfy needs to reduce the cost of fabricating field emitters, make them compatible with established techniques for deposition of and on silicon, and enable monolithic integration of field emitters with silicon-based driving circuitry. In fabricating a device of this type, one deposits a nitride of one or more group-III elements on a substrate of (111) silicon or other suitable material. One example of a suitable deposition process is chemical vapor deposition in a reactor that contains plasma generated by use of electron cyclotron resonance. Under properly chosen growth conditions, the large mismatch between the crystal lattices of the substrate and the nitride causes strains to accumulate in the growing nitride film, such that the associated stresses cause the film to crack. The cracks lie in planes parallel to the direction of growth, so that the growing nitride film becomes divided into microscopic growing single-crystal columns. The outer ends of the fully-grown columns can serve as field-emission tips. By virtue of their chemical compositions and crystalline structures, the columns have low work functions and high electrical conductivities, both of which are desirable for field emission of electrons. From examination of transmission electron micrographs of a prototype device, the average column width was determined to be about 100 nm and the sharpness of the tips was determined to be characterized by a dimension somewhat less than 100 nm. The areal density of the columns was found to about  $5 \times 10^{10}$ /sq cm . about 4 to 5 orders of magnitude greater than the areal density of tips in prior field-emission devices. The electric field necessary to turn on the emission current and the current per tip in this device are both lower than in prior field-emission devices, such that it becomes possible to achieve longer operational lifetime. Moreover, notwithstanding the lower current per tip, because of the greater areal density of tips, it becomes possible to achieve greater current density averaged over the cathode area. The thickness of the grown nitride film (equivalently, the length of the columns) could lie between about 0.5 microns and a few microns; in any event, a thickness of about 1 micron is sufficient and costs less than do greater thicknesses. It may be possible to grow nitride emitter columns on glass or other substrate materials that cost less than silicon does. What is important in the choice of substrate material is the difference between the substrate and nitride crystalline structures. Inasmuch as the deposition process is nondestructive, an ability to grow emitter columns on a variety of materials would be advantageous in that it would facilitate the integration of field-emitter structures onto previously processed integrated circuits.

Author

*Field Emission; Microelectronics; Cold Cathodes; Crystal Structure; Electron Cyclotron Resonance; Display Devices*

**20080048171** California Inst. of Tech., Pasadena, CA, USA

#### **Adaptive MGS Phase Retrieval**

Basinger, Scott A.; Bikkannavar, Siddarayappa; Cohen, David; Green, Joseph J.; Lou, John; Ohara, Catherine; Redding, David; Shi, Fang; NASA Tech Briefs, September 2008; September 2008, pp. 51; In English; See also [20080048125](#)

Report No.(s): NPO-43857; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3197>

Adaptive MGS Phase Retrieval software uses the Modified Gerchberg-Saxton (MGS) algorithm, an image-based sensing method that can turn any focal plane science instrument into a wavefront sensor, avoiding the need to use external metrology equipment. Knowledge of the wavefront enables intelligent control of active optical systems.

Derived from text

*Algorithms; Image Analysis; Metrology; Optical Measurement*

**20080048174** California Inst. of Tech., Pasadena, CA, USA

#### **Nano-Engineered Catalysts for Direct Methanol Fuel Cells**

Myung, Nosang; Narayanan, Sekharipuram; Wiberg, Dean; NASA Tech Briefs, September 2008; September 2008, pp. 6-7; In English; See also [20080048125](#); Original contains color and black and white illustrations

Report No.(s): NPO-30840; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3080>

Nano-engineered catalysts, and a method of fabricating them, have been developed in a continuing effort to improve the performances of direct methanol fuel cells as candidate power sources to supplant primary and secondary batteries in a variety of portable electronic products. In order to realize the potential for high energy densities (as much as 1.5 W h/g) of direct methanol fuel cells, it will be necessary to optimize the chemical compositions and geometric configurations of catalyst layers and electrode structures. High performance can be achieved when catalyst particles and electrode structures have the necessary small feature sizes (typically of the order of nanometers), large surface areas, optimal metal compositions, high porosity, and hydrophobicity. The present method involves electrodeposition of one or more catalytic metal(s) or a catalytic-metal/polytetrafluoroethylene nanocomposite on an alumina nanotemplate. The alumina nanotemplate is then dissolved, leaving the desired metal or metal/polytetrafluoroethylene-composite catalyst layer. Unlike some prior methods of making fine metal catalysts, this method does not involve processing at elevated temperature; all processing can be done at room temperature. In addition, this method involves fewer steps and is more amenable to scaling up for mass production. Alumina nanotemplates are porous alumina membranes that have been fabricated, variously, by anodizing either pure aluminum or aluminum that has been deposited on silicon by electronbeam evaporation. The diameters of the pores (7 to 300 nm), areal densities of pores (as much as  $7 \times 10^{10}$  sq cm), and lengths of pores (up to about 100 nm) can be tailored by selection of fabrication conditions. In a given case, the catalytic metal, catalytic metal alloy, or catalytic metal/ polytetrafluoroethylene composite is electrodeposited in the pores of the alumina nanotemplate. The dimensions of the pores, together with the electrodeposition conditions, determine the sizes and surface areas of the catalytic particles. Hence, the small features and large surface areas of the porosity translate to the desired small particle size and large surface area of the catalyst (see figure). When polytetrafluoroethylene is included, it is for the purpose of imparting hydrophobicity in order to prevent water from impeding the desired diffusion of gases through the catalyst layer. To incorporate polytetrafluoroethylene into a catalytic-metal/polytetrafluoroethylene nanocomposite, one suspends polytetrafluoroethylene nanoparticles in the electrodeposition solution. The polytetrafluoroethylene content can be varied to obtain the desired degree of hydrophobicity and permeability by gas.

Author

*Catalysts; Electrocatalysts; Nanocomposites; Methyl Alcohol; Nanoparticles; Fuel Cells; Electrodeposition; Gaseous Diffusion*

**20080048175** California Inst. of Tech., Pasadena, CA, USA

#### **Nanotip Carpets as Antireflection Surfaces**

Bae, Youngsam; Mobasser, Sohrab; Manohara, Harish; Lee, Choonsup; NASA Tech Briefs, September 2008; September 2008, pp. 5-6; In English; See also [20080048125](#); Original contains color and black and white illustrations

Report No.(s): NPO-42592; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3070>

Carpet-like random arrays of metal-coated silicon nanotips have been shown to be effective as antireflection surfaces. Now undergoing development for incorporation into Sun sensors that would provide guidance for robotic exploratory vehicles on Mars, nanotip carpets of this type could also have many uses on Earth as antireflection surfaces in instruments that handle or detect ultraviolet, visible, or infrared light. In the original Sun-sensor application, what is required is an array of

50-micron-diameter apertures on what is otherwise an opaque, minimally reflective surface, as needed to implement a miniature multiple-pinhole camera. The process for fabrication of an antireflection nanotip carpet for this application (see Figure 1) includes, and goes somewhat beyond, the process described in A New Process for Fabricating Random Silicon Nanotips (NPO-40123), NASA Tech Briefs, Vol. 28, No. 1 (November 2004), page 62. In the first step, which is not part of the previously reported process, photolithography is performed to deposit etch masks to define the 50-micron apertures on a silicon substrate. In the second step, which is part of the previously reported process, the non-masked silicon area between the apertures is subjected to reactive ion etching (RIE) under a special combination of conditions that results in the growth of fluorine-based compounds in randomly distributed formations, known in the art as 'polymer RIE grass,' that have dimensions of the order of microns. The polymer RIE grass formations serve as microscopic etch masks during the next step, in which deep reactive ion etching (DRIE) is performed. What remains after DRIE is the carpet of nano - tips, which are high-aspect-ratio peaks, the tips of which have radii of the order of nanometers. Next, the nanotip array is evaporatively coated with Cr/Au to enhance the absorption of light (more specifically, infrared light in the Sun-sensor application). The photoresist etch masks protecting the apertures are then removed by dipping the substrate into acetone. Finally, for the Sun-sensor application, the back surface of the substrate is coated with a 57-nm-thick layer of Cr for attenuation of sunlight.

Author

*Antireflection Coatings; Solar Sensors; Robotics; Photolithography; Miniaturization; Electromagnetic Absorption; Silicon*

**20080048176** California Inst. of Tech., Pasadena, CA, USA

#### **UV-Resistant Non-Spore-Forming Bacteria From Spacecraft-Assembly Facilities**

Venkateswaran, Kasthuri; NASA Tech Briefs, September 2008; September 2008, pp. 28; In English; See also [20080048125](#)

Report No.(s): NPO-45739; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3142>

Four species of non-spore-forming bacteria collected from clean-room surfaces in spacecraft-assembly facilities could survive doses of ultraviolet (UV) radiation that would suffice to kill most known cultivable bacterial species. In a previous study, high UV resistance was found in spores of the SAFR-032 strain of *Bacillus pumilus*, as reported in 'Ultraviolet-Resistant Bacterial Spores,' NASA Tech Briefs, Vol. 31, No. 9 (September 2007), page 94. These studies are parts of a continuing effort to understand the survival of hardy species of bacteria under harsh conditions, and develop means of sterilizing spacecraft to prevent biocontamination of Mars that could in turn interfere with future life detection missions. The four species investigated were *Arthrobacter* sp. KSC\_Ak2i, *Microbacterium schleiferi* LMA\_AkK1, *Brevundimonas diminuta* KSC\_Ak3a, and *Sphingomonas trueperi* JSC\_Ak7-3. In the study, cells of these species were mixed into Atacama Desert soil (to elucidate the shadowing effect of soil particles) and the resulting mixtures were tested both in solution and in a desiccated state under simulated Martian atmospheric and UV conditions. The UV-survival indices of *Arthrobacter* sp. and *Microbacterium schleiferi* were found to be comparable to those of *Bacillus pumilus* spores.

Author

*Bacteria; Ultraviolet Radiation; Spores; Meteorology*

**20080048178** NASA Langley Research Center, Hampton, VA, USA

#### **Displaying CFD Solution Parameters on Arbitrary Cut Planes**

Pao, S. Paul; NASA Tech Briefs, September 2008; September 2008, pp. 45; In English; See also [20080048125](#)

Report No.(s): LAR-17527-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/content/view/3180/123>

USMC6 is a Fortran 90 computer program for post-processing in support of visualization of flows simulated by computational fluid dynamics (CFD). The name 'USMC6' is partly an abbreviation of 'TetrUSS - USM3D Solution Cutter,' reflecting its origin as a post-processor for use with USM3D - a CFD program that is a component of the Tetrahedral Unstructured Software System and that solves the Navier-Stokes equations on tetrahedral unstructured grids. 'Cutter' here refers to a capability to acquire and process solution data on (1) arbitrary planes that cut through grid volumes, or (2) user-selected spheroidal, conical, cylindrical, and/or prismatic domains cut from within grids. Cutting saves time by enabling concentration of post-processing and visualization efforts on smaller solution domains of interest. The user can select from among more than 40 flow functions. The cut planes can be trimmed to circular or rectangular shape. The user specifies cuts and functions in a free-format input file using simple and easy-to-remember keywords. The USMC6 command line is simple enough that the slicing process can readily be embedded in a shell script for assembly-line post-processing. The output of USMC6 is a data file ready for plotting.

Author

*Computational Fluid Dynamics; Unstructured Grids (Mathematics); Computer Programs; FORTRAN; Applications Programs (Computers)*

**20080048180** California Inst. of Tech., Pasadena, CA, USA

**On-Wafer Measurement of a Silicon-Based CMOS VCO at 324 GHz**

Samoska, Lorene; Man Fung, King; Gaier, Todd; Huang, Daquan; Larocca, Tim; Chang, M. F.; Campbell, Richard; Andrews, Michael; NASA Tech Briefs, September 2008; September 2008, pp. 11; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): NPO-45494; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3092>

The world's first silicon-based complementary metal oxide/semiconductor (CMOS) integrated-circuit voltage-controlled oscillator (VCO) operating in a frequency range around 324 GHz has been built and tested. Concomitantly, equipment for measuring the performance of this oscillator has been built and tested. These accomplishments are intermediate steps in a continuing effort to develop low-power-consumption, low-phase-noise, electronically tunable signal generators as local oscillators for heterodyne receivers in submillimeter-wavelength (frequency > 300 GHz) scientific instruments and imaging systems. Submillimeter-wavelength imaging systems are of special interest for military and law-enforcement use because they could, potentially, be used to detect weapons hidden behind clothing and other opaque dielectric materials. In comparison with prior submillimeter-wavelength signal generators, CMOS VCOs offer significant potential advantages, including great reductions in power consumption, mass, size, and complexity. In addition, there is potential for on-chip integration of CMOS VCOs with other CMOS integrated circuitry, including phase-lock loops, analog-to-digital converters, and advanced microprocessors.

Author

*CMOS; Integrated Circuits; Voltage Controlled Oscillators; Signal Generators; Analog to Digital Converters; Energy Consumption; Imaging Techniques*

**20080048182** NASA Langley Research Center, Hampton, VA, USA; Analytical Mechanics Associates, Inc., USA

**Stochastic Analysis of Orbital Lifetimes of Spacecraft**

Sasamoto, Washito; Goodliff, Kandyce; Cornelius, David; NASA Tech Briefs, September 2008; September 2008, pp. 43; In English; See also [20080048125](#)

Report No.(s): LAR-17498-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3155>

A document discusses (1) a Monte-Carlo-based methodology for probabilistic prediction and analysis of orbital lifetimes of spacecraft and (2) Orbital Lifetime Monte Carlo (OLMC)--a Fortran computer program, consisting of a previously developed long-term orbit-propagator integrated with a Monte Carlo engine. OLMC enables modeling of variances of key physical parameters that affect orbital lifetimes through the use of probability distributions. These parameters include altitude, speed, and flight-path angle at insertion into orbit; solar flux; and launch delays. The products of OLMC are predicted lifetimes (durations above specified minimum altitudes) for the number of user-specified cases. Histograms generated from such predictions can be used to determine the probabilities that spacecraft will satisfy lifetime requirements. The document discusses uncertainties that affect modeling of orbital lifetimes. Issues of repeatability, smoothness of distributions, and code run time are considered for the purpose of establishing values of code-specific parameters and number of Monte Carlo runs. Results from test cases are interpreted as demonstrating that solar-flux predictions are primary sources of variations in predicted lifetimes. Therefore, it is concluded, multiple sets of predictions should be utilized to fully characterize the lifetime range of a spacecraft.

Author

*Orbital Lifetime; Spacecraft; Performance Prediction; Stochastic Processes; Monte Carlo Method; FORTRAN; Applications Programs (Computers)*

**20080048186** NASA Ames Research Center, Moffett Field, CA, USA

**JPEG 2000 Encoding with Perceptual Distortion Control**

Watson, Andrew B.; Liu, Zhen; Karam, Lina J.; NASA Tech Briefs, September 2008; September 2008, pp. 37-38; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): ARC-15522-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3149>

An alternative approach has been devised for encoding image data in compliance with JPEG 2000, the most recent still-image data-compression standard of the Joint Photographic Experts Group. Heretofore, JPEG 2000 encoding has been implemented by several related schemes classified as rate-based distortion-minimization encoding. In each of these schemes, the end user specifies a desired bit rate and the encoding algorithm strives to attain that rate while minimizing a mean squared

error (MSE). While rate-based distortion minimization is appropriate for transmitting data over a limited-bandwidth channel, it is not the best approach for applications in which the perceptual quality of reconstructed images is a major consideration. A better approach for such applications is the present alternative one, denoted perceptual distortion control, in which the encoding algorithm strives to compress data to the lowest bit rate that yields at least a specified level of perceptual image quality. Some additional background information on JPEG 2000 is prerequisite to a meaningful summary of JPEG encoding with perceptual distortion control. The JPEG 2000 encoding process includes two subprocesses known as tier-1 and tier-2 coding. In order to minimize the MSE for the desired bit rate, a rate-distortion- optimization subprocess is introduced between the tier-1 and tier-2 subprocesses. In tier-1 coding, each coding block is independently bit-plane coded from the most-significant-bit (MSB) plane to the least-significant-bit (LSB) plane, using three coding passes (except for the MSB plane, which is coded using only one 'clean up' coding pass). For M bit planes, this subprocess involves a total number of  $(3M - 2)$  coding passes. An embedded bit stream is then generated for each coding block. Information on the reduction in distortion and the increase in the bit rate associated with each coding pass is collected. This information is then used in a rate-control procedure to determine the contribution of each coding block to the output compressed bit stream.

Author

*Coding; Data Compression; Optimization; Mean Square Values; Image Resolution; Distortion*

**20080048187** California Inst. of Tech., Pasadena, CA, USA

### **Toward Better Modeling of Supercritical Turbulent Mixing**

Selle, Laurent; Okongo'o, Nora; Bellan, Josette; Harstad, Kenneth; NASA Tech Briefs, September 2008; September 2008, pp. 37; In English; See also [20080048125](#)

Report No.(s): NPO-44402; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3148>

study was done as part of an effort to develop computational models representing turbulent mixing under thermodynamic supercritical (here, high pressure) conditions. The question was whether the large-eddy simulation (LES) approach, developed previously for atmospheric-pressure compressible-perfect-gas and incompressible flows, can be extended to real-gas non-ideal (including supercritical) fluid mixtures. [In LES, the governing equations are approximated such that the flow field is spatially filtered and subgrid-scale (SGS) phenomena are represented by models.] The study included analyses of results from direct numerical simulation (DNS) of several such mixing layers based on the Navier-Stokes, total-energy, and conservation-of-chemical-species governing equations. Comparison of LES and DNS results revealed the need to augment the atmospheric-pressure LES equations with additional SGS momentum and energy terms. These new terms are the direct result of high-density-gradient-magnitude regions found in the DNS and observed experimentally under fully turbulent flow conditions. A model has been derived for the new term in the momentum equation and was found to perform well at small filter size but to deteriorate with increasing filter size. Several alternative models were derived for the new SGS term in the energy equation that would need further investigations to determine if they are too computationally intensive in LES.

Author

*Turbulent Mixing; Reaction Kinetics; Direct Numerical Simulation; Flow Distribution; High Pressure; Gas Flow*

**20080048189** NASA Goddard Space Flight Center, Greenbelt, MD, USA

### **Flow Solver for Incompressible Rectangular Domains**

Kalb, Virginia L.; NASA Tech Briefs, September 2008; September 2008, pp. 45; In English; See also [20080048125](#)

Report No.(s): GSC-15111-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3182>

This is an extension of the Flow Solver for Incompressible 2-D Drive Cavity software described in the preceding article. It solves the Navier-Stokes equations for incompressible flow using finite differencing on a uniform, staggered grid. There is a runtime choice of either central differencing or modified upwinding for the convective term. The domain must be rectangular, but may have a rectangular walled region within it. Currently, the position of the interior region and exterior boundary conditions are changed by modifying parameters in the code and recompiling. These features make it possible to solve a variety of classical fluid flow problems such as an L-shaped cavity, channel flow, or wake flow past a square cylinder. The code uses fourth-order Runge-Kutta time-stepping and overall second-order spatial accuracy. This software permits the walled region to be positioned such that flow past a square cylinder, an L-shaped cavity, and the flow over a back-facing step can all be solved by reconfiguration. Also, this extension has an automatic detection of periodicity, as well as use of specialized data structure for ease of configuring domain decomposition and computing convergence in overlap regions.

Author

*Channel Flow; Cavity Flow; Incompressible Flow; Fluid Flow; Navier-Stokes Equation; Computational Fluid Dynamics; Computational Grids*

**20080048192** California Inst. of Tech., Pasadena, CA, USA

**Parametric-Studies and Data-Plotting Modules for the SOAP**

NASA Tech Briefs, September 2008; September 2008, pp. 59-60; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): NPO-45059; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3214>

'Parametric Studies' and 'Data Table Plot View' are the names of software modules in the Satellite Orbit Analysis Program (SOAP). Parametric Studies enables parameterization of as many as three satellite or ground-station attributes across a range of values and computes the average, minimum, and maximum of a specified metric, the revisit time, or 21 other functions at each point in the parameter space. This computation produces a one-, two-, or three-dimensional table of data representing statistical results across the parameter space. Inasmuch as the output of a parametric study in three dimensions can be a very large data set, visualization is a paramount means of discovering trends in the data (see figure). Data Table Plot View enables visualization of the data table created by Parametric Studies or by another data source: this module quickly generates a display of the data in the form of a rotatable three-dimensional-appearing plot, making it unnecessary to load the SOAP output data into a separate plotting program. The rotatable three-dimensional-appearing plot makes it easy to determine which points in the parameter space are most desirable. Both modules provide intuitive user interfaces for ease of use.

Author

*Computer Programs; Parameterization; Scientific Visualization; Tables (Data); Loads (Forces); Modules*

**20080048205** California Inst. of Tech., Pasadena, CA, USA; Skull Base Inst., USA

**Adjustable-Viewing-Angle Endoscopic Tool for Skull Base and Brain Surgery**

Bae, Youngsam; Liao, Anna; Manohara, Harish; Shahinian, Hrayr; NASA Tech Briefs, September 2008; September 2008, pp. 27-28; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): NPO-45579; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3141>

The term Multi-Angle and Rear Viewing Endoscopic tool (MARVEL) denotes an auxiliary endoscope, now undergoing development, that a surgeon would use in conjunction with a conventional endoscope to obtain additional perspective. The role of the MARVEL in endoscopic brain surgery would be similar to the role of a mouth mirror in dentistry. Such a tool is potentially useful for in-situ planetary geology applications for the close-up imaging of unexposed rock surfaces in cracks or those not in the direct line of sight. A conventional endoscope provides mostly a frontal view that is, a view along its longitudinal axis and, hence, along a straight line extending from an opening through which it is inserted. The MARVEL could be inserted through the same opening as that of the conventional endoscope, but could be adjusted to provide a view from almost any desired angle. The MARVEL camera image would be displayed, on the same monitor as that of the conventional endoscopic image, as an inset within the conventional endoscopic image. For example, while viewing a tumor from the front in the conventional endoscopic image, the surgeon could simultaneously view the tumor from the side or the rear in the MARVEL image, and could thereby gain additional visual cues that would aid in precise three-dimensional positioning of surgical tools to excise the tumor. Indeed, a side or rear view through the MARVEL could be essential in a case in which the object of surgical interest was not visible from the front. The conceptual design of the MARVEL exploits the surgeon's familiarity with endoscopic surgical tools. The MARVEL would include a miniature electronic camera and miniature radio transmitter mounted on the tip of a surgical tool derived from an endo-scissor (see figure). The inclusion of the radio transmitter would eliminate the need for wires, which could interfere with manipulation of this and other surgical tools. The handgrip of the tool would be connected to a linkage similar to that of an endo-scissor, but the linkage would be configured to enable adjustment of the camera angle instead of actuation of a scissor blade. It is envisioned that thicknesses of the tool shaft and the camera would be less than 4 mm, so that the camera-tipped tool could be swiftly inserted and withdrawn through a dime-size opening. Electronic cameras having dimensions of the order of millimeters are already commercially available, but their designs are not optimized for use in endoscopic brain surgery. The variety of potential endoscopic, thoracoscopic, and laparoscopic applications can be expected to increase as further development of electronic cameras yields further miniaturization and improvements in imaging performance.

Author

*Surgery; Visual Stimuli; Endoscopes; Imaging Techniques; Adjusting; Brain; Viewing; Line of Sight*

**20080048256** NASA Johnson Space Center, Houston, TX, USA

**Sheet Membrane Spacesuit Water Membrane Evaporator Thermal Test**

Trevino, Luis A.; Bue, Grant C.; [2009]; 1 pp.; In English; 39th International Conference on Environmental Systems, 12-16 Jul. 2009, Savannah, GA, USA; Copyright; Avail.: Other Sources; Abstract Only

For future lunar extravehicular activities (EVA), one method under consideration for rejecting crew and electronics heat involves evaporating water through a hydrophobic, porous Teflon(Registered Trademark) membrane. A Spacesuit Water Membrane Evaporator (SWME) prototype using this membrane was successfully tested by Ungar and Thomas (2001) with predicted performance matching test data well. The above referenced work laid the foundation for the design of a compact sheet membrane SWME development unit for use in the Constellation System Spacesuit Element Portable Life Support System (Vogel and et. al., ICES 2008). Major design objectives included minimizing mass, volume, and manufacturing complexity while rejecting a minimum of 810 watts of heat from water flowing through the SWME at 91 kg/hr with an inlet temperature of 291K. The design meeting these objectives consisted of three concentric cylindrical water channels interlaced with four water vapor channels. Two units were manufactured for the purpose of investigating manufacturing techniques and performing thermal testing. The extensive thermal test measured SWME heat rejection as a function of water inlet temperatures, water flow-rates, water absolute pressures, water impurities, and water vapor back-pressures. This paper presents the test results and subsequent analysis, which includes a comparison of SWME heat rejection measurements to pretest predictions. In addition, test measurements were taken such that an analysis of the commercial-off-the-shelf vapor pressure control valve could be performed.

Author

*Evaporators; Extravehicular Activity; Space Suits; Membranes; Life Support Systems; Hydrophobicity; Vapor Pressure*

**20080048282** NASA Johnson Space Center, Houston, TX, USA

**Demonstration of Super Cooled Ice as a Phase Change Material Heat Sink for Portable Life Support Systems**

Leimkuehler, Thomas O.; Bue, Grant C.; [2009]; 1 pp.; In English; 39th International Conference on Environmental Systems, 12-16 Jul. 2009, Savannah, GA, USA; Copyright; Avail.: Other Sources; Abstract Only

A phase change material (PCM) heat sink using super cooled ice as a nontoxic, nonflammable PCM is being developed. The latent heat of fusion for water is approximately 70% larger than most paraffin waxes, which can provide significant mass savings. Further mass reduction is accomplished by super cooling the ice significantly below its freezing temperature for additional sensible heat storage. Expansion and contraction of the water as it freezes and melts is accommodated with the use of flexible bag and foam materials. A demonstrator unit has been designed, built, and tested to demonstrate proof of concept. Both testing and modeling results are presented along with recommendations for further development of this technology.

Author

*Portable Life Support Systems; Heat Sinks; Heat of Fusion; Ice; Cooling*

**20080048305** NASA White Sands Test Facility, NM, USA

**Advanced Crew Escape Suits (ACES): Particle Impact Test**

Rosales, Keisa R.; Stoltzfus, Joel M.; [2009]; 18 pp.; In English; 12th International Symposium on Flammability and Sensitivity of Materials in Oxygen-Enriched Atmospheres, 7-9 Oct. 2009, Berlin, Germany; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080048305>

NASA Johnson Space Center (JSC) requested NASA JSC White Sands Test Facility to assist in determining the effects of impaired anodization on aluminum parts in advanced crew escape suits (ACES). Initial investigation indicated poor anodization could lead to an increased risk of particle impact ignition, and a lack of data was prevalent for particle impact of bare (unanodized) aluminum; therefore, particle impact tests were performed. A total of 179 subsonic and 60 supersonic tests were performed with no ignition of the aluminum targets. Based on the resulting test data, WSTF found no increased particle impact hazard was present in the ACES equipment.

Author

*Space Suits; Impact Tests; Hazards; Anodizing*

**20080048416** Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Soesterberg, Netherlands  
**Geluidsexpositie bij Gebruik van Otoplastieken met Communicatie (Sound Exposure Level of F-16 Crew Chiefs Using Custom Molded Communications Earplugs)**

Houben, M M; Verhave, J A; Oct 2008; 24 pp.; In Dutch; Original contains color illustrations

Report No.(s): AD-A489812; TNO-DV-2008-A395; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489812>

Because of the noisy environment, F-16 crew chiefs at Air Base Volkel use communications earplugs (CEPs). CEPs are earplugs that incorporate a miniature loudspeaker through which the intercom can be presented to the user unattenuated while the earplugs do attenuate environmental sounds. In a previous study, we developed a method to assess the sound exposure level of CEP users. Not only was the attenuated F 16 noise taken into account, but also the sound exposure resulting from communication through the CEP. The latter was accounted for through the CEP's sensitivity - the relation between electric power level to the CEP and perceived sound level. Those measurements were all on CEPs with foam earplugs. In the current study, we extended it to custom molded earplugs (CME). The results show that the CME has a higher sound attenuation compared to the foam earplug in the frequency range of 250 Hz to 1 kHz only, resulting in a slight decrease in sound exposure of 2 dB. Furthermore, the CEP with foam earplug and the CEP with CME do not differ in electric to acoustic sensitivity. The estimated per-day dose, based on recordings of crew chiefs that use the CEP with CME, is 74 dB(A).

DTIC

*Ear Protectors; Exposure; F-16 Aircraft*

## 55

### EXO BIOLOGY

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see *52 Aerospace Medicine*; on animals and plants see *51 Life Sciences*. For psychological and behavioral effects of aerospace environments see *53 Behavioral Sciences*.

**20080048027** California Inst. of Tech., Pasadena, CA, USA

**Sealing and External Sterilization of a Sample Container**

Bar-Cohen, Yoseph; Badescu, Mircea; Bao, Xiaoqi; Sheritt, Stewart; Olorunsola, Ayoola; NASA Tech Briefs, December 2008; December 2008, pp. 15-16; In English; See also [20080048022](#); Original contains color illustrations

Report No.(s): NPO-45610; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3426>

A method of (1) sealing a sample of material acquired in a possibly biologically contaminated ('dirty') environment into a hermetic container, (2) sterilizing the outer surface of the container, then (3) delivering the sealed container to a clean environment has been proposed. The method now proposed was originally intended to be used to return samples from Mars to Earth, but could also be used on Earth to transport material samples acquired in environments that contain biological hazards and/or, in some cases, chemical hazards.

Derived from text

*Sterilization; Hermetic Seals; Biological Hazards*

## 59

### MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see *categories 60 through 67*.

**20080047260** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Bisimilarity in Term Graph Rewriting**

Ariola, Z. M.; Klop, J. W.; Plump, D.; Jan. 31, 1998; 26 pp.; In English

Report No.(s): PB2009-102328; SEN-R9801; Copyright; Avail.: National Technical Information Service (NTIS)

We present a survey of confluence properties of (acyclic) term graph rewriting. Results and counterexamples are given for different kinds of term graph rewriting - besides plain applications of rewrite rules, extensions with the operations of collapsing and copying, and with both operations together are considered. Collapsing and copying together constitute bisimilarity of term graphs. We establish sufficient conditions for, and counterexamples to, confluence, confluence modulo



bisimilarity and the Church-Rosser property modulo bisimilarity. Moreover, we address rewriting modulo bisimilarity, that is, rewriting of bisimilarity classes of term graphs.

NTIS

*Graph Theory; Reproduction (Copying)*

**20080047262** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Automata and Coinduction: An Exercise in Coalgebra**

Rutten, J. J. M. M.; May 31, 1998; 26 pp.; In English

Report No.(s): PB2009-102330; SEN-R9803; Copyright; Avail.: National Technical Information Service (NTIS)

The classical theory of deterministic automata is presented in terms of the notions of homomorphism and bisimulation, which are the cornerstones of the theory of (universal) coalgebra. This leads to a transparent and uniform presentation of automata theory and yields some new insights, amongst which coinduction proof methods for language equality and language inclusion. At the same time, the present treatment of automata theory may serve as an introduction to coalgebra.

NTIS

*Automata Theory; Physical Exercise; Algebra; Proving*

**20080047263** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Verification of Temporal Properties of Processes in a Setting with Data**

Groote, J. F.; Mateescu, R.; May 31, 1998; 22 pp.; In English

Report No.(s): PB2009-102331; SEN-R9804; Copyright; Avail.: National Technical Information Service (NTIS)

We define a value-based modal (Mu)-calculus, built from first-order formulas, modalities, and fixed point operators parameterized by data variables, which allows to express temporal properties involving data. We interpret this logic over (Mu)CRL terms defined by linear process equations. The satisfaction of a temporal formula by a (Mu)CRL term is translated to the satisfaction of a first-order formula containing parameterized fixed point operators. We provide proof rules for these fixed point operators and show their applicability on various examples.

NTIS

*Calculus; Proving*

**20080047265** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Leap Year Problem**

Van Deursen, A.; Jun. 30, 1998; 10 pp.; In English

Report No.(s): PB2009-102334; SEN-R9807; Copyright; Avail.: National Technical Information Service (NTIS)

A significant number of programs incorrectly treats the year 2000 as a non-leap year. We list 21 real life code fragments illustrating the large variety of ways that are used to determine whether a given year is a leap year or not. Some of these fragments are correct; others will fail in the year 2000. The fragments are written in C, Pascal, COBOL, and assembly language. We discuss the consequences for automated tool support, as well as the organizational implications of the leap year problem.

NTIS

*Fragments; Pascal (Programming Language); C (Programming Language); Assembly Language*

**20080047266** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Basic Theorems for Parallel Processes in Timed (Mu)CRL**

Groote, J. F.; Van Wamel, J. J.; Jun. 30, 1998; 34 pp.; In English

Report No.(s): PB2009-102335; SEN-R9808; Copyright; Avail.: National Technical Information Service (NTIS)

Timed (Mu)CRL is a process algebra-based formalism for the specification and verification of parallel, communicating systems with explicit time. In this paper various basic results are derived, such as theorems for 'basic forms', the expansion of terms with operators for parallelism, elimination of parallelism, and commutativity and associativity of the merge and communication merge (the operators (two vertical lines) and (vertical line)). The interpretation of the operators, in particular the left merge, is far from trivial, and more in general, it has to be stated that working with a time-based formalism such as time (Mu)CRL can be fairly complicated. Therefore we pay a lot of attention to all kinds of proof details that could enhance

the understanding, and thus facilitate the use of the formalism. Many basic dilemmas are included, and examples are used to illustrate the intuition behind the various results.

NTIS

*Theorems; Parallel Processing (Computers)*

**20080047267** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Discrete Time Process Algebra and the Semantics of SDL (Software Description Language)**

Bergstra, J. A.; Middelburg, C. A.; Usenko, Y. S.; Jun. 30, 1998; 50 pp.; In English

Report No.(s): PB2009-102336; SEN-R9809; Copyright; Avail.: National Technical Information Service (NTIS)

We present an extension of discrete time process algebra with relative timing where recursion, propositional signals and conditions, a counting process creation operator, and the state operator are combined. Except the counting process creation operator, which subsumes the original process creation operator, these features have been developed earlier as largely separate extensions of time free process algebra. The change to the discrete time case and the combination of the features turn out to be far from trivial. We also propose a semantics for a simplified version of SDL, using this extension of discrete time process algebra to describe the meaning of the language constructs. This version covers all behavioural aspects of SDL, except for communication via delaying channels, which can easily be modeled. The semantics presented here facilitates the generation of finitely branching transition systems for SDL specifications and thus it enables validation.

NTIS

*Algebra; Programming Languages; Semantics*

**20080047268** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Waitfree Distributed Memory Management by Create, and Read Until Deletion (CRUD)**

Hesselink, W. H.; Groote, J. F.; Jul. 31, 1998; 22 pp.; In English

Report No.(s): PB2009-102338; SEN-R9811; Copyright; Avail.: National Technical Information Service (NTIS)

The acronym CRUD represents an interface specification and an algorithm for the management of memory shared by concurrent processes. The memory cells form a directed acyclic graph. This graph is only modified by adding a new node with a list of reachable children, and by removing unreachable nodes. If memory is not full, the algorithm ensures waitfree redistribution of free nodes. It uses atomic counters for reference counting and consensus variables to ensure exclusive access. Performance is enhanced by using nondeterminacy guided by insecure knowledge. Experiments indicate that the algorithm is very suitable for multiprocessing.

NTIS

*Deletion; Distributed Memory*

**20080047269** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Truth of Duration Calculus Formulae in Timed Frames**

Middelburg, C. A.; Aug. 1998; 26 pp.; In English

Report No.(s): PB2009-102339; SEN-R9812; Copyright; Avail.: National Technical Information Service (NTIS)

Duration calculus is a logical formalism designed for expressing and refining real-time requirements for systems. Timed frames are essentially transition systems meant for modeling the time-dependent behaviour of programs. We investigate the interpretation of duration calculus formulae in timed frames. We elaborate this topic from different angles and show that they agree with each other. The resulting interpretation is expected to make it generally easier to establish semantic links between duration calculus and formalisms aimed at programming. Such semantic links are prerequisites for a solid underpinning of approaches to system development that cover requirement capture through coding using both duration calculus and some formalism(s) aimed at programming.

NTIS

*Calculus; Formalism*

**20080047273** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Identifying Objects Using Cluster and Concept Analysis**

Van Deursen, A.; Kuipers, T.; Sep. 1998; 24 pp.; In English

Report No.(s): PB2009-102501; SEN-R9814; Copyright; Avail.: National Technical Information Service (NTIS)

Many approaches to support (semi-automatic) identification of objects in legacy code take the data structures as starting point for candidate classes. Unfortunately, legacy data structures tend to grow over time, and may contain many unrelated

fields at the time of migration. We propose a method for identifying objects by semi-automatically restructuring the legacy data structures. Issues involved include the selection of record fields of interest, the identification of procedures actually dealing with such fields, and the construction of coherent groups of fields and procedures into candidate classes. We explore the use of cluster and concept analysis for the purpose of object identification, and we illustrate their effect on a 100,000 LOC COBOL system. Furthermore, we use these results to contrast clustering with concept analysis techniques.

NTIS

*Cluster Analysis; Identifying*

**20080047274** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Analysis of Three Hybrid Systems in Time (Mu)CRL**

Groote, J. F.; Van Wamel, J. J.; Sep. 1998; 28 pp.; In English

Report No.(s): PB2009-102502; SEN-R9815; Copyright; Avail.: National Technical Information Service (NTIS)

We study three simple hybrid control systems in timed (Mu)CRL. A temperature regulation system, a bottle filling system and a railway gate control system are specified component-wise and expanded to linear process equations. Some basic properties of the systems are analysed and a few correctness requirements are proven to be satisfied. Although not designed for this purpose, timed (Mu)CRL seems to allow detailed analysis and verification of hybrid systems. The operators for parallelism and encapsulation are handled using some basic results. It turns out that the expansion and encapsulation of a parallel composition of processes generally leads to a considerable number of potential ‘time deadlocks’, which generally turn out to be harmless. Also inherent to parallelism are the multiple time dependencies between the summands of the separate components. As a consequence, expansions tend to lead to large numbers of terms. Various techniques, such as the use of invariants, have to be employed to master these complications.

NTIS

*Linear Equations; Encapsulating; Time Measurement*

**20080047275** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Survey of Computational Steering Environments**

Mulder, J. D.; Van Wijk, J. J.; Van Liere, R.; Sep. 1998; 18 pp.; In English

Report No.(s): PB2009-102503; SEN-R9816; Copyright; Avail.: National Technical Information Service (NTIS)

Computational steering is a powerful concept that allows scientists to interactively control a computational process during its execution. In this paper, a survey of computational steering environments for the on-line steering of ongoing scientific and engineering simulations is presented. These environments can be used to create steerable applications for model exploration, algorithm experimentation, or performance optimization. For each environment the scope is identified, the architecture is summarized, and the concepts of the user interface is described. The environments are compared and conclusions and future research issues are given.

NTIS

*Interactive Control; Steering; Surveys*

**20080047277** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Syntax and Semantics of Timed (mu)CRL**

Groote, J. F.; Jun. 30, 1997; 46 pp.; In English

Report No.(s): PB2009-102250; SEN-R9709; Copyright; Avail.: National Technical Information Service (NTIS)

We define a specification language called ‘timed (mu)CRL’. This language is designed to describe communicating processes employing data and time. Timed (mu)CRL is the successor of (mu)CRL. It differs in two main aspects. It is possible to make explicit reference to time using a new ‘at’ operator;  $p(\text{sup } c)t$  is the process  $p$  where the first action must take place at time  $t$ . Furthermore, a distinction has been made between constructors and functions in the datatypes. Care has been taken that every (mu)CRL specification is also a correct timed (mu)CRL specification with exactly the same meaning.

NTIS

*Communicating; Time Measurement; Semantics; Syntax*

**20080047278** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Nonconvex Continuous Models for Combinatorial Optimization Problems with Application to Satisfiability and Node Packing Problems**

Warners, J. P.; Jul. 31, 1997; 22 pp.; In English

Report No.(s): PB2009-102251; SEN-R9710; Copyright; Avail.: National Technical Information Service (NTIS)

We show how a large class of combinatorial optimization problems can be reformulated as a nonconvex minimization

problem over the unit hyper cube with continuous variables. No additional constraints are required; all constraints are incorporated in the non-convex objective function, which is a polynomial function. The application of the general transform to satisfiability and node packing problems is discussed, and various approximation algorithms are briefly reviewed. To give an indication of the strength of the proposed approaches, we conclude with some computational results on instances of the graph coloring problem.

NTIS

*Combinatorial Analysis; Optimization*

**20080047279** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Weighted Co-Limits and Formal Balls in Generalized Metric Spaces**

Rutten, J. J. M. M.; Jul. 31, 1997; 26 pp.; In English

Report No.(s): PB2009-102252; SEN-R9711; Copyright; Avail.: National Technical Information Service (NTIS)

This report is attempting to convey two efforts: (a) Limits of Cauchy sequences in a (possibly non-symmetric) metric space are shown to be weighted co-limits (a notion introduced by Borceux and Kelly, 1975). As a consequence, further insights from enriched category theory are applicable to the theory of metric spaces, thus continuing Lawvere's (1973) approach. Many of the recently proposed definitions of generalized limit turn out to be theorems from enriched category theory; and (b) The dual of the space of metrical predicates ('fuzzy subsets') of a metric space is shown to contain the collection F of formal balls (Weihrauch and Schreiber, 1981; Edalat and Heckmann, 1996) as a quasi-metric subspace. Formal balls are related to ordinary closed balls by means of the Isbell conjugation. For an ordinary metric space X, the subspace of minimal elements of F is isometric to X by the co-Yoneda embedding.

NTIS

*Metric Space; Theorems; Conjugation*

**20080047287** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**Reliability Results of NERSC Systems**

Mokhtarani, A.; Kramer, W.; Hick, J.; May 27, 2008; 19 pp.; In English

Contract(s)/Grant(s): DE-AC02-05CH11231

Report No.(s): DE2008-934480; LBNL-430E; No Copyright; Avail.: National Technical Information Service (NTIS)

In order to address the needs of future scientific applications for storing and accessing large amounts of data in an efficient way, one needs to understand the limitations of current technologies and how they may cause system instability or unavailability. A number of factors can impact system availability ranging from facility-wide power outage to a single point of failure such as network switches or global file systems. In addition, individual component failure in a system can degrade the performance of that system. This paper focuses on analyzing both of these factors and their impacts on the computational and storage systems at NERSC. Component failure data presented in this report primarily focuses on disk drive in one of the computational system and tape drive failure in HPSS. NERSC collected available component failure data and system-wide outages for its computational and storage systems over a six-year period and made them available to the HPC community through the Petascale Data Storage Institute.

NTIS

*Energy Technology; Project Management; Reliability*

**20080047314** Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA

**Digital Specimen and Multiple Functional Digital Tester Technique for Performance Evaluation of Asphalt Mixes**

Wang, L.; Feb. 2008; 33 pp.; In English

Report No.(s): PB2009-102139; No Copyright; Avail.: National Technical Information Service (NTIS)

This report summarizes the work completed under NCHRP-IDEA 122 project. The project goal was to develop a 3-D digital representation of the microstructure of an asphalt concrete specimen and an asphalt mastic specimen and evaluating the performance of the 'digital specimens' using modeling and simulation techniques. Therefore, the final product would be a computer program that reads processed computed-tomography images, reconstructs them into 'digital specimens', and performs the stiffness test on them using the platform of a Finite Element code. The work was accomplished in two phases.

NTIS

*Asphalt; Computer Programs; Digital Techniques; Evaluation; Microstructure; Performance Tests*

**20080047315** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Singularities of the Generator of a Markov Additive Process with One-Sided Jumps**

Ivanovs, J.; Boxma, O. J.; Mandjes, M. R. H.; Sep. 2008; 26 pp.; In English

Report No.(s): PB2009-102241; PNA-R0813; Copyright; Avail.: National Technical Information Service (NTIS)

We analyze the number of zeros of  $\det(F(\alpha))$ , where  $F(\alpha)$  is the matrix cumulant generating function of a Markov Additive Process (MAP) with one-sided jumps. The focus is on the number of zeros in the right half of the complex plane, where  $\det(F(\alpha))$  is well-defined. Moreover, we analyze the case of a killed MAP with state-dependent killing rates, and the limiting behavior of the zeros as all killing rates converge to 0. We argue that our results are particularly useful for the fluctuation theory of MAP's. For example, they lead, under mild assumptions, to a straightforward identification of the stationary distribution of a reflected MAP with one-sided jumps.

NTIS

*Additives; Markov Processes; Singularity (Mathematics); Matrices (Mathematics)*

**20080047316** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Mixing Evolutionary Algorithm: Independent Selection and Allocation of Trials**

Van Kemenade, C. M. H.; Dec. 31, 1997; 10 pp.; In English

Report No.(s): PB2009-102327; SEN-R9726; Copyright; Avail.: National Technical Information Service (NTIS)

When using an evolutionary algorithm to solve a problem involving building blocks we have to grow the building blocks and then mix these building blocks to obtain the (optimal) solution. Finding a good balance between the growing and the mixing process is a prerequisite to get a reliable evolutionary algorithm. Different building blocks can have different probabilities of being mixed. Such differences can easily lead to a loss of the building blocks that are difficult to mix and as a result to premature convergence. By allocating relatively many trials to individuals that contain building blocks with a low mixing probability we can prevent such effects. We developed the mixing evolutionary algorithm (mixEA) in which the allocation of trials is a more explicit procedure than in the standard evolutionary algorithms. Experiments indicate that the mixEA is a reliable optimizer on a set of building block problems that are difficult to handle with more traditional genetic algorithms. In the case that the global optimum is not found, the mixEA creates a small population containing a high concentration of building blocks.

NTIS

*Algorithms; Probability Theory; Convergence*

**20080047379** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Pixel Masks for Screen-Door Transparency**

Mulder, J. D.; Groen, F. C. A.; Van Wijk, J. J.; Sep. 1998; 20 pp.; In English

Report No.(s): PB2009-102504; SEN-R9817; Copyright; Avail.: National Technical Information Service (NTIS)

Rendering objects transparently gives additional insight in complex and overlapping structures. However, traditional techniques for the rendering of transparent objects such as alpha blending are not very well suited for the rendering of multiple transparent objects in dynamic scenes. Screen-door transparency is a technique to render transparent objects in a simple and efficient way: No sorting is required and intersecting polygons can be handled without further preprocessing. With this technique, polygons are rendered through a mask - only where the mask is present, pixels are set. However, artifacts such as incorrect opacities and distracting patterns can easily occur if the masks are not carefully designed. In this paper, first the requirements on the masks are considered. Next, three algorithms are presented for the generation of pixel masks. One algorithm is designed for the creation of small (e.g., 4 x 4) masks. The other two algorithms can be used for the creation of larger masks (e.g., 32 x 32). For each of these algorithms results are presented and discussed.

NTIS

*Doors; Masks; Pixels*

**20080047380** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Computational Steering in the CAVE**

Mulder, J. D.; Van Liere, R.; Van Wijk, J. J.; Sep. 1998; 14 pp.; In English

Report No.(s): PB2009-102505; SEN-R9818; Copyright; Avail.: National Technical Information Service (NTIS)

Scientists can gain much more insight from their simulations if they are enabled to change simulation parameters on the fly while observing the results immediately. A crucial aspect of such 'computational steering' is an intuitive user interface. We have developed an environment that enables researchers to construct such interfaces efficiently and effectively for graphical

workstations. In this paper we report on our next step towards more intuitive user-interfaces; we have modified our system for use in the CAVE. The CAVE is a projection-based virtual environment. Virtual environments are designed to provide the effect of immersion in an interactive three-dimensional computer-generated environment. We show that the use of virtual environments for computational steering interfaces can improve interaction with the simulation and immersion in the computational process. We present our system, the methods we have developed for improved 3D interaction, and describe three applications.

NTIS

*Caves; Computerized Simulation; Steering; Virtual Reality*

**20080047381** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Remote Object Translation Methods for Immersive Virtual Environments**

Mulder, J. D.; Sep. 1998; 14 pp.; In English

Report No.(s): PB2009-102506; SEN-R9819; Copyright; Avail.: National Technical Information Service (NTIS)

In this paper, seven methods are described to perform remote object translations with a six degree-of-freedom input device in an immersive virtual environment. By manipulating objects remotely, a number of disadvantages of the real-world 'direct grab and drag' metaphor can be avoided. The different methods are evaluated with a pilot user experiment. From the results of the experiment, some initial recommendations are formulated on the use of the methods for different manipulation tasks.

NTIS

*Computer Graphics; Translating; Virtual Reality; Degrees of Freedom*

**20080047382** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Distributed Blackboard Architecture for Interactive Data Visualization**

Van Liere, R.; Harkes, J. A.; De Leeuw, W. C.; Sep. 1998; 20 pp.; In English

Report No.(s): PB2009-102507; SEN-R9820; Copyright; Avail.: National Technical Information Service (NTIS)

In this paper the motivation, design and application of a distributed blackboard architecture for interactive data visualization is discussed. The main advantages of the architecture is twofold. First, it allows visualization tools to be tightly integrated with simulations. Second, it allows qualitative and quantitative analysis to be combined during the visualization process.

NTIS

*Computer Programming; Scientific Visualization; Software Engineering*

**20080047383** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Porting a Visualization Package from IRIX to NT: What Will I Get and What Will I Pay**

Van Liere, R.; Harkes, J. A.; Kniesmeijer, J. H.; Sep. 1998; 14 pp.; In English

Report No.(s): PB2009-102508; SEN-R9821; Copyright; Avail.: National Technical Information Service (NTIS)

We discuss our experiences in porting a moderately large scientific visualization environment from IRIX to NT approximate to 4.0. Two porting strategies have been taken: (1) a port via a POSIX emulation layer; and (2) a native NT port. POSIX compliant code can be ported to NT with relatively little effort if the code adheres to general accepted programming principles, such as modularity and encapsulation. The performance of a modern 3D Wintel machine is quite satisfactory for a variety of scientific desktop tasks. We have compared the performance of a 2 CPU Dell OptiPlex with FireGL 4000 graphics option to various SGI desktop workstations.

NTIS

*Scientific Visualization; Encapsulating; Modularity*

**20080047385** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Just-In-Time: on Strategy Annotations**

Van de Pol, J. C.; Mar. 31, 2001; 22 pp.; In English

Report No.(s): PB2009-102519; SEN-R0105; Copyright; Avail.: National Technical Information Service (NTIS)

A simple kind of strategy annotations is investigated, giving rise to a class of strategies, including leftmost-innermost. It is shown that under certain restrictions, an interpreter can be written which computes the normal form of a term in a bottom-up traversal. The main contribution is a correctness proof of this interpreter. Furthermore, a default strategy is provided, called

just-in-time, which satisfies the criteria for the interpreter. The just-in-time strategy has a better termination behaviour than innermost rewriting for many interesting examples.

NTIS

*Computer Programming; Proving; Strategy*

**20080047386** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Prover for the muCRL Toolset with Applications: Version 0.1**

Van de Pol, J. C.; Apr. 30, 2001; 36 pp.; In English

Report No.(s): PB2009-102520; SEN-R0106; Copyright; Avail.: National Technical Information Service (NTIS)

This document describes an automated theorem prover, based on an extension of binary decision diagrams. The prover transforms quantifier-free formulae into equivalent BDD-forms, i.e., to some algebraic data specification. The prover is used by four tools for the symbolic analysis of distributed systems specified in muCRL (i.e. process algebra plus algebraic data types). The main techniques are invariants and confluence. Two case studies are reported: (1) the DKR leader election protocol; and (2) SPLICE, a coordination architecture of industrial origin. In both cases using confluence information leads to a reduced state space.

NTIS

*Kernel Functions; Theorems; Proving; Transformations (Mathematics)*

**20080047387** National Inst. of Standards and Technology, Gaithersburg, MD, USA; Mitretek Systems, Inc., Falls Church, VA, USA

**Effects of Scanner Height on Fingerprint Capture**

Micheals, R. J.; Stanton, B.; Theofanos, M.; Orandi, S.; Zhang, N. F.; Dec. 2006; 58 pp.; In English

Report No.(s): PB2009-102521; NISTIR-7382; No Copyright; Avail.: CASI: [A04](#), Hardcopy

;Contents: Background; Introduction; Review of current systems (Work surfaces, US-VISIT; US-VISIT point of entry, NIV/TPLS); Experimental process (Design and implementation, Hardware and software); Findings (Participants, Usability metrics); Recommendations and Conclusions; References; Appendices A-C.

NTIS

*Imaging Techniques; Experiment Design; Biometrics*

**20080047388** National Inst. of Standards and Technology, Gaithersburg, MD, USA

**Analytical Approach to Cost-Effective, Risk-Based Budgeting for Federal Information System Security**

Lippiatt, B. C.; Fuller, S. K.; Jan. 2007; 52 pp.; In English

Report No.(s): PB2009-102522; NISTIR-7385; No Copyright; Avail.: CASI: [A04](#), Hardcopy

The purpose of this report is to identify and illustrate an approach to simplify and strengthen capital planning for information system security in compliance with federal policy and guidance. The report provides the theoretical underpinnings of a methodology that will enable budgeting officials, system owners, and managers to select cost-effective strategies for optimizing the level of information system security to be achieved, given the level of vulnerability faced by the organization. The method of evaluation used is the Analytic Hierarchy Process (AHP), a multi-attribute decision approach. It integrates quantitative and qualitative information in a hierarchical structure in such a way that decision-makers can logically and consistently evaluate all the alternatives in a complex decision problem. An illustrative case study applies the AHP to the selection of a cost-effective security investment, given the likelihood and magnitude of threats to the information system. Expert judgments of risks, overall agency goals, and existing system weaknesses are merged with investment costs to illustrate the AHP process for calculating a measure of merit for evaluating investment alternatives.

NTIS

*Budgeting; Cost Effectiveness; Hierarchies; Information Systems; Risk; Security*

**20080047389** National Inst. of Standards and Technology, Gaithersburg, MD, USA

**MINEX II: An Assessment of ISO/IEC 786 Card-Based Match-on-Card Capabilities**

Grother, P.; Salamon, W.; Feb. 2008; 49 pp.; In English

Report No.(s): PB2009-102523; No Copyright; Avail.: National Technical Information Service (NTIS)

The MINEX program is intended to improve template-based interoperability from the state reported in MINEX 041 and MTIT2 toward that achievable with image-based implementations. The approach is to conduct several trials, MINEX II, III, IV etc, each of which will embed development, evaluation, targeted feedback and consultation activities between NIST,

industry and other interested parties. Within scope is anything to do with fingerprint minutiae as an interoperable biometric for identity management. Typical outcomes will be measurements of accuracy, processing time, template size, and proposals to revise the relevant standards, studies of utility of quality measures, calibration information, and new metrics.

NTIS

*Cards; Interoperability; Biometrics; Identities; Templates*

**20080047396** Department of Justice, Washington, DC, USA

**Cybercrime against Businesses, 2005**

Rantala, R. R.; Sep. 2008; 20 pp.; In English

Report No.(s): PB2009-101814; NCJ-221943; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Presents the nature and prevalence of computer security incidents among 7,818 businesses in 2005. This is the first report to provide data on monetary loss and system downtime resulting from cyber incidents. It examines details on types of offenders, reporting of incidents to law enforcement, reasons for not reporting incidents, types of systems affected, and the most common security vulnerabilities. The report also compares in-house security to outsourced security in terms of prevalence of cyber attacks.

NTIS

*Commerce; Computer Information Security; Crime*

**20080047397** National Inst. of Standards and Technology, Gaithersburg, MD, USA

**Common Vulnerability Scoring System (CVSS) and Its Applicability to Federal Agency Systems**

Mell, P.; Scarfone, K.; Romanosky, S.; Aug. 2007; 33 pp.; In English

Report No.(s): PB2009-102233; NISTIR-7435; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The Common Vulnerability Scoring System (CVSS) provides an open framework for communicating the characteristics and impacts of IT vulnerabilities. The National Vulnerability Database (NVD) provides specific CVSS scores for publicly known vulnerabilities. Federal agencies can use the Federal Information Processing Standards (FIPS) 199 security categories with the NVD CVSS scores to obtain impact scores that are tailored to each agency's environment. CVSS consists of three groups: Base, Temporal and Environmental. Each group produces a numeric score ranging from 0.0 to 10.0, and a vector, a compressed textual representation that reflects the values used to derive the score. The Base group represents the intrinsic qualities of a vulnerability. The Temporal group reflects the characteristics of a vulnerability that change over time. The Environmental group represents the characteristics of a vulnerability that are unique to any user's environment. CVSS enables IT managers, vulnerability bulletin providers, security vendors, application vendors and researchers to all benefit by adopting this common language of scoring IT vulnerabilities.

NTIS

*Information Systems; Scoring; Vulnerability*

**20080047398** National Inst. of Standards and Technology, Gaithersburg, MD, USA

**Secure Biometric Match-on-Card Feasibility Report**

Cooper, D.; Dang, H.; Lee, P.; MacGregor, W.; Mehta, K.; Nov. 2007; 112 pp.; In English

Report No.(s): PB2009-102234; NISTIR-7452; No Copyright; Avail.: National Technical Information Service (NTIS)

On August 27, 2004, the President signed Homeland Security Presidential Directive 12 (HSPD-12), entitled Policy for a Common Identification Standard for Federal Employees and Contractors. HSPD-12 required the development and implementation of a government-wide standard for secure and reliable forms of identification for Federal employees and contractors. In response, NIST developed the Federal Information Processing Standard 201 (FIPS 201), Personal Identity Verification (PIV) of Federal Employees and Contractors, to establish a standard for identity credentials. NIST also issued several special publications in support of FIPS 201 to enable interoperable implementations. FIPS 201 and its associated special publications define a method to perform biometric match-off-card authentication of a PIV cardholder when the PIV card is inserted into a contact smart card reader. Today, many smart cards, however, implement match-on-card technologies and are designed to perform cardholder authentication using contactless interface. Contactless match-on-card operation requires additional security measures to ensure the transaction data is encrypted and can be securely transmitted, which can impact performance. NIST conducted the Secure Biometric Match-on-Card (SBMOC) feasibility study to understand the effects of security on performance. This report describes the tests that were conducted to obtain timing metrics for the SBMOC feasibility study and provides a summary of the test results. This feasibility study also allows NIST to explore smart card



technology advancements for possible extension of the FIPS 201 and/or other smart card standards.

NTIS

*Biometrics; Cards; Feasibility; Identities; Personnel; Security*

**20080047400** National Inst. of Standards and Technology, Gaithersburg, MD, USA

**Style Guide for Voting System Documentation**

Chisnell, D. E.; Becker, S. C.; Laskowski, S. J.; Lowry, S. Z.; Aug. 2008; 252 pp.; In English

Report No.(s): PB2009-102236; NISTIR-7519; No Copyright; Avail.: CASI: [A12](#), Hardcopy

This style guide is a product of the voting system standards and test methods research at the National Institute of Standards and Technology (NIST). NIST provides technical assistance to the Election Assistance Commission (EAC) and the Technical Guidelines Development Committee, an advisory group to the EAC as established by the Help America Vote Act of 2002. The most recent version of the technical standard, the Voluntary Voting System Guidelines (VVSG) of August, 2007, contains requirements for the usability of documentation used by poll workers and election support staff. Our approach to testing these requirements has two components: Style guide incorporating best practices for voting system documentation; Test protocol for voting system test laboratories to use to measure the usability of instructions supplied by voting system manufacturers for election workers. This document is the style guide, which sets out guidelines for voting system manufacturers to use to implement best practices in their documentation for poll workers and election support staff. Ideally, these guidelines could eventually be incorporated in the VVSG, in a section equivalent to the direction already included for user interfaces of voting systems (Part 1: 3.2.4-C Plain Language). At the very least, they form a basis for voting system test laboratories to evaluate documentation.

NTIS

*Voting; C (Programming Language)*

**20080047403** National Inst. of Standards and Technology, Gaithersburg, MD USA

**Proceedings of the Third NIST Workshop on the Performance Evaluation of 3D imaging Systems held on March 2-3, 2006**

Cheok, G. S.; Oct. 2006; 147 pp.; In English

Report No.(s): PB2009-102239; NISTIR-7357; No Copyright; Avail.: National Technical Information Service (NTIS)

Two 3D Imaging Systems Performance Evaluation Workshops have been held at the National Institute of Standards and Technology (NIST) the first in 2003 and the second in 2005. These workshops were conducted in an effort to determine the need for standard test methods for evaluating 3D imaging systems (previously referred to as LADAR - LAser Detection and Ranging - systems), to determine the types of measurements and test methods required, to provide a forum to discuss the on-going efforts in this area, and to initiate the process towards standardization of these test methods or protocols. To continue the effort, NIST conducted a 3rd Workshop on the Performance Evaluation of 3D Imaging systems on March 2-3, 2006. This report presents the proceedings from the third workshop.

NTIS

*Conferences; Detection; Evaluation; Imaging Techniques; Laser Applications; Laser Range Finders; Lasers; Optical Radar; Performance Tests; Rangefinding; Scanning*

**20080047404** National Inst. of Standards and Technology, Gaithersburg, MD, USA; Mitretek Systems, Inc., Falls Church, VA, USA

**Taxonomy of Definitions for Usability Studies in Biometrics**

Micheals, R. J.; Stanton, B.; Theofanos, M.; Orandi, S.; Nov. 2006; 9 pp.; In English

Report No.(s): PB2009-102240; NISTIR-7378; No Copyright; Avail.: CASI: [A02](#), Hardcopy

This handbook provides an overview of the user-centered design process and examples of how the process can be applied to the design and development of biometric technology systems.

NTIS

*Biometrics; Identities; Taxonomy*

**20080047472** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Equations as a Uniform Framework for Partial Evaluation and Abstract Interpretation**

Field, J.; Heering, J.; Dinesh, T. B.; Nov. 30, 1997; 10 pp.; In English

Report No.(s): PB2009-102323; SEN-R9722; Copyright; Avail.: National Technical Information Service (NTIS)

A variety of disparate methods have traditionally been used to define the execution semantics of programming languages,

to describe partial evaluation, to formalize program analysis as abstract interpretation, and to implement each of these operations in practical systems. We argue here that equational logic can serve to unify each of these aspects of language manipulation.

NTIS

*Programming Languages; Semantics*

**20080047473** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Complete Calculus for Equational Deduction in Coalgebraic Specification**

Corradini, A.; Nov. 30, 1997; 28 pp.; In English

Report No.(s): PB2009-102324; SEN-R9723; Copyright; Avail.: National Technical Information Service (NTIS)

The use of co-algebras for the specification of dynamical systems with a hidden state space is receiving more and more attention in the years, as a valid alternative to algebraic methods based on observational equivalences. However, to our knowledge, the co-algebraic framework is still lacking a complete equational deduction calculus which enjoys properties similar to those stated in Birkhoff's completeness theorem for the algebraic case. In this paper we present a sound and complete equational calculus for co-algebras of a restricted class of polynomial functors. This restriction allows us to borrow some 'algebraic' notions for the formalization of the calculus. Additionally, we discuss the notion of 'colours' as a suitable dualization of variables in the algebraic case. Then the completeness result is extended to the 'non-ground' or 'coloured' case, which is shown to be expressive enough to deal with equations of a hidden sort. Finally we discuss some weaknesses of the proposed results with respect to Birkhoff's theorem, and we suggest possible future extensions.

NTIS

*Calculus; Polynomials; Operators (Mathematics); Dynamical Systems*

**20080047702** Texas Univ., Austin, TX, USA

**Numerical Modeling of Narrow MSE Walls with Extensible Reinforcements**

Yang, K. H.; Zornberg, J. G.; Wright, S. G.; Feb. 2008; 72 pp.; In English

Report No.(s): PB2009-102122; REPT-0-5506-2; Copyright; Avail.: National Technical Information Service (NTIS)

The Texas Department of Transportation (TxDOT) is experiencing wider use of Mechanically Stabilized Earth (MSE) Walls placed adjacent to an existing stable wall. In numerous cases, the space (width) available for the new wall is less than the width established in current guidelines for stand-alone MSE walls. This wall system combining an existing stable wall and a new MSE wall with constrained space is referred as a narrow MSE wall system. Although walls have already been designed and constructed for such applications, the actual mechanism of the narrow MSE wall system is still unclear. Accordingly, the current research project was undertaken. A detailed review of relevant literature has been compiled and design considerations have been proposed and presented in the companion project report. This report presents a series of numerical analyses of narrow MSE wall systems. The numerical models were conducted using finite element and limit equilibrium methods. Both models were validated by the results of centrifuge testing. The proposed procedure of numerical modeling narrow MSE wall system serves as a basis of practical applications. Furthermore, a series of parametric studies was performed based on the validity of the calibrated numerical models. The behaviors and mechanics of the narrow MSE wall systems were investigated and studied through the parametric studies. The results of parametric studies allow us to define the actual location of failure surface in a narrow MSE wall and to understand the mechanism causing the external failure when wall aspect ratio below 0.25.

NTIS

*Mathematical Models; Retaining; Walls; Structural Analysis*

**20080047769** Wood, Herron and Evans, LLP, Cincinnati, OH, USA; International Business Machines Corp., Armonk, NY, USA

**All-To-All Sequenced Fault Detection System**

Archer, C. J., Inventor; Pinnow, K. W., Inventor; Ratterman, J. D., Inventor; Smith, B. E., Inventor; 7 Feb 05; 10 pp.; In English

Contract(s)/Grant(s): DE-B519700

Patent Info.: Filed Filed 7 Feb 05; US-Patent-Appl-SN-11-052 658

Report No.(s): PB2008-105474; No Copyright; Avail.: CASI: [A02](#), Hardcopy

An apparatus, program product and method enable nodal fault detection by sequencing communications between all system nodes. A master node may coordinate communications between two slave nodes before sequencing to and initiating

communications between a new pair of slave nodes. The communications may be analyzed to determine the nodal fault.  
NTIS

*Computer Systems Design; Detection; Fault Detection; Fault Tolerance; Patent Applications*

**20080047772** Chau (F.) and Associates, Woodbury, NY, USA; International Business Machines Corp., Armonk, NY, USA  
**System and Method for Selective Image Capture, Transmission and Reconstruction**

Berman, S. T., Inventor; Greier, P. F., Inventor; Ho, K. C., Inventor; Kaufman, R. I., Inventor; Lanzetta, A. P., Inventor; 8 Feb 05; 15 pp.; In English

Contract(s)/Grant(s): DAAD19-02-2-0023

Patent Info.: Filed 8 Feb 05; US-Patent-Appl-SN-11-053 648

Report No.(s): PB2008-105477; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A video processing method and system for generating a foveated video display with sections having different resolutions uses a network channel for communicating video images having video sections of different resolutions, and includes a video transmission system for processing and transmitting the received video images over the network channel. The system assigns a larger portion of the network channel's bandwidth to a video section with higher resolution. Further, the system includes a video receiving system for receiving and seamlessly combining the first and second video sections of different resolutions to form an output video image on a display device, and a control unit for sending one or more video control parameters to the video transmission system to control capturing, transmitting and processing of the video images.

NTIS

*Cameras; Data Transmission; Image Processing; Image Reconstruction; Patent Applications*

**20080047773** McCarter and English, LLP, Newark, NJ, USA

**Robust Hidden Data Extraction Method for Scaling Attacks**

Subbalakshmi, K. P., Inventor; Amin, P. K., Inventor; 10 Aug 05; 19 pp.; In English

Contract(s)/Grant(s): F30602-03-2-0044

Patent Info.: Filed 10 Aug 05; US-Patent-Appl-SN-11-200 866

Report No.(s): PB2008-105478; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A product and process for extracting hidden data from a stego-image that has been subjected to scaling attacks are disclosed. The hidden data extraction method of the present invention retains the one-to-one mapping of the stego-image blocks to the corresponding blocks in the scaled image. When the stego-image is scaled down, the block size for extracting the hidden data is reduced proportionally. When the stego-image is scaled up, the block size for extracting the hidden data is increased proportionally. The total overall number of blocks of pixels to be examined is kept constant between the scaled image and the stego-image. The hidden data extraction method can be combined with any existing block-DCT based data hiding method to provide an overall method for dealing with scaling attacks. Both the extraction method and the combined method can be implemented in software and stored within a machine-readable medium.

NTIS

*Data Management; Extraction; Image Processing; Patent Applications*

**20080047780** Department of Health and Human Services, Washington, DC USA

**Data Security**

Aug. 08, 2003; 8 pp.; In English

Report No.(s): PB2008-105616; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Principal Investigators (PIs) of data-collection projects must devise data security procedures that protect respondent confidentiality, while maximizing access to the data by the scientific community. The potential risk of identifying a respondent varies with each data set, as does the potential harm caused by respondent identification. Thus, data security plans must be tailored to the unique needs and concerns of each data set: a one-security-plan-fits-all approach is neither feasible nor desirable. Nevertheless, population researchers responsible for assuring the security of their data can learn much from each other. Sharing experiences and approaches can help to create a consensus of minimum standards or practices necessary for any data-collection project and can provide examples of successful security practices available for more challenging circumstances. This document summarizes the results of the second of two workshops convened by the DBSB of the NICHD, to facilitate discussion of data sharing and data security practices among population researchers.

NTIS

*Computer Information Security; Procedures; Identifying*

**20080047803** Government Accountability Office, Washington, DC, USA

**Information Security: IRS Needs to Address Pervasive Weaknesses**

Jan. 2008; 31 pp.; In English

Report No.(s): PB2008-105104; GAO-08-211; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The Internal Revenue Service (IRS) relies extensively on computerized systems to carry out its demanding responsibilities to collect taxes (about \$2.7 trillion in fiscal year 2007), process tax returns, and enforce the nation's tax laws. Effective information security controls are essential to ensuring that financial and taxpayer information is adequately protected from inadvertent or deliberate misuse, fraudulent use, improper disclosure, or destruction. As part of its audit of IRS's fiscal years 2007 and 2006 financial statements, GAO assessed (1) IRS's actions to correct previously reported information security weaknesses and (2) whether controls were effective in ensuring the confidentiality, integrity, and availability of financial and sensitive taxpayer information. To do this, GAO examined IRS information security policies and procedures, guidance, security plans, reports, and other documents; tested controls over key financial applications at three IRS data centers; and interviewed key security representatives and management officials. IRS made limited progress toward correcting previously reported information security weaknesses. It has corrected or mitigated 29 of the 98 information security weaknesses that GAO reported as unresolved at the time of its last review.

NTIS

*Information Management; Revenue; Security; Information Systems*

**20080047804** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Domain Model Enhanced Search: A Comparison of Taxonomy, Thesaurus and Ontology**

Schwarz, K.; Jul. 15, 2005; 86 pp.; In English

Report No.(s): PB2008-105166; INS-E0514; Copyright; Avail.: National Technical Information Service (NTIS)

This thesis investigates the use of domain models for improving electronic search in the context of an enterprise. Specifically the three domain modeling schemes taxonomy, thesaurus and ontology are compared. The result is intended to support information architects in the decision making process to determine the best solution to a search problem.

NTIS

*Thesauri; Domains; Searching*

**20080047805** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Ontologies in Information Integration Within Multimedia Presentation Generation**

Enrech, J. S.; Oct. 05, 2005; 72 pp.; In English

Report No.(s): PB2008-105167; INS-E0515; Copyright; Avail.: National Technical Information Service (NTIS)

Nowadays an enormous quantity of heterogeneous and distributed information is stored in the current World Wide Web. Sharing of different information sources is needed. Recently the word Semantic Web has become very popular. The Semantic Web provides a common framework that allows data to be shared and re-used through ontologies. Ontologies make information explicit and can be used in the integration information task. The relation of an ontology with information sources or other ontologies plays an essential role in information integration and multimedia presentation. Multimedia presentation generators use a set of media items. The challenge is to combine these items in a coherent presentation to the user. For this, a large amount of information about these media items and their relations is needed. The collection and maintenance of information is a time-consuming costly effort that leads to the requirement for using existing information whenever possible to re-use the input metadata from the databases. In this document, we study the different approaches for combining information and propose an ontology construction method for developing shared ontologies. This document further illustrates the example integration of two art-media ontologies applying this process.

NTIS

*Multimedia; World Wide Web; Semantics; Data Bases; Information Systems*

**20080047806** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Composing Discourse Based on Genre Semantics**

Falkovych, K. I.; Nack, F. M.; Dec. 2005; 24 pp.; In English

Report No.(s): PB2008-105168; INS-E0516; Copyright; Avail.: National Technical Information Service (NTIS)

The availability of semantically enriched data in repositories of larger content providers offers a means for new ways of multimedia presentation authoring. Existing (semi-)automatic content composition environments explore limited numbers of genres and concentrate on template-based approaches for composing discourse structures for these genres. We analyze a

number of genres based on identifiable genre characteristics. We show that existing template-based approaches to content composition support the essay and biography genres that belong to one characteristic genre category but fail in supporting genres of another category. We present our approach to overcome this limitation and apply this approach to composing newspaper articles in the domain of fine arts.

NTIS

*Semantics; Data Bases; Multimedia*

**20080047807** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Investigation of Methods for User Adapted Visualisation of Information in a Hypermedia Generation System**

Werner, J.; Dec. 2005; 92 pp.; In English

Report No.(s): PB2008-105169; INS-E0517; Copyright; Avail.: National Technical Information Service (NTIS)

A literature review of user interaction to support creative processes is given. A design for an authoring system for semi-automatically generated hypermedia presentations is developed. The system designed is called SampLe (a Semi-Automatic Multimedia Presentation generation Environment).

NTIS

*Information Systems; Multimedia*

**20080047808** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Combining Coherence and Adaptation in Discourse-Oriented Hypermedia Generation**

Falkovych, K. I.; Cena, F.; Nack, F. M.; Feb. 2006; 14 pp.; In English

Report No.(s): PB2008-105170; INS-E0601; Copyright; Avail.: National Technical Information Service (NTIS)

This paper provides a solution to discourse structure adaptation in the process of automatic hypermedia presentation generation. Existing approaches to discourse structure composition are based on the assumption that a user can comprehend relations between the elements in a discourse structure if the overall structure is semantically coherent. This assumption does not, so far, take into account specific user needs. In this paper we show that although discourse structure composition approaches significantly differ, a general model of the composition process can be derived. Within this general model we identify how adaptation can be applied. We formulate the problem of discourse adaptation with regard to the general model and present our proposed solution. We implement this solution within the process of composing discourse structures for newspaper articles.

NTIS

*Multimedia; User Requirements*

**20080047816** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Creating Meaningful Multimedia Presentations**

Hardman, L.; Van Ossenbruggen, J. R.; Feb. 2006; 8 pp.; In English

Report No.(s): PB2008-105171; INS-E0602; Copyright; Avail.: National Technical Information Service (NTIS)

Finding relevant information is one step in the chain of understanding information. Presenting material to a user in a suitable way is a further step. Our research focuses on using semantic annotations of multimedia elements to increase the 'presentability' of retrieved information. We investigate the use of domain semantics and discourse semantics for improving information presentation. In particular, we present work showing the use of domain semantics for grouping search results, the combined use of domain and discourse semantics for creating a particular genre of multimedia presentation (biography) and finally show the combination of argumentation structures and domain semantics for generating coherent sequences of video material. We provide comments and insights into the viability of these techniques.

NTIS

*Multimedia; Sequencing; Biography*

**20080047900** Hodgson Russ LLP, Buffalo, NY, USA

**Hand Scanner with Moveable Platen**

Schneider, J. K., Inventor; Kitchens, J. C., Inventor; Gojevic, S. M., Inventor; 17 Oct 05; 11 pp.; In English

Contract(s)/Grant(s): DEA-01-C0028

Patent Info.: Filed Filed 17 Oct 05; US-Patent-Appl-SN-11-251 662

Report No.(s): PB2008-105454; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A hand scanner according to the invention may obtain an image of the hand and fingers including the bracelet

crease/carpel delta area and palm surface regions up to the tips of the fingers using ultrasound measurement techniques. A hand scanner according to the invention may include a movable arcuate platen and an energy transducer. In a method according to the invention, the transducer may be moved back and forth while moving a platen surface in order to advance the hand and thereby produce a raster type scan image. In this manner, the image of the hand print may be collected as a raster image representative of the scanned surface of the friction ridge skin.

NTIS

*Patent Applications; Platens*

**20080047993** California Inst. of Tech., Pasadena, CA, USA

**Expressions Module for the Satellite Orbit Analysis Program**

Edmonds, Karina; NASA Tech Briefs, October 2008; October 2008, pp. 18; In English; See also [20080047981](#)

Report No.(s): NPO-45052; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3279>

The Expressions Module is a software module that has been incorporated into the Satellite Orbit Analysis Program (SOAP). The module includes an expressions- parser submodule built on top of an analytical system, enabling the user to define logical and numerical variables and constants. The variables can capture output from SOAP orbital-prediction and geometric-engine computations. The module can combine variables and constants with built-in logical operators (such as Boolean AND, OR, and NOT), relational operators (such as >, <, or =), and mathematical operators (such as addition, subtraction, multiplication, division, modulus, exponentiation, differentiation, and integration). Parentheses can be used to specify precedence of operations. The module contains a library of mathematical functions and operations, including logarithms, trigonometric functions, Bessel functions, minimum/ maximum operations, and floating- point-to-integer conversions. The module supports combinations of time, distance, and angular units and has a dimensional- analysis component that checks for correct usage of units. A parser based on the Flex language and the Bison program looks for and indicates errors in syntax. SOAP expressions can be built using other expressions as arguments, thus enabling the user to build analytical trees. A graphical user interface facilitates use.

Author

*Satellite Orbits; Floating Point Arithmetic; Bessel Functions; Boolean Algebra; Dimensional Analysis; Graphical User Interface; Trigonometric Functions; Parsing Algorithms*

**20080048019** California Inst. of Tech., Pasadena, CA, USA

**SHINE Virtual Machine Model for In-flight Updates of Critical Mission Software**

Plesea, Lucian; NASA Tech Briefs, October 2008; October 2008, pp. 17; In English; See also [20080047981](#)

Report No.(s): NPO-45959; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3275>

This software is a new target for the Spacecraft Health Inference Engine (SHINE) knowledge base that compiles a knowledge base to a language called Tiny C - an interpreted version of C that can be embedded on flight processors. This new target allows portions of a running SHINE knowledge base to be updated on a 'live' system without needing to halt and restart the containing SHINE application. This enhancement will directly provide this capability without the risk of software validation problems and can also enable complete integration of BEAM and SHINE into a single application. This innovation enables SHINE deployment in domains where autonomy is used during flight-critical applications that require updates. This capability eliminates the need for halting the application and performing potentially serious total system uploads before resuming the application with the loss of system integrity. This software enables additional applications at JPL (microsensors, embedded mission hardware) and increases the marketability of these applications outside of JPL.

Author

*Knowledge Based Systems; Program Verification (Computers); Microinstrumentation; Sensors; Computer Programs; Targets; Deployment*

**20080048120** Geological Survey, Reston, VA USA

**Everglades Depth Estimation Network (EDEN) for Support of Ecological and Biological Assessments**

May 2006; 4 pp.; In English

Report No.(s): PB2008-105706; No Copyright; Avail.: National Technical Information Service (NTIS)

The Everglades Depth Estimation Network (EDNE) is an Integrated Network of real-time water-level monitoring , ground-elevation modeling, and water-surface modeling that provides scientists and managers with current (1999-present),

on-line water-depth information for the entire freshwater portion of Greater Everglades.

NTIS

*Depth; Everglades (FL)*

**20080048232** Lowenstein Sandler PC, Roseland, NJ, USA

**Method and Apparatus for Unsupervised Learning of Discriminative Edge Measures for Vehicle Matching Between Non-Overlapping Cameras**

Shan, Y., Inventor; Kumar, R., Inventor; Sawhney, H., Inventor; 5 Dec 05; 29 pp.; In English

Contract(s)/Grant(s): NBCH030085

Patent Info.: Filed Filed 5 Dec 05; US-Patent-Appl-SN-11 295 143

Report No.(s): PB2008-104841; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method and apparatus for unsupervised learning of measures for matching objects between images from at least two non-overlapping cameras is disclosed. The method includes collecting at least one two pairs of feature maps, where the at least one two pairs of feature maps are derived from features of objects captured in the images. The method further includes computing, as a function of at least one two pairs of feature maps, at least one first and second match measures, wherein the first match measure is of a same class and the second match measure is of a different class.

NTIS

*Cameras; Image Processing; Patent Applications*

**20080048249** Howrey, LLP, Falls Church, VA, USA

**Systems and Methods for Authoring and Protecting Digital Property**

Schneck, P. B., Inventor; Abrams, M. D., Inventor; 13 Mar 06; 49 pp.; In English

Contract(s)/Grant(s): OTA-TCT-606

Patent Info.: Filed Filed 13 Mar 06; US-Patent-Appl-SN-11-373 156

Report No.(s): PB2008-105867; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method and device are provided for controlling access to data. Portions of the data are protected and rules concerning access rights to the data are determined. Access to the protected portions of the data is prevented, other than in a non-useable form; and users are provided access to the data only in accordance with the rules as enforced by a mechanism protected by tamper detection. A method is also provided for distributing data for subsequent controlled use of those data. The method includes protecting portions of the data; preventing access to the protected portions of the data other than in a non-useable form; determining rules concerning access rights to the data; protecting the rules; and providing a package including: the protected portions of the data and the protected rules. A user is provided controlled access to the distributed data only in accordance with the rules as enforced by a mechanism protected by tamper protection. A device is provided for controlling access to data having protected data portions and rules concerning access rights to the data. The device includes means for storing the rules; and means for accessing the protected data portions only in accordance with the rules, whereby user access to the protected data portions is permitted only if the rules indicate that the user is allowed to access the portions of the data.

NTIS

*Access Control; Patent Applications*

**20080048270** Opticus IP Law, PLLC, Sarasota, FL, USA

**Universal Quantum Computing (PAT-APPL-10-547 262)**

Vala, J., Inventor; Whaley, B., Inventor; 21 Jan 04; 13 pp.; In English

Contract(s)/Grant(s): ONR-N00014-01-1-0826; AF-F30602-01-2-0524

Patent Info.: Filed Filed 21 Jan 04; US-Patent-Appl-SN-10-547 262

Report No.(s): PB2008-105868; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention is directed to systems and methods of providing universal quantum computation that avoid certain external control fields that either are hard or impossible to implement, or are serious sources of decoherence (errors). The systems and methods extend the set of scalable physical platforms suitable for implementing quantum computation in solid state, condensed matter and atomic and molecular physics systems. The invention includes identifying of suitable encodings of logical qubits into three physical qubits--i.e. three quantum mechanical systems of two levels--and performing quantum computing operations by changing the quantum states of physical qubits making up one or more logical qubits using only generalized anisotropic exchange interactions. This includes performing a quantum unitary operation over a single logical qubit or a non-local (entangling) two-qubit unitary operation. An exemplary embodiment of the invention uses a physical qubit

represented by two electronic quantum levels of a nanoparticle supported in an electromagnetic cavity. The physical qubit, i.e. its quantum levels can be tuned by electromagnetic field from a pulsed laser, so that the qubit can be brought into the interaction (resonance) with another physical qubit via exchange of cavity quantum electromagnetic modes.

NTIS

*Patent Applications; Quantum Computation*

**20080048271** Wells Saint John, PS, Spokane, WA, USA; General Hospital Corp., Boston, MA, USA

**Methods and Apparatus for Steering the Analyses of Collections of Documents**

Whitney, P. D., Inventor; Havre, S. L., Inventor; McGee, D. R., Inventor; 3 Nov 05; 27 pp.; In English

Contract(s)/Grant(s): DE-AC0676RL01830

Patent Info.: Filed Filed 3 Nov 05; US-Patent-Appl-SN-11-268 283

Report No.(s): PB2008-105869; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method for steering the analysis of a collection of documents includes receiving query terms for use in querying a database including a collection of documents; representing at least some of the query terms in a matrix; rotating document vectors associated with the documents to match the matrix to produce a matrix of rotated document vectors, each document vector representing a numeric vector created in association with individual documents; grouping the rotated document vectors into clusters, each cluster having one or more documents; and projecting the clusters to display visual information of the documents, the visual information including a summary view of the collection of documents. Program code and a system are also provided.

NTIS

*Information; Patent Applications; Visual Perception*

**20080048273** McGinn Intellectual Property Law Group, PLLC, Vienna, VA, USA

**System and Method for Algorithmic Cache-Bypass**

Chatterjee, S., Inventor; Gunnels, J. A., Inventor; Gustavson, F. G., Inventor; 9 Feb 05; 13 pp.; In English

Contract(s)/Grant(s): DOE-B517552

Patent Info.: Filed Filed 9 Feb 05; US-Patent-Appl-SN-11-052 877

Report No.(s): PB2008-105871; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A system for (and method of) algorithmic cache-bypass which includes acting on at least one level of cache to at least one of bypass at least one level of cache, stream through at least one level of cache, force utilization of at least one other level of cache, bypass at least one level of cache, bypass all levels of cache, force utilization of a main memory, and force utilization of an out-of core memory.

NTIS

*Algorithms; Bypasses; Loops; Patent Applications*

**20080048274** Wood, Herron and Evans, LLP, Cincinnati, OH, USA

**Row Fault Detection System (PAT-APPL-11-052 660)**

Archer, C. J., Inventor; Pinnow, K. W., Inventor; Ratterman, J. D., Inventor; Smith, B. E., Inventor; 7 Feb 05; 9 pp.; In English

Contract(s)/Grant(s): DOE-B519700

Patent Info.: Filed Filed 7 Feb 05; US-Patent-Appl-SN-11-052 660

Report No.(s): PB2008-105873; No Copyright; Avail.: CASI: [A02](#), Hardcopy

An apparatus, program product and method checks for nodal faults in a row of nodes by causing each node in the row to concurrently communicate with its adjacent neighbor nodes in the row. The communications are analyzed to determine a presence of a faulty node or connection.

NTIS

*Fault Detection; Parallel Processing (Computers); Patent Applications*

**20080048275** Wood, Herron and Evans, LLP, Cincinnati, OH, USA

**Multi-Directional Fault Detection System (PAT-APPL-11-052 661)**

Archer, C. J., Inventor; Pinnow, K. W., Inventor; Ratterman, J. D., Inventor; Smith, B. E., Inventor; 7 Feb 05; 9 pp.; In English

Contract(s)/Grant(s): DOE-B519700



Patent Info.: Filed Filed 7 Feb 05; US-Patent-Appl-SN-11-052 661

Report No.(s): PB2008-105874; No Copyright; Avail.: CASI: [A02](#), Hardcopy

An apparatus, program product and method checks for nodal faults in a group of nodes comprising a center node and all adjacent nodes. The center node concurrently communicates with the immediately adjacent nodes in three dimensions. The communications are analyzed to determine a presence of a faulty node or connection.

NTIS

*Computers; Fault Detection; Parallel Processing (Computers); Patent Applications*

**20080048276** Wood, Herron and Evans, LLP, Cincinnati, OH, USA

**All Row, Planar Fault Detection System (PAT-APPL-11-052 662)**

Archer, C. J., Inventor; Pinnow, K. W., Inventor; Ratterman, J. D., Inventor; Smith, B. E., Inventor; 7 Feb 05; 10 pp.; In English

Contract(s)/Grant(s): DOE-B519700

Patent Info.: Filed Filed 7 Feb 05; US-Patent-Appl-SN-11-052 662

Report No.(s): PB2008-105875; No Copyright; Avail.: CASI: [A02](#), Hardcopy

An apparatus, program product and method for detecting nodal faults may simultaneously cause designated nodes of a cell to communicate with all nodes adjacent to each of the designated nodes. Furthermore, all nodes along the axes of the designated nodes are made to communicate with their adjacent nodes, and the communications are analyzed to determine if a node or connection is faulty.

NTIS

*Fault Detection; Parallel Processing (Computers); Patent Applications*

**20080048277** Wood, Herron and Evans, LLP, Cincinnati, OH, USA

**Bisectional Fault Detection System (PAT-APPL-11-052 663)**

Archer, C. J., Inventor; Pinnow, K. W., Inventor; Ratterman, J. D., Inventor; Smith, B. E., Inventor; 7 Feb 05; 9 pp.; In English

Contract(s)/Grant(s): DOE-B519700

Patent Info.: Filed Filed 7 Feb 05; US-Patent-Appl-SN-11-052 663

Report No.(s): PB2008-105876; No Copyright; Avail.: CASI: [A02](#), Hardcopy

An apparatus, program product and method logically divides a group of nodes and causes node pairs comprising a node from each section to communicate. Results from the communications may be analyzed to determine performance characteristics, such as bandwidth and proper connectivity.

NTIS

*Computers; Detection; Fault Detection; Parallel Processing (Computers); Patent Applications*

**20080048279** McGinn Intellectual Property Law Group, PLLC, Vienna, VA, USA

**System and Method for Detecting a Faulty Object in a System**

Gunnels, J. A., Inventor; Gustavson, F. G., Inventor; Engle, R. D., Inventor; 7 Feb 05; 15 pp.; In English

Contract(s)/Grant(s): DOE-B517552

Patent Info.: Filed Filed 7 Feb 05; US-Patent-Appl-SN-11-050 945

Report No.(s): PB2008-105878; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method (and system) for detecting at least one faulty object in a system including a plurality of objects in communication with each other in an n-dimensional architecture, includes probing a first plane of objects in the n-dimensional architecture and probing at least one other plane of objects in the n-dimensional architecture which would result in identifying a faulty object in the system.

NTIS

*Computers; Detection; Fault Detection; Patent Applications*

**20080048280** Wood, Herron and Evans, LLP, Cincinnati, OH, USA

**Cell Boundary Fault Detection System (PAT-APPL-11-052 659)**

Archer, C. J., Inventor; Pinnow, K. W., Inventor; Ratterman, J. D., Inventor; 7 Feb 05; 11 pp.; In English

Contract(s)/Grant(s): DOE-B519700

Patent Info.: Filed 7 Feb 05; US-Patent-Appl-SN-11-052 659

Report No.(s): PB2008-105879; No Copyright; Avail.: CASI: A03, Hardcopy

An apparatus, program product and method determine a nodal fault along the boundary, or face, of a computing cell. Nodes on adjacent cell boundaries communicate with each other, and the communications are analyzed to determine if a node or connection is faulty.

NTIS

*Boundaries; Fault Detection; Parallel Processing (Computers); Patent Applications*

**20080048294** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**VAMP: Semantic Validation for MPEG-7 Profile Descriptions**

Troncy, R.; Bailer, W.; Hausenblas, M.; Hoffernig, M.; Apr. 2007; 34 pp.; In English

Report No.(s): PB2008-105197; INS-E0705; Copyright; Avail.: National Technical Information Service (NTIS)

MPEG-7 can be used to create complex and comprehensive metadata descriptions of multimedia content. Since MPEG-7 is defined in terms of an XML schema, the semantics of its elements has no formal grounding. In addition, certain features can be described in multiple ways. MPEG-7 profiles are subsets of the standard that apply to specific application areas and that aim to reduce this syntactic variability, but they still lack formal semantics. We propose an approach for expressing the semantics explicitly by formalizing the constraints of various profiles using ontologies and logical rules, thus enabling interoperability and automatic use for MPEG-7 based applications. We have implemented VAMP, a full semantic validation service that detects any inconsistencies of the semantic constraints formalized. Another contribution of this paper is an analysis of how MPEG-7 is practically used. We report on experiments about the semantic validity of MPEG-7 descriptions produced by numerous tools and projects and we categorize the most common errors found.

NTIS

*Images; Multimedia; Semantics; Document Markup Languages*

**20080048295** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Analysis of Search-Based User Interaction on the Semantic Web**

Hildebrand, M.; Van Ossenbruggen, J.; Hardman, L.; May 2007; 18 pp.; In English

Report No.(s): PB2008-105198; INS-E0706; Copyright; Avail.: National Technical Information Service (NTIS)

Many Semantic Web applications provide access to their resources through text-based search queries, using explicit semantics to improve the search results. This paper provides an analysis of the current state of the art in semantic search, based on 35 existing systems. We identify different types of semantic search features that are used during query construction, the core search process, the presentation of the search results and user feedback on query and results. For each of these, we consider the functionality that the system provides and how this is made available through the user interface.

NTIS

*Semantics; World Wide Web; Feedback*

**20080048296** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Design Space of a Configurable Autocompletion Component**

Hildebrand, M.; Van Ossenbruggen, J.; Amin, A.; Nov. 2007; 14 pp.; In English

Report No.(s): PB2008-105199; INS-E0708; Copyright; Avail.: National Technical Information Service (NTIS)

Autocompletion is a commonly used interface feature in diverse applications. Semantic Web data has, on the one hand, the potential to provide new functionality by exploiting the semantics in the data used for generating autocompletion suggestions. Semantic Web applications, on the other hand, typically pose extra requirements on the semantic properties of the suggestions given. When the number of syntactic matches becomes too large, some means of selecting a semantically meaningful subset of suggestions to be presented to the user is needed. In this paper we identify a number of key design dimensions of autocompletion interface components. Our hypothesis is that a one-size-fits-all solution to autocompletion interface components does not exist, because different tasks and different data sets require interfaces corresponding to different points in our design space. We present a fully configurable architecture, which can be used to configure autocompletion components to the desired point in this design space. The architecture has been implemented as an open source software component that can be plugged into a variety of applications. We report on the results of a user evaluation that confirms this hypothesis, and describe the need to evaluate semantic autocompletion in a task and application-specific context.

NTIS

*Applications Programs (Computers); Open Source Licensing (Computers); Hypotheses*

**20080048298** Geological Survey, Reston, VA USA

**Hydrologic Record Extension of Water-Level Data in the Everglades Depth Estimation Network (EDEN) Using Artificial Neural Network Models, 2000-2006**

January 2007; 66 pp.; In English

Report No.(s): PB2008-105713; USGS/OFR-2007-1350; No Copyright; Avail.: National Technical Information Service (NTIS)

The Everglades Depth Estimation Network (EDEN) is an Integrated network of real-time water-level gaging stations, ground-elevation models, and water-surface models designed to provide scientists, engineers, and water-resource managers with current (2000-present) water-depth information for the entire freshwater portion of the Everglades. The U.S. Geological Survey Greater Everglades Priority Ecosystem Science provides support of EDEN and the goal of providing quality assured monitoring data for the U.S. Army Corps of Engineers Comprehensive Everglades Restoration Plan. To increase the accuracy of the water-surface models, 25 real-time water-level gaging stations incorporate the data from the newly added stations to the 7 year EDEN database. The short-term water-level records (generally less than 1 year) needed to be simulated back in time to be concurrent with data from the established gaging stations in the database. The water-surface models, 25-real-time water-level gaging stations, incorporate the data from the newly added stations to the 7 year EDEN database in the Greater Everglades, the short-term water-level records (generally less than 1 year) needed to be simulated back in time (hindcasted) to be concurrent with data from the established gaging stations in the database.

NTIS

*Depth; Everglades (FL); Neural Nets; Water*

**20080048299** Geological Survey, Reston, VA USA

**Conceptual Design of the Everglades Depth Estimation Network (EDEN) Grid**

Jones, J. W.; Price, S. D.; January 2007; 20 pp.; In English

Report No.(s): PB2008-105714; USGS/OFR-2007-1200; No Copyright; Avail.: National Technical Information Service (NTIS)

The Everglades Depth Estimation Network (EDEN) offers a consistent and documented dataset that can be used to guide large-scale field operations, to integrate hydrologic and ecological responses, and to support biological and ecological assessments that measure ecosystem responses to the Comprehensive Everglades Restoration Plan (Telis, 2006). Ground elevation data for the greater Everglades and the digital ground elevation models derived from them form the foundation for all EDEN water depth and associated ecologic/hydrologic modeling (Jones, 2004, Jones and Price, 2007). To use EDEN water depth and duration information most effectively, it is important to be able to view and manipulate information on elevation data quality and other land cover and habitat characteristics across the Everglades region. These requirements led to the development of the geographic data layer described in this techniques and methods report. Relying on extensive experience in GIS data development, distribution, and analysis, a great deal of forethought went into the design of the geographic data layer used to index elevation and other surface characteristics for the Greater Everglades region. To allow for simplicity of design and use, the EDEN area was broken into a large number of equal-sized rectangles (cells) that in total are referred to here as the grid. Some characteristics of this grid, such as the size of its cells, its origin, the area of Florida it is designed to represent, and individual grid cell identifiers, could not be changed once the grid database was developed. Therefore, these characteristics were selected to design as robust a grid as possible and to ensure the grids long-term utility. It is desirable to include all pertinent information known about elevation and elevation data collection as grid attributes. Also, it is very important to allow for efficient grid post-processing, sub-setting, analysis, and distribution. This document details the conceptual design of the EDEN grid spatial parameters and cell attribute-table content.

NTIS

*Everglades (FL); Water Depth; Estimating; Ecosystems; Digital Elevation Models; Elevation*

**20080048301** Geological Survey, Reston, VA USA

**Initial Everglades Depth Estimation Network (EDEN) Digital Elevation Model Research and Development**

Jones, J. W.; Price, S. D.; January 2007; 29 pp.; In English

Report No.(s): PB2008-105720; USGS/OFR-2007-1034; No Copyright; Avail.: CASI: [A03](#), Hardcopy

As indicated in TCRP Report 86, Volume 13, these technologies need to be thoroughly tested in transit environments to determine their performance and ensure that they meet operational and functional performance criteria. Since some of the information provided for newer technologies is based on laboratory tests and information received from manufacturers, results

of any testing that have been or are currently being conducted by TSA and other objective organizations in operational settings should be obtained and evaluated by transit agencies.

NTIS

*Water Depth; Digital Elevation Models; Everglades (FL); Research and Development; Estimating*

**20080048303** Geological Survey, Reston, VA USA; Nebraska Game and Parks Commission, Lincoln, NE, USA; Oregon State Univ., Corvallis, OR, USA

**High-Resolution Topographic, Bathymetric, and Oceanographic Data for the Pleasure Point Area, Santa Cruz County, California: 2005-2007**

Storlazzi, C. D.; Barnard, P. L.; Collins, B. D.; Finlayson, D. P.; Golden, N. E.; January 2007; 29 pp.; In English  
Report No.(s): PB2008-105730; USGS-OFR-2007-1270; No Copyright; Avail.: National Technical Information Service (NTIS)

The County of Santa Cruz Department of Public Works and the County of Santa Cruz Redevelopment Agency requested the U.S. Geological Survey (USGS) Western Coastal and Marine Geology Team (WCMG) to provide baseline geologic and oceanographic information on the coast and inner shelf at Pleasure Point, Santa Cruz County, California. The rationale for this proposed work is a need to better understand the environmental consequences of a proposed bluff stabilization project on the beach, the nearshore and the surf at Pleasure Point, Santa Cruz County, California. To meet these information needs, the USGS-WCMG Team collected baseline scientific information on the morphology and waves at Pleasure Point. This study provided high-resolution topography of the coastal bluffs and bathymetry of the inner shelf off East Cliff Drive between 32nd Avenue and 41st Avenue. The spatial and temporal variation in waves and their breaking patterns at the study site were documented. Although this project did not actively investigate the impacts of the proposed bluff stabilization project, these data provide the baseline information required for future studies directed toward predicting the impacts of stabilization on the sea cliffs, beach and nearshore sediment profiles, natural rock reef structures, and offshore habitats and resources. They also provide a basis for calculating potential changes to wave transformations into the shore at Pleasure Point.

NTIS

*Bathymeters; Coasts; Geological Surveys; Geology; High Resolution; Ocean Bottom; Oceanographic Parameters; Oceanography; Surveys; Topography*

**20080048304** Geological Survey, Reston, VA USA

**Simulations of Potential Runout and Deposition of the Ferguson Rockslide, Merced River Canyon, California**

Denlinger, R. P.; January 2007; 25 pp.; In English  
Report No.(s): PB2008-105731; USGS-OFR-2007-1275; No Copyright; Avail.: National Technical Information Service (NTIS)

An active rockslide in Merced River Canyon was first noticed on April 29, 2006 when a few rocks rolled onto Highway 140 between mileposts 103 and 104, compromising traffic on this highway and signaling the onset of renewed activity of the Ferguson rockslide. State highway 140 is one of the main entrances to Yosemite National Park and is the primary road for large commercial trucks access into the park from the west. Continued rockslide activity during 2006 built a large talus cone that covered the highway and encroached into the Merced River below it. Observations by the US Forest Service (USFS), the California Department of Transportation (CALTRANS), and the U.S. Geological Survey (USGS) confirm that the rockslide remained active through 2006 and represents a potential threat to traffic along the rerouted highway as well as to recreational users of the Merced River in the runout path below the rockslide. Delineation of the hazards posed by the Ferguson rockslide is a necessary prerequisite to mitigating them.

NTIS

*Canyons; Forests; Geological Surveys; Rivers; Transportation*

**20080048318** Chief Information Officers Council, Washington, DC, USA

**Lessons Learned on Information Technology Performance Management: Applying the Balanced Scorecard and Applied Information Economics to Federal Information Technology Initiatives**

January 2007; 36 pp.; In English  
Report No.(s): PB2008-104624; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Measuring the contribution of IT investments to complex missions such as providing for the health, welfare, and defense of the citizens of the USA requires Federal executive agencies to overcome significant technical and management challenges. These challenges are magnified by a lack of an established body of knowledge for determining ITs contribution and methods

to measure it efficiently. Federal executive agencies also lack examples relevant to their missions to guide their measurement practices and help them overcome organizational resistance as they incorporate measurement into their management practices. To address this knowledge gap, the Federal Chief Information Officers (CIO) Council completed experiments of two measurement methodologies applied to two major Federal IT initiatives in 2001. The two methodologies were the Balanced Scorecard (BSC) and Applied Information Economics (AIE). These pilot demonstrations showed that both methodologies determined and measured the contribution of specific IT investments to the missions of two Federal departments. They also showed that the methodologies are management tools for improving performance, though their focus and approach are quite different. Even though the pilots were completed more than two years ago, the performance measures developed would be still appropriate to include in annual performance plans and budget exhibits for capital investments. They also would be compliant with the Performance Reference Model developed by the Office of Management Budget in September 2003.

NTIS

*Economics; Information Systems; Lessons Learned*

**20080048319** Chief Information Officers Council, Washington, DC, USA

**Workforce and Human Capital for IT Committee: Update 2002**

Feb. 2003; 40 pp.; In English

Report No.(s): PB2008-104625; No Copyright; Avail.: CASI: [A03](#), Hardcopy

For the past several years, the Federal Chief Information Officers (CIO) Councils Workforce and Human Capital for Information Technology (IT) Committee has addressed the Federal Governments ongoing demand for highly skilled IT workers. The Committee is the Governments key advocate for strategies to recruit, develop and maintain an effective Federal IT workforce. The Committees broad agenda encompasses the full employment life cycle: workforce planning, recruitment and retention, and career development. As the Councils committee structure was reformed with the advent of E-Government initiatives, the Committees importance has not only been sustained, but also increased. In a December 16, 2002, memorandum to CIOs, Council Vice-Chair Karen Evans confirmed this, stating that as the Council engages in corporate management of IT resources, with a Government-wide enterprise approach to projects, it must also ensure that the IT workforce is well-versed in project management and trained to execute such projects with minimum risk. The Councils immediate focus is on todays critical workforce needs: project managers, solution architects, and security specialists. However, the potential for severe shortages across the spectrum of IT competencies looms in the future as a result of an aging workforce, limited recruitment at entry levels, and the eventual resurgence of the U.S. economy. Todays low turnover rates and plentitude of applicants may be deceptive. The crisis is merely postponed, not averted. This temporary relief from an IT workforce crisis is a window of opportunity. It provides time to put into place practices that will enable CIOs not only to prevent chronic skill gaps, but also to create the highly skilled workforce needed in the future.

NTIS

*Information Systems; Labor*

**20080048323** Federal Trade Commission, Washington, DC, USA

**Spam Summit: The Next Generation of Threats and Solutions**

Nov. 2007; 39 pp.; In English

Report No.(s): PB2008-104771; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Spam is one of the most intractable consumer protection problems faced by computer users. For the past decade, the Federal Trade Commission has been steadfast in the fight against fraudulent and deceptive spam. The nature of spam, however, has shifted, and a new generation of malicious spam is on the rise. This shift is marked by a change in both spammers methods and motives for sending spam. In the early years, spammers used basic traceable computer scripts to mass market products via email. In tracking the communications path, law enforcement often could find and shut down illegal spamming operations. Spammers soon adopted various methods to conceal their identities, including, for example, spoofing, which is the use of falsified email headers to disguise the origin of their email messages. Spammers also used creative strategies for obtaining email addresses, including harvesting the automated collection of email addresses from public areas of the Internet. A recent FTC staff study finds that despite spammers ongoing use of spoofing and harvesting techniques, ISPs spam filters continue to serve a key role in reducing the amount of spam delivered to consumers in boxes.

NTIS

*Consumers; Protection*

**20080048325** Townsend and Townsend and Crew, LLP, San Francisco, CA, USA  
**Computer-Aided Probability Base Calling for Arrays of Nucleic Acid Probes on Chips**

Lipshutz, R. J., Inventor; Walker, M. G., Inventor; 14 Oct 05; 18 pp.; In English

Contract(s)/Grant(s): NIST-70NANB5H1031

Patent Info.: Filed Filed 14 Oct 05; US-Patent-Appl-SN-11-251 385

Report No.(s): PB2008-104814; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A computer system for analyzing nucleic acid sequences is provided. The computer system is used to calculate probabilities for determining unknown bases by analyzing the fluorescence intensities of hybridized nucleic acid probes on biological chips. Additionally, information from multiple experiments is utilized to improve the accuracy of calling unknown bases.

NTIS

*Chips; Computer Techniques; Nucleic Acids; Patent Applications; Probability Theory; Sequencing*

**20080048326** McGinn Intellectual Property Law Group, PLLC, Vienna, VA, USA  
**Method and Structure for Cache Aware Transposition Via Rectangular Subsections**

Gustavson, F. G., Inventor; Gunnels, J. A., Inventor; 14 Jan 05; 22 pp.; In English

Contract(s)/Grant(s): DOE-B517552

Patent Info.: Filed Filed 14 Jan 05; US-Patent-Appl-SN-11-035 933

Report No.(s): PB2008-104815; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method and structure for transposing a rectangular matrix A in a computer includes subdividing the rectangular matrix A into one or more square submatrices and executing an in-place transposition for each of the square submatrices A(sub ij).

NTIS

*Algebra; Matrices (Mathematics); Patent Applications*

**20080048327** McGinn Intellectual Property Law Group, PLLC, Vienna, VA, USA  
**Method and Structure for a Generalized Cache-Register File Interface with Data Restructuring Methods for Multiple Cache Levels and Hardware Pre-Fetching**

Gustavson, F. G., Inventor; Gunnels, J. A., Inventor; Sexton, J. C., Inventor; 14 Jan 05; 14 pp.; In English

Contract(s)/Grant(s): DOE-B517552

Patent Info.: Filed Filed 14 Jan 05; US-Patent-Appl-SN-11-035 902

Report No.(s): PB2008-104816; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method and structure for executing a matrix algorithm requiring an order of  $N^3$  operations including data reformatting operations, where N is a dimension of an operand of said algorithm on a computer, includes initially reformatting data for at least one matrix used in the matrix algorithm into a data structure stored in a memory, such that stride one data is presented for all submatrices used as operands involved in the matrix algorithm in a format required by the matrix algorithm with substantially no further data re-formatting beyond an order N data re-formatting required for executing the algorithm.

NTIS

*Algorithms; Matrices (Mathematics); Patent Applications*

**20080048348** Center for Mathematics and Computer Science, Amsterdam, Netherlands  
**Optimal Semicomputable Approximations to Reachable and Invariant Sets**

Collins, P. J.; Feb. 2006; 18 pp.; In English

Report No.(s): PB2008-106024; MAS-R0603; Copyright; Avail.: National Technical Information Service (NTIS)

In this paper we consider the computation of reachable, viable and invariant sets for discrete-time systems. We use the framework of type-two effectivity, in which computations are performed by Turing machines with infinite input and output tapes, with the representations of computable topology. We see that the reachable set is lower-semicomputable, and the viability and invariance kernels are upper-semicomputable. We then define an upper-semicomputable over-approximation to the reachable set, and lower-semicomputable under-approximations to the viability and invariance kernels, and show that these approximations are optimal.

NTIS

*Viability; Invariance; Topology*

**20080048350** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Casimir Scaling, Glueballs, and Hybrid Gluelumps**

Mathieu, V.; Semay, C.; Brau, F.; Feb. 2006; 10 pp.; In English

Report No.(s): PB2008-106026; MAS-R0604; Copyright; Avail.: National Technical Information Service (NTIS)

Assuming that the Casimir scaling hypothesis is well verified in QCD, masses of glueballs and hybrid gluelumps (gluon attached to a point-like cc pair) are computed within the framework of the rotating string formalism. In our model, two gluons are attached by an adjoint string in a glueball, while the gluon and the colour octet cc pair are attached by two fundamental strings in a hybrid gluelump. Masses for such exotic hadrons are computed with very few free parameters. These predictions can serve as a guide for experimental searches. In particular, the ground state glueballs lie on a Regge trajectory and the lightest  $2(\text{sup } ++)$  state has a mass compatible with some experimental candidates.

NTIS

*Gluons; Quark Models*

**20080048352** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Nonlinear Instability and Saturation of Linearly Stable Current-Carrying Pair Plasmas**

Luque, A.; Schamel, H.; Eliasson, B.; Shukla, P. K.; Feb. 2006; 18 pp.; In English

Report No.(s): PB2008-106028; MAS-R0605; Copyright; Avail.: National Technical Information Service (NTIS)

The nonlinear instability of current-carrying pair plasmas is investigated with a Vlasov-Poisson model for the two particle species. It is shown that linearly stable configurations are unstable against small incoherent perturbations of the particle distribution functions. The instability gives rise to a self-acceleration and growth of phase space holes. After the growth of the phase-space holes, the instability reaches a chaotic saturation where the finite-amplitude holes interact and merge, and after a long time, the system attains a stable equilibrium state with a smaller drift and a larger temperature than the initial one, and where a few stable phase-space holes are present.

NTIS

*Electric Current; Nonlinearity; Plasmas (Physics); Perturbation*

**20080048353** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Improved Front Tracking Method for the Euler Equations**

Witteveen, J. A. S.; Bakker, P. G.; Koren, B.; Jan. 2006; 14 pp.; In English

Report No.(s): PB2008-106029; MAS-E0605; Copyright; Avail.: National Technical Information Service (NTIS)

In this paper an improved front tracking method for the Euler equations is presented. The method is improved by assigning wave types to the fronts. These wave types determine the velocities of the fronts and their mutual interactions. This results in a physically more consistent, a more accurate and a faster simulation. The method is applied to the Euler equations for one-dimensional unsteady and supersonic two-dimensional steady flow.

NTIS

*Differential Equations; Discontinuity*

**20080048385** Commerce Dept., Washington, DC, USA

**Bureau of the Census: Actions to Address the Impact on the Accuracy and Coverage Evaluation of Suspected Duplicate Persons in the 2000 Decennial Census. Inspection Report No. OSE-13812**

Mar. 2001; 8 pp.; In English

Report No.(s): PB2009-102818; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The objective of this evaluation was to determine whether the bureaus methodology for handling the reinstatement of 2.4 million person records into the decennial census minimized the impact on the accuracy and reliability of the A.C.E. This issue arose during our review of the process used in the A.C.E. for automated person matching.

NTIS

*Census; Inspection*

**20080048392** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Coalgebraic Automata Theory: Basic Results**

Kupke, C. A.; Venema, Y.; Apr. 17, 2007; 50 pp.; In English

Report No.(s): PB2009-103421; SEN-E0701; Copyright; Avail.: National Technical Information Service (NTIS)

We generalize some of the central results in automata theory to the abstraction level of coalgebras and thus lay out the

foundations of the theory of coalgebra automata. In particular, we prove the following results for any functor  $F$  that preserves weak pullbacks. We show that the class of recognizable languages of  $F$ -coalgebras is closed under taking unions, intersections, and projections. We also prove that if an  $F$ -automaton accepts some coalgebra it accepts a finite one of bounded size. Our main technical result concerns an explicit construction which transforms a given alternating  $F$ -automaton into an equivalent nondeterministic one, of bounded size.

NTIS

*Automata Theory; Games; Parity; Transformations (Mathematics); Operators (Mathematics)*

**20080048393** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Behavioural Differential Equations and Coinduction for Binary Trees**

Silva, A. M.; Rutten, J. J. M. M.; May 2007; 16 pp.; In English

Report No.(s): PB2009-103424; SEN-R0702; Copyright; Avail.: National Technical Information Service (NTIS)

We study the set  $TA$  of infinite binary trees with nodes labelled in a semi-ring  $A$  from a coalgebraic perspective. We present coinductive definition and proof principles based on the fact that  $TA$  carries a final coalgebra structure. By viewing trees as formal power series, we develop a calculus where definitions are presented as behavioural differential equations. We present a general format for these equations that guarantees the existence and uniqueness of solutions. Although technically not very difficult, the resulting framework has surprisingly nice applications, which is illustrated by various concrete examples.

NTIS

*Differential Equations; Algebra*

**20080048394** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Regular Expressions for Polynomial Coalgebras**

Bonsangue, M. M.; Rutten, J. J. M. M.; Silva, A. M.; Dec. 2007; 24 pp.; In English

Report No.(s): PB2009-103425; SEN-E0703; Copyright; Avail.: National Technical Information Service (NTIS)

For polynomial functors  $\mathcal{G}\mathcal{G}$ , we show how to generalize the classical notion of regular expression to  $\mathcal{G}\mathcal{G}$ -coalgebras. We introduce a language of expressions for describing elements of the final  $\mathcal{G}\mathcal{G}$ -coalgebra and, analogously to Kleene's theorem, we show the correspondence between expressions and finite  $\mathcal{G}\mathcal{G}$ -coalgebras.

NTIS

*Polynomials; Operators (Mathematics); Algebra*

**20080048578** Center for Mathematics and Computer Science, Amsterdam, Netherlands; Lucent Technologies, Huizen, Netherlands

**Cost-Effective Maintenance Tools for Proprietary Languages**

De Jonge, M.; Monajemi, R.; May 31, 2001; 18 pp.; In English

Report No.(s): PB2009-102730; SEN-R0116; Copyright; Avail.: National Technical Information Service (NTIS)

Maintenance of proprietary languages and corresponding tooling is expensive. Postponing maintenance to reduce these costs is an often applied, short-term solution which eventually may lead to an unoperational toolset. This paper describes a case study carried out in cooperation with Lucent Technologies where maintenance cost is decreased by simplifying the development process of languages and tools. The development process is simplified by using a language-centered software engineering approach which increases software reuse and language dependent code generation. The case study was concerned with Lucent's proprietary sdl dialect and involved the re-engineering of an sdl grammar and the construction of an sdl documentation generator.

NTIS

*Cost Effectiveness; Languages; Maintenance*

**20080048579** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Refactoring Test Code**

Van Deursen, A.; Moonen, L. M. F.; Van den Bergh, A.; Kok, G.; Jul. 31, 2001; 10 pp.; In English

Report No.(s): PB2009-102733; SEN-R0119; Copyright; Avail.: National Technical Information Service (NTIS)

Two key aspects of extreme programming (XP) are unit testing and merciless refactoring. Given the fact that the ideal test code/production code ratio approaches 1:1, it is not surprising that unit tests are being refactored. We found that refactoring test code is different from refactoring production code in two ways: (1) there is a distinct set of bad smells involved, and (2) improving test code involves additional test-specific refactorings. To share our experiences with other XP practitioners, we



describe a set of bad smells that indicate trouble in test code, and a collection of test refactorings to remove these smells.  
NTIS

*Computer Programs; Performance Tests; Variable*

## 60

### COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware and data processing. For components see *33 Electronics and Electrical Engineering*. For computer vision see *63 Cybernetics, Artificial Intelligence and Robotics*.

**20080047305** NASA Goddard Space Flight Center, Greenbelt, MD, USA

#### **Benchmark Comparison of Dual- and Quad-Core Processor Linux Clusters with Two Global Climate Modeling Workloads**

McGalliard, James; October 23, 2008; 37 pp.; In English; Southern Computer Measurement Group Fall Conference, 23 Oct. 2008, Richmond, VA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NG08HZOI I; No Copyright; Avail.: CASI: **A03**, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047305>

This viewgraph presentation details the science and systems environments that NASA High End computing program serves. Included is a discussion of the workload that is involved in the processing for the Global Climate Modeling. The Goddard Earth Observing System Model, Version 5 (GEOS-5) is a system of models integrated using the Earth System Modeling Framework (ESMF). The GEOS-5 system was used for the Benchmark tests, and the results of the tests are shown and discussed. Tests were also run for the Cubed Sphere system, results for these test are also shown.

CASI

*Computer Systems Performance; Performance Tests; Computer Design; Computer Systems Design; Architecture (Computers); Interprocessor Communication*

**20080048049** California Inst. of Tech., Pasadena, CA, USA

#### **Spaceborne Hybrid-FPGA System for Processing FTIR Data**

Bekker, Dmitriy; Blavier, Jean-Francois L.; Pingree, Paula J.; Lukowiak, Marcin; Shaaban, Muhammad; NASA Tech Briefs, December 2008; December 2008, pp. 9; In English; See also **20080048022**

Report No.(s): NPO-45957; Copyright; Avail.: CASI: **A01**, Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3416>

Progress has been made in a continuing effort to develop a spaceborne computer system for processing readout data from a Fourier-transform infrared (FTIR) spectrometer to reduce the volume of data transmitted to Earth. The approach followed in this effort, oriented toward reducing design time and reducing the size and weight of the spectrometer electronics, has been to exploit the versatility of recently developed hybrid field-programmable gate arrays (FPGAs) to run diverse software on embedded processors while also taking advantage of the reconfigurable hardware resources of the FPGAs.

Derived from text

*Field-Programmable Gate Arrays; Infrared Spectrometers; Data Systems; Airborne/Spaceborne Computers; Spacecraft Electronic Equipment*

**20080048147** California Inst. of Tech., Pasadena, CA, USA

#### **Multichannel Networked Phasemeter Readout and Analysis**

Edmonds, Karina; NASA Tech Briefs, September 2008; September 2008, pp. 54; In English; See also **20080048125**

Report No.(s): NPO-45505; Copyright; Avail.: CASI: **A01**, Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3203>

Netmeter software reads a data stream from up to 250 networked phasemeters, synchronizes the data, saves the reduced data to disk (after applying a low-pass filter), and provides a Web server interface for remote control. Unlike older phasemeter software that requires a special, real-time operating system, this program can run on any general-purpose computer. It needs about five percent of the CPU (central processing unit) to process 20 channels because it adds built-in data logging and network-based GUIs (graphical user interfaces) that are implemented in Scalable Vector Graphics (SVG). Netmeter runs on Linux and Windows. It displays the instantaneous displacements measured by several phasemeters at a user-selectable rate, up to 1 kHz. The program monitors the measure and reference channel frequencies. For ease of use, levels of status in Netmeter are color coded: green for normal operation, yellow for network errors, and red for optical misalignment problems.

Netmeter includes user-selectable filters up to 4 k samples, and user-selectable averaging windows (after filtering). Before filtering, the program saves raw data to disk using a burst-write technique.

Author

*Readout; Software Engineering; Computer Networks; Multichannel Communication; Computer Graphics*

**20080048425** Carnegie-Mellon Univ., Pittsburgh, PA USA

**SMART: Analyzing the Reuse Potential of Legacy Components in a Service-Oriented Architecture Environment**

Lewis, Grace A; Morris, Edwin J; Smith, Dennis B; Simanta, Soumya; Jun 2008; 47 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A489853; CMU/SEI-2008-TN-008; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489853>

Service-oriented architecture (SOA) has become an increasingly popular mechanism for achieving interoperability between systems. Because it has characteristics of loose coupling, published interfaces, and a standard communication model, SOA enables existing legacy systems to expose their functionality as services, presumably without making significant changes to the legacy systems. Migration of legacy systems to service-oriented environments has been achieved within a number of domains including banking, electronic payment, and development tools showing that the promise is beginning to be fulfilled. While migration can have significant value, any specific migration requires a concrete analysis of the feasibility, risk, and cost involved. This technical note describes a new release of the Service Migration and Reuse Technique (SMART), which was initially developed in 2005. The Carnegie Mellon Software Engineering Institute (SEI) SMART process helps organizations to make initial decisions about the feasibility of reusing legacy components as services within an SOA environment. SMART considers the specific interactions that will be required by the target SOA environment and any changes that must be made to the legacy components. To achieve this, SMART gathers information about legacy components, the target SOA environment, and candidate services to produce (1) a preliminary analysis of the viability of migrating legacy components to services, (2) an analysis of the migration strategies available, and (3) preliminary estimates of the costs and risks involved in the migration.

DTIC

*Architecture (Computers); Service Oriented Architecture*

## 61

### COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

**20080047240** Army Research Lab., Fort Knox, KY USA

**Effects of Crew-Aiding Behaviors on Soldier Performance During Target Engagement Tasks in a Virtual Battlefield Simulation**

Perala, Chuck H; Sterling, Bruce S; Jun 2007; 22 pp.; In English; Original contains color illustrations

Report No.(s): AD-A488675; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Overview: \*Research focused on key aspect of 'Seek out, close with, and destroy enemy forces' -Target prioritization, -Weapon selection, -Munition matching (weapon type and target) -Target engagement; \*Decision aids (Crew Aiding Behaviors) for target prioritization, weapon and munition selection, and target engagement.

DTIC

*Decision Support Systems; Military Personnel; Simulation; Target Acquisition; Targets*

**20080047410** NASA Goddard Space Flight Center, Greenbelt, MD, USA; Thinking Systems, Inc., Tucson, AZ, USA

**General Mission Analysis Tool (GMAT) User's Guide (Draft)**

Hughes, Steven P; July 12, 2007; 77 pp.; In English; Original contains black and white illustrations; No Copyright;

Avail.: CASI: A05, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047410>

4The General Mission Analysis Tool (GMAT) is a space trajectory optimization and mission analysis system. This

document is a draft of the users guide for the tool. Included in the guide is information about Configuring Objects/Resources, Object Fields: Quick Look-up Tables, and Commands and Events.

CASI

*Trajectory Optimization; Computer Programs; On-Line Systems; Spacecraft Trajectories*

**20080047478** Naval Postgraduate School, Monterey, CA USA

**Integration and Interoperability: An Analysis to Identify the Attributes for System of Systems**

Gay, John E; Turso, Denise L; Sep 2008; 115 pp.; In English; Original contains color illustrations

Report No.(s): AD-A488988; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA488988>

A system of systems design is the development of multiple systems that individually provide various functions that collectively support a holistic functional capability. With the evolution of today's increased demand of heterogeneous systems that integrate to form complex system of systems, integration and interoperability are critical to cost, schedule and performance during the lifecycle of a product. Enterprises must explore and discover the current and future techniques of building both human and technical systems that requires a deep knowledge and understanding of integration and interoperability. In support of this goal, this thesis, through research and analysis, develops a descriptive and prescriptive approach to assist management in achieving integration and interoperability. This thesis discovers the key attributes that result in an integrated and interoperable system and determines new procedures and techniques that can be recommended to achieve the system engineering required to support interoperability and ensure integration of system of systems.

DTIC

*Command and Control; Intelligence; Interoperability*

**20080047479** Naval Postgraduate School, Monterey, CA USA

**An Engineering Context for Software Engineering**

Riehle, Richard D; Sep 2008; 139 pp.; In English; Original contains color illustrations

Report No.(s): AD-A488989; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA488989>

New engineering disciplines are emerging in the late Twentieth and early Twenty-first Century. One such emerging discipline is software engineering. The engineering community at large has long harbored a sense of skepticism about the validity of the term software engineering. During most of the fifty-plus years of software practice, that skepticism was probably justified. Professional education of software developers often fell short of the standard expected for conventional engineers; software practice seemed to be a 'hit or miss' approach; and the available knowledge, tools, and language designs were not sufficiently mature to support an engineering model for software practice. Much progress has occurred in recent years, due to improved tools and languages along with a better ways of reasoning about and designing software products. This progress has contributed to the increase in success in the way software is developed and managed. However, even with a growing number of software successes, there are still enough horror-stories to reinforce the skepticism of the larger engineering community. Those skeptics continue to ask the reasonable question, 'Where is the engineering in software engineering?' The primary contribution of this dissertation is to establish a foundation for answering the question at the end of the previous paragraph. Another contribution is a foundation for answering that same question for other emerging engineering disciplines. We call this foundation a context. The context is derived from: a study of conventional engineering, a review of contemporary software practices, recent advances in software engineering and computer science, and analysis of the relationships between those four concerns. This engineering context for software engineering includes two chapters on the topic of engineering.

DTIC

*Computer Programming; Software Engineering*

**20080047494** Carnegie-Mellon Univ., Pittsburgh, PA USA

**SoS Navigator 2.0: A Context-Based Approach to System-of-Systems Challenges**

Boxer, Philip; Carney, David; Garcia, Suzanne; Brownsword, Lisa; Anderson, William; Kirwan, Patrick; Smith, Dennis; Morley, John; Jun 2008; 49 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A489051; CMU/SEI-2008-TN-001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489051>

Organizations struggle with many problems in complex systems of systems for which solutions are not codified or even

conceived, such as a mutual understanding of ‘common’ terms and concepts across participating enterprises and the lack of a global view by any single system-of-systems participant. System and software purchasers and suppliers need a different set of approaches and techniques than are typically in use today to satisfy user demands that reflect turbulent operational environments. Beyond purchasers and engineers, all participants in a complex, systems-of-systems environment need a different set of perspectives and expectations about user demands than those typical in product-centered engineering. The SoS Navigator approach provides leaders participating in complex systems of systems with (1) novel insights into critical aspects of the demand and supply sides of their situation and (2) criteria on which to decide whether their systems-of-systems context requires the adoption and sustainment of a different business model than ones that are typical today. This technical note introduces the fundamental concepts, processes, and techniques of the evolving SoS Navigator approach. It also summarizes case studies that illustrate the use of SoS Navigator processes and tools in healthcare, military, and civilian government systems-of-systems contexts.

DTIC

*Computer Programming; Context; Navigators; Software Engineering*

**20080047506** Virginia Univ., Charlottesville, VA USA

**An Acquisition Process for the Management of Nontechnical Risks Associated with Software Development**

Haimes, Yacov Y; Chittister, Clyde; Jan 1995; 35 pp.; In English

Report No.(s): AD-A489173; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489173>

The ability to quantify risk is essential to the process of budgeting and scheduling. During the process of hiring to complete specified tasks, customers must be able to verify contractor estimates and to make sound judgments on the risks of cost overruns and time delays. The following questions are central to this paper. Do developers with little experience overestimate or underestimate the complexity of the task because of their experience, the assumptions they make, the models they select, or how they define the model limits? What are the sources of risk associated with project cost estimation? How can such risk be quantified? This article proposes a systematic acquisition process aimed at assessing and managing the risks of cost overruns and time delays associated with software development. The authors propose an acquisition process of four phases grounded on three basic premises: (1) any single-value estimate of cost or completion time is inadequate to capture and represent the variability and uncertainty associated with cost and schedule; (2) the common expected value, when used as a measure of risk, is inadequate, and if it is used as the sole measure of risk, it may lead to inaccurate results; (3) probing the sources of risks and uncertainties associated with cost overruns and time delays in software development is essential for the ultimate management of technical and nontechnical risks. This article is based on a technical report published by the Software Engineering Institute in 1993.

DTIC

*Computer Programming; Contractors; Costs; Procurement; Quantitative Analysis; Risk; Software Engineering*

**20080047510** Innovative Decisions, Inc., Chantilly, VA USA

**Validating the Performance of Networks Used to Model Decisions Involving the UAV**

Kobylski, Gerald; Graves, Greg; Gibson, Hise; Souhan, Brian; Hickman, Randal; Boucher, Randy; Buede, Dennis; Cassidy, Michael; Jun 1, 2008; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489197; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489197>

Items discussed in these viewgraphs are the research effort, what is the Dynamic Decision Network (DDN) and validation of the DDNs. A Dynamic Decision Network (DDN) is a computer based decision engine that recommends optimal (or near optimal) alternatives for recurring dynamic decisions, particularly when it is important to consider uncertainty and multiple competing objectives. Examples include: shoot or don't shoot, divert a sensor platform or keep it where it is.

DTIC

*Decision Making; Networks*

**20080047516** Mississippi State Univ., Mississippi State, MS USA

**Graphical User Interface Version 2.8 with Fire and Smoke Simulation Model (FSSIM) Version 1.2: User Manual**

Haupt, Tomasz A; Henley, Greg; Parihar, Bhargavi S; Kirkland, Robert; Floyd, Jason; Scheffey, Joseph; Tatem, Patricia A; Williams, Frederick W; Oct 10, 2008; 79 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00173-07-2-C008

Report No.(s): AD-A489263; NRL/MR/6180--08-9145; XB-NRL/MR/6100; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489263>

The collaborative work of Hughes Associates, Inc. (HAI), the Naval Research Laboratory (NRL), and a group at Mississippi State University resulted in developing a simulation system including Graphical User Interface (GUI) and visualization. The simulation environment provides a runtime environment for a third-party simulation package currently, FSSIM developed by HAI. This updated user's manual for the viewer provides documentation of the GUI layout and detailed discussion of features of the output display.

DTIC

*Computerized Simulation; Fires; Graphical User Interface; Manuals; Ships; Simulation; Smoke; User Manuals (Computer Programs)*

**20080047532** Naval Air Warfare Center, Orlando, FL USA

**Cognitive and Behavioral Modeling Techniques for CGFs: A New Initiative**

Lyons, Denise; Hawkins, Harold; Jan 2008; 4 pp.; In English

Report No.(s): AD-A489393; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489393>

A recent NRC report identified that a shortcoming in the area of military simulations is the lack of behavioral realism in computer generated forces (CGFs). Given the military's growing reliance on large-scale simulations as a means to prepare our warfighting teams, this deficiency has far reaching consequences. Therefore, ONR and NAWCTSD are launching a research initiative to investigate cognitive and behavioral modeling (CBM) techniques suitable for injecting into executable models of combatant behavior. In particular, it is necessary to devise robust strategies for simulating higher-order processes in CGFs, including decision making, intent, deception, adaptability, creativity, and problem solving. This initiative will be executed in three phases: Phase 1 -- Develop a taxonomy that describes military simulation applications and modeling methodologies with a common set of discriminating features/attributes to study the technical capabilities and shortcomings of current CGFs and CBMs; Phase 2 -- Convene a multi-disciplinary panel of experts at a workshop to validate the findings and provide feedback (the results will be published as guidelines to advance, implement and apply CBM techniques for CGFs); and Phase 3 -- Based on the initial findings, this initiative will facilitate the application of CBM methodologies currently viable for military simulation, implement hybridization of CBM techniques that provide part of a solution, and invest in CBM advancements where insufficient theory exists.

DTIC

*Cognition; Combat; Education; Military Operations; Military Technology; Planning; Simulation*

**20080047575** Space and Naval Warfare Systems Command, San Diego, CA USA

**The Myth of the Best Practices Silver Bullet**

Evans, Michael W; Segura, Corinne; Doherty, Frank; Sep 2005; 6 pp.; In English

Report No.(s): AD-A489472; No Copyright; Avail.: Defense Technical Information Center (DTIC)

For many years, there has been much work attempting to identify a set of best practices that software-intensive projects could apply to aid in the acquisition, production, or upgrade of software. Spurred on by the 1987 and 2001 Defense Science Board findings, efforts conducted by the Software Engineering Institute and the Software Program Managers Network have identified and documented specific practices that have had apparent success in lowering project risk, improving cost and schedule performance, and enhancing user satisfaction. Since Section 804 of the National Defense Authorization Act for Fiscal Year 2003 was enacted on December 2, 2002, and became law, there has been much activity in this area, particularly in the Department of Defense and its various services. This article explores some of these efforts, looks at the practices that have resulted, and attempts to examine certain key relationships that must be considered when applying them to projects.

DTIC

*Computer Programming; Defense Program; Procedures; Procurement; Project Management; Quality Control; Risk; Software Engineering; User Requirements*

**20080047576** Industrial Coll. of the Armed Forces, Washington, DC USA

**Handheld Computing**

Alford, Kenneth L; Jun 2005; 6 pp.; In English

Report No.(s): AD-A489474; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Handheld computers, especially personal digital assistants (PDAs), are increasingly being used throughout the Department of Defense. This article highlights some of the ways that PDAs are used today and are envisioned for the future. It outlines some of the considerations involved in a PDA procurement, discusses four tools for developing PDA resource materials -- programming tools, hypertext markup language- and eXtensible markup language-based tools, text tools, and calendar tools -- outlines some of the benefits and challenges associated with using PDAs, and shares several lessons learned.

DTIC

*Augmentation; Computers; Defense Program; Military Technology; Procurement; Software Development Tools*

**20080047580** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Risk Management (Is Not) for Dummies**

Glazewski, Steven R; Feb 2005; 4 pp.; In English

Report No.(s): AD-A489496; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Software program managers crave a silver bullet in the form of a comprehensive checklist of things to watch so the program does not suffer from bad surprises. Highlighted in this article are some prime examples from almost 15 years' experience acquiring software in Department of Defense programs, from identifying broad areas where software risks tend to hide to describing an eight-step risk management process. While there are no silver bullets to be found, there are a few golden nuggets if you make the focused effort to look!

DTIC

*Computer Programming; Defense Program; Dummies; Management Planning; Project Management; Risk; Risk Management; Software Engineering*

**20080047581** Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ USA

**Lightweight Handheld Mortar Ballistic Computer**

Patriarca, Mike; Zhelesnik, Mark; Sep 2005; 3 pp.; In English

Report No.(s): AD-A489498; No Copyright; Avail.: Defense Technical Information Center (DTIC)

While supporting Operation Iraqi Freedom, the enhanced functionality of the Lightweight Handheld Mortar Ballistic Computer (LHMBC) in providing updated ballistic solutions to fire missions for infantry mortar combat units has proven to be a great success. With the LHMBC, mortar fire direction centers are computing faster, more accurate ballistic solutions to fire missions for 60mm, 81mm, and 120mm mortar systems.

DTIC

*Computer Programming; Computers; Fire Control; Project Management; Software Engineering*

**20080047582** Army Simulation Training, and Instrumentation Command, Orlando, FL USA

**WARSIM Enters the Scene in Army Training**

Payne, Ed; Dietrick, Kevin; Sep 2005; 3 pp.; In English

Report No.(s): AD-A489499; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Warfighter's Simulation (WARSIM) is the U.S. Army's next generation constructive simulation capability. Revolutionary in scope, WARSIM allows commanders and their staffs to train in the contemporary environment they will face in Iraq, Afghanistan, and other trouble spots in the world. WARSIM provides additional needed realism, will decrease the resources' need to train, and when combined with the other systems of the Army's Constructive Training Federation will provide all the capabilities required for a fully integrated live-virtual-constructive training environment.

DTIC

*Combat; Computer Programming; Education; Government Procurement; Project Management; Simulation; Software Engineering*

**20080047583** Program Executive Office for C4I and Space, San Diego, CA USA

**Managing Acquisition Risk by Applying Proven Best Practices**

Evans, Mike; Segura, Corinne; Doherty, Frank; Feb 2005; 6 pp.; In English

Report No.(s): AD-A489501; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Data analysis from recent acquisition program assessments has identified common characteristics of successful programs

and supporting organizations. First and foremost, organizations with successful acquisition processes must embrace risk management throughout the entire product life cycle. While risk management is ingrained within their culture, these organizations take active measures to sustain effective implementation across programs by routinely conducting assessments to maintain currency, applying proven best practices to address specific risks, and using historical lessons learned to improve future performance. These assessment results also revealed characteristics of unsuccessful programs, primarily a lack of understanding and distinction between acquisition and development processes. This confusion resulted in an increase in interface issues as well as observable impacts on product cost, schedule, and quality. As a result of their analysis, the authors conclude that successful acquisition risk management is based on the following: (1) providing educated leadership and a supportive organizational culture, (2) adapting proven best practices in response to specific circumstances, and (3) emphasizing the program environment rather than process maturity.

DTIC

*Computer Programming; Contractors; Government Procurement; Procedures; Project Management; Risk; Software Engineering*

**20080047584** Software Technology Support Center, Hill AFB, UT USA

**Configuration Management Fundamentals**

Jul 2005; 7 pp.; In English

Report No.(s): AD-A489512; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The U.S. Air Force's Software Technology Support Center offers an updated and condensed version of the 'Guidelines for Successful Acquisition and Management of Software-Intensive Systems' (GSAM) on its Web site <[www.stsc.hill.af.mil/resources/tech\\_docs](http://www.stsc.hill.af.mil/resources/tech_docs)>. This article is taken from Chapter 9, 'Configuration Management,' of the GSAM (Version 4.0). The authors are pleased that all editions have been so well received and that many individuals and programs have worked hard to implement the principles contained therein. The latest edition provides a usable desk reference that gives a brief but effective overview of important software acquisition and development topics, provides checklists for rapid self-inspection, and provides pointers to additional information on the topics covered.

DTIC

*Computer Programming; Configuration Management; Management Planning; Project Management; Software Engineering*

**20080047585** 309th Software Maintenance Group (SMXG), Hill AFB, UT USA

**UML Design and Auto-Generated Code: Issues and Practical Solutions**

Lipkin, Ilya; Huber, A K; Nov 2005; 5 pp.; In English

Report No.(s): AD-A489516; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This article is based on experience gained during the early history of a project being worked on at Hill Air Force Base, Utah. One of the customer requirements on this project was a specific development tool based on Unified Modeling Language (UML) Version 1.3, namely Rational Rose RealTime (RoseRT). The project issues and solutions presented in this article are from the real-time control system. The configured software items consist of software design elements expressed in UML from which C++ code can be automatically generated. The observations presented in this article do not necessarily apply to all UML-based development tools, but the authors have made an attempt to raise a few issues of general interest to those involved in similar projects. The focus of UML is to model systems using object-oriented concepts and methodology. UML consists of a set of model elements that standardize the design description. These elements include a number of fundamental model elements and modeling concepts, in addition to views that allow designers to examine a design from different perspectives, and diagrams to illustrate the relationships among model elements.

DTIC

*Coding; Computer Programming; Design Analysis; Object-Oriented Programming; Real Time Operation; Software Engineering*

**20080047588** Warner Robbins Air Logistics Center, Robbins AFB, GA USA

**Delivering Capabilities through Partnerships**

Moore, Chris D; Aug 2005; 5 pp.; In English

Report No.(s): AD-A489523; No Copyright; Avail.: Defense Technical Information Center (DTIC)

As public-private partnerships become more prevalent in the Department of Defense for providing logistics support for advanced weapon systems, integrated teams must look for unconventional opportunities to exploit the best capabilities of their combined resources to support many diverse program objectives. The challenge is figuring out how to evolve traditional

customer-supplier relationships into truly integrated teams with common objectives at the forefront. Warner Robins-Air Logistics Center and the Northrop Grumman Corporation are pioneering a new path with their partnered E-8C Joint STARS software maintenance team.

DTIC

*Computer Programming; Contractors; Government Procurement; Maintenance; Radar Tracking; Software Engineering*

**20080047589** Army Simulation Training, and Instrumentation Command, Orlando, FL USA

**Open Source Opens Opportunities for Army's Simulation System**

Parsons, Douglas J; Wittman, Jr, Robert L; Jan 2005; 5 pp.; In English

Report No.(s): AD-A489526; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The One Semi-Automated Forces (OneSAF) Objective System is the U.S. Army's next-generation, entity-level, simulation system planned to provide a comprehensive set of tools supporting computer-based simulation event setup, execution, and review. Postured as an open-architecture, open-source application, the OneSAF program will put this software into the hands of a vast number of developers throughout the Department of Defense with the intent of creating unprecedented participation across the modeling and simulation community to include multi-service, international, industry, and academia experts in the evolution of the OneSAF system. This article describes the factors that led OneSAF to an open source development methodology, the open source principles OneSAF is supporting, and the key processes and tools supporting the open source development.

DTIC

*Architecture (Computers); Computer Programming; Computerized Simulation; Feedback; Open Source Licensing (Computers); Simulation; Software Engineering*

**20080047590** Ogden Air Logistics Center, Hill AFB, UT USA

**Personal Earned Value: Why Projects Using the Team Software Process Consistently Meet Schedule Commitments**

Webb, David R; Tuma, David; Mar 2005; 6 pp.; In English

Report No.(s): AD-A489527; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Data from dozens of projects using the Team Software Process(SM) (TSP(SM)) provide powerful proof of success at consistently meeting cost and schedule commitments. While disciplined engineering and high quality processes are important factors contributing to these successes, mathematical analyses of project data indicate that the most important factor is the proper management of earned value techniques at the team member level. In fact, this practice - unique to TSP teams - can produce a 10-times reduction in schedule variance by properly balancing team workload using personal data.

DTIC

*Computer Programming; Project Management; Schedules; Software Engineering*

**20080047591** Naval Air Warfare Center, China Lake, CA USA

**A TSP Software Maintenance Life Cycle**

Ricketts, Chris A; Mar 2005; 4 pp.; In English

Report No.(s): AD-A489531; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Team Software Process (trademark) (TSP (trademark)) and Personal Software Process (trademark) (PSP (trademark)) have always been associated with software development, but what about TSP/PSP for software maintenance? This article discusses how TSP/PSP was adapted for use on a software maintenance project, resulting in a new proxy for estimating maintenance activity and the creation of a TSP software maintenance life cycle.

DTIC

*Computer Programming; Life (Durability); Maintenance; Navy; Project Management; Software Engineering*

**20080047593** Oklahoma City Air Logistics Center, Tinker AFB, OK USA

**Key Elements in Fielding Capabilities**

Holcomb, John D; Hoehn, Michael; Aug 2005; 5 pp.; In English

Report No.(s): AD-A489535; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Organizations that develop software for the Department of Defense must have knowledgeable people to do the work according to documented and mature processes and standards that guide how the work is accomplished. The organization must also have in place the hardware and tools that are used to execute the processes to develop and test the end products. The



success of their efforts depends on two key elements: the fidelity of the test environment, and the amount of collaboration with other agencies involved in their program.

DTIC

*Computer Programming; Evaluation; Maintenance; Risk; Software Engineering; System Effectiveness; Weapon Systems*

**20080047594** Boeing Co., Seattle, WA USA

**Solving Computationally Expensive Optimization Problems with CPU Time-Correlated Functions**

Abramson, Mark A; Asaki, Thomas J; Dennis, Jr, John E; Magallanez, Jr , Raymond; Sottile, Matthew J; May 27, 2008; 12 pp.; In English

Report No.(s): AD-A489551; RICE-CAAM-TR08-06; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper, we characterize a new class of optimization problems in which objective function values are correlated with the computational time required to obtain these values. That is, as the optimal solution is approached, the computational time required to compute an objective function values decreases significantly. This is motivated by an application in which each objective function evaluation requires both a numerical fluid dynamics simulation and an image registration process, and the goal is to find the parameter values of a predetermined reference image by comparing the flow dynamics from the numerical simulation and the reference image through the image comparison process. In designing an approach to numerically solve the more general class of problems in an efficient way, we make use of surrogates based on CPU times of previously evaluated points, rather than their function values, all within the search step framework of mesh adaptive direct search algorithms. Because of the expected CPU time correlation, a time cutoff parameter was added to the objective function evaluation to allow its termination during the comparison process if the computational time exceeds a specified threshold. The approach was tested using the NOMADm and DACE MATLABr software packages, and results are presented.

DTIC

*Optimization; Software Development Tools; Time Functions*

**20080047714** NASA Ames Research Center, Moffett Field, CA, USA

**Requirements for Next Generation Comprehensive Analysis of Rotorcraft**

Johnson, Wayne; Data, Anubhav; January 23, 2008; 8 pp.; In English; American Helicopter Society Specialists' Conference on Aeromechanics, 23-25 Jan. 2008, San Francisco, CA, USA; Copyright; Avail.: CASI: A02, Hardcopy

The unique demands of rotorcraft aeromechanics analysis have led to the development of software tools that are described as comprehensive analyses. The next generation of rotorcraft comprehensive analyses will be driven and enabled by the tremendous capabilities of high performance computing, particularly modular and scaleable software executed on multiple cores. Development of a comprehensive analysis based on high performance computing both demands and permits a new analysis architecture. This paper describes a vision of the requirements for this next generation of comprehensive analyses of rotorcraft. The requirements are described and substantiated for what must be included and justification provided for what should be excluded. With this guide, a path to the next generation code can be found.

Author

*Rotary Wing Aircraft; Software Development Tools; Computer Programs; Modularity; Fluid Mechanics*

**20080047802** Office of the Secretary of Defense (Program Analysis and Evaluation), Arlington, VA USA

**The Oz Wargame Integration Toolkit: Supporting Wargames for Analysis**

Duong, Deborah V; Ellerbe, Will; Murphy, Lauren; Jun 2008; 36 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A489554; No Copyright; Avail.: Defense Technical Information Center (DTIC)

There are two complementary approaches to analysis of Irregular Warfare: Human (Wargaming) and Machine (Simulation). The Oz Wargame Integration Toolkit is a solution that takes the best of both approaches. It integrates wargames, simulations, rule-based systems, and data.

DTIC

*Computerized Simulation; War Games; Warfare*

**20080047854** Army Research Lab., Adelphi, MD USA

**Performance Requirements of Tools and Methods for Specifying Network Communication Scenarios Using the Real-Time Application Representative Version 1.0**

Hardy, Rommie; Nguyen, Binh; Sep 2008; 30 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489225; ARL-TR-4614; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489225>

This report identifies the performance needs of tools and methods that will be potentially capable of specifying data

communication scenarios. These communication scenarios will be automatically generated using the Real-time Application Representative (RAPR) tool. The specifications define a specific behavior of a communication scenario for the RAPR tool being deployed in the wireless emulation laboratory (WEL) at the U.S. Army Research Laboratory (ARL). The report includes examples descriptions of the RAPR input files and scripts used to specify network communication scenarios.

DTIC

*Communication Networks; Computer Programs; Real Time Operation*

**20080047857** Air Force Research Lab., Rome, NY USA

**Semantic Interoperability in Distributed Planning. Track 1: C2 Concepts, Theory, and Policy**

Staskevich, Gennady R; Hudack, Jeffrey W; Lawton, James; Carozzoni, Joseph A; Oct 2008; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-558S

Report No.(s): AD-A489216; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489216>

The USAF Command and Control (C2) is undergoing a transformation from a co-located, theater-centric process to one that is worldwide and distributed. A key challenge for this transformation to Globally-Linked Air and Space Operations Centers is developing the ability to collaboratively plan and execute operation with multiple cooperating command centers. This paper describes an in-house program underway at the USAF Research Laboratory Information Directorate that is developing technologies to support the concepts of Network Centric Operations. In particular, research is presented that extends the Object Model Working Group's Core Plan Representation (CPR) framework utilizing semantic technologies to capture planning experiences in both human and machine-readable form. A key feature of these extensions is common,interoperable plan representation amongst the distributed heterogeneous planning agents. Semantic interoperability of the plan representation is critical to support distributed planning. The initial approach to achieving interoperability is a limited taxonomy for describing key plan-related information. The research presented utilizes open standards semantic technology to encapsulate plans as self-describing semantic objects.

DTIC

*Interoperability; Policies; Semantics*

**20080047961** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**The Analysis of Image Segmentation Hierarchies with a Graph-based Knowledge Discovery System**

Tilton, James C.; Cooke, diane J.; Ketkar, Nikhil; Aksoy, Selim; [2008]; 27 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Currently available pixel-based analysis techniques do not effectively extract the information content from the increasingly available high spatial resolution remotely sensed imagery data. A general consensus is that object-based image analysis (OBIA) is required to effectively analyze this type of data. OBIA is usually a two-stage process; image segmentation followed by an analysis of the segmented objects. We are exploring an approach to OBIA in which hierarchical image segmentations provided by the Recursive Hierarchical Segmentation (RHSEG) software developed at NASA GSFC are analyzed by the Subdue graph-based knowledge discovery system developed by a team at Washington State University. In this paper we discuss out initial approach to representing the RHSEG-produced hierarchical image segmentations in a graphical form understandable by Subdue, and provide results on real and simulated data. We also discuss planned improvements designed to more effectively and completely convey the hierarchical segmentation information to Subdue and to improve processing efficiency.

Author

*Image Analysis; Data Mining; Computer Programs; Graphs (Charts)*

**20080047994** California Inst. of Tech., Pasadena, CA, USA

**Using LDPC Code Constraints to Aid Recovery of Symbol Timing**

Jones, Christopher; Villasnor, John; Lee, Dong-U; Vales, Esteban; NASA Tech Briefs, October 2008; October 2008, pp. 11; In English; See also [20080047981](#); Original contains color illustrations

Report No.(s): NPO-43112; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3268>

A method of utilizing information available in the constraints imposed by a low-density parity-check (LDPC) code has been proposed as a means of aiding the recovery of symbol timing in the reception of a binary-phase-shift-keying (BPSK)

signal representing such a code in the presence of noise, timing error, and/or Doppler shift between the transmitter and the receiver. This method and the receiver architecture in which it would be implemented belong to a class of timing-recovery methods and corresponding receiver architectures characterized as pilotless in that they do not require transmission and reception of pilot signals. Acquisition and tracking of a signal of the type described above have traditionally been performed upstream of, and independently of, decoding and have typically involved utilization of a phase-locked loop (PLL). However, the LDPC decoding process, which is iterative, provides information that can be fed back to the timing-recovery receiver circuits to improve performance significantly over that attainable in the absence of such feedback. Prior methods of coupling LDPC decoding with timing recovery had focused on the use of output code words produced as the iterations progress. In contrast, in the present method, one exploits the information available from the metrics computed for the constraint nodes of an LDPC code during the decoding process. In addition, the method involves the use of a waveform model that captures, better than do the waveform models of the prior methods, distortions introduced by receiver timing errors and transmitter/ receiver motions. An LDPC code is commonly represented by use of a bipartite graph containing two sets of nodes. In the graph corresponding to an  $(n,k)$  code, the  $n$  variable nodes correspond to the code word symbols and the  $n-k$  constraint nodes represent the constraints that the code places on the variable nodes in order for them to form a valid code word. The decoding procedure involves iterative computation of values associated with these nodes. A constraint node represents a parity-check equation using a set of variable nodes as inputs. A valid decoded code word is obtained if all parity-check equations are satisfied. After each iteration, the metrics associated with each constraint node can be evaluated to determine the status of the associated parity check. Heretofore, normally, these metrics would be utilized only within the LDPC decoding process to assess whether or not variable nodes had converged to a codeword. In the present method, it is recognized that these metrics can be used to determine accuracy of the timing estimates used in acquiring the sampled data that constitute the input to the LDPC decoder. In fact, the number of constraints that are satisfied exhibits a peak near the optimal timing estimate. Coarse timing estimation (or first-stage estimation as described below) is found via a parametric search for this peak. The present method calls for a two-stage receiver architecture illustrated in the figure. The first stage would correct large time delays and frequency offsets; the second stage would track random walks and correct residual time and frequency offsets. In the first stage, constraint-node feedback from the LDPC decoder would be employed in a search algorithm in which the searches would be performed in successively narrower windows to find the correct time delay and/or frequency offset. The second stage would include a conventional first-order PLL with a decision-aided timing-error detector that would utilize, as its decision aid, decoded symbols from the LDPC decoder. The method has been tested by means of computational simulations in cases involving various timing and frequency errors. The results of the simulations in the ideal case of perfect timing in the receiver.

Author (revised)

*Error Correcting Codes; Time Measurement; Binary Phase Shift Keying; Decoding; Receivers; Transmitters; Signal Processing*

**20080048001** California Inst. of Tech., Pasadena, CA, USA; Aerospace Corp., Pasadena, CA, USA

#### **Scripting Module for the Satellite Orbit Analysis Program (SOAP)**

Carnright, Robert; Paget, Jim; Coggi, John; Stodden, David; NASA Tech Briefs, October 2008; October 2008, pp. 18-19; In English; See also [20080047981](#)

Report No.(s): NPO-45055; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3282>

This add-on module to the SOAP software can perform changes to simulation objects based on the occurrence of specific conditions. This allows the software to encompass simulation response of scheduled or physical events. Users can manipulate objects in the simulation environment under programmatic control. Inputs to the scripting module are Actions, Conditions, and the Script. Actions are arbitrary modifications to constructs such as Platform Objects (i.e. satellites), Sensor Objects (representing instruments or communication links), or Analysis Objects (user-defined logical or numeric variables). Examples of actions include changes to a satellite orbit ( $v$ ), changing a sensor-pointing direction, and the manipulation of a numerical expression. Conditions represent the circumstances under which Actions are performed and can be couched in If-Then-Else logic, like performing  $v$  at specific times or adding to the spacecraft power only when it is being illuminated by the Sun. The SOAP script represents the entire set of conditions being considered over a specific time interval. The output of the scripting module is a series of events, which are changes to objects at specific times. As the SOAP simulation clock runs forward, the scheduled events are performed. If the user sets the clock back in time, the events within that interval are automatically undone. This script offers an interface for defining scripts where the user does not have to remember the vocabulary of various keywords. Actions can be captured by employing the same user interface that is used to define the objects themselves. Conditions can be set to invoke Actions by selecting them from pull-down lists. Users define the script by selecting from the

pool of defined conditions. Many space systems have to react to arbitrary events that can occur from scheduling or from the environment. For example, an instrument may cease to draw power when the area that it is tasked to observe is not in view. The contingency of the planetary body blocking the line of sight is a condition upon which the power being drawn is set to zero. It remains at zero until the observation objective is again in view. Computing the total power drawn by the instrument over a period of days or weeks can now take such factors into consideration. What makes the architecture especially powerful is that the scripting module can look ahead and behind in simulation time, and this temporal versatility can be leveraged in displays such as x-y plots. For example, a plot of a satellite's altitude as a function of time can take changes to the orbit into account.

Author

*Computer Programs; Computerized Simulation; Orbits; Space Missions*

**20080048005** California Inst. of Tech., Pasadena, CA, USA

**Small-Body Extensions for the Satellite Orbit Analysis Program (SOAP)**

Carrington, Robert; Stodden, David; Coggi, John; NASA Tech Briefs, October 2008; October 2008, pp. 18; In English; See also [20080047981](#)

Report No.(s): NPO-45054; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3281>

An extension to the SOAP software allows users to work with tri-axial ellipsoid-based representations of planetary bodies, primarily for working with small, natural satellites, asteroids, and comets. SOAP is a widely used tool for the visualization and analysis of space missions. The small body extension provides the same visualization and analysis constructs for use with small bodies. These constructs allow the user to characterize satellite path and instrument cover information for small bodies in both 3D display and numerical output formats. Tri-axial ellipsoids are geometric shapes the diameters of which are different in each of three principal x, y, and z dimensions. This construct provides a better approximation than using spheres or oblate spheroids (ellipsoids comprising two common equatorial diameters as a distinct polar diameter). However, the tri-axial ellipsoid is considerably more difficult to work with from a modeling perspective. In addition, the SOAP small-body extensions allow the user to actually employ a plate model for highly irregular surfaces. Both tri-axial ellipsoids and plate models can be assigned to coordinate frames, thus allowing for the modeling of arbitrary changes to body orientation. A variety of features have been extended to support tri-axial ellipsoids, including the computation and display of the spacecraft sub-orbital point, ground trace, instrument footprints, and swaths. Displays of 3D instrument volumes can be shown interacting with the ellipsoids. Longitude/latitude grids, contour plots, and texture maps can be displayed on the ellipsoids using a variety of projections. The distance along an arbitrary line of sight can be computed between the spacecraft and the ellipsoid, and the coordinates of that intersection can be plotted as a function of time. The small-body extension supports the same visual and analytical constructs that are supported for spheres and oblate spheroids in SOAP making the implementation of the more complex algorithms largely transparent to the user.

Author

*Computer Programs; Scientific Visualization; Space Missions; Orbits*

**20080048006** California Inst. of Tech., Pasadena, CA, USA

**The Interplanetary Overlay Networking Protocol Accelerator**

Pang, Jackson; Torgerson, Jordan L.; Clare, Loren P.; NASA Tech Briefs, October 2008; October 2008, pp. 35; In English; See also [20080047981](#)

Report No.(s): NPO-45584; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3317>

A document describes the Interplanetary Overlay Networking Protocol Accelerator (IONAC) an electronic apparatus, now under development, for relaying data at high rates in spacecraft and interplanetary radio-communication systems utilizing a delay-tolerant networking protocol. The protocol includes provisions for transmission and reception of data in bundles (essentially, messages), transfer of custody of a bundle to a recipient relay station at each step of a relay, and return receipts. Because of limitations on energy resources available for such relays, data rates attainable in a conventional software implementation of the protocol are lower than those needed, at any given reasonable energy-consumption rate. Therefore, a main goal in developing the IONAC is to reduce the energy consumption by an order of magnitude and the data-throughput capability by two orders of magnitude. The IONAC prototype is a field-programmable gate array that serves as a reconfigurable hybrid (hardware/ firmware) system for implementation of the protocol. The prototype can decode 108,000 bundles per second and encode 100,000 bundles per second. It includes a bundle-cache static randomaccess memory that

enables maintenance of a throughput of 2.7Gb/s, and an Ethernet convergence layer that supports a duplex throughput of 1Gb/s.

Author

*Protocol (Computers); Radio Communication; Computer Networks; Reconfigurable Hardware*

**20080048013** California Inst. of Tech., Pasadena, CA, USA

**Ensemble: an Architecture for Mission-Operations Software**

Norris, Jeffrey; Powell, Mark; Fox, Jason; Rabe, Kenneth; Shu, IHsiang; McCurdy, Michael; Vera, Alonso; NASA Tech Briefs, October 2008; October 2008, pp. 32; In English; See also [20080047981](#)

Report No.(s): NPO-41814; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3310>

Ensemble is the name of an open architecture for, and a methodology for the development of, spacecraft mission operations software. Ensemble is also potentially applicable to the development of non-spacecraft mission-operations- type software. Ensemble capitalizes on the strengths of the open-source Eclipse software and its architecture to address several issues that have arisen repeatedly in the development of mission-operations software: Heretofore, mission-operations application programs have been developed in disparate programming environments and integrated during the final stages of development of missions. The programs have been poorly integrated, and it has been costly to develop, test, and deploy them. Users of each program have been forced to interact with several different graphical user interfaces (GUIs). Also, the strategy typically used in integrating the programs has yielded serial chains of operational software tools of such a nature that during use of a given tool, it has not been possible to gain access to the capabilities afforded by other tools. In contrast, the Ensemble approach offers a low-risk path towards tighter integration of mission-operations software tools.

Derived from text

*Software Engineering; Architecture (Computers); Applications Programs (Computers); Mission Planning*

**20080048028** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Converting EOS Data from HDF-EOS to netCDF**

Ullman, Richard; Bame, Bob; Yang, Jingli; NASA Tech Briefs, December 2008; December 2008, pp. 17; In English; See also [20080048022](#)

Report No.(s): GSC-15007-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3435>

A C-language computer program accepts, as input, a set of scientific data and metadata from an Earth Observing System (EOS) satellite and converts the set from (1) the format in which it was created and delivered to (2) another format for processing and exchange of data on Earth.

Derived from text

*Computer Programs; Data Systems; Data Conversion Routines*

**20080048035** United Space Alliance, Houston, TX, USA

**Replication of Space-Shuttle Computers in FPGAs and ASICs**

Ferguson, Roscoe C.; NASA Tech Briefs, December 2008; December 2008, pp. 25; In English; See also [20080048022](#)

Report No.(s): MSC-24141-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3460>

A document discusses the replication of the functionality of the onboard space-shuttle general-purpose computers (GPCs) in field-programmable gate arrays (FPGAs) and application-specific integrated circuits (ASICs). The purpose of the replication effort is to enable utilization of proven space-shuttle flight software and software-development facilities to the extent possible during development of software for flight computers for a new generation of launch vehicles derived from the space shuttles. The replication involves specifying the instruction set of the central processing unit and the input/output processor (IOP) of the space-shuttle GPC in a hardware description language (HDL). The HDL is synthesized to form a 'core' processor in an FPGA or, less preferably, in an ASIC. The core processor can be used to create a flight-control card to be inserted into a new avionics computer. The IOP of the GPC as implemented in the core processor could be designed to support data-bus protocols other than that of a multiplexer interface adapter (MIA) used in the space shuttle. Hence, a computer containing the core processor could be tailored to communicate via the space-shuttle GPC bus and/or one or more other buses.

Author

*Field-Programmable Gate Arrays; Airborne/Spaceborne Computers; Application Specific Integrated Circuits; Applications Programs (Computers); Channels (Data Transmission); Computer Programs*

**20080048037** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**HDF-EOS Web Server**

Ullman, Richard; Bane, Bob; Yang, Jingli; NASA Tech Briefs, December 2008; December 2008, pp. 17; In English; See also [20080048022](#)

Report No.(s): GSC-15011-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3439>

A shell script has been written as a means of automatically making HDF-EOS-formatted data sets available via the World Wide Web. ('HDF-EOS' and variants thereof are defined in the first of the two immediately preceding articles.) The shell script chains together some software tools developed by the Data Usability Group at Goddard Space Flight Center to perform the following actions: Extract metadata in Object Definition Language (ODL) from an HDF-EOS file, Convert the metadata from ODL to Extensible Markup Language (XML), Reformat the XML metadata into human-readable Hypertext Markup Language (HTML), Publish the HTML metadata and the original HDF-EOS file to a Web server and an Open-source Project for a Network Data Access Protocol (OPeN-DAP) server computer, and Reformat the XML metadata and submit the resulting file to the EOS Clearinghouse, which is a Web-based metadata clearinghouse that facilitates searching for, and exchange of, Earth-Science data.

Author

*Hierarchies; World Wide Web; Metadata; Earth Sciences; Communication Networks; Document Markup Languages; Hypertext*

**20080048038** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**HDF-EOS 5 Validator**

Ullman, Richard; Bane, Bob; Yang, Jingli; NASA Tech Briefs, December 2008; December 2008, pp. 17; In English; See also [20080048022](#)

Report No.(s): GSC-15015-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

A computer program partly automates the task of determining whether an HDF-EOS 5 file is valid in that it conforms to specifications for such characteristics as attribute names, dimensionality of data products, and ranges of legal data values. ['HDF-EOS' and variants thereof are defined in 'Converting EOS Data From HDF-EOS to netCDF' (GSC-15007-1), which is the first of several preceding articles in this issue of NASA Tech Briefs.] Previously, validity of a file was determined in a tedious and error-prone process in which a person examined human-readable dumps of data-file-format information. The present software helps a user to encode the specifications for an HDFEOS 5 file, and then inspects the file for conformity with the specifications: First, the user writes the specifications in Extensible Markup Language (XML) by use of a document type definition (DTD) that is part of the program. Next, the portion of the program (denoted the validator) that performs the inspection is executed, using, as inputs, the specifications in XML and the HDF-EOS 5 file to be validated. Finally, the user examines the output of the validator.

Author

*Document Markup Languages; Computer Programs; Errors; Format; Specifications*

**20080048042** Foster-Miller Associates, Inc., MA, USA

**Crew Activity Analyzer**

Murray, James; Kirillov, Alexander; NASA Tech Briefs, December 2008; December 2008, pp. 5-6; In English; See also [20080048022](#); Original contains color illustrations

Report No.(s): ARC-15162-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3410>

The crew activity analyzer (CAA) is a system of electronic hardware and software for automatically identifying patterns of group activity among crew members working together in an office, cockpit, workshop, laboratory, or other enclosed space. The CAA synchronously records multiple streams of data from digital video cameras, wireless microphones, and position sensors, then plays back and processes the data to identify activity patterns specified by human analysts. The processing greatly reduces the amount of time that the analysts must spend in examining large amounts of data, enabling the analysts to concentrate on subsets of data that represent activities of interest. The CAA has potential for use in a variety of governmental and commercial applications, including planning for crews for future long space flights, designing facilities wherein humans must work in proximity for long times, improving crew training and measuring crew performance in military settings, human-factors and safety assessment, development of team procedures, and behavioral and ethnographic research. The data-acquisition hardware of the CAA (see figure) includes two video cameras: an overhead one aimed upward at a paraboloidal mirror on the ceiling and one mounted on a wall aimed in a downward slant toward the crew area. As many as

four wireless microphones can be worn by crew members. The audio signals received from the microphones are digitized, then compressed in preparation for storage. Approximate locations of as many as four crew members are measured by use of a Cricket indoor location system. [The Cricket indoor location system includes ultrasonic/radio beacon and listener units. A Cricket beacon (in this case, worn by a crew member) simultaneously transmits a pulse of ultrasound and a radio signal that contains identifying information. Each Cricket listener unit measures the difference between the times of reception of the ultrasound and radio signals from an identified beacon. Assuming essentially instantaneous propagation of the radio signal, the distance between that beacon and the listener unit is estimated from this time difference and the speed of sound in air.] In this system, six Cricket listener units are mounted in various positions on the ceiling, and as many as four Cricket beacons are attached to crew members. The three-dimensional position of each Cricket beacon can be estimated from the time-difference readings of that beacon from at least three Cricket listener units

Author

*Spacecrews; Human Factors Engineering; Human Performance; Flight Crews; Computer Programs; Data Acquisition; Time Response; Digital Television; Microphones; Audio Signals*

**20080048051** Mississippi State Univ., Bay Saint Louis, MS, USA

### **MODIS Atmospheric Data Handler**

Anantharaj, Valentine; Fitzpatrick, Patrick; NASA Tech Briefs, December 2008; December 2008, pp. 7; In English; See also [20080048022](#)

Report No.(s): SSC-00267; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3413>

The Moderate Resolution Imaging Spectroradiometer (MODIS) Atmosphere Data Handler software converts the HDF data to ASCII format, and outputs: (1) atmospheric profiles of temperature and dew point and (2) total precipitable water. Quality-control data are also considered in the export procedure.

Derived from text

*Imaging Spectrometers; MODIS (Radiometry); Computer Programming; Data Conversion Routines*

**20080048063** NASA Goddard Space Flight Center, Greenbelt, MD, USA

### **HDF-EOS 2 and HDF-EOS 5 Compatibility Library**

Ullman, Richard; Bane, Bob; Yang, Jingli; NASA Tech Briefs, December 2008; December 2008, pp. 17; In English; See also [20080048022](#)

Report No.(s): GSC-15008-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3436>

The HDF-EOS 2 and HDF-EOS 5 Compatibility Library contains C-language functions that provide uniform access to HDF-EOS 2 and HDF-EOS 5 files through one set of application programming interface (API) calls. ('HDFEOS 2' and 'HDF-EOS 5' are defined in the immediately preceding article.) Without this library, differences between the APIs of HDF-EOS 2 and HDF-EOS 5 would necessitate writing of different programs to cover HDF-EOS 2 and HDF-EOS 5. The API associated with this library is denoted 'he25.' For nearly every HDF-EOS 5 API call, there is a corresponding he25 API call. If a file in question is in the HDF-EOS 5 format, the code reverts to the corresponding HDF-EOS 5 call; if the file is in the HDF-EOS 2 format, the code translates the arguments to HDF-EOS 2 equivalents (if necessary), calls the HDFEOS 2 call, and retranslates the results back to HDF-EOS 5 (if necessary).

Author

*Libraries; Application Programming Interface; C (Programming Language); Compatibility*

**20080048129** West Virginia Univ., Morgantown, WV, USA; California Inst. of Tech., Pasadena, CA, USA

### **Estimating Software-Development Costs With Greater Accuracy**

Baker, Dan; Hihn, Jairus; Lum, Karen; NASA Tech Briefs, September 2008; September 2008, pp. 58; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): NPO-44858; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3212>

COCOMOST is a computer program for use in estimating software development costs. The goal in the development of COCOMOST was to increase estimation accuracy in three ways: (1) develop a set of sensitivity software tools that return not only estimates of costs but also the estimation error; (2) using the sensitivity software tools, precisely define the quantities of data needed to adequately tune cost estimation models; and (3) build a repository of software-cost-estimation information that

NASA managers can retrieve to improve the estimates of costs of developing software for their project. COCOMOST implements a methodology, called '2cee', in which a unique combination of well-known pre-existing data-mining and software-development- effort-estimation techniques are used to increase the accuracy of estimates. COCOMOST utilizes multiple models to analyze historical data pertaining to software-development projects and performs an exhaustive data-mining search over the space of model parameters to improve the performances of effort-estimation models. Thus, it is possible to both calibrate and generate estimates at the same time. COCOMOST is written in the C language for execution in the UNIX operating system.

Author

*Software Engineering; Cost Estimates; Computer Programs*

**20080048137** California Inst. of Tech., Pasadena, CA, USA

**Fault-Tolerant, Multiple-Zone Temperature Control**

Granger, James; Franklin, Brian; Michalik, Martin; Yates, Phillip; Peterson, Erik; Borders, James; NASA Tech Briefs, September 2008; September 2008, pp. 47; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): NPO-45230; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3186>

A computer program has been written as an essential part of an electronic temperature control system for a spaceborne instrument that contains several zones. The system was developed because the temperature and the rate of change of temperature in each zone are required to be maintained to within limits that amount to degrees of precision thought to be unattainable by use of simple bimetallic thermostats. The software collects temperature readings from six platinum resistance thermometers, calculates temperature errors from the readings, and implements a proportional + integral + derivative (PID) control algorithm that adjusts heater power levels. The software accepts, via a serial port, commands to change its operational parameters. The software attempts to detect and mitigate a host of potential faults. It is robust to many kinds of faults in that it can maintain PID control in the presence of those faults.

Author

*Computer Programs; Fault Tolerance; Temperature Control; Spacecraft Electronic Equipment*

**20080048139** California Inst. of Tech., Pasadena, CA, USA

**Post-Flight Estimation of Motion of Space Structures: Part 1**

Brugarolas, Paul; Breckenridge, William; NASA Tech Briefs, September 2008; September 2008, pp. 48; In English; See also [20080048125](#)

Report No.(s): NPO-45072; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3188>

A computer program estimates the relative positions and orientations of two space structures from data on the angular positions and distances of fiducial objects on one structure as measured by a target tracking electronic camera and laser range finders on another structure. The program is written specifically for determining the relative alignments of two antennas, connected by a long truss, deployed in outer space from a space shuttle. The program is based partly on transformations among the various coordinate systems involved in the measurements and on a nonlinear mathematical model of vibrations of the truss. The program implements a Kalman filter that blends the measurement data with data from the model. Using time series of measurement data from the tracking camera and range finders, the program generates time series of data on the relative position and orientation of the antennas. A similar program described in a prior NASA Tech Briefs article was used onboard for monitoring the structures during flight. The present program is more precise and designed for use on Earth in post-flight processing of the measurement data to enable correction, for antenna motions, of scientific data acquired by use of the antennas.

Author

*Computer Programs; Mathematical Models; Spacecraft Structures; Space Shuttles*

**20080048149** NASA Glenn Research Center, Cleveland, OH, USA

**Platform for Postprocessing Waveform-Based NDE**

Roth, Don; NASA Tech Briefs, September 2008; September 2008, pp. 55; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): LEW-18261-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3205>

Taking advantage of the similarities that exist among all waveform-based non-destructive evaluation (NDE) methods, a



common software platform has been developed containing multiple- signal and image-processing techniques for waveforms and images. The NASA NDE Signal and Image Processing software has been developed using the latest versions of LabVIEW, and its associated Advanced Signal Processing and Vision Toolkits. The software is useable on a PC with Windows XP and Windows Vista. The software has been designed with a commercial grade interface in which two main windows, Waveform Window and Image Window, are displayed if the user chooses a waveform file to display. Within these two main windows, most actions are chosen through logically conceived run-time menus. The Waveform Window has plots for both the raw time-domain waves and their frequency- domain transformations (fast Fourier transform and power spectral density). The Image Window shows the C-scan image formed from information of the time-domain waveform (such as peak amplitude) or its frequency-domain transformation at each scan location. The user also has the ability to open an image, or series of images, or a simple set of X-Y paired data set in text format. Each of the Waveform and Image Windows contains menus from which to perform many user actions. An option exists to use raw waves obtained directly from scan, or waves after deconvolution if system wave response is provided. Two types of deconvolution, time-based subtraction or inverse-filter, can be performed to arrive at a deconvolved wave set. Additionally, the menu on the Waveform Window allows preprocessing of waveforms prior to image formation, scaling and display of waveforms, formation of different types of images (including non-standard types such as velocity), gating of portions of waves prior to image formation, and several other miscellaneous and specialized operations. The menu available on the Image Window allows many further image processing and analysis operations, some of which are found in commercially-available image-processing software programs (such as Adobe Photoshop), and some that are not (removing outliers, Bscan information, region-of-interest analysis, line profiles, and precision feature measurements).

Author

*Image Processing; Nondestructive Tests; Waveforms; Software Engineering; Signal Processing*

**20080048158** California Inst. of Tech., Pasadena, CA, USA

### **Injecting Artificial Memory Errors Into a Running Computer Program**

Bornstein, Benjamin J.; Granat, Robert A.; Wagstaff, Kiri L.; NASA Tech Briefs, September 2008; September 2008, pp. 46; In English; See also [20080048125](#)

Report No.(s): NPO-45368; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3185>

Single-event upsets (SEUs) or bitflips are computer memory errors caused by radiation. BITFLIPS (Basic Instrumentation Tool for Fault Localized Injection of Probabilistic SEUs) is a computer program that deliberately injects SEUs into another computer program, while the latter is running, for the purpose of evaluating the fault tolerance of that program. BITFLIPS was written as a plug-in extension of the open-source Valgrind debugging and profiling software. BITFLIPS can inject SEUs into any program that can be run on the Linux operating system, without needing to modify the program s source code. Further, if access to the original program source code is available, BITFLIPS offers fine-grained control over exactly when and which areas of memory (as specified via program variables) will be subjected to SEUs. The rate of injection of SEUs is controlled by specifying either a fault probability or a fault rate based on memory size and radiation exposure time, in units of SEUs per byte per second. BITFLIPS can also log each SEU that it injects and, if program source code is available, report the magnitude of effect of the SEU on a floating-point value or other program variable.

Author

*Memory (Computers); Program Verification (Computers); Unix (Operating System); Systematic Errors; Fault Tolerance; Artificial Intelligence*

**20080048166** United Space Alliance, Houston, TX, USA

### **Computational Model of Heat Transfer on the ISS**

Torian, John G.; Rischar, Michael L.; NASA Tech Briefs, September 2008; September 2008, pp. 49-50; In English; See also [20080048125](#)

Report No.(s): MSC-23622-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3193>

SCRAM Lite (SCRAM signifies Station Compact Radiator Analysis Model) is a computer program for analyzing convective and radiative heat-transfer and heat-rejection performance of coolant loops and radiators, respectively, in the active thermal-control systems of the International Space Station (ISS). SCRAM Lite is a derivative of prior versions of SCRAM but is more robust. SCRAM Lite computes thermal operating characteristics of active heat-transport and heat-rejection subsystems for the major ISS configurations from Flight 5A through completion of assembly. The program performs integrated analysis of both internal and external coolant loops of the various ISS modules and of an external active thermal control system, which includes radiators and the coolant loops that transfer heat to the radiators. The SCRAM Lite run time is of the

order of one minute per day of mission time. The overall objective of the SCRAM Lite simulation is to process input profiles of equipment-rack, crew-metabolic, and other heat loads to determine flow rates, coolant supply temperatures, and available radiator heat-rejection capabilities. Analyses are performed for timelines of activities, orbital parameters, and attitudes for mission times ranging from a few hours to several months.

Author

*Heat Transfer; International Space Station; Heat Radiators; Active Control; Temperature Control; Computer Programs*

**20080048167** California Inst. of Tech., Pasadena, CA, USA

#### **Optimization of Angular-Momentum Biases of Reaction Wheels**

Lee, Clifford; Lee, Allan; NASA Tech Briefs, September 2008; September 2008, pp. 50; In English; See also [20080048125](#)

Report No.(s): NPO-42011; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3194>

RBOT [RWA Bias Optimization Tool (wherein RWA signifies Reaction Wheel Assembly )] is a computer program designed for computing angular momentum biases for reaction wheels used for providing spacecraft pointing in various directions as required for scientific observations. RBOT is currently deployed to support the Cassini mission to prevent operation of reaction wheels at unsafely high speeds while minimizing time in undesirable low-speed range, where elasto-hydrodynamic lubrication films in bearings become ineffective, leading to premature bearing failure. The problem is formulated as a constrained optimization problem in which maximum wheel speed limit is a hard constraint and a cost functional that increases as speed decreases below a low-speed threshold. The optimization problem is solved using a parametric search routine known as the Nelder-Mead simplex algorithm. To increase computational efficiency for extended operation involving large quantity of data, the algorithm is designed to (1) use large time increments during intervals when spacecraft attitudes or rates of rotation are nearly stationary, (2) use sinusoidal-approximation sampling to model repeated long periods of Earth-point rolling maneuvers to reduce computational loads, and (3) utilize an efficient equation to obtain wheel-rate profiles as functions of initial wheel biases based on conservation of angular momentum (in an inertial frame) using pre-computed terms.

Author

*Angular Momentum; Bias; Computer Programs; Reaction Wheels; Optimization*

**20080048197** California Inst. of Tech., Pasadena, CA, USA

#### **Facilitating Analysis of Multiple Partial Data Streams**

Maimone, Mark W.; Liebersbach, Robert R.; NASA Tech Briefs, September 2008; September 2008, pp. 62; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): NPO-45367; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3218>

Robotic Operations Automation: Mechanisms, Imaging, Navigation report Generation (ROAMING) is a set of computer programs that facilitates and accelerates both tactical and strategic analysis of time-sampled data especially the disparate and often incomplete streams of Mars Explorer Rover (MER) telemetry data described in the immediately preceding article. As used here, tactical refers to the activities over a relatively short time (one Martian day in the original MER application) and strategic refers to a longer time (the entire multi-year MER missions in the original application). Prior to installation, ROAMING must be configured with the types of data of interest, and parsers must be modified to understand the format of the input data (many example parsers are provided, including for general CSV files). Thereafter, new data from multiple disparate sources are automatically resampled into a single common annotated spreadsheet stored in a readable space-separated format, and these data can be processed or plotted at any time scale. Such processing or plotting makes it possible to study not only the details of a particular activity spanning only a few seconds, but also longer-term trends. ROAMING makes it possible to generate mission-wide plots of multiple engineering quantities [e.g., vehicle tilt as in Figure 1(a), motor current, numbers of images] that, heretofore could be found only in thousands of separate files. ROAMING also supports automatic annotation of both images and graphs. In the MER application, labels given to terrain features by rover scientists and engineers are automatically plotted in all received images based on their associated camera models (see Figure 2), times measured in seconds are mapped to Mars local time, and command names or arbitrary time-labeled events can be used to label engineering plots, as in Figure 1(b).

Author

*Data Flow Analysis; Mars Surface; Robotics; Telemetry; Computer Programs*

**20080048198** California Inst. of Tech., Pasadena, CA, USA

**Mars Reconnaissance Orbiter Wrapper Script**

Gladden, Roy; Fisher, Forest; Khanampornpan, Teerapat; NASA Tech Briefs, September 2008; September 2008, pp. 63; In English; See also [20080048125](#); Original contains color illustrations  
Report No.(s): NPO-45242; Copyright; Avail.: CASI: [A01](#), Hardcopy  
ONLINE: <http://www.techbriefs.com/component/content/article/3220>

The MRO OLVM wrapper script software allows Mars Reconnaissance Orbiter (MRO) sequence and spacecraft engineers to rapidly simulate a spacecraft command product through a tool that simulates the onboard sequence management software (OLVM). This script parses sequence files to determine the appropriate time boundaries for the sequence, and constructs the script file to be executed by OLVM to span the entirety of the designated sequence. It then constructs script files to be executed by OLVM, constructs the appropriate file directories, populates these directories with needed input files, initiates OLVM to simulate the actual command product that will be sent to the spacecraft, and captures the results of the simulation run to an external file for later review. Additionally, the tool allows a user to manually construct the script, if desired, and then execute the script with a simple command line.

Author

*Mars Reconnaissance Orbiter; Computer Systems Programs; Computerized Simulation; Software Engineering; Airborne/Spaceborne Computers*

**20080048234** Utah Univ., Salt Lake City, UT USA

**VISPACK**

Whitaker, Ross T; Cates, Josh; Burgiss, Jr, Samuel; Jan 2008; 72 pp.; In English  
Contract(s)/Grant(s): N00014-97-0227; N00014-01-1-0033

Report No.(s): AD-A489410; UUCS-08-0011; No Copyright; Avail.: Defense Technical Information Center (DTIC)

VISPACK (volume-image-surface package) is a C++ library that includes matrix, image, and volume objects and tools for manipulating level-set surface models.

DTIC

*Computer Programs; Computer Program Integrity; C (Programming Language)*

**20080048397** TRADOC Analysis Command, Monterey, CA USA

**Modeling Uncertainty from Sensors to Decision Makers**

Ahner, Darryl; Anderson, Tom; Martin, Mike; Jun 2008; 21 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A489701; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489701>

Purpose: To share information on the TRAC-MTRY led representation of uncertainty within combat models research. This research includes representation of uncertainty from false positive targets and sensor errors. Agenda: JDL Data Fusion Model; False Positives -Research Objectives, -Definition, -Technical Approach, -Summary; Sensor Errors -Research Objectives

DTIC

*Combat; Simulation*

**20080048412** Naval Research Lab., Bay Saint Louis, MS USA

**Software Design Description for the Polar Ice Prediction System (PIPS) Version 3.0**

Posey, Pamela G; Smedstad, Lucy F; Preller, Ruth H; Metzger, E J; Carroll, Suzanne; Nov 5, 2008; 149 pp.; In English  
Report No.(s): AD-A489793; NRL/MR/7320--08-9150; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489793>

The Polar Ice Prediction System (PIPS) Version 3.0 is a dynamic sea-ice model that forecasts conditions in all sea-ice covered areas in the northern hemisphere (down to 30 degrees north in latitude). It has a horizontal resolution of approximately 9 km. The vertical resolution in the model has been set at 45 levels so that Arctic shelves, continental slopes, and submarine ridges are accurately represented. Currently, the domain includes the Irminger, Labrador, North, and Baltic Seas on the Atlantic side and the Bering Sea, Sea of Japan, and the Sea of Okhotsk on the Pacific. The PIPS 3.0 system is based on the Los Alamos ice model and coupled (via file transfer) to the operational, global Navy Coastal Ocean Model (gNCOM). The system forecasts daily ice thickness, concentration, and drift in the Arctic Ocean. This report documents the mathematical formulations, flow charts, and descriptions of the programs and subroutines.

DTIC

*Ice; Ice Formation; Ice Reporting; Prediction Analysis Techniques; Sea Ice; Software Engineering; Weather Forecasting*

**20080048413** Naval Research Lab., Bay Saint Louis, MS USA

**The Polar Ice Prediction System (PIPS) Version 3.0 (User's Manual)**

Posey, Pamela G; Smedstad, Lucy F; Preller, Ruth H; Metzger, E J; Carroll, Suzanne N; Nov 5, 2008; 86 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489794; NRL/MR/7320--08-9154; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489794>

The Polar Ice Prediction System (PIPS) Version 3.0 is a dynamic sea-ice model that forecasts conditions in all sea-ice covered areas in the northern hemisphere (down to 30 degrees north in latitude). It has a horizontal resolution of approximately 9 km. The vertical resolution in the model has been set at 45 levels so that Arctic shelves, continental slopes, and submarine ridges are accurately represented. Currently, the domain includes the Irminger, Labrador, North, and Baltic Seas on the Atlantic side and the Bering Sea, Sea of Japan, and the Sea of Okhotsk on the Pacific. The PIPS 3.0 system is based on the Los Alamos ice model and coupled (via file transfer) to the operational, global Navy Coastal Ocean Model (gNCOM). The system forecasts daily ice thickness, concentration and drift in the Arctic Ocean. This report documents the setup and execution of the PIPS 3.0 system.

DTIC

*Ice; Ice Formation; Ice Reporting; Prediction Analysis Techniques; Sea Ice; User Manuals (Computer Programs); Weather Forecasting*

**20080048424** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Requirements and Their Impact Downstream: Improving Casual Analysis Processes Through Measurement and Analysis of Textual Information**

Monarch, Ira A; Goldenson, Dennis R; Osiecki, Lawrence T; Sep 2008; 75 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A489852; CMU/SEI-2008-TR-018; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489852>

Requirements documents, test procedures, and problem and change reports from a U. S. Army Software Engineering Center (SEC) were analyzed to identify, clarify, and begin categorizing recurring patterns of issues raised throughout the product life cycle. Semiautomated content analysis was used to identify underlying patterns in the SEC documents. Automated tools and techniques were used to support efficient search and related semantic analysis that would not be possible manually. Discussions with Army personnel were used to confirm and elaborate initial findings and interpretations. The same analytic methods can be used as a basis for novel, proactive causal analysis processes. One of the patterns identified here suggests that usability is not sufficiently articulated and quantified early in the product life cycle. While the SEC has established exemplary processes to handle usability-related issues when they arise, some of them might be mitigated or prevented by documented consideration upstream.

DTIC

*Computer Programming; Software Engineering*

**20080048435** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Interoperability Test and Evaluation: A System of Systems Field Study**

Colombi, John; Cohee, Brannen C; Turner, Chuck W; Nov 2008; 6 pp.; In English

Report No.(s): AD-A489885; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489885>

Effective operational test and evaluation (OT&E) is an essential part of successful systems and software engineering. But increased program dependencies, network-centric operations, and growing interoperability requirements have greatly complicated test and evaluation. This article examines the policy, process, and practice of the Air Force (AF) test and evaluation programs, such as Force Development Evaluations (FDEs), particularly during the sustainment of systems. Several observations are made regarding the current process and five areas are emphasized for improvement.

DTIC

*Computer Programming; Evaluation; Flying Platforms; Ground Stations; Interoperability; Software Engineering; System Effectiveness; Systems Integration*

**20080048436** Naval Research Lab., Stafford, VA USA

**A NIFTI Solution to Far-Field Antenna Transformations**

Borodin, Windie; King, Danielle; Sep 2005; 3 pp.; In English

Report No.(s): AD-A489902; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489902>

The Near Imaging Field Tower Implementation was developed to provide a mid-range system that performs far-field characterization of several 60-foot antenna systems. The challenge was to take a highly complex development effort and bring it in on time and within cost. This article describes the team's success using an object-oriented design under a tailored IBM Rational Unified Process and established metrics to monitor the progress.

DTIC

*Antennas; Calibrating; Characterization; Computer Programming; Far Fields; Imaging Techniques; Near Fields; Object-Oriented Programming; Software Engineering; Towers*

**20080048476** Mitre Corp., McLean, VA USA

**Systems Engineering for Capabilities**

Dahmann, Judith S; Rebovich, Jr , George; Lane, Jo Ann; Nov 2008; 7 pp.; In English

Report No.(s): AD-A489896; No Copyright; Avail.: Defense Technical Information Center (DTIC)

With the increased emphasis on capabilities and networking, the DoD is recognizing the criticality of effective end-to-end performance of systems of systems (SoS) to meet user needs. While acquisition continues to focus on systems, systems requirements are increasingly based on the assessment of gaps in user capabilities and in priority areas; there is an increasing focus on integration across systems to enable capabilities. Thus, the role of systems engineering (SE) is expanding to the engineering of SoS that provide user capabilities. This article discusses the shape of SoS in the DoD today. It outlines a recent initiative to provide guidance on the application of SE processes to the definition and evolution of SoS.

DTIC

*Defense Program; Interoperability; Management Planning; Systems Engineering; Systems Integration; User Requirements*

**20080048480** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Software Acquisition Improvement in the Aeronautical Systems Center**

Pogorzelski, William A; Sep 2008; 146 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489914; AFIT/GRD/ENV/08-S1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In the past 20 years, over 150 recommendations have been made to improve software systems development by organizations such as the Defense Science Board, National Research Council and the U.S. General Accountability Office. It has been discovered that many of these recommendation have remained unimplemented. The research had the purpose of confirming the application of these previous recommendations to improve software acquisition in the Aeronautical Systems Center. This was accomplished through interviews with 20 software practitioners in the acquisition community and the review of relevant literature. Through the analysis of the interviews and literature, this research was able to confirm that many of the recommendations have been applied in programs through out the Aeronautical Systems Center.

DTIC

*Computer Programs; Government Procurement*

**20080048495** Carnegie-Mellon Univ., Pittsburgh, PA USA

**CMMI High Maturity Measurement and Analysis Workshop Report: March 2008**

Stoddard, II, Robert W; Goldenson, Dennis R; Zubrow, Dave; Harper, Erin; Nov 2008; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A489991; CMU/SEI-2008-TN-027; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Organizations are increasingly looking for guidance on what it takes to implement Capability Maturity Model Integration (CMMI) high maturity practices and how to sustain their momentum for improvement. As high maturity organizations work to improve their use of measurement and analysis, they often look to examples of successful implementations for guidance. In response to the need for clarification and guidance on implementing measurement and analysis in the context of high maturity processes, members of the SEI's Software Engineering Measurement and Analysis (SEMA) initiative organized a workshop at the 2008 SEPG North America conference to bring leaders in the field together at a forum on the topic. Other

workshops will be held as part of an ongoing series to allow high maturity organizations to share best practices and case studies.

DTIC

*Computer Programming; Software Engineering*

**20080048496** Naval Postgraduate School, Monterey, CA USA

**Conversation Thread Extraction and Topic Detection in Text-Based Chat**

Adams, Paige H; Sep 2008; 191 pp.; In English

Report No.(s): AD-A490001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Text-based chat systems are widely used within the Department of Defense, but the standard systems available do not provide robust capabilities for search, information retrieval, or information assurance. The objective of this research is to explore methods for the extraction of conversation threads from text-based chat systems in order to enable such tasks. As part of the research, we manually annotated over 20,000 Internet Relay Chat posts with conversation thread information and constructed a probabilistic model for automatically classifying posts according to conversation thread. We also provide an algorithm for extracting these conversation threads from the chat session in order to form discrete documents that may be used in a vector space model information retrieval system. We elaborate how this technique can be used to support search and data mining systems, as well as auditing tasks and guard functions in a security system. Using the developed probabilistic models, we have achieved classification results on par with those of human annotators.

DTIC

*Conversation; Extraction; Internets; Texts; Threads; Voice Communication*

**20080048499** Army Engineer Research and Development Center, Vicksburg, MS USA

**Attribution Concepts for Sub-meter Resolution Ground Physics Models**

Jun 2008; 21 pp.; In English; Original contains color illustrations

Report No.(s): AD-A490043; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Summary: \*ERDC research is now heavily focused on using high performance computing simulation testbeds. \*Simulations like VANE involving sensor-terrain interaction will require relevant and realistically heterogeneous attributions for large scale, high resolution, numerical models. -Techniques for characterizing spatial variability at multiple scales including sub-meter resolutions. -Techniques for populating sparsely measured attributions using material attribute correlations to densely measured attributions.

DTIC

*Computerized Simulation; High Resolution; Mathematical Models*

**20080048500** Naval Postgraduate School, Monterey, CA USA

**The Use of Agent-Based Modeling and Data Farming for Planning System of Systems Tests in Joint Environments**

McDonald, Mary; Upton, Stephen; Horne, Gary; Jun 2008; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-A490055; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Agenda: \*SEED Center and Philosophy \*Data Farming \*Support to Joint Test and Evaluation Methodology (JTEM) \*Agent Based Modeling \*'TheTester' ABM

DTIC

*Computerized Simulation; Data Systems; Systems Engineering*

**20080048502** Carnegie-Mellon Univ., Pittsburgh, PA USA

**CMMI (registered trademark) or Agile: Why Not Embrace Both!**

Glazer, Hillel; Dalton, Jeff; Anderson, David; Anderson, David J; Konrad, Mike; Shrum, Sandy; Nov 2008; 48 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A490064; CMU/SEI-2008-TN-003; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Agile development methods and CMMI (Capability Maturity Model (registered trademark) Integration) best practices are often perceived to be at odds with each other. This report clarifies why the discord need not exist and proposes that CMMI

and Agile champions work toward deriving benefit from using both and exploit synergies that have the potential to dramatically improve business performance.

DTIC

*Computer Programming; Management Planning; Software Engineering*

**20080048503** Carnegie-Mellon Univ., Pittsburgh, PA USA

**CMMI Roadmaps**

Cannegieter, Jan J; Heijstek, Andre; Linders, Ben; Solingen, Rini van; Nov 2008; 30 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A490065; CMU/SEI-2008-TN-010; No Copyright; Avail.: Defense Technical Information Center (DTIC)

CMMI 'roadmaps' -- which are a goal-driven approach to selecting and deploying relevant process areas from the CMMI-DEV model -- can provide guidance and focus for effective CMMI adoption. The Dutch Software Process Improvement (SPIDER) network convened a workshop in November 2006 to develop several CMMI roadmaps for the continuous representation, each with a specific set of improvement goals. These roadmaps combine the strengths of both the staged and the continuous representations.

DTIC

*Computer Programming; Management Planning; Maps; Project Management; Software Engineering*

**20080048505** Bae Systems Advanced Information Technologies, Inc., Burlington, MA USA

**A Case Study in Integrated PMESII Modeling and Simulation**

Melhuish, James; Pioch, Nicholas J; Cook, Michael F; Jun 2008; 33 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-06-C-0086; SPO700-98-D-4000-0052

Report No.(s): AD-A490074; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Agenda: \*Background Evaluating CMIST \*What is CMIST? \*Evaluation goals \*Pacifica overview \*PMESII Modeling \*Modeling methodology \*PsyOps/MCO model \*Experimental Results \*Running different COAs \*COA Comparison & Drilldown \*Lessons Learned \*Modeling process \*Tool insights \*Future Work \*Conclusions

DTIC

*Control Units (Computers); Memory (Computers); Models; Simulation*

**20080048508** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Cuckoo: Layered Clustering for NFS**

Klosterman, Andrew J; Ganger, Gregory; Oct 2002; 23 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0433

Report No.(s): AD-A490118; CMU-CS-02-183; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Layered clustering allows unmodified distributed file systems to enjoy many of the benefits of cluster-based file services. By interposing between clients and servers, layered clustering requires no changes to clients, servers, or the client-server protocol. Cuckoo demonstrates one particular use of layered clustering: spreading load among a set of otherwise independent NFS servers. Specifically, Cuckoo replicates frequently read, rarely updated files from each server onto others. When one server has a queue of requests, read requests to its replicated files are offloaded to other servers. No client-server protocol changes are involved. Sitting between clients and servers, the Cuckoo interposer simply modifies selected fields of NFS requests and responses. Cuckoo provides this load shedding with about 2000 semicolons of C code. Further, analyses of NFS traces indicate that replicating only 1000-10,000 objects allows 42% to 77% of all operations to be offloaded.

DTIC

*Balancing; Client Server Systems; Distributed Processing; Loads (Forces); Replicas; Workloads (Psychophysiology)*

**20080048509** Carnegie-Mellon Univ., Pittsburgh, PA USA

**A Prototype User Interface for Coarse-Grained Desktop Access Control**

Long, A C; Moskowitz, Courtney; Ganger, Greg; Nov 13, 2003; 19 pp.; In English

Report No.(s): AD-A490119; CMU-CS-03-200; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Viruses, trojan horses, and other malware are a growing problem for computer users, but current tools and research do not adequately aid users in fighting these threats. One approach to increasing security is to partition all applications and data

based on general task types, or 'roles' such as 'Personal,' 'Work,' and 'Communications'. This can limit the effects of malware to a single role rather than allowing it to affect the entire computer. We are developing a prototype to investigate the usability of this security model. Our initial investigation uses cognitive walkthrough and think-aloud user studies of paper prototypes to look at this model in the context of realistic tasks, and to compare different user interface mechanisms for managing data and applications in a role-based system. For most participants, our interface was simple to understand and use. In addition to a security model that is intrinsically useful, we believe development of this system will inform issues in the design and implementation of usable security interfaces, such as refinement of design guidelines.

DTIC

*Access Control; Coarseness; Computer Viruses; Computers; Grain Size; Prototypes; Security*

**20080048512** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Finding and Containing Enemies within the Walls with Self-Securing Network Interfaces**

Ganger, Gregory R; Economou, Gregg; Bielski, Stanley M; Jan 2003; 25 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0433

Report No.(s): AD-A490126; CMU-CS-03-109; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Self-securing network interfaces (NIs) examine the packets that they move between network links and host software, looking for and potentially blocking malicious network activity. This paper describes how self-securing network interfaces can help administrators to identify and contain compromised machines within their intranet. By shadowing host state, self-securing NIs can better identify suspicious traffic originating from that host, including many explicitly designed to defeat network intrusion detection systems. With normalization and detection-triggered throttling, self-securing NIs can reduce the ability of compromised hosts to launch attacks on other systems inside (or outside) the intranet. The authors describe a prototype self-securing NI and example scanners for detecting such things as TTL abuse, fragmentation abuse, 'SYN bomb' attacks, and random-propagation worms like Code-Red.

DTIC

*Access Control; Application Programming Interface; Computer Viruses; Data Transmission; Local Area Networks; Numerical Control; Security; Walls*

**20080048515** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Byzantine-Tolerant Erasure-Coded Storage**

Goodson, Garth R; Wylie, Jay J; Ganger, Gregory R; Reiter, Michael K; Sep 2003; 25 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0433; F30602-99-2-0539

Report No.(s): AD-A490141; CMU-CS-03-187; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper describes a decentralized consistency protocol for survivable storage that exploits data versioning within storage-nodes. Versioning enables the protocol to efficiently provide linearizability and wait-freedom of read and write operations to erasure-coded data in asynchronous environments with Byzantine failures of clients and servers. Exploiting versioning storage-nodes, the protocol shifts most work to clients. Reads occur in a single round-trip unless clients observe concurrency or write failures. Measurements of a storage system using this protocol show that the protocol scales well with the number of failures tolerated, and that it outperforms a highly-tuned instance of Byzantine-tolerant state machine replication.

DTIC

*Client Server Systems; Coding; Computer Storage Devices; Computer Systems Design; Consistency; Data Storage; Fault Tolerance; Protocol (Computers)*

**20080048519** Lockheed Martin Corp., Owego, USA

**Design Description for Team-Based Execution of Autonomous Missions (TEAM), Spiral 1**

Nov 18, 2008; 41 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-08-C-0142

Report No.(s): AD-A490152; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The sea lines of communication are threatened by mines just as land lines. In addition, adversaries can deny forces entry to coastal regions. These regions are often in the littorals requiring shallow draft vessels to defend them. To face this threat, the new Littoral Combat Ship (LCS) will be able to be equipped with a mine countermeasures (MCM) mission module. One of the critical issues for Mine Countermeasures (MCM) missions aboard the LCS is the simultaneous management of multi-vehicle (both manned and unmanned) teams. As such, the main objective to meet the requirements of future LCS



missions is to change from a vehicle-centric to a mission-centric paradigm. Team-Based Execution Of Autonomous Missions (TEAM) seeks to demonstrate technologies that can plan and execute mine countermeasures missions using the various assets available to it. The Design Description for TEAM program describes the structure and behavior of the components in the system and their interrelationships and principles. The TEAM program is broken into two spirals. This document describes the design for Spiral 1, which focuses on mission planning. Spiral 2 focuses on mission execution. The design will also be updated in Spiral 2 and there will be revisions to this document.

DTIC

*Autonomy; Countermeasures*

**20080048521** Carnegie-Mellon Univ., Pittsburgh, PA USA

**A Protocol Family for Versatile Survivable Storage Infrastructures**

Goodson, Garth R; Wylie, Jay J; Ganger, Gregory R; Reiter, Michael K; Dec 2003; 28 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0433; F30602-99-2-0539

Report No.(s): AD-A490155; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Survivable storage systems mask faults. A protocol family shifts the decision of which types of faults from implementation time to data-item creation time. If desired, each data-item can be protected from different types and numbers of faults. This paper describes and evaluates a family of storage access protocols that exploit data versioning to efficiently provide consistency for erasure-coded data. This protocol family supports a wide range of fault models with no changes to the client-server interface or server implementations. Its members also shift overheads to clients. Readers only pay these overheads when they actually observe concurrency or failures. Measurements of a prototype block-store show the efficiency and scalability of protocol family members.

DTIC

*Client Server Systems; Computer Storage Devices; Computer Systems Design; Data Storage; Fault Tolerance; Protocol (Computers)*

**20080048522** Carnegie-Mellon Univ., Pittsburgh, PA USA

**The Safety and Liveness Properties of a Protocol Family for Versatile Survivable Storage Infrastructures**

Goodson, Garth R; Wylie, Jay J; Ganger, Gregory R; Reiter, Michael K; Mar 2004; 29 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0433; F30602-99-2-0539

Report No.(s): AD-A490157; CMU-PDL-03-105; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Survivable storage systems mask faults. A protocol family shifts the decision of which types of faults from implementation time to data-item creation time. If desired, each data-item can be protected from different types and numbers of faults with changes only to client-side logic. This paper presents proofs of the safety and liveness properties for a family of storage access protocols that exploit data versioning to efficiently provide consistency for erasure-coded data. Members of the protocol family may assume either a synchronous or asynchronous model, can tolerate hybrid crash-recovery and Byzantine failures of storage-nodes, may tolerate either crash or Byzantine clients, and may or may not allow clients to perform repair. Additional protocol family members for synchronous systems under omission and fail-stop failure models of storage-nodes are developed.

DTIC

*Client Server Systems; Computer Storage Devices; Computer Systems Design; Data Storage; Fault Tolerance; Protocol (Computers); Safety*

**20080048524** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Eliminating Cross-Server Operations in Scalable File Systems**

Hendricks, James; Sinnamohideen, Shafeeq; Sambasivan, Raja R; Ganger, Gregory R; May 2006; 20 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0433; DAAD19-02-1-0389

Report No.(s): AD-A490161; CMU-PDL-06-105; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Distributed file systems that scale by partitioning files and directories among a collection of servers inevitably encounter cross-server operations. A common example is a RENAME that moves a file from a directory managed by one server to a directory managed by another. Systems that provide the same semantics for cross-server operations as for those that do not span servers traditionally implement dedicated protocols for these rare operations. This paper suggests an alternate approach that exploits the existence of dynamic redistribution functionality to avoid cross-server operations (e.g., for load balancing, incorporation of new servers, etc.). When a client request would involve files on multiple servers, the system can redistribute

those files onto one server and have it service the request. Although such redistribution is more expensive than a dedicated cross-server protocol, the rareness of such operations makes the overall performance impact minimal. Analysis of NFS traces indicates that cross-server operations make up fewer than 0.001% of client requests, and experiments with a prototype implementation show that the performance impact is negligible when such operations make up as much as 0.01% of operations. Thus, when dynamic redistribution functionality exists in the system, cross-server operations can be handled with little additional implementation complexity.

DTIC

*Client Server Systems; Computer Storage Devices; Data Storage; Distributed Processing; Loads (Forces); Parallel Processing (Computers); Workloads (Psychophysiology)*

**20080048526** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Proceedings of the International Workshop on the Foundations of Service-Oriented Architecture (FSOA 2007)**

Lewis, Grace A; Smith, Dennis B; Jun 2008; 83 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A490181; CMU/SEI-2008-SR-011; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report presents the results of the Foundations of Software-Oriented Architecture (FSOA) workshop held at the Third International Conference on Interoperability for Enterprise Software and Applications (I-ESA 2007). This workshop was organized to provide a forum for a concerted effort to develop a long-term, community-wide research agenda to bridge the gap between SOA research and the real needs of the practitioners in the field. An initial research agenda for SOA was presented along with three papers that focus on specific aspects of operations, engineering, and business challenges. The papers are each presented in this report, and the discussion and its implications for an evolving research agenda are summarized.

DTIC

*Computer Programming; Conferences; Service Oriented Architecture; Software Engineering*

**20080048534** Carnegie-Mellon Univ., Pittsburgh, PA USA

**On the Feasibility of Intrusion Detection Inside Workstation Disks**

Griffin, John L; Pennington, Adam; Bucy, John S; Choundappan, Deepa; Muralidharan, Nithya; Ganger, Gregory R; Dec 2003; 30 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0433; F30602-99-2-0539

Report No.(s): AD-A490208; CMU-PDL-03-106; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Storage-based intrusion detection systems (IDSs) can be valuable tools in monitoring for and notifying administrators of malicious software executing on a host computer, including many common intrusion tool kits. This paper makes a case for implementing IDS functionality in the firmware of workstations' locally attached disks, on which the bulk of important system files typically reside. To evaluate the feasibility of this approach, the authors built a prototype disk-based IDS into a SCSI disk emulator. Experimental results from this prototype indicate that it would indeed be feasible, in terms of CPU and memory costs, to include IDS functionality in low-cost desktop disk drives.

DTIC

*Computer Storage Devices; Computer Viruses; Data Storage; Detection; Embedding; Firmware; Warning Systems; Workstations*

## 62

### COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.

**20080047596** Naval Postgraduate School, Monterey, CA USA

**Can SNMP be Used to Create a Silent SS in an 802.16 Implementation**

Harrison, II, Joseph K; Sep 2008; 115 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489556; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The IEEE 802.16 standard is a wireless communications standard which holds great potential for use by the U.S. military. As IEEE Std. 802.16 is a commercial standard, it can be used as a COTS solution for extending the reach of the internet down to the level of the individual soldier without incurring any development costs. Additionally, 802.16 out of the box supports end-to-end routing and is compatible/interoperable with other ubiquitous networking technologies such as Ethernet and IP.

Given the wireless nature of 802.16, every soldier within range of an 802.16 Base Station (BS) has the potential to benefit from the flow of information from the Command and Control network, as well as the ability to contribute back to the network, increasing the situational awareness of all who are connected. While the default configuration of 802.16 has tremendous potential, it is at its base a commercial standard. There is a potential for modification of the standard to increase the usefulness of 802.16 for the military. This thesis explores one such possibility by investigating the use of SNMP to obviate the need for a Subscriber Station (SS) to transmit, eliminating the associated risk of detection through signal tracking.

DTIC

*Computer Networks; Interprocessor Communication*

**20080047820** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**The Great Firewall of China: A Critical Analysis**

Whiting, Michael D; Jun 2008; 50 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489497; AFIT/ICW/ENG/08-12; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Censorship has a great impact on society as we enter the cyber environment. The Chinese 'Great Firewall', as it is commonly called, brings great attention to China as they enter into the global economy. The Great Firewall is one approach China tries to censor their people. Many techniques are used to establish this cyber boundary such as: firewalls, real-name internet registration, filtering, political controls, police actions and governmental controls. These controls are being challenged by Chinese nationals through the mass public, technology, and software. There are many political, diplomatic, international, and non-governmental organizations who continue their efforts to minimize the affects of the Great Firewall. The USA finds itself in a unique situation trying to eliminate human rights violations while encouraging freedom. Some USA companies find themselves in a moral dilemma; accept the Chinese requirements to do business which may include supporting censorship and human rights violations or to eliminate doing business with the Chinese and missing out on a great financial opportunity.

DTIC

*China; Internets*

**20080047858** Office of Inspector General, Arlington, VA USA

**Comprehensive Plan Needed to Guide the Future of the Iraq Reconstruction Management System**

Haigler, W D; Keays, Walt R; Naumann, Milton L; Warren, David R; Jul 25, 2008; 16 pp.; In English

Report No.(s): AD-A489211; SIGIR-08-021; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489211>

In November 2003, the Congress passed Public Law 108-106, the Emergency Supplemental Appropriations Act for Defense and for the Reconstruction of Iraq and Afghanistan, 2004, which created the \$18.4 billion Iraq Relief and Reconstruction Fund (IRRF). In addition to providing funding for Iraq reconstruction, the law contained a requirement to submit reports to the Congress on how the funding was being used, and provided \$50 million to be used to fulfill the reporting and monitoring requirements of this Act and for the preparation and maintenance of public records required by this Act. In 2004, a management information system was developed to meet the IRRF reporting requirements. Now known as the Iraq Reconstruction Management System (IRMS), the system was intended to meet three objectives: \* Provide a single, unified management information system with a common data dictionary that would provide a common operating picture of the Iraq reconstruction effort. \* Support the production of reports required by Public Law 108-106. \* Serve as a joint U.S.-Iraq system that could be transferred to the Government of Iraq (GOI) to provide management information on U.S.-funded reconstruction projects.

DTIC

*Iraq; Management Information Systems; Management Systems*

**20080047970** Rose-Hulman Inst. of Tech., Terre Haute, IN, USA

**The Marshall Space Flight Center Fault Detection Diagnosis and Recovery Laboratory**

Burchett, Bradley T.; Gamble, Jonathan; Rabban, Michael; August 18, 2008; 3 pp.; In English; Modeling and Simulation Technologies Conference, 18-21 Aug. 2008, Honolulu, HI, USA

Contract(s)/Grant(s): NNM07AA02A; Copyright; Avail.: CASI: A01, Hardcopy

The Fault Detection Diagnosis and Recovery Lab (FDDR) has been developed to support development of, fault detection algorithms for the flight computer aboard the Ares I and follow-on vehicles. It consists of several workstations using Ethernet and TCP/IP to simulate communications between vehicle sensors, flight computers, and ground based support computers. Isolation of tasks between workstations was set up intentionally to limit information flow and provide a realistic simulation

of communication channels within the vehicle and between the vehicle and ground station.

Author

*Fault Detection; Channels (Data Transmission); Airborne/Spaceborne Computers; Flight Control; Computers*

**20080047983** NASA Kennedy Space Center, Cocoa Beach, FL, USA

**Core Technical Capability Laboratory Management System**

Shaykhian, Linda; Dugger, Curtis; Griffin, Laurie; NASA Tech Briefs, October 2008; October 2008, pp. 19-20; In English;

See also [20080047981](#)

Report No.(s): KSC-13051; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3283>

The Core Technical Capability Lab - oratory Management System (CTCLMS) consists of dynamically generated Web pages used to access a database containing detailed CTC lab data with the software hosted on a server that allows users to have remote access.

Derived from text

*Management Systems; Information Systems; Resource Allocation; Logistics*

**20080047984** California Inst. of Tech., Pasadena, CA, USA

**MRO SOW Daily Script**

Fisher, Forest E.; Khanampornpan, Teerapat; Gladden, Roy E.; NASA Tech Briefs, October 2008; October 2008, pp. 20; In English; See also [20080047981](#)

Report No.(s): NPO-45439; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3284>

The MRO SOW daily script (wherein 'MRO' signifies 'Mars Reconnaissance Orbiter' and 'SOW' signifies 'sequence systems engineer of the week') is a computer program that automates portions of the MRO daily SOW procedure, which includes checking file-system sizes and automated sequence processor (ASP) log files. The MRO SOW daily script effects clear reporting of (1) the status of, and requirements imposed on, the file system and (2) the ASP log files.

Author

*Computer Programs; Data Processing; Automatic Control*

**20080048043** TenXys, Inc., Eagle, ID, USA

**Distributing Data to Hand-Held Devices in a Wireless Network**

Hodges, Mark; Simmons, Layne; NASA Tech Briefs, December 2008; December 2008, pp. 6; In English; See also [20080048022](#)

Report No.(s): MSC-23152-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3411>

ADROIT is a developmental computer program for real-time distribution of complex data streams for display on Web-enabled, portable terminals held by members of an operational team of a spacecraft-command-and-control center who may be located away from the center. Examples of such terminals include personal data assistants, laptop computers, and cellular telephones. ADROIT would make it unnecessary to equip each terminal with platform- specific software for access to the data streams or with software that implements the information-sharing protocol used to deliver telemetry data to clients in the center. ADROIT is a combination of middleware plus software specific to the center. (Middleware enables one application program to communicate with another by performing such functions as conversion, translation, consolidation, and/or integration.) ADROIT translates a data stream (voice, video, or alphanumeric data) from the center into Extensible Markup Language, effectuates a subscription process to determine who gets what data when, and presents the data to each user in real time. Thus, ADROIT is expected to enable distribution of operations and to reduce the cost of operations by reducing the number of persons required to be in the center.

Author

*Applications Programs (Computers); Data Flow Analysis; Document Markup Languages; Real Time Operation; Computer Programs; Command and Control; Spacecraft Control*

**20080048057** California Inst. of Tech., Pasadena, CA, USA

**Delivering Images for Mars Rover Science Planning**

Edmonds, Karina; NASA Tech Briefs, December 2008; December 2008, pp. 18-19; In English; See also [20080048022](#)

Report No.(s): NPO-45671; Copyright; Avail.: CASI: [A01](#), Hardcopy

A methodology has been developed for delivering, via the Internet, images transmitted to Earth from cameras on the Mars

Explorer Rovers, the Phoenix Mars Lander, the Mars Science Laboratory, and the Mars Reconnaissance Orbiter spacecraft. The images in question are used by geographically dispersed scientists and engineers in planning Rover scientific activities and Rover maneuvers pertinent thereto.

Derived from text

*Mars Surface; Image Processing; Imaging Techniques; Data Transfer (Computers); Computer Programs; Data Transmission*

**20080048061** Science Systems and Applications, Inc., Greenbelt, MD, USA

**Delivering Alert Messages to Members of a Work Force**

Loftis, Julia; Nickens, Stephanie; Pell, Melissa; Pell, Vince; NASA Tech Briefs, December 2008; December 2008, pp. 18; In English; See also [20080048022](#)

Report No.(s): GSC-14927-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3447>

Global Alert Resolution Network (GARNET) is a software system for delivering emergency alerts as well as less-urgent messages to members of the Goddard Space Flight Center work force via an intranet or the Internet, and can be adapted to similar use in other large organizations.

Derived from text

*Computer Networks; Emergencies; Internets; Computer Programs*

**20080048133** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**Testing of Error-Correcting Sparse Permutation Channel Codes**

Shcheglov, Kirill, V.; Orlov, Sergei S.; NASA Tech Briefs, September 2008; September 2008, pp. 60; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): NPO-45196; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3215>

A computer program performs Monte Carlo direct numerical simulations for testing sparse permutation channel codes, which offer strong error-correction capabilities at high code rates and are considered especially suitable for storage of digital data in holographic and volume memories. A word in a code of this type is characterized by, among other things, a sparseness parameter (M) and a fixed number (K) of 1 or 'on' bits in a channel block length of N.

Derived from text

*Computer Programs; Error Analysis; Error Correcting Codes; Monte Carlo Method*

**20080048135** California Inst. of Tech., Pasadena, CA, USA

**Parallel Computing for the Computed-Tomography Imaging Spectrometer**

Lee, Seungwon; NASA Tech Briefs, September 2008; September 2008, pp. 56; In English; See also [20080048125](#)

Report No.(s): NPO-45831.; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3208>

This software computes the tomographic reconstruction of spatial-spectral data from raw detector images of the Computed-Tomography Imaging Spectrometer (CTIS), which enables transient-level, multi-spectral imaging by capturing spatial and spectral information in a single snapshot.

Author

*Imaging Techniques; Parallel Processing (Computers); Tomography; Ground Penetrating Radar; Computer Programs*

**20080048160** Innovative Concepts in Engineering, LLC, Anchorage, AK, USA

**Automated Assistance for Designing Active Magnetic Bearings**

Imlach, Joseph; NASA Tech Briefs, September 2008; September 2008, pp. 49; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): SSC-00176-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3191>

MagBear12 is a computer code that assists in the design of radial, heteropolar active magnetic bearings (AMBs). MagBear12 was developed to help in designing the system described in 'Advanced Active-Magnetic-Bearing Thrust-Measurement System'. Beyond this initial application, MagBear12 is expected to be useful for designing AMBs for a variety of rotating machinery. This program incorporates design rules and governing equations that are also implemented in other, proprietary design software used by AMB manufacturers. In addition, this program incorporates an advanced unpublished

fringing-magnetic-field model that increases accuracy beyond that offered by the other AMB-design software.  
Derived from text

*Computer Programs; Magnetic Bearings; Computer Aided Design*

**20080048164** NASA Langley Research Center, Hampton, VA, USA

**Predicting Boundary-Layer Transition on Space-Shuttle Re-Entry**

Berry, Scott; Horvath, Tom; Merski, Ron; Liechty, Derek; Greene, Frank; Bibb, Karen; Buck, Greg; Hamilton, Harris; Weilmuenster, Jim; Campbell, Chuck; Bouslog, Stan; Kirk, Ben; Bourland, Garry; Cassady, Amy; Anderson, Brian; Reda, Dan; Reuther, James; Kinder, Gerry; Chao, Dennis; Hyatt, Jay; Barnwell, Maria; Wang, K. C.; Schneider, Steve; NASA Tech Briefs, September 2008; September 2008, pp. 52-53; In English; See also [20080048125](#); Original contains color illustrations  
Report No.(s): LAR-17337-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3198>

The BLT Prediction Tool ('BLT' signifies 'Boundary Layer Transition') is provided as part of the Damage Assessment Team analysis package, which is utilized for analyzing local aerothermodynamics environments of damaged or repaired space-shuttle thermal protection tiles. Such analyses are helpful in deciding whether to repair launch-induced damage before re-entering the terrestrial atmosphere.

Derived from text

*Aerothermodynamics; Boundary Layer Transition; Damage Assessment; Computer Programs; Space Shuttle Orbiters*

**20080048169** H and R Technical Associates, Inc., USA

**Computational Simulation of a Water-Cooled Heat Pump**

Bozarth, Duane; NASA Tech Briefs, September 2008; September 2008, pp. 49; In English; See also [20080048125](#)  
Report No.(s): MSC-23375-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3192>

A Fortran-language computer program for simulating the operation of a water-cooled vapor-compression heat pump in any orientation with respect to gravity has been developed by modifying a prior general-purpose heat-pump design code used at Oak Ridge National Laboratory (ORNL).

Derived from text

*Applications Programs (Computers); Heat Pumps; Computerized Simulation*

**20080048172** California Inst. of Tech., Pasadena, CA, USA

**Automated Camera Array Fine Calibration**

Clouse, Daniel; Padgett, Curtis; Ansar, Adnan; Cheng, Yang; NASA Tech Briefs, September 2008; September 2008, pp. 54; In English; See also [20080048125](#)

Report No.(s): NPO-45505; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3202>

Using aerial imagery, the JPL FineCalibration (JPL FineCal) software automatically tunes a set of existing CAHVOR camera models for an array of cameras. The software finds matching features in the overlap region between images from adjacent cameras, and uses these features to refine the camera models. It is not necessary to take special imagery of a known target and no surveying is required. JPL FineCal was developed for use with an aerial, persistent surveillance platform.

Derived from text

*Aerial Photography; Calibrating; Cameras; Image Processing; Computer Programs*

**20080048173** California Inst. of Tech., Pasadena, CA, USA

**Rock Segmentation through Edge Regrouping**

Burl, Michael; NASA Tech Briefs, September 2008; September 2008, pp. 56-57; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): NPO-44417; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3210>

Rockster is an algorithm that automatically identifies the locations and boundaries of rocks imaged by the rover hazard cameras (hazcams), navigation cameras (navcams), or panoramic cameras (pancams). The software uses edge detection and

edge regrouping to identify closed contours that separate the rocks from the background.

Derived from text

*Algorithms; Edge Detection; Position (Location); Rocks; Imaging Techniques; Image Processing*

**20080048185** California Inst. of Tech., Pasadena, CA, USA

**Service-Oriented Architecture for NVO and TeraGrid Computing**

Jacob, Joseph; Miller, Craig; Williams, Roy; Steenberg, Conrad; Graham, Matthew; NASA Tech Briefs, September 2008; September 2008, pp. 63; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): NPO-45067; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3219>

The National Virtual Observatory (NVO) Extensible Secure Scalable Service Infrastructure (NESSSI) is a Web service architecture and software framework that enables Web-based astronomical data publishing and processing on grid computers such as the National Science Foundation's TeraGrid. Characteristics of this architecture include the following: (1) Services are created, managed, and upgraded by their developers, who are trusted users of computing platforms on which the services are deployed. (2) Service jobs can be initiated by means of Java or Python client programs run on a command line or with Web portals. (3) Access is granted within a graduated security scheme in which the size of a job that can be initiated depends on the level of authentication of the user.

Derived from text

*Client Server Systems; Service Oriented Architecture; Web Services; Grid Computing (Computer Networks)*

**20080048190** California Inst. of Tech., Pasadena, CA, USA

**Visual Target Tracking on the Mars Exploration Rovers**

Kim, Won; Biesiadecki, Jeffrey; Ali, Khaled; NASA Tech Briefs, September 2008; September 2008, pp. 60-61; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): NPO-45019; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3213>

Visual target tracking (VTT) software has been incorporated into Release 9.2 of the Mars Exploration Rover (MER) flight software, now running aboard the rovers Spirit and Opportunity. In the VTT operation (see figure), the rover is driven in short steps between stops and, at each stop, still images are acquired by actively aimed navigation cameras (navcams) on a mast on the rover (see artistic rendition). The VTT software processes the digitized navcam images so as to track a target reliably and to make it possible to approach the target accurately to within a few centimeters over a 10-m traverse.

Derived from text

*Applications Programs (Computers); Mars Roving Vehicles; Roving Vehicles; Photographic Tracking; Tracking (Position); Automatic Control*

**20080048207** California Inst. of Tech., Pasadena, CA, USA

**Enhanced Reporting of Mars Exploration Rover Telemetry**

Maimone, Mark W.; Biesiadecki, Jeffrey J.; Liebersbach, Robert T.; Carsten, Joseph L.; Leger, Chris; NASA Tech Briefs, September 2008; September 2008, pp. 64; In English; See also [20080048125](#); Original contains color and black and white illustrations

Report No.(s): NPO-45366; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/content/view/3217/34/>

Mars Exploration Rover Enhanced Telemetry Extraction and Reporting System (METERS) is software that generates a human-readable representation of the state of the mobility and arm-related systems of the Mars Exploration Rover (MER) vehicles on each Martian solar day (sol). Data are received from the MER spacecraft in multiple streams having various formats including text messages, sparsely-sampled engineering quantities, images, and individual motor-command histories.

Derived from text

*Mars (Planet); Telemetry; Roving Vehicles; Computer Programs; Trajectory Planning*

**20080048399** Air Univ., Maxwell AFB, AL USA

**Terrorism and Cybercrime**

Chargualaf, Jr, Joseph; May 2008; 37 pp.; In English

Report No.(s): AD-A489730; AU/ACSC/CHARGUALA/AY08; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489730>

Since 11 Sep 02, and the beginning of the declared U.S. War on Terror, modern terrorists increasingly rely on the Internet to conduct daily operations. They can no longer openly conduct meetings, recruit new members, train, and raise funds without the threat of U.S. attack. They were forced to adapt and have since successfully leveraged Internet capabilities to carry out their missions. They have proven their skills in spreading propaganda to shape public opinion and gain support from sympathizers. However, what is not as well publicized is their use of the Internet to conduct cybercrimes such as identity theft and credit card fraud for the express intent of raising funds in support of terrorist activities. The U.S. must adapt to these techniques and develop counter-measures with the same level of effort as when they froze assets in large financial institutions believed to belong to terrorists and their supporters. The methodology utilized for this research paper is Problem/Solution. The problem is identified through the research and analysis of numerous periodicals and online articles. The solution is sought by interpreting legal documents, analyzing the roles of responsible organizations, exploring Internet technologies, and understanding ideologies leading to the establishment of terrorist organizations.

DTIC

*Computer Information Security; Crime; Terrorism*

**63**

**CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS**

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also *54 Man/System Technology and Life Support*.

**20080047822** Air Force Research Lab., Mesa, AZ USA

**Mechanisms for Human Spatial Competence**

Gunzelmann, Glenn; Lyon, Don R; Jan 2007; 21 pp.; In English

Contract(s)/Grant(s): 02HE01COR; Proj-1123

Report No.(s): AD-A489520; AFRL-RH-AZ-BC-2007-0001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Research spanning decades has generated a long list of phenomena associated with human spatial information processing. Additionally, a number of theories have been proposed about the representation, organization, and processing of spatial information by humans. This paper presents a broad account of human spatial competence, integrated with the ACT-R cognitive architecture. Using a cognitive architecture grounds the research in a validated theory of human cognition, enhancing the plausibility of the overall account. This work posits a close link of aspects of spatial information processing to vision and motor planning, and integrates theoretical perspectives that have been proposed over the history of research in this area. In addition, the account is supported by evidence from neuropsychological investigations of human spatial ability. The mechanisms provide a means of accounting for a broad range of phenomena described in the experimental literature.

DTIC

*Cognition; Human Performance; Information*

**20080047985** California Inst. of Tech., Pasadena, CA, USA

**XML-Based SHINE Knowledge Base Interchange Language**

James, Mark; Mackey, Ryan; Tikidjian, Raffi; NASA Tech Briefs, October 2008; October 2008, pp. 19; In English; See also [20080047981](http://www.techbriefs.com/component/content/article/3274)

Report No.(s): NPO-44546; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3274>

The SHINE Knowledge Base Interchange Language software has been designed to more efficiently send new knowledge bases to spacecraft that have been embedded with the Spacecraft Health Inference Engine (SHINE) tool. The intention of the behavioral model is to capture most of the information generally associated with a spacecraft functional model, while



specifically addressing the needs of execution within SHINE and Livingstone. As such, it has some constructs that are based on one or the other.

Derived from text

*Knowledge Based Systems; Data Systems; Data Processing; Artificial Intelligence; Document Markup Languages*

**20080047989** California Inst. of Tech., Pasadena, CA, USA

**Object Recognition using Feature- and Color-Based Methods**

Duong, Tuan; Duong, Vu; Stubberud, Allen; NASA Tech Briefs, October 2008; October 2008, pp. 32-33; In English; See also [20080047981](#); Original contains color illustrations

Report No.(s): NPO-41370; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/content/view/3308/34/>

An improved adaptive method of processing image data in an artificial neural network has been developed to enable automated, real-time recognition of possibly moving objects under changing (including suddenly changing) conditions of illumination and perspective. The method involves a combination of two prior object-recognition methods one based on adaptive detection of shape features and one based on adaptive color segmentation to enable recognition in situations in which either prior method by itself may be inadequate. The chosen prior feature-based method is known as adaptive principal-component analysis (APCA); the chosen prior color-based method is known as adaptive color segmentation (ACOSE). These methods are made to interact with each other in a closed-loop system to obtain an optimal solution of the object-recognition problem in a dynamic environment. One of the results of the interaction is to increase, beyond what would otherwise be possible, the accuracy of the determination of a region of interest (containing an object that one seeks to recognize) within an image. Another result is to provide a minimized adaptive step that can be used to update the results obtained by the two component methods when changes of color and apparent shape occur. The net effect is to enable the neural network to update its recognition output and improve its recognition capability via an adaptive learning sequence. In principle, the improved method could readily be implemented in integrated circuitry to make a compact, low-power, real-time object-recognition system. It has been proposed to demonstrate the feasibility of such a system by integrating a 256-by-256 active-pixel sensor with APCA, ACOSE, and neural processing circuitry on a single chip. It has been estimated that such a system on a chip would have a volume no larger than a few cubic centimeters, could operate at a rate as high as 1,000 frames per second, and would consume in the order of milliwatts of power.

Author

*Pattern Recognition; Image Processing; Shapes; Color; Neural Nets; Artificial Intelligence*

**20080048021** California Inst. of Tech., Pasadena, CA, USA

**Control Architecture for Robotic Agent Command and Sensing**

Huntsberger, Terrance; Aghazarian, Hrand; Estlin, Tara; Gaines, Daniel; NASA Tech Briefs, October 2008; October 2008, pp. 5; In English; See also [20080047981](#); Original contains color illustrations

Report No.(s): NPO-43635; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3251>

Control Architecture for Robotic Agent Command and Sensing (CARACaS) is a recent product of a continuing effort to develop architectures for controlling either a single autonomous robotic vehicle or multiple cooperating but otherwise autonomous robotic vehicles. CARACaS is potentially applicable to diverse robotic systems that could include aircraft, spacecraft, ground vehicles, surface water vessels, and/or underwater vessels. CARACaS includes an integral combination of three coupled agents: a dynamic planning engine, a behavior engine, and a perception engine. The perception and dynamic planning engines are also coupled with a memory in the form of a world model. CARACaS is intended to satisfy the need for two major capabilities essential for proper functioning of an autonomous robotic system: a capability for deterministic reaction to unanticipated occurrences and a capability for re-planning in the face of changing goals, conditions, or resources. The behavior engine incorporates the multi-agent control architecture, called CAMPOUT, described in An Architecture for Controlling Multiple Robots (NPO-30345), NASA Tech Briefs, Vol. 28, No. 11 (November 2004), page 65. CAMPOUT is used to develop behavior-composition and -coordination mechanisms. Real-time process algebra operators are used to compose a behavior network for any given mission scenario. These operators afford a capability for producing a formally correct kernel of behaviors that guarantee predictable performance. By use of a method based on multi-objective decision theory (MODT), recommendations from multiple behaviors are combined to form a set of control actions that represents their consensus. In this approach, all behaviors contribute simultaneously to the control of the robotic system in a cooperative rather than a competitive manner. This approach guarantees a solution that is good enough with respect to resolution of complex,

possibly conflicting goals within the constraints of the mission to be accomplished by the vehicle(s).

Derived from text

*Robotics; Architecture (Computers); Software Engineering; Command and Control*

**20080048156** California Inst. of Tech., Pasadena, CA, USA

**Microgravity, Mesh-Crawling Legged Robots**

Behar, Alberto; Marzwell, Neville; Matthews, Jaret; Richardson, Krandalyn; Wall, Jonathan; Poole, Michael; Foor, David; Rodgers, Damian; NASA Tech Briefs, September 2008; September 2008, pp. 21; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): NPO-42672; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3137>

The design, fabrication, and microgravity flight-testing are part of a continuing development of palm-sized mobile robots that resemble spiders (except that they have six legs apiece, whereas a spider has eight legs). Denoted SpiderBots (see figure), they are prototypes of proposed product line of relatively inexpensive walking robots that could be deployed in large numbers to function cooperatively in construction, repair, exploration, search, and rescue activities in connection with exploration of outer space and remote planets.

Author

*Fabrication; Robots; Walking; Mesh*

**20080048423** New Jersey Inst. of Tech., Newark, NJ USA

**High Resolution Krylov Space 3-D Wavenumber-Frequency Analysis**

Ge, Hongya; Kirsteins, Ivars P; Apr 2007; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489848; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489848>

Driven by the need for identifying the presence of flow noise components in a towed volumetric acoustic array, methodologies are developed for high resolution 3-dimensional (3-D) wavenumber-frequency (k-f) analysis based on Krylov space techniques. These methods are applied to actual noise data from a sea trial. The experimental results indicate that the Krylov-based method outperforms conventional approaches and provides efficient and effective solutions to k-f analysis.

DTIC

*Flow Noise; Frequencies; High Resolution; Signal Processing; Sonar*

**20080048473** Defense Energy Support Center, Fort Belvoir, VA USA

**Innovating the Federal Acquisition Process through Intelligent Agents**

Fowler, David N; Nissen, Mark E; Jan 2001; 17 pp.; In English

Report No.(s): AD-A488462; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Information technology (IT) developments are helping to improve many processes -- defense acquisition being one of them. One acquisition reform initiative is to increase efficiency through leveraging standardized IT applications such as the Standard Procurement System (SPS). Benefits to date have been only marginal, however, one reason being that their implementation was accomplished without first redesigning the existing inefficient process. This article examines opportunities for innovation in the federal acquisition process, focusing specifically on intelligent agent (IA) technologies that offer potential for order-of-magnitude gains in terms of performance.

DTIC

*Commerce; Contract Management; Government Procurement; Knowledge Based Systems; Management Planning; Standardization*

**20080048477** Oregon State Univ., Corvallis, OR USA

**Multi-Channel Parametric Estimator Fast Block Matrix Inverses**

Marple, Jr , S L; Corbell, Phillip M; Rangaswamy, Muralidhar; Apr 2007; 5 pp.; In English

Contract(s)/Grant(s): Proj-2304

Report No.(s): AD-A489899; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The optimal (adaptive) linear combiner (beamformer) weights for a sensor array are expressed in terms of the inverse of the multi-channel (MC) covariance matrix. Rather than form an estimate of the covariance matrix directly from the available data and inverting it, an alternative direct estimate of the inverse may be obtained by forming parametric MC linear prediction

estimates and then expressing the inverse in terms of these parametric MC estimates. The resulting parametric estimate of the inverse is typically more accurate than inverting the estimate of the covariance matrix. This paper reveals, for the first time, the structure of the inverse of the covariance matrix for the MC version of the covariance least squares linear prediction algorithm. The inverse structure involves products of triangular block MC Toeplitz matrices, which leads to fast computational solutions for the optimal weights.

DTIC

*Estimates; Independent Variables; Inversions*

**20080048538** Air Force Research Lab., Rome, NY USA

**Experimental Results for a Photonic Time Reversal Processor for Adaptive Control of an Ultra Wideband Phased Array Antenna**

Zmuda, Henry; Fanto, Michael; McEwen, Thomas; Mar 2008; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-AWGD

Report No.(s): AD-A490215; AFRL-RY-RS-TP-2008-10; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The process does not require analog to digital conversion to implement and is therefore particularly suited for high bandwidth applications. Significantly, propagation distortion due to atmospheric effects, clutter, etc. is automatically accounted for with the time reversal process. The approach utilizes the reflection of an initial interrogation signal from off an extended target to precisely time match the radiating elements of the array so as to re-radiate signals precisely back to the target's location. The backscattered signal(s) from the desired location is captured by each antenna and used to modulate a pulsed laser. An electrooptic switch acts as a time gate to eliminate any unwanted signals such as those reflected from other targets whose range is different from that of the desired location resulting in a spatial null at that location.

DTIC

*Adaptive Control; Antenna Arrays; Broadband; Phased Arrays; Photonics*

**20080048543** Army Cold Regions Research and Engineering Lab., Hanover, NH USA

**Demonstration of Remotely Operated Vehicles to Aid Underwater Inspection of Corps of Engineers Navigation Structures. Winfield Locks and Dam 13-17 August 2007**

Lever, James H; Phetteplace, Gary E; Sep 2008; 36 pp.; In English; Original contains color illustrations

Report No.(s): AD-A490244; ERDC/CRREL-TR-08-15; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We organized a demonstration of remotely operated vehicles (ROVs) at Winfield Locks and Dam to assess their merits to aid underwater inspections at U.S. Army Corps of Engineers navigation facilities. The demo was informative, not competitive, with tasks varying according to concurrent diver-based inspections. The demo illustrated that commercially available ROVs can significantly aid divers, not replace them, in conducting underwater inspections. ROVs increase safety whenever their use precludes the need for divers and through pre-dive reconnaissance when dives are unavoidable. They also offer shorter mobilization, easier access to confined areas, and permanent visual inspections records. When gates are closed, ROVs can work safely within the turbulent leakage flow in stilling basins and could in principle be used to investigate leaky valves and gates with no risks to divers. Learning curves for the systems demonstrated were shortened by the divers' exceptional knowledge of the underwater terrain and components to be inspected. Sonar was essential to navigate the ROVs in the low-visibility conditions, and the imaging sonar's quasi-3D images made precision navigation easier. The costs of ROV systems are modest in relation to capital equipment common at locks and dams, and pale in comparison to the expense of unplanned maintenance arising from insufficient inspection coverage.

DTIC

*Dams; Engineers; Inspection; Navigation; Robots; Sonar; Underwater Vehicles*

## NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

**20080047408** NASA Goddard Space Flight Center, Greenbelt, MD, USA

### **Parameter Estimation using Numerical Merger Waveforms**

Thorpe, J. I.; McWilliams, S.; Kelly, B.; Fahey, R.; Arnaud, K.; Baker, J.; June 16, 2008; 15 pp.; In English; 7th International LISA Symposium/Space Sciences Institute of Catalonia, 16-20 Jun. 2008, Barcelona, Spain; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNH06CC03B; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047408>

Results: Developed parameter estimation model integrating complete waveforms and improved instrumental models. Initial results for equal-mass non-spinning systems indicate moderate improvement in most parameters, significant improvement in some Near-term improvement: a) Improved statistics; b) T-channel; c) Larger parameter space coverage. Combination with other results: a) Higher harmonics; b) Spin precession; c) Instrumental effects.

Derived from text

*Parameter Identification; Waveforms; Estimating*

**20080047480** Naval Postgraduate School, Monterey, CA USA

### **Path Optimization for Single and Multiple Searchers: Models and Algorithms**

Sato, Hiroyuki; Sep 2008; 141 pp.; In English

Report No.(s): AD-A488991; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA488991>

We develop models and solution methodologies to solve the discrete-time path-optimization problem where a single or multiple searchers look for a moving target in a finite set of cells. The single searcher is constrained by maximum limits on the consumption of several resources such as time, fuel, and risk along any path. We develop a specialized branch-and-bound algorithm for this problem that utilizes several new network reduction procedures as well as new bounding technique based on Lagrangian relaxation and network expansion. The resulting algorithm is quite efficient and promising. For the multiple searchers, an optimal set of paths (search plan) is determined by taking advantage of the cooperative search effect. We present a new exact algorithm and two new heuristics to find an optimal or near-optimal search plan. One of the heuristics is based on the cross-entropy method and is found to perform well for a broad range of problem instances. The exact algorithm deals with the specific case of homogeneous searchers and is based on outer approximations by several new cutting planes. In addition, we prove that under certain assumptions the path-optimization problem becomes equivalent to a large-scale linear mixed-integer program.

DTIC

*Algorithms; Trajectory Optimization*

**20080047482** Massachusetts Inst. of Tech., Cambridge, MA USA

### **Model Reduction for Dynamic Sensor Steering: A Bayesian Approach to Inverse Problems**

Wogrin, Sonja; Jun 2008; 102 pp.; In English

Report No.(s): AD-A488998; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA488998>

In many settings, distributed sensors provide dynamic measurements over a specified time horizon that can be used to reconstruct information such as parameters, states or initial conditions. This estimation task can be posed formally as an inverse problem: given a model and a set of measurements, estimate the parameters of interest. We consider the specific problem of computing in real-time the prediction of a contamination event, based on measurements obtained by mobile sensors. The spread of the contamination is modeled by the convection diffusion equation. A Bayesian approach to the inverse problem yields an estimate of the probability density function of the initial contaminant concentration, which can then be propagated through the forward model to determine the predicted contaminant field at some future time and its associated uncertainty distribution. Sensor steering is effected by formulating and solving an optimization problem that seeks the sensor locations that minimize the uncertainty in this prediction. An important aspect of this Dynamic Sensor Steering Algorithm is the ability to execute in real-time. We achieve this through reduced-order modeling, which (for our two-dimensional examples) yields models that can be solved two orders of magnitude faster than the original system, but only incur average

relative errors of magnitude. The methodology is demonstrated on the contaminant transport problem, but is applicable to a broad class of problems where we wish to observe certain phenomena whose location or features are not known a priori.

DTIC

*Bayes Theorem; Models; Steering*

**20080047521** Yale Univ., New Haven, CT USA

**On the Inverse Scattering Problem in the Acoustic Environment**

Duan, Ran; Rokhlin, Vladimir; Mar 3, 2008; 65 pp.; In English

Contract(s)/Grant(s): N00014-07-1-0711; FA9550-06-1-0239

Report No.(s): AD-A489358; YALEU/DCS/TR-1395; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489358>

In this report, we construct numerical algorithms for the solution of inverse scattering problems in layered acoustic media. Our inverse scattering schemes are based on a collection of so-called trace formulae, and can be viewed as extension of the work started in [3].

DTIC

*Acoustics; Inverse Scattering*

**20080047795** Advatech Pacific, Inc., Palmdale, CA USA

**A Numerical Approach to Solving the Hall MHD Equations Including Diamagnetic Drift**

Loverich, J; Cambier, J-L; Feb 19, 2008; 21 pp.; In English

Contract(s)/Grant(s): FA9300-06-D-0002-0003

Report No.(s): AD-A489574; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper a second order discontinuous Galerkin method for the Hall MHD equations including diamagnetic drift is developed. The equations are formulated in gas dynamic conservative form and tested on the Brio and Wu MHD shock as well as the GEM challenge magnetic reconnection problem. Solutions compare well with previously published results. The algorithm is easily extended to general geometries.

DTIC

*Algorithms; Diamagnetism; Hall Effect; Magnetohydrodynamics*

**20080048003** California Inst. of Tech., Pasadena, CA, USA

**Algorithm for Wavefront Sensing Using an Extended Scene**

Sidick, Erkin; Green, Joseph; Ohara, Catherine; NASA Tech Briefs, October 2008; October 2008, pp. 6; In English; See also [20080047981](http://www.techbriefs.com/component/content/article/3264)

Report No.(s): NPO-44770; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3264>

A recently conceived algorithm for processing image data acquired by a Shack-Hartmann (SH) wavefront sensor is not subject to the restriction, previously applicable in SH wavefront sensing, that the image be formed from a distant star or other equivalent of a point light source. That is to say, the image could be of an extended scene. (One still has the option of using a point source.) The algorithm can be implemented in commercially available software on ordinary computers. The steps of the algorithm are the following: 1. Suppose that the image comprises  $M$  sub-images. Determine the  $x,y$  Cartesian coordinates of the centers of these sub-images and store them in a  $2 \times M$  matrix. 2. Within each sub-image, choose an  $N \times N$ -pixel cell centered at the coordinates determined in step 1. For the  $i$ th sub-image, let this cell be denoted as  $s_i(x,y)$ . Let the cell of another subimage (preferably near the center of the whole extended-scene image) be designated a reference cell, denoted  $r(x,y)$ . 3. Calculate the fast Fourier transforms of the sub-sub-images in the central  $N \times N$  portions (where  $N < N$  and both are preferably powers of 2) of  $r(x,y)$  and  $s_i(x,y)$ . 4. Multiply the two transforms to obtain a cross-correlation function  $C_i(u,v)$ , in the Fourier domain. Then let the phase of  $C_i(u,v)$  constitute a phase function,  $\phi_i(u,v)$ . 5. Fit  $u$  and  $v$  slopes to  $\phi_i(u,v)$  over a small  $u,v$  subdomain. 6. Compute the fast Fourier transform,  $S_i(u,v)$  of the full  $N \times N$  cell  $s_i(x,y)$ . Multiply this transform by the  $u$  and  $v$  slopes obtained in step 4. Then compute the inverse fast Fourier transform of the product. 7. Repeat steps 4 through 6 in an iteration loop, cumulating the  $u$  and  $v$  slopes, until a maximum iteration number is reached or the change in image shift becomes smaller than a predetermined tolerance. 8. Repeat steps 4 through 7 for the cells of all other sub-images.

Author

*Algorithms; Iteration; Wave Fronts; Detection; Point Sources*

**20080048068** NASA Ames Research Center, Moffett Field, CA, USA

**Efficient Evaluation Functions for Evolving Coordination**

Agogino, Adrian; Tumer, Kagan; [2006]; 11 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

This paper presents a method for creating evaluation functions that efficiently promote coordination in a multi-agent system, allowing single-agent evolutionary computation techniques to be extended to multi-agent domains. While this problem can be addressed directly by treating the entire multi-agent system as a large single agent, the search space is prohibitively large in most cases. Instead, the proposed method focuses on having each agent use its own evolutionary computation method to maximize its own evaluation function. There are two fundamental issues in this approach: 1) how to create an evaluation function for an agent that is aligned with the global evaluation function and 2) how to create an evaluation function that is sensitive to the fitness changes of the agent, while relatively insensitive to the fitness changes of other agents. If the first issue is not addressed, the evolved agents will not coordinate well. If the second issue is not addressed, the collective evolutionary process will be inefficient and the system will be slow to converge to good solutions. This paper shows how to construct evaluation functions that resolve these issues in dynamic, noisy and communication-limited multi-agent environments. On a rover coordination problem, a control policy evolved using aligned and member-sensitive evaluations outperforms global evaluation methods by up to 400%. More notably, in the presence of a larger number of rovers or rovers with noisy and communication limited sensors, the proposed method outperforms global evaluation by a higher number than in noise-free conditions with a small number of rovers.

Author

*Game Theory; Complex Systems; Controllers; Coordination; Computation; Genetic Algorithms*

**20080048488** Woods Hole Oceanographic Inst., MA USA

**Sparse Bayesian Information Filters for Localization and Mapping**

Walter, Matthew R; Feb 2008; 171 pp.; In English

Report No.(s): AD-A489937; MIT/WHOI-2008-12; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis formulates an estimation framework for Simultaneous Localization and Mapping (SLAM) that addresses the problem of scalability in large environments. We describe an estimation-theoretic algorithm that achieves significant gains in computational efficiency while maintaining consistent estimates for the vehicle pose and the map of the environment. The thesis takes a Bayesian approach whereby we maintain a joint posterior over the vehicle pose and feature states, conditioned upon measurement data. We model the distribution as Gaussian and parametrize the posterior in the canonical form. This thesis proposes an alternative scalable filter that maintains sparsity while preserving the consistency of the distribution. We leverage insights into the natural structure of the feature-based canonical parametrization and derive a method that actively maintains an exactly sparse posterior. The thesis concludes with an extension of our SLAM filter to a complex underwater environment. We describe a systems-level framework for localization and mapping relative to a ship hull with an Autonomous Underwater Vehicle (AUV) equipped with a forward-looking sonar. The approach utilizes our filter to fuse measurements of vehicle attitude and motion from onboard sensors with data from sonar images of the hull. We employ the system to perform three-dimensional, 6- DOF SLAM on a ship hull.

DTIC

*Bayes Theorem; Mapping; Position (Location)*

65

**STATISTICS AND PROBABILITY**

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

**20080047258** Bureau of the Census, Washington, DC, USA

**Geographic Distribution and Characteristics of Older Workers in Minnesota: 2004. Local Employment Dynamics**

Taeuber, C.; Graham, M. R.; Oct. 2008; 12 pp.; In English

Report No.(s): PB2009-101902; LED-OW04-MN; No Copyright; Avail.: National Technical Information Service (NTIS)

The statistics about older workers in Minnesota in 2004 show this groups proportion of the states labor force has increased. Changes in the size and composition of age groups may affect government program and policy choices and the options available to businesses. National projections indicate that the population 65 and older will increase from about 1 in 8 people to 1 in 5 people by 2030, so that older workers will likely compose an increasingly larger proportion of each states workforce. Whether, and in what industries, the large wave of workers born during the Baby Boom of 1946 to 1964 are

currently working may influence their labor force behavior beyond traditional retirement ages. That is important information for firms planning for the eventual loss of experienced workers and the payout of pensions. In 2004, the Baby Boom cohort was aged 40 to 58. This report uses data from the Local Employment Dynamics (LED) program to show the geographic distribution and the economic dynamics among private sector workers 55 and older (also including some statistics on those aged 45 to 54). It includes comparisons among the counties (and county equivalents) and between metropolitan and nonmetropolitan areas of Minnesota.

NTIS

*Age Factor; Geographic Distribution; Personnel*

**20080047276** Bureau of the Census, Washington, DC, USA

**Geographic Distribution and Characteristics of Older Workers in Pennsylvania: 2004. Local Employment Dynamics**

Taeuber, C.; Graham, M. R.; Oct. 2008; 12 pp.; In English

Report No.(s): PB2009-101903; LED-OW04-PA; No Copyright; Avail.: National Technical Information Service (NTIS)

The statistics about older workers in Pennsylvania in 2004 show this groups proportion of the states labor force has increased. Changes in the size and composition of age groups may affect government program and policy choices and the options available to businesses. National projections indicate that the population 65 and older will increase from about 1 in 8 people to 1 in 5 people by 2030, so that older workers will likely compose an increasingly larger proportion of each states workforce. Whether, and in what industries, the large wave of workers born during the Baby Boom of 1946 to 1964 are currently working may influence their labor force behavior beyond traditional retirement ages. That is important information for firms planning for the eventual loss of experienced workers and the payout of pensions. In 2004, the Baby Boom cohort was aged 40 to 58. This report uses data from the Local Employment Dynamics (LED) program to show the geographic distribution and the economic dynamics among private sector workers 55 and older (also including some statistics on those aged 45 to 54). It includes comparisons among the counties (and county equivalents) and between metropolitan and nonmetropolitan areas of Pennsylvania.

NTIS

*Age Factor; Geographic Distribution; Personnel*

**20080047296** Bureau of the Census, Washington, DC, USA

**Geographic Distribution and Characteristics of Older Workers in Virginia: 2004. Local Employment Dynamics**

Taeuber, C.; Graham, M. R.; Nov. 2008; 12 pp.; In English

Report No.(s): PB2009-101904; LED-OW04-VA; No Copyright; Avail.: National Technical Information Service (NTIS)

The statistics about older workers in Virginia in 2004 show this groups proportion of the states labor force has increased. Changes in the size and composition of age groups may affect government program and policy choices and the options available to businesses. National projections indicate that the population 65 and older will increase from about 1 in 8 people to 1 in 5 people by 2030, so that older workers will likely compose an increasingly larger proportion of each states workforce. Whether, and in what industries, the large wave of workers born during the Baby Boom of 1946 to 1964 are currently working may influence their labor force behavior beyond traditional retirement ages. That is important information for firms planning for the eventual loss of experienced workers and the payout of pensions. In 2004, the Baby Boom cohort was aged 40 to 58. This report uses data from the Local Employment Dynamics (LED) program to show the geographic distribution and the economic dynamics among private sector workers 55 and older (also including some statistics on those aged 45 to 54). It includes comparisons among the counties (and county equivalents) and between metropolitan and nonmetropolitan areas of Virginia.

NTIS

*Age Factor; Geographic Distribution; Personnel*

**20080047377** Geological Survey, Reston, VA USA

**Mobility Statistics and Automated Hazard Mapping for Debris Flows and Rock Avalanches**

Griswold, J. P.; Iverson, R. M.; January 2007; 68 pp.; In English

Report No.(s): PB2009-101396; USGS/SIR-2007-5276; No Copyright; Avail.: National Technical Information Service (NTIS)

Power-law equations that are physically motivated and statistically tested and calibrated provide a basis for forecasting areas likely to be inundated by debris flows, rock avalanches, and lahars with diverse volumes. The equations  $A=a1V^{2/3}$  and  $B=a2V^{2/3}$  are based on the postulate that the maximum valley cross-sectional area (A) and total valley planimetric area (B)

likely to be inundated by a flow depend only on its volume (V) and the topography of the flow path. Testing of these equations involves determining whether or not they fit data for documented flows satisfactorily, and calibration entails determining best-fit values of the coefficients  $a_1$  and  $a_2$  for debris flows, rock avalanches, and lahars. This report describes statistical testing and calibration of the equations by using field data compiled from many sources, and it describes application of the equations to delineation of debris-flow hazard zones. Statistical results show that for each type of flow (debris flows, rock avalanches, and lahars), the dependence of A and B on V is described well by power laws with exponents equal to  $2/3$ . This value of the exponent produces fits that are effectively indistinguishable from the best fits obtained by using adjustable power-law exponents. Statistically calibrated values of the coefficients  $a_1$  and  $a_2$  provide scale-invariant indices of the relative mobilities of rock avalanches ( $a_1 = 0.2$ ,  $a_2 = 20$ ), nonvolcanic debris flows ( $a_1 = 0.1$ ,  $a_2 = 20$ ), and lahars ( $a_1 = 0.05$ ,  $a_2 = 200$ ). These values show, for example, that a lahar of specified volume can be expected to inundate a planimetric area ten times larger than that inundated by a rock avalanche or nonvolcanic debris flow of the same volume. The utility of the calibrated debris-flow inundation equations  $A=0.1V^{2/3}$  and  $B=20V^{2/3}$  is demonstrated by using them within the GIS program LAHARZ to delineate nested hazard zones for future debris flows in an area bordering the Umpqua River in the south-central Oregon Coast Range. This application requires use of high-resolution topographic data derived from LIDAR surveys, knowledge of local geology to specify a suitable range of prospective debris-flow volumes, and development and use of a new algorithm for identification of prospective debris-flow source areas in finely dissected terrain.

NTIS

*Avalanches; Computer Aided Mapping; Debris; Hazards; Mobility; Rocks*

**20080047474** Center for Mathematics and Computer Science, Amsterdam, Netherlands

#### **Modeling of Genetic Algorithms with a Finite Population**

Van Kemenade, C. H. M.; Dec. 31, 1997; 30 pp.; In English

Report No.(s): PB2009-102326; SEN-R9725; Copyright; Avail.: National Technical Information Service (NTIS)

Cross-competition between non-overlapping building blocks can strongly influence the performance of evolutionary algorithms. The choice of the selection scheme can have a strong influence on the performance of a genetic algorithm. This paper describes a number of different genetic algorithms, all involving elitism. Infinite population models are presented for each of these algorithms. A problem involving cross-competition is introduced and we show how we can make use of equivalence-classes to make an efficient tracing of the transmission-function models possible on this type of problems. By adding a small extension to the models it is possible to predict the qualitative behavior of finite population genetic algorithms on this type of problems also. Using this model the reliability of the different genetic algorithms and the influence of population sizing on the reliability is investigated.

NTIS

*Genetic Algorithms; Populations*

**20080047520** Army Concepts Analysis Agency, Bethesda, MD USA

#### **STOCCEM Investigation of COSAGE Sampling (SICS)**

Bauman, Walter J; Aug 1997; 73 pp.; In English

Report No.(s): AD-A489349; CAA-MR-97-43; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489349>

The Stochastic Concepts Evaluation Model (STOCCEM) is a fully automated simulation of theater combat applied by the US Army Concepts Analysis Agency. The STOCCEM was designed as a stochastic version of the deterministic Concepts Evaluation Model 1X (CEM 1X). The STOCCEM uses weapons effectiveness data, denoted as combat samples, which are preprocessed by the Combat Sample Generator (COSAGE) simulation. In the SICS analysis, STOCCEM case variations are constructed, using a single scenario, with an objective of reducing divergence from deterministic CEM, and of increasing variability of STOCCEM results over replications. The STOCCEM case variations are constructed by varying the ways that COSAGE combat samples are used in STOCCEM, and by varying the types of combat processes represented stochastically in STOCCEM. For each case variant, assessment is made of STOCCEM divergence from deterministic CEM, and of variability of STOCCEM results over replications. Closeness of STOCCEM results to historical results is also assessed for selected cases. The principal finding is that the preferred method for applying STOCCEM is to deactivate the stochastic FEBA move rate process and to apply a single randomly selected (in each replication) set of COSAGE samples to all simulated battles in a replication.

DTIC

*Computerized Simulation; Sampling; Stochastic Processes*



**20080047522** Yale Univ., New Haven, CT USA

**High-Order Quadratures for the Solution of Scattering Problems in Two Dimensions**

Duan, Ran; Rokhlin, Vladimir; Apr 22, 2008; 36 pp.; In English

Contract(s)/Grant(s): N00014-07-1-0711; FA9550-06-1-0239

Report No.(s): AD-A489360; YALEU/DCS/TR-1401; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489360>

We construct an iterative algorithm for the solution of forward scattering problems in two dimensions. The scheme is based on the combination of high-order quadrature formulae, fast application of integral operators in Lippmann-Schwinger equations, and the stabilized biconjugate gradient method (BI-CGSTAB). While the FFT-based fast application of integral operators and the BI-CGSTAB for the solution of linear systems are fairly standard, a large part of this paper is devoted to constructing a class of high-order quadrature formulae applicable to a wide range of singular functions in two and three dimensions; these are used to obtain rapidly convergent discretizations of Lippmann-Schwinger equations. The performance of the algorithm is illustrated with several numerical examples.

DTIC

*Quadratures; Scattering*

**20080047586** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Inference for Distributions over the Permutation Group**

Huang, Jonathan; Guestrin, Carlos; Guibas, Leonidas; May 2008; 68 pp.; In English

Report No.(s): AD-A489517; CMU-ML-08-108; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Permutations are ubiquitous in many real-world problems, such as voting, ranking, and data association. Representing uncertainty over permutations is challenging, since there are 'n' possibilities, and typical compact and factorized probability distribution representations, such as graphical models, cannot capture the mutual exclusivity constraints associated with permutations. In this paper, we use the 'low-frequency' terms of a Fourier decomposition to represent distributions over permutations compactly. We present Kronecker conditioning, a new general and efficient approach for maintaining and updating these distributions directly in the Fourier domain. Low order Fourier-based approximations, however, may lead to functions that do not correspond to valid distributions. To address this problem, we present an efficient quadratic program defined directly in the Fourier domain for projecting the approximation onto a relaxation of the polytope of legal marginal distributions. We demonstrate the effectiveness of our approach on a real camera-based multi-person tracking scenario.

DTIC

*Identities; Inference; Permutations; Probability Distribution Functions*

**20080048200** ASRC Aerospace Corp., USA

**Monte Carlo Simulation to Estimate Likelihood of Direct Lightning Strikes**

Mata, Carlos; Medelius, Pedro; NASA Tech Briefs, September 2008; September 2008, pp. 50-51; In English; See also [20080048125](#)

Report No.(s): KSC-12882; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3196>

A software tool has been designed to quantify the lightning exposure at launch sites of the stack at the pads under different configurations. In order to predict lightning strikes to generic structures, this model uses leaders whose origins (in the x-y plane) are obtained from a 2D random, normal distribution.

Derived from text

*Lightning; Monte Carlo Method; Simulation; Maximum Likelihood Estimates*

**20080048420** Bucknell Univ., Lewisburg, PA USA

**Classification VIA Information-Theoretic Fusion of Vector-Magnetic and Acoustic Sensor Data**

Kozick, Richard J; Sadler, Brian M; Apr 2007; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489841; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489841>

We present a general approach for multi-modal sensor fusion based on nonparametric probability density estimation and maximization of a mutual information criterion. We apply this approach to fusion of vector-magnetic and acoustic data for classification of vehicles. Linear features are used, although the approach may be applied more generally with other sensor modalities, nonlinear features, and other classification targets. For the magnetic data, we present a parametric model with

computationally efficient parameter estimation. Experimental results are provided illustrating the effectiveness of a classifier that discriminates between cars and sport utility vehicles.

DTIC

*Acoustics; Classifications; Information Theory; Magnetic Fields; Multisensor Fusion; Passengers; Pattern Recognition; Signal Detectors*

**20080048479** Logistics Management Inst., McLean, VA USA

**Blue SLAACM: A Stochastic Lanchester Air-to-Air Campaign Model for Blue Attack**

Eckhause, Jeremy; Hemm, Robert; Lee, David; Jun 2008; 24 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489913; No Copyright; Avail.: Defense Technical Information Center (DTIC)

SLAACM Summary: \*The Stochastic Lanchester Air-to-Air Campaign Model determines statistics of day-by-day attrition and destruction, for a two-sided campaign. -Each 'day' the attacking side launches its forces in optimal attack packages. -Defensive counter-air forces respond. Certain defender aircraft respond with optimal sets of defending flights, while others encounter attack packages randomly and may encounter no opponents. Defender forces may include local air defenders, with different optimization rules from the other defense forces. \*SLAACM does not simulate; rather, it calculates engagement outcome statistics analytically, with parsimonious probabilistic models.

DTIC

*Air Defense; Color; Mathematical Models; Models; Stochastic Processes*

**20080048501** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Developing a Predictive Model for Unscheduled Maintenance Requirements on USA Air Force Installations**

Kovich, Matthew D; Norton, J D; Jun 2008; 72 pp.; In English; Original contains color illustrations

Report No.(s): AD-A490056; AFIT/ILM/ENS/08-05; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The USA Air Force Civil Engineer community continually strives for more descriptive methods to explain the impact of funding decisions on future infrastructure conditions. This paper develops one such method by using linear regression and time series analysis to develop a predictive model to forecast future year man-hour and funding requirements for unscheduled maintenance. The results provide predictive models for up to a 5 year forecast with improved results for a 3 year outlook and routine maintenance calls.

DTIC

*Maintenance; Prediction Analysis Techniques; Predictions; United States*

**20080048542** Army Research Lab., Adelphi, MD USA

**ZIV-ZAKAI Time Delay Estimation Bound for Ultra-Wideband Signals**

Sadler, Brian M; Huang, Lili; Xu, Zhengyuan; Jan 2007; 5 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-01-2-0011

Report No.(s): AD-A490241; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Ziv-Zakai bound (ZZB) provides a general mean-square error analytical baseline to evaluate time delay estimation (TDE) techniques for a wide range of time-bandwidth products and signal-to noise ratios, but generally can only be numerically evaluated. The Weiss-Weinstein bound (WWB) further improves characterization of the attainable system performance, for narrowband and wideband signals with small to moderate fractional bandwidth. Similar to the WWB, here we find a simplified closed-form ZZB for TDE with ultra-wideband (UWB) signals. The resulting simplified bound is found over disjoint segments, separated by thresholds that characterize different regions of ambiguity. The closed-form simplified bound can be analytically studied, and approaches both the ZZB and the TDE performance of a maximum likelihood estimator.

DTIC

*Broadband; Maximum Likelihood Estimates; Time Lag*

66

**SYSTEMS ANALYSIS AND OPERATIONS RESEARCH**

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

**20080047237** NATO Supreme Allied Command Transformation, Norfolk, VA USA

**A Multi-Attributes Analysis Vignette For Warfighting Experiments**

Jastrzembski, Jennie; Jun 2007; 23 pp.; In English; Original contains color illustrations

Report No.(s): AD-A488586; No Copyright; Avail.: Defense Technical Information Center (DTIC)

There are many well-defined model-building procedures for experiments. Multi-Attributes Utility Theory (MAUT) is a

practical approach in quantifying a decision maker's preferences. MAUT has been used in industrial decision making for several decades. Recently it has been adopted into military applications. NATO school used the MAUT for its asymmetric simulation tools in its Operational Planning Course. Multi-Attributes utility analysis is a useful tool for facilitating good decision making, with its inherent iterative process for refinement. However Multi-Attributes utility analysis is not a tool for justifying a decision nor proving soundness of it.

DTIC

*Problem Solving; Decision Making; Military Technology; Computerized Simulation*

**20080047259** Idaho National Lab., Idaho Falls, ID, USA

**Stochastic Event Counter for Discrete-Event Systems Under Unreliable Observations**

Tae-Sic, Y.; Humberto, E. G.; Jun. 01, 2008; 9 pp.; In English

Contract(s)/Grant(s): DE-AC07-99ID-13727

Report No.(s): DE2008-935446; INL/CON-07-13239; No Copyright; Avail.: Department of Energy Information Bridge

This paper addresses the issues of counting the occurrence of special events in the framework of partially observed discrete-event dynamical systems (DEDS). First, we develop a noble recursive procedure that updates active counter information state sequentially with available observations. In general, the cardinality of active counter information state is unbounded, which makes the exact recursion infeasible computationally. To overcome this difficulty, we develop an approximated recursive procedure that regulates and bounds the size of active counter information state. Using the approximated active counting information state, we give an approximated minimum mean square error (MMSE) counter. The developed algorithms are then applied to count special routing events in a material flow system.

NTIS

*Control Theory; Dynamical Systems; Stochastic Processes*

**20080047261** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Two Phase Algorithm for Solving a Class of Hard Satisfiability Problems**

Warners, J. P.; Van Maaren, H.; Apr. 30, 1998; 14 pp.; In English

Report No.(s): PB2009-102329; SEN-R9802; Copyright; Avail.: National Technical Information Service (NTIS)

The DIMACS suite of satisfiability (SAT) benchmarks contains a set of instances that are very hard for existing algorithms. These instances arise from learning the parity function on 32 bits. In this paper we develop a two phase algorithm that is capable of solving these instances. In the first phase, a polynomially solvable subproblem is identified and solved. Using the solution to this problem, we can considerably restrict the size of the search-space in the second phase of the algorithm, which is an extension of the well-known Davis-Putnam-Loveland algorithm for SAT problems. We conclude with reporting on our computational results on the parity instances.

NTIS

*Algorithms; Problem Solving*

**20080047564** Naval Postgraduate School, Monterey, CA USA

**Scheduling Ocean Transportation of Crude Oil**

Brown, Gerald G; Graves, Glenn W; Ronen, David; Mar 1987; 14 pp.; In English

Report No.(s): AD-A487249; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A crude oil tanker scheduling problem faced by a major oil company is presented and solved using an elastic set partitioning model. The model takes into account all fleet cost components, including the opportunity cost of ship time, port and canal charges, and demurrage and bunker fuel. The model determines optimal speeds for the ships and the best routing of ballast (empty) legs, as well as which cargos to load on controlled ships and which to spot charter. All feasible schedules are generated, the cost of each is accurately determined, and the best set of schedules is selected. For the problems encountered, optimal integer solutions to set partitioning problems with thousands of binary variables have been achieved in less than a minute.

DTIC

*Crude Oil; Oceans; Optimization; Scheduling; Tanker Ships; Transportation*

**20080047565** Center for Army Analysis, Fort Belvoir, VA USA

**ORSA Handbook for the Senior Commander**

Mar 2008; 37 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489398; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this handbook is to provide essential information about expectations that a Commander may have

regarding Operations Research/Systems Analyst (ORSA) personnel in the operational environment. This handbook is intended as a quick-reference for military Commanders at Brigade-level and above to employ the unique skill sets that ORSA personnel possess.

DTIC

*Decision Making; Handbooks; Operations Research*

**20080047597** Defense Threat Reduction Agency, Fort Belvoir, VA USA

**Computational Models of Group Dynamics for National and International Security Applications**

Quirk, Mihaela D; Jun 2008; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489568; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Topics discussed: classes of problems, algorithmic representation of social dynamics, identify and evaluate 'soft metrics', mathematical models of strategic interactions, models for soft metrics, formalism for scenario specification, validation and technological challenges, knowledge bases and model refinement and concluding remarks.

DTIC

*Group Dynamics; Mathematical Models; Security*

**20080047617** Department of the Army, Washington, DC USA

**System-of-System Analysis and Experimentation for the Future Force Warrior**

Harris, William F; Alexander, Robert A; Jun 2008; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489715; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Future Force Warrior ATD - Program Goals \*Design, build, and demonstrate a System of Systems architecture... ..that maximizes combat effectiveness of the dismounted Rifle platoon and squad... ..while meeting several very tight constraints of -cost, -weight of the Soldier load, and -power consumption.

DTIC

*Combat; Systems Analysis; Systems Engineering*

**20080047882** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Using Deformation Modes to Identify Cracks in Turbine Engine Compressor Disks (Preprint)**

Brockman, Robert A; John, Reji; Huelsman, Marc A; Oct 2008; 30 pp.; In English

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A489311; AFRL-RX-WP-TP-2008-4329; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489311>

Recent studies show that analytical predictions of crack growth in rotating components can be used in conjunction with displacement measurement techniques to identify critical levels of fatigue damage. However, investigations of this type traditionally have focused on the detection of damage at known flaw locations. This paper addresses the related problem of estimating damage associated with flaws at unknown locations, through the combined use of analytical models and measured vibration signatures. Because the measured data are insufficient to identify a unique solution for the location and severity of fatigue cracks, the function of the analytical model is to bound the extent of damage occurring at life-limiting locations. The prediction of remaining life based on estimates of worst-case damage and crack locations also is discussed.

DTIC

*Compressors; Cracks; Deformation; Life (Durability); Predictions; Turbine Engines*

**20080048142** Rowan Univ., Glassboro, NJ, USA; Jacobs Sverdrup Technology, Inc., USA

**Intelligent Integrated Health Management for a System of Systems**

Smith, Harvey; Schmalzel, John; Figueroa, Fernando; NASA Tech Briefs, September 2008; September 2008, pp. 38-39; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): SSC-00234; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3150>

An intelligent integrated health management system (IIHMS) incorporates major improvements over prior such systems. The particular IIHMS is implemented for any system defined as a hierarchical distributed network of intelligent elements (HDNIE), comprising primarily: (1) an architecture (Figure 1), (2) intelligent elements, (3) a conceptual framework and taxonomy (Figure 2), and (4) an ontology that defines standards and protocols. Some definitions of terms are prerequisite to

a further brief description of this innovation: A system-of-systems (SoS) is an engineering system that comprises multiple subsystems (e.g., a system of multiple possibly interacting flow subsystems that include pumps, valves, tanks, ducts, sensors, and the like); 'Intelligent' is used here in the sense of artificial intelligence. An intelligent element may be physical or virtual, it is network enabled, and it is able to manage data, information, and knowledge (DIaK) focused on determining its condition in the context of the entire SoS; As used here, 'health' signifies the functionality and/or structural integrity of an engineering system, subsystem, or process (leading to determination of the health of components); 'Process' can signify either a physical process in the usual sense of the word or an element into which functionally related sensors are grouped; 'Element' can signify a component (e.g., an actuator, a valve), a process, a controller, an actuator, a subsystem, or a system; The term Integrated System Health Management (ISHM) is used to describe a capability that focuses on determining the condition (health) of every element in a complex system (detect anomalies, diagnose causes, prognosis of future anomalies), and provide data, information, and knowledge (DIaK) not just data to control systems for safe and effective operation. A major novel aspect of the present development is the concept of intelligent integration. The purpose of intelligent integration, as defined and implemented in the present IIHMS, is to enable automated analysis of physical phenomena in imitation of human reasoning, including the use of qualitative methods. Intelligent integration is said to occur in a system in which all elements are intelligent and can acquire, maintain, and share knowledge and information. In the HDNIE of the present IIHMS, an SoS is represented as being operationally organized in a hierarchical-distributed format. The elements of the SoS are considered to be intelligent in that they determine their own conditions within an integrated scheme that involves consideration of data, information, knowledge bases, and methods that reside in all elements of the system. The conceptual framework of the HDNIE and the methodologies of implementing it enable the flow of information and knowledge among the elements so as to make possible the determination of the condition of each element. The necessary information and knowledge is made available to each affected element at the desired time, satisfying a need to prevent information overload while providing context-sensitive information at the proper level of detail. Provision of high-quality data is a central goal in designing this or any IIHMS. In pursuit of this goal, functionally related sensors are logically assigned to groups denoted processes. An aggregate of processes is considered to form a system. Alternatively or in addition to what has been said thus far, the HDNIE of this IIHMS can be regarded as consisting of a framework containing object models that encapsulate all elements of the system, their individual and relational knowledge bases, generic methods and procedures based on models of the applicable physics, and communication processes (Figure 2). The framework enables implementation of a paradigm inspired by how expert operators monitor the health of systems with the help of (1) DIaK from various sources, (2) software tools that assist in rapid visualization of the condition of the system, (3) analytical software tools that assist in reasoning about the condition, (4) sharing of information via network communication hardware and software, and (5) software tools that aid in making decisions to remedy unacceptable conditions or improve performance.

Author

*Systems Engineering; Systems Integration; Systems Management; Systems Health Monitoring; Smart Structures; Artificial Intelligence; Decision Support Systems*

**20080048266** NASA Marshall Space Flight Center, Huntsville, AL, USA

### **Integrated Safety Analysis Teams**

Wetherholt, Jonathan C.; August 25, 2008; 8 pp.; In English; System Safety Society, 25-29 Aug. 2008, Vancouver, BC, Canada; Original contains color illustrations; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080048266>

Today's complex systems require understanding beyond one person's capability to comprehend. Each system requires a team to divide the system into understandable subsystems which can then be analyzed with an Integrated Hazard Analysis. The team must have both specific experiences and diversity of experience. Safety experience and system understanding are not always manifested in one individual. Group dynamics make the difference between success and failure as well as the difference between a difficult task and a rewarding experience. There are examples in the news which demonstrate the need to connect the pieces of a system into a complete picture. The Columbia disaster is now a standard example of a low consequence hazard in one part of the system; the External Tank is a catastrophic hazard cause for a companion subsystem, the Space Shuttle Orbiter. The interaction between the hardware, the manufacturing process, the handling, and the operations contributed to the problem. Each of these had analysis performed, but who constituted the team which integrated this analysis together? This paper will explore some of the methods used for dividing up a complex system; and how one integration team has analyzed the parts. How this analysis has been documented in one particular launch space vehicle case will also be discussed.

Author

*Complex Systems; Launch Vehicles; Group Dynamics; Safety; Space Shuttle Orbiters*

**20080048378** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Lower Bounds for On-line Single-machine Scheduling**

Epstein, L.; Van Stee, R.; Feb. 28, 2001; 16 pp.; In English

Report No.(s): PB2009-102517; SEN-R0103; Copyright; Avail.: National Technical Information Service (NTIS)

The problem of scheduling jobs that arrive over time on a single machine is well-studied. We study the preemptive model and the model with restarts. We provide lower bounds for deterministic and randomized algorithms for several optimality criteria: weighted and unweighted total completion time, and weighted and unweighted total flow time. By using new techniques, we provide the first lower bounds for several of these problems, and we significantly improve the bounds that were known.

NTIS

*On-Line Systems; Scheduling; Tasks*

**20080048379** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Fractal Beauty of Bin Packing**

Epstein, L.; Seiden, S.; Van Stee, R.; Feb. 28, 2001; 22 pp.; In English

Report No.(s): PB2009-102518; SEN-R0104; Copyright; Avail.: National Technical Information Service (NTIS)

In the variable-sized online bin packing problem, one has to assign items to bins one by one. The bins are drawn from some fixed set of sizes, and the goal is to minimize the sum of the sizes of the bins used. We present the first unbounded space algorithms for this problem. We also show the first lower bounds on the asymptotic performance ratio. The case where bins of two sizes, 1 and  $(\alpha)$  ( $\sigma$ ) (0, 1), are used is studied in detail. This investigation leads us to the discovery of several interesting fractal-like curves.

NTIS

*Fractals; Algorithms*

**20080048396** Delaware Univ., Newark, DE USA

**A Curvilinear Version of a Quasi-3D Nearshore Circulation Model**

Shi, Fengyan; Svendsen, Ib A; Kirby, James T; Smith, Jane M; Jan 2002; 27 pp.; In English

Report No.(s): AD-A489691; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489691>

A curvilinear version of the nearshore circulation model SHORECIRC is developed based on the quasi-3D nearshore circulation equations derived by Putrevu and Svendsen [Eur. J. Mech. 18 (1999) 409 427]. We use a generalized coordinate transformation and re-derive the equations in tensor-invariant forms. The contravariant component technique is used to simplify both the transformed equations and boundary conditions. A high-order finite-difference scheme with a staggered grid in the image domain is adopted for the numerical model. Very good convergence rates with both grid refinement and time refinement are obtained in a simple convergence test. The model is then applied to four cases involving either a non-orthogonal quadrilateral grid or a generalized curvilinear grid. The versatility of the curvilinear model in dealing with curved shorelines, nearshore breakwaters and other complicated geometries is demonstrated in the test cases. The accuracy of the model is shown in the paper through model/data comparisons in two of the case studies.

DTIC

*Mathematical Models; Ocean Models; Three Dimensional Models*

**20080048400** National Defense Univ., Washington, DC USA

**Human, Social, Cultural Behavior (HSCB) Modeling Workshop I: Characterizing the Capability Needs for HSCB Modeling**

Hartley III, Dean S; Jul 2008; 107 pp.; In English

Report No.(s): AD-A489736; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489736>

On 28 - 30 July 2008, a workshop was conducted on the campus of the National Defense University (NDU) to characterize the capabilities needed to perform effective Human, Social, Culture Behavioral (HSCB) modeling in support of operational users and senior decision makers. The workshop was sponsored by Dr. Robert Foster, Director, BioSystems, in the Office of the Director, Defense Research & Development (DDR&E). The workshop was organized and conducted by the Center for Technology and National Security Policy (CTNSP), NDU. To achieve the primary goal of the workshop, approximately 120 participants were assembled from the social sciences and operations analyses communities. Participants

were drawn from government, academia, industry, Federally Funded Research & Development Centers (FFRDCs) and University Affiliated Research Centers. The workshop was divided into three parts. The first part consisted of plenary briefings, which characterized the nature of the problem, depicted the state-of-the-practice, and identified the steps needed to achieve desired capabilities. The second and third parts were organized as working groups. On the first day of the workshop, the participants were assigned to discipline panels (i.e., Social Sciences (Micro); Social Sciences (Macro); Operations Research (methodologies and tools); Operations Research (data and verification, validation, and accreditation (VV&A))). On the second day of the workshop, the participants were assigned to problem-domain panels to address issues posed by operational users and senior decision makers (e.g., deterrence; counterterrorism; counter insurgency; stability, security, transition, reconstruction (SSTR) operations). In each case, the groups were asked to characterize the capabilities needed to satisfy the interests of operational users and senior decision makers.

DTIC

*Human Behavior; Operations Research*

**20080048419** Science Applications International Corp., McLean, VA USA

**Exploratory Analysis - Using All the Tools in Our Kitbag**

Alexander, Robert S; Garrity, Michael E; Jun 2008; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489837; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489837>

A classic error in Operations Analysis is to use the tool we are most familiar with to solve every problem that comes our way. The better way is to assess each problem and design a methodology to solve the problem with whatever tools are most suitable. Exploratory Analysis is a methodology designed to solve a certain class of problems, using a whole range of tools: Human-in-the-loop wargaming \* Simulation \* Regression Analysis \* Costing \* Spreadsheet and Database Analyses \* Mathematical Programming.

DTIC

*Cost Analysis; Cost Effectiveness; Operations Research*

**20080048487** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**A Network Flow Approach to the Initial Skills Training Scheduling Problem**

Illig, Anthony A; Roesener, August; Knighton, Shane; Hall, Shane; Jun 1, 2008; 34 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489936; No Copyright; Avail.: Defense Technical Information Center (DTIC)

After commissioning, new Air Force officers typically require multiple rounds of training to be certified to perform their duties. With nearly 4000 2nd Lts. commissioned each year, scheduling of this training can be cumbersome. General personnel scheduling techniques are computationally intensive. We have developed a network flow approach to the Initial Skills Training Scheduling Problem.

DTIC

*Education; Network Analysis; Personnel; Scheduling*

**20080048489** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Intelligence Surveillance and Reconnaissance Asset Assignment for Optimal Mission Effectiveness**

Kappedal, Ryan; Roesener, August; Hall, Shane; Jun 2008; 30 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489943; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Problem statement: \*USSTRATCOM has requested assistance assigning sensors to multi-stage missions; \*Each mission has several stages, and some sensors may be shared between missions; \*Each sensor has a distinct probability of success at a unique mission's stage, -These probabilities are not always known until just prior to tasking.

DTIC

*Intelligence; Reconnaissance; Resource Allocation; Resources Management; Surveillance*

**20080048510** Decisive Analytics Corp., Arlington, VA USA

**Ensuring Schedulability in the Weapon Target Assignment Problem**

Pederson, Debbie; Jun 12, 2008; 34 pp.; In English; Original contains color illustrations

Report No.(s): AD-A490120; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Weapon Target Assignment (WTA): Given a set of weapon batteries and a set of incoming targets, what is the assignment

of interceptors to targets that will maximize the value of targets killed? \*Difficult problem to solve optimally for large numbers of weapons/targets. \*May need to be re-solved repeatedly as battlespace evolves. \*Need good, quick solution method. Goal: Compute a schedulable allocation of interceptors to threats within a relatively short amount of time.

DTIC

*Scheduling; Targets*

## 67

### THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

**20080047577** California Univ., Davis, CA USA

#### **A Nonlinear Optimization Procedure for Generalized Gaussian Quadratures**

Bremer, James; Gimbutas, Zydrunas; Rokhlin, Vladimir; Jun 30, 2008; 35 pp.; In English

Contract(s)/Grant(s): HM1582-06-1-2039; HM1582-06-1-2037

Report No.(s): AD-A489478; YALEU/DCS/TR-1406; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present a new nonlinear optimization procedure for the computation of generalized Gaussian quadratures for a broad class of functions. While some of the components of this algorithm have been previously published, we present a simple and robust scheme for the determination of a sparse solution to an underdetermined nonlinear optimization problem which replaces the continuation scheme of the previously published works. The performance of the resulting procedure is illustrated with several numerical examples.

DTIC

*Nonlinearity; Numerical Analysis; Quadratures*

**20080047606** Naval Research Lab., Washington, DC USA

#### **The Bloch Sphere for Topologists**

Moskowitz, Ira S; Nov 5, 2008; 12 pp.; In English

Report No.(s): AD-A489598; NRL/MR/5540-08-9160; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The author uses this note to clear up some of the mysteries of the Bloch sphere representation of pure states. The Bloch sphere is a representation of a pure state as a point on the unit sphere  $S(\sup 2)$  proper subset  $R(\sup 3)$ . Pure state kets that are norm one scalar multiples of each other share the same representation. The author shall make this clear. He makes no claims of originality in this note. His purpose is to simply explain some of the basics of quantum information.

DTIC

*Algebra; Coordinates; Mapping; Quantum Theory; Spheres; Topology*

**20080047615** Syracuse Univ., NY USA

#### **Sum Capacity (Sub)optimality of Orthogonal Transmissions in Vector Gaussian Multiple Access Channels**

Shang, Xiaohu; Chen, Biao; Matyjas, John; Apr 2007; 5 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-06-1-0051

Report No.(s): AD-A489671; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We study in this paper the sum capacity achievability of orthogonal transmissions in vector Gaussian multiple access channels (MAC). Specifically, we derive the sufficient and necessary conditions, in terms of channel matrices and transmitter power constraints, for orthogonal transmission to achieve the sum capacity of a vector Gaussian MAC. The obtained conditions provide a unified framework in explaining many of the results that are intuitively true. They also enable us to explore cases that have not been addressed to determine the (sub)optimality of orthogonal transmissions compared with the overlay transmission.

DTIC

*Alternating Current; Frequency Division Multiple Access; Multiple Access; Numerical Analysis; Orthogonality; Quadratures*



70  
**PHYSICS (GENERAL)**

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see *categories 71 through 77*. For related instrumentation see *35 Instrumentation and Photography*; for geophysics, astrophysics, or solar physics see *46 Geophysics, 90 Astrophysics, or 92 Solar Physics*.

**20080047242** Trento Univ., Italy

**Measurement of the  $t\bar{t}$  Production Cross Section in the MET+jets Channel at CDF**

Vallauri, R.; Lazzizzera, I.; Compostella, G.; Mar. 2008; 162 pp.; In English

Report No.(s): DE2008-935790; No Copyright; Avail.: National Technical Information Service (NTIS)

This thesis is focused on an inclusive search of the  $t(\bar{t})$  (yields)  $E(\text{sub } T) + \text{jets}$  decay channel by means of neural network tools in proton antiproton collisions at  $(\text{radical})s = 1.96$  TeV recorded by the Collider Detector at Fermilab (CDF). At the Tevatron  $p(\bar{p})$  collider top quarks are mainly produced in pairs through quark-antiquark annihilation and gluon-gluon fusion processes; in the Standard Model description, the top quark then decays to a W boson and a b quark almost 100% of the times, so that its decay signatures are classified according to the W decay modes. When only one W decays leptonically, the  $t(\bar{t})$  event typically contains a charged lepton, missing transverse energy due to the presence of a neutrino escaping from the detector, and four high transverse momentum jets, two of which originate from b quarks. In this thesis we describe a  $t(\bar{t})$  production cross section measurement which uses data collected by a 'multijet' trigger, and selects this kind of top decays by requiring a high- $P(\text{sub } T)$  neutrino signature and by using an optimized neural network to discriminate top quark pair production from backgrounds. In Chapter 1, a brief review of the Standard Model of particle physics will be discussed, focusing on top quark properties and experimental signatures. In Chapter 2 will be presented an overview of the Tevatron accelerator chain that provides  $p(\bar{p})$  collisions at the center-of-mass energy of  $(\text{radical})s = 1.96$  TeV, and proton and antiproton beams production procedure will be discussed. The CDF detector and its components and subsystems used for the study of  $p(\bar{p})$  collisions provided by the Tevatron will be described in Chapter 3. Chapter 4 will detail the reconstruction procedures used in CDF to detect physical objects exploiting the features of the different detector subsystems. Chapter 5 will provide an overview of the main concepts regarding Artificial Neural Networks, one of the most important tools we will use in the analysis. Chapter 6 will be devoted to the description of the main characteristics of the  $t(\bar{t})$  (yields)  $E(\text{sub } T) + \text{jets}$  decay channel used to train our neural network to discriminate the top pair production from background processes. We will discuss the event selection method and the technique used for background prediction, that will rely on b-jets identification rate parameterization. Finally, Chapter 7 will provide a description of the final data sample and a detailed discussion of the systematic uncertainties before determining the cross section measurement by means of a likelihood maximization.

NTIS

*Antiprotons; Quarks*

**20080047243** Lawrence Livermore National Lab., Livermore, CA USA; Fermi National Accelerator Lab., Batavia, IL, USA

**Design of the ILC RTML Extraction Lines**

Seletskiy, S.; Tenenbaum, P.; Walz, D.; Solyak, N.; January 2008; 3 pp.; In English

Report No.(s): DE2008-935792; FERMILAB-CONF-08-200-TD; No Copyright; Avail.: National Technical Information Service (NTIS)

The ILC Damping Ring to the Main Linac beamline (RTML) contains three extraction lines (EL). Each EL can be used both for an emergency abort dumping of the beam and tune-up continual train-by-train extraction. Two of the extraction lines are located downstream of the first and second stages of the RTML bunch compressor, and must accept both compressed and uncompressed beam with energy spreads of 2.5% and 0.15%, respectively. In this paper we report on an optics design that allowed minimizing the length of the extraction lines while offsetting the beam dumps from the main line by the distance required for acceptable radiation levels in the service tunnel. The proposed extraction lines can accommodate beams with different energy spreads while at the same time providing the beam size acceptable for the aluminum dump window.

NTIS

*Extraction; Linear Accelerators*

**20080047244** California Univ., Davis, CA, USA

**CDF L2 Track Trigger Upgrade**

Cox, D.; January 2008; 7 pp.; In English

Report No.(s): DE2008-935794; FERMILAB-CONF-08-288-E; No Copyright; Avail.: National Technical Information Service (NTIS)

This proceedings describes the XFT stereo upgrade for the CDF Level 2 trigger system. Starting with the stereo finder

boards, up to the XFT stereo track algorithm implementation in the Level 2 PC. This note will discuss the effectiveness of the Level 2 Stereo track algorithm at achieving reduced trigger rates with high efficiencies during high luminosity running.

NTIS

*Actuators; Conferences; Efficiency*

**20080047245** California Univ., Santa Barbara, CA, USA

**Top Quark Mass and Cross Section Results from the Tevatron**

Garberson, F.; January 2008; 9 pp.; In English

Report No.(s): DE2008-935796; FERMILAB-CONF-08-275-E; No Copyright; Avail.: National Technical Information Service (NTIS)

No abstract available

*Particle Accelerators; Quarks*

**20080047246** Helsinki Univ., Finland

**Measurements of the Top Quark Mass at CDF**

van Remortel, N.; January 2008; 8 pp.; In English

Report No.(s): DE2008-935797; FERMILAB-CONF-08-292-E; CDF/PUB/TOP/PUBLIC/9373; No Copyright; Avail.:

National Technical Information Service (NTIS)

We review the most recent measurements of the top quark mass using data collected by the CDF experiment at the Tevatron 1.96 TeV pp collider. The mass measurements are performed in all main decay modes of the produced tt pairs using integrated luminosities up to 2fb<sup>-1</sup>. In most channels the total uncertainty is dominated by systematic effects, most of which are currently being revised. The precise measurement of the top quark mass is one of the Tevatrons main and long lasting legacies. Besides serving as a benchmark measurement at the LHC collider, it will serve as a consistency check of the Standard Model in case a neutral CP even Higgs boson is found, either at the Tevatron or at the LHC.

NTIS

*Quarks; Decay*

**20080047247** McGill Univ., Montreal, Quebec, Canada

**Decays of B(sup 0)(sub s) Mesons and b Baryons: A Review of Recent First Observations and Branching Fractions**

Warburton, A.; January 2008; 10 pp.; In English

Report No.(s): DE2008-935802; FERMILAB-CONF-08-223-E; No Copyright; Avail.: National Technical Information Service (NTIS)

Heavier b- avoured hadrons represent a fecund source of particle physics. While the rich inteectsy be- typically poses formidable experimental and theoretical challenges, decays of hadrons with masses at the frontiers of Standard Model speective theories, QCD factorization and lattice methods, as well as potential models. Moreover, such heavy hadronic states present opportunities to uncover real or constrain hypothetical new physics lying beyond the Standard Model.

NTIS

*Baryons; Mesons*

**20080047248** Pennsylvania Univ., Philadelphia, PA, USA

**W+- / Z + Jets and W+- / Z + Heavy Flavor Jets at the Tevatron**

Neu, C.; January 2008; 4 pp.; In English

Report No.(s): DE2008-935804; FERMILAB-CONF-08-237-E; No Copyright; Avail.: National Technical Information Service (NTIS)

Studies of the production of W(sup (+-))/Z+ jets are important for a variety of reasons. Herein the latest Tevatron results on these production mechanisms are reviewed with an emphasis on comparison of data results to the latest theoretical models.

NTIS

*Particle Accelerators; Mathematical Models*

**20080047249** Barcelona Univ., Spain; Bergen Univ., Norway; California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**Observation of  $B^0 \rightarrow \chi_{c0} K^*0$  and Evidence of  $B^+ \rightarrow \chi_{c0} K^{*+}$**

Aubert, B.; Bona, M.; Karyotakis, Y.; Lees, J. P.; Poireau, V.; Aug. 2008; 8 pp.; In English

Report No.(s): DE2008-935950; BABAR-PUB-08/034; SLAC-PUB-13362; No Copyright; Avail.: National Technical Information Service (NTIS)

No abstract available

*Linear Accelerators; Mesons*

**20080047250** Rutherford Appleton Lab., Chilton, UK

**Application of the HOTWAXS Detector to Imaging at Higher X-ray Energies (10keV 30keV)**

Bateman, J. E.; Duxbury, D. M.; Harvey, I.; Helsby, W. I.; Spill, E. J.; Oct. 2008; 12 pp.; In English

Report No.(s): PB2009-100968; RAL-TR-2008-030; Copyright; Avail.: National Technical Information Service (NTIS)

The HOTWAXS (High Overall Throughput Wide Angle X-ray Scattering) gas detector system, aimed at X-ray diffraction (XRD) and wide angle X-ray scattering (WAXS) applications has been a successful user facility on stations 2.1 and 9.3 at the Daresbury SRS offering high speed data acquisition. The facility has been duplicated on station 122 of the Diamond light source. The energy range covered by stations 122 and 9.3 are very similar varying from 6 to 30keV, well above the energy range conventionally covered by gas detectors. Here we report studies of the options for successful operation of HOTWAXS at the upper end of this energy range, made possible by this particular design.

NTIS

*Imaging Techniques; X Rays; Detection*

**20080047264** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Undecidability and Completeness Results for Process Algebras with Alternative Quantification over Data**

Groote, J. F.; Luttkik, S. P.; Jun. 30, 1998; 26 pp.; In English

Report No.(s): PB2009-102333; SEN-R9806; Copyright; Avail.: National Technical Information Service (NTIS)

We define a class of process algebras with a generalised operation  $\Sigma$  that allows explicit treatment of 'alternative' quantification over data, and investigate the specific subclass formed by the algebras of finite processes modulo strong bisimulation. We prove that, in such algebras, equality between process terms is definable by means of a first-order data formula, and that, if the data is computable and has a built-in equality predicate, any  $\Pi(\text{sub}4)(\text{sup}0)$  data formula is definable as an equation between ground process terms. From these results we work to the conclusion that equality in strong bisimulation algebras with a computable data part is  $\Pi(\text{sub}4)(\text{sup}0)$  hard. We also investigate a restricted version of alternative quantification: the input prefix mechanism of Parrow and Sangiorgi (1995) and Hennessy and Lin (1996). We show that this restriction yields a less expressive formalism if the data is computable and has a built-in equality predicate: equality between input prefix processes coincides with the universal fragment of first-order logic for the data. That is, the input prefix mechanism gives rise to strong bisimulation algebras for which equality is complete  $\Pi(\text{sub}1)(\text{sup}0)$ . Finally, we give a ground complete axiomatisation for those strong bisimulation algebras of which the data part has built-in equality and Skolem functions.

NTIS

*Algebra; Formalism*

**20080047283** National Security Technologies, LLC, Las Vegas, NV, USA

**Variable Energy 2-MeV S-Band Linac for X-Ray and Other Applications**

Bender, H.; Schwellenbach, D.; Sturges, R.; Trainham, R.; Jul. 01, 2008; 3 pp.; In English

Contract(s)/Grant(s): DE-AC52-06NA25946

Report No.(s): DE2008-934451; DOE/NV/25946--491; No Copyright; Avail.: National Technical Information Service (NTIS)

This paper describes the design and operation of a compact, 2-MeV, S-band linear accelerator (linac) with variable energy tuning and short-pulse operation down to 15 ps with 100-A peak current. The design consists of a buncher cavity for short-pulse operation and two coupled resonator sections for acceleration. Single-pulse operation is accomplished through a fast injector system with a 219-MHz subharmonic buncher. The machine is intended to support a variety of applications, such

as x-ray and electron beam diagnostic development, and recently, electron diffraction studies of phase transitions in shocked materials.

NTIS

*Linear Accelerators; Superhigh Frequencies; Ultrahigh Frequencies; X Rays*

**20080047317** Fermi National Accelerator Lab., Batavia, IL, USA

**Commissioning the Cryogenic System of the First LHC Sector**

Millet, F.; Claudet, S.; Ferlin, G.; Riddone, G.; Serio, L.; Dec. 01, 2008; 9 pp.; In English

Contract(s)/Grant(s): DE-AC02-76CH03000

Report No.(s): DE2008-934570; FERMILAB-CONF-07-744-TD; No Copyright; Avail.: Department of Energy Information Bridge

The LHC machine, composed of eight sectors with superconducting magnets and accelerating cavities, requires a complex cryogenic system providing high cooling capacities (18 kW equivalent at 4.5 K and 2.4 W at 1.8 K per sector produced in large cold boxes and distributed via 3.3-km cryogenic transfer lines). After individual reception tests of the cryogenic subsystems (cryogen storages, refrigerators, cryogenic transfer lines and distribution boxes) performed since 2000, the commissioning of the cryogenic system of the first LHC sector has been under way since November 2006. After a brief introduction to the LHC cryogenic system and its specificities, the commissioning is reported detailing the preparation phase (pressure and leak tests, circuit conditioning and flushing), the cool-down sequences including the handling of cryogenic fluids, the magnet powering phase and finally the warm-up. Preliminary conclusions on the commissioning of the first LHC sector will be drawn with the review of the critical points already solved or still pending. The last part of the paper reports on the first operational experience of the LHC cryogenic system in the perspective of the commissioning of the remaining LHC sectors and the beam injection test.

NTIS

*Cryogenics; Complex Systems; Superconducting Magnets*

**20080047318** Fermi National Accelerator Lab., Batavia, IL, USA; Tata Energy Research Inst., Bombay, India; California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**Validation and Performance of the LHC Cryogenic System through Commissioning of the First Sector**

Serio, L.; Bouillot, A.; Casas-Cubillos, J.; Chakravarty, A.; Claudet, S.; Dec. 01, 2007; 9 pp.; In English

Contract(s)/Grant(s): DE-AC02-76CH03000

Report No.(s): DE2008-934571; FERMILAB-CONF-07-745-TD; No Copyright; Avail.: National Technical Information Service (NTIS)

The cryogenic system for the Large Hadron Collider accelerator is presently in its final phase of commissioning at nominal operating conditions. The refrigeration capacity for the LHC is produced using eight large cryogenic plants and eight 1.8 K refrigeration units installed on five cryogenic islands. Machine cryogenic equipment is installed in a 26.7-km circumference ring deep underground tunnel and are maintained at their nominal operating conditions via a distribution system consisting of transfer lines, cold interconnection boxes at each cryogenic island and a cryogenic distribution line. The functional analysis of the whole system during all operating conditions was established and validated during the first sector commissioning in order to maximize the system availability. Analysis, operating modes, main failure scenarios, results and performance of the cryogenic system are presented.

NTIS

*Cryogenics; Accelerators*

**20080047320** Sandia National Labs., Albuquerque, NM USA

**Innovative High Pressure Gas MEMs Based Neutron Detector for ICF and Active SNM Detection**

Martin, S. B.; Derzon, M.; Renzi, R. F.; Chandler, G. A.; Dec. 01, 2007; 54 pp.; In English

Contract(s)/Grant(s): DE-AC04-94AL85000

Report No.(s): DE2008-934580; SAND2007-7177; No Copyright; Avail.: National Technical Information Service (NTIS)

An innovative helium3 high pressure gas detection system, made possible by utilizing Sandia's expertise in Micro-electrical Mechanical fluidic systems, is proposed which appears to have many beneficial performance characteristics with regards to making these neutron measurements in the high bremsstrahlung and electrical noise environments found in High Energy Density Physics experiments and especially on the very high noise environment generated on the fast pulsed

power experiments performed here at Sandia. This same system may dramatically improve active WMD and contraband detection as well when employed with ultrafast (10-50 ns) pulsed neutron sources.

NTIS

*Compressed Gas; Gas Detectors; Microelectromechanical Systems; Neutron Counters*

**20080047321** Sandia National Labs., Albuquerque, NM USA

**Simulation of Neutron Radiation Damage in Silicon Semiconductor Devices**

Shadid, J. N.; Hoekstra, R. J.; Hennigan, G. L.; Castro, J. P.; Fixel, D. A.; Dec. 01, 2007; 66 pp.; In English

Contract(s)/Grant(s): DE-AC04-94AL85000

Report No.(s): DE2008-934581; SAND2007-7157; No Copyright; Avail.: National Technical Information Service (NTIS)

A code, Charon, is described which simulates the effects that neutron damage has on silicon semiconductor devices. The code uses a stabilized, finite-element discretization of the semiconductor drift-diffusion equations. The mathematical model used to simulate semiconductor devices in both normal and radiation environments will be described. Modeling of defect complexes is accomplished by adding an additional drift-diffusion equation for each of the defect species. Additionally, details are given describing how Charon can efficiently solve very large problems using modern parallel computers. Comparison between Charon and experiment will be given, as well as comparison with results from commercially-available TCAD codes.

NTIS

*Neutrons; Radiation Damage; Semiconductor Devices; Semiconductors (Materials); Silicon; Simulation*

**20080047322** Sandia National Labs., Albuquerque, NM USA

**Low Inductance Gas Switching**

Chavez, R.; Harjes, H. C.; Wallace, Z.; Elizondo, J. E.; Oct. 01, 2007; 46 pp.; In English

Contract(s)/Grant(s): DE-AC04-94AL85000

Report No.(s): DE2008-934582; SAND2007-7045; No Copyright; Avail.: National Technical Information Service (NTIS)

The laser trigger switch (LTS) is a key component in ZR-type pulsed power systems. In ZR, the pulse rise time through the LTS is > 200 ns and additional stages of pulse compression are required to achieve the desired <100 ns rise time. The inductance of the LTS ((approx.) 500nH) in large part determines the energy transfer time through the switch and there is much to be gained in improving system performance and reducing system costs by reducing this inductance. The current path through the cascade section of the ZR LTS is at a diameter of (approx.) 6-inches which is certainly not optimal from an inductance point of view. The LTS connects components of much greater diameter (typically 4-5 feet). In this LDRD the viability of switch concepts in which the diameter of cascade section is greatly increased have been investigated. The key technical question to be answered was, will the desired multi-channel behavior be maintained in a cascade section of larger diameter.

NTIS

*Inductance; Switching; Gas Lasers*

**20080047327** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**Modeling Microbunching from Shot Noise Using Vlasov Solvers**

Venturini, M.; Zholents, A.; May 01, 2008; 5 pp.; In English

Contract(s)/Grant(s): DE-AC02-05CH11231

Report No.(s): DE2008-934723; LBNL-567E; No Copyright; Avail.: National Technical Information Service (NTIS)

Unlike macroparticle simulations, which are sensitive to unphysical statistical fluctuations when the number of macroparticles is smaller than the bunch population, direct methods for solving the Vlasov equation are free from sampling noise and are ideally suited for studying microbunching instabilities evolving from shot noise. We review a 2D (longitudinal dynamics) Vlasov solver we have recently developed to study the microbunching instability in the beam delivery systems for x-ray FELs and present an application to FERMI(at)Elettra. We discuss, in particular, the impact of the spreader design on microbunching.

NTIS

*Boltzmann-Vlasov Equation; Bunching; Shot Noise*

**20080047328** Stanford Linear Accelerator Center, CA, USA

**Radiolocation of a HOM Source in the PEP-II Rings**

Novokhatski, A.; Seeman, J.; Sullivan, M.; Jul. 11, 2008; 3 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2008-934739; SLAC-PUB-13299; No Copyright; Avail.: Department of Energy Information Bridge

A signal from an antenna situated in the Low Energy Ring (LER) was used to find a broken shield in a bellows in the High Energy Ring (HER) during a single-bunch HER operation.

NTIS

*Storage Rings (Particle Accelerators); Antennas*

**20080047376** Geological Survey, Reston, VA USA

**Evolution of Deformation Studies on Active Hawaiian Volcanoes**

Decker, R.; Okamura, A.; Miklius, A.; Poland, M.; January 2008; 32 pp.; In English

Report No.(s): PB2009-101394; USGS/SIR-2008-5090; No Copyright; Avail.: National Technical Information Service (NTIS)

Deformation studies involve measuring and interpreting the changes in elevations and horizontal positions of the land surface or sea floor. These studies are variously referred to as geodetic changes or ground-surface deformations and are sometimes indexed under the general heading of geodesy. Deformation studies have been particularly useful on active volcanoes and in active tectonic areas. A great amount of time and energy has been spent on measuring geodetic changes on Kilauea and Mauna Loa Volcanoes in Hawaii. These changes include the build-up of the surface by the piling up and ponding of lava flows, the changes in the surface caused by erosion, and the uplift, subsidence, and horizontal displacements of the surface caused by internal processes acting beneath the surface. It is these latter changes that are the principal concern of this review. A complete and objective review of deformation studies on active Hawaiian volcanoes would take many volumes. Instead, we attempt to follow the evolution of the most significant observations and interpretations in a roughly chronological way. It is correct to say that this is a subjective review. We have spent years measuring and recording deformation changes on these great volcanoes and more years trying to understand what makes these changes occur. We attempt to make this a balanced as well as a subjective review; the references are also selective rather than exhaustive.

NTIS

*Deformation; Geodesy; Volcanoes*

**20080047378** Fermi National Accelerator Lab., Batavia, IL, USA; Wroclaw Technical Univ., Poland

**Design, Production and First Commissioning Results of the Electrical Feedboxes of the LHC**

Perin, A.; Metral, I.; Koczorowski, S.; Genet, M.; Fydrych, J.; Dec. 01, 2007; 9 pp.; In English

Contract(s)/Grant(s): DE-AC02-76CH03000

Report No.(s): DE2008-934569; FERMILAB-CONF-07-743-TD; No Copyright; Avail.: National Technical Information Service (NTIS)

A total of 44 CERN designed cryogenic electrical feedboxes are needed to power the LHC superconducting magnets. The feedboxes include more than 1000 superconducting circuits fed by high temperature superconductor and conventional current leads ranging from 120 A to 13 kA. In addition to providing the electrical current to the superconducting circuits, they also ensure specific mechanical and cryogenic functions for the LHC. The paper focuses on the main design aspects and related production operations and gives an overview of specific technologies employed. Results of the commissioning of the feedboxes of the first LHC sectors are presented.

NTIS

*Electric Equipment; High Temperature Superconductors; Circuits*

**20080047391** Fermi National Accelerator Lab., Batavia, IL, USA; Universidad Autonoma de Barcelona (Spain), Spain  
**Measurement of Inclusive Jet Cross Sections in  $Z/\gamma^*(\rightarrow e^+e^-)$  + jets Production in ppbar Collisions at  $\sqrt{s} = 1.96$  TeV with the CDF Detector, (Thesis/Dissertation)**

Salto Bauza, O.; Apr. 01, 2008; 144 pp.; In English

Contract(s)/Grant(s): DE-AC02-76CH03000

Report No.(s): DE2008-934553; FERMILAB-THESIS-2008-17; No Copyright; Avail.: National Technical Information Service (NTIS)

In this thesis, a number of measurements are performed to test different models of underlying event and hadronization

implemented in LO plus parton shower Monte Carlo generator programs. Chapter 2 is devoted to the description of the theory of strong interactions and jet phenomenology at hadron colliders. Chapter 3 contains the description of the Tevatron collider and the CDF detector. The analysis is described in detail in Chapter 4. Chapter 5 shows the measurement of those observables sensitive to non-perturbative effects compared to the predictions from several Monte Carlo programs. Chapter 6 discusses the final results and the comparison with theoretical expectations. Finally, Chapter 7 is devoted to the conclusions.

NTIS

*Collisions; Cross Sections; Phenomenology*

**20080047392** Fermi National Accelerator Lab., Batavia, IL, USA

**LFSC - Linac Feedback Simulation Code**

Ivanov, V.; May 01, 2008; 33 pp.; In English

Contract(s)/Grant(s): DE-AC02-76CH03000

Report No.(s): DE2008-934559; FERMILAB-TM-2409-CD; No Copyright; Avail.: National Technical Information Service (NTIS)

The computer program LFSC (<Linac Feedback Simulation Code>) is a numerical tool for simulation beam based feedback in high performance linacs. The code LFSC is based on the earlier version developed by a collective of authors at SLAC (L.Hendrickson, R. McEwen, T. Himel, H. Shoaee, S. Shah, P. Emma, P. Schultz) during 1990-2005. That code was successively used in simulation of SLC, TESLA, CLIC and NLC projects. It can simulate as pulse-to-pulse feedback on timescale corresponding to 5-100 Hz, as slower feedbacks, operating in the 0.1-1 Hz range in the Main Linac and Beam Delivery System. The code LFSC is running under Matlab for MS Windows operating system. It contains about 30,000 lines of source code in more than 260 subroutines. The code uses the LIAR ('Linear Accelerator Research code') for particle tracking under ground motion and technical noise perturbations. It uses the Guinea Pig code to simulate the luminosity performance. A set of input files includes the lattice description (XSIF format), and plane text files with numerical parameters, wake fields, ground motion data etc. The Matlab environment provides a flexible system for graphical output.

NTIS

*Computer Programs; Computerized Simulation; Feedback; Linear Accelerators; Simulation*

**20080047394** Fermi National Accelerator Lab., Batavia, IL, USA

**Quantum Chromodynamics with Advanced Computing**

Kronfeld, A. S.; Jul. 01, 2008; 17 pp.; In English

Contract(s)/Grant(s): DE-AC02-76CH03000

Report No.(s): DE2008-934561; FERMILAB-CONF-08-208-T; No Copyright; Avail.: National Technical Information Service (NTIS)

We survey results in lattice quantum chromodynamics from groups in the USQCD Collaboration. The main focus is on physics, but many aspects of the discussion are aimed at an audience of computational physicists.

NTIS

*Quantum Chromodynamics; Surveys*

**20080047395** Fermi National Accelerator Lab., Batavia, IL, USA; Oklahoma Univ., Norman, OK, USA

**Evidence for Single Top Production at the Tevatron**

Jain, S.; May 01, 2008; 4 pp.; In English

Contract(s)/Grant(s): DE-AC02-76CH03000

Report No.(s): DE2008-934566; FERMILAB-CONF-08-145-E; No Copyright; Avail.: National Technical Information Service (NTIS)

We present first evidence for the production of single top quarks at the Fermilab Tevatron  $p(\bar{p})$  collider. Both D0 and CDF experiments have measured the single top production cross section with a 3-standard-deviation significance using 0.9 fb(sup -1) and 2.2 fb(sup -1) of lepton+jets data, respectively. A direct measurement of the CKM matrix element that describes the  $Wtb$  coupling is also performed for the first time.

NTIS

*Particle Accelerators; Quarks; Standard Deviation*

**20080047443** NASA Glenn Research Center, Cleveland, OH, USA

**High-Temperature Properties of Piezoelectric Langatate Single Crystals**

Sehirlioglu, Alp; Sayir, Ali; Klemenz, Christine; December 02, 2007; 4 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNC07BA13B; WBS 984754.02.07.03.16.04; Copyright; Avail.: CASI: [A01](#), Hardcopy

Langasite type crystals belong to non-polar point group of 32 and do not show any phase transformations up to the melting temperature. Langatate ( $\text{La}_3\text{Ga}(5.5)\text{Ta}(0.5)\text{O}_{14}$ ) demonstrates piezoelectric activity better than quartz and possesses attractive properties for high temperature sensors, resonators and filter applications. High-quality and colorless langatate crystals were grown by the Czochralski technique. The electromechanical and electrical properties of langatate crystals in different crystallographic directions were characterized at elevated temperature. The piezoelectric coefficient along x-axis was 7 pC/N as measured by a Berlincourt meter for a plate geometry with an aspect ratio of 10:1. The dielectric constant did not exhibit any significant temperature dependence (K33 approx. 21 at 30 C and K33 approx. 23 at 600 C). Loss tangent at 100 kHz remained <0.003 up to 300 C and <0.65 at 600 C. The dielectric properties along the y-axis were similar and its temperature dependence was analogous to the x-axis. Electromechanically, the inactive z-axis exhibited no resonance with K33 approx. 84 at room temperature, decreasing down to approx. 49 at 600 C. Resistivity of these crystals along x-axis decreased from approx.  $6 \times 10^{11}$   $\Omega\text{-cm}$  at room temperature, to approx.  $1.6 \times 10^6$   $\Omega\text{-cm}$  at 600 C.

Author

*Dielectric Properties; Temperature Dependence; Piezoelectricity; Phase Transformations; Electrical Resistivity; Single Crystals; Temperature Sensors*

**20080047610** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Electronic State Distributions of  $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$  Laser Ablated Plumes**

Kee, Patrick D; Sep 2008; 219 pp.; In English

Report No.(s): AD-A489661; AFIT/DSP/ENP/08-S05; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Emission from YBCO laser-ablated plumes was studied to characterize the PLD process. A KrF laser was used to ablate a bulk YBCO target at oxygen pressures ranging from 50-400 mTorr. Spectra were collected for the 500-860 nm bandpass at target distances ranging from 31.4-55.0 mm. Line fluences were corrected for self-absorption, and state distributions were calculated using recently updated transition probabilities. Electronic temperatures ranged from 0.28 +/- 0.01 eV to 0.37 +/- 0.03 eV for Y I, 0.28 +/- 0.01 eV to 0.35 +/- 0.03 eV for Ba I, and 0.40 +/- 0.02 eV to 0.48 +/- 0.05 eV for Cu I-consistent with prior literature. Results were insensitive to position and oxygen pressure. Spectrally-filtered imagery was used to determine plume velocities, shock strengths, and time-of-flight curves. Effects of time-varying temperatures and number densities on observed state distributions were modeled, predicting a slight elevation of Cu temperatures compared to Ba. However, this was not sufficient to explain experimental results. Surprisal analysis of state distributions resulted in linear constraints, consistent with an exponential gap law for electronic excitation.

DTIC

*Ceramics; Deposition; Emission Spectra; Lasers; Manufacturing; Plumes; Superconductors (Materials); YBCO Superconductors*

**20080047767** Venable, LLP, Washington, DC, USA

**Monitoring Molecular Interactions Using Photon Arrival-Time Interval Distribution Analysis**

Laurence, T. A., Inventor; Weiss, S., Inventor; 25 Jul 03; 50 pp.; In English

Contract(s)/Grant(s): DE-AC03-76SF00098

Patent Info.: Filed Filed 25 Jul 03; US-Patent-Appl-SN-10-521 632

Report No.(s): PB2008-105472; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method for analyzing/monitoring the properties of species that are labeled with fluorophores. A detector is used to detect photons emitted from species that are labeled with one or more fluorophores and located in a confocal detection volume. The arrival time of each of the photons is determined. The interval of time between various photon pairs is then determined to provide photon pair intervals. The number of photons that have arrival times within the photon pair intervals is also determined. The photon pair intervals are then used in combination with the corresponding counts of intervening photons to analyze properties and interactions of the molecules including brightness, concentration, coincidence and transit time. The method can be used for analyzing single photon streams and multiple photon streams.

NTIS

*Molecular Interactions; Molecules; Patent Applications; Photons*



**20080047770** Tarolli, Sundheim, Covell and Tummino, LLP, Cleveland, OH, USA

**System for Establishing an Attenuation Frequency**

Gounalis, A. J., Inventor; 11 Mar 04; 11 pp.; In English

Contract(s)/Grant(s): N00019-93-C-0196

Patent Info.: Filed Filed 11 Mar 04; US-Patent-Appl-SN-10-798 612

Report No.(s): PB2008-105475; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A system in accordance with the present invention determines signal attenuation for an electronic support measure receiver. The system includes a detection module for receiving electromagnetic signals from a surrounding environment and a processing module for chronologically segregating the electromagnetic signals into a plurality of dwells. The processing module controls the processing of the plurality of dwells. The processing module determines an analysis dwell from the plurality of dwells. The processing module computes a coarse attenuation for the analysis dwell. The processing module further computes a fine attenuation from the coarse attenuation and an offset table value.

NTIS

*Electromagnetic Radiation; Frequencies; Patent Applications*

**20080047850** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Experimental Ejection Forces of Thermoplastic Parts From Rapid Tooled Injection Mold Inserts (Preprint)**

Kinsella, Mary E; Lilly, Blaine; Jun 2007; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A489290; AFRL-RX-WP-TP-2008-4313; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489290>

The application of rapid prototyped tools for injection molding, if technically feasible, may allow for small quantity production by reducing the cost of tooling. This work has investigated one aspect of the technical feasibility through testing and experimentation to determine ejection force requirements and coefficients of friction. Injection molding experiments were conducted using three mold insert materials, P-20 steel, laser sintered ST-100, and stereolithography SL 5170 resin. Ejection forces for cylindrical parts molded with high density polyethylene and high impact polystyrene were measured directly and compared with values calculated from an ejection force differently, depending on the materials characteristics. Results show that ST-100 is a good candidate for injection molding tools, and that SL 5170 might be a candidate for molding some thermoplastics, but only in very small quantities.

DTIC

*Ejection; Friction; Injection; Injection Molding; Inserts; Thermoplastic Resins; Thermoplasticity*

**20080047852** Air Force Research Lab., Wright-Patterson AFB, OH USA

**Variability in Component Life Due to Fatigue Crack Growth Variability (Preprint)**

Rosenberger, A H; Oct 2008; 26 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A489285; AFRL-RX-WP-TP-2008-4311; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489285>

The variation in component damage tolerance life is assessed in terms of the variation in crack growth rate using a cycle by cycle integration technique. The results of a fatigue crack growth rate interlaboratory study are reanalyzed in order to predict the life of a component-like structure. It was determined that the variability in crack growth rate is fundamentally the same as the variability in the predicted fracture mechanics life for 4130 steel, and the aluminum alloys 2024-T351 and 7075-T6. Through only a limited K range able to be examined, it appears that the match of the variability of crack growth rate and component life is relatively independent of the range of K used in the comparison.

DTIC

*Crack Propagation; Fatigue (Materials); Variability*

**20080047902** Nutter McClennen and Fish LLP, Boston, MA, USA

**Radiofrequency Coil and Catheter for Surface NMR Imaging and Spectroscopy**

Ackerman, J. L., Inventor; Wedeen, V. J., Inventor; 21 Oct 03; 32 pp.; In English

Patent Info.: Filed Filed 21 Oct 03; US-Patent-Appl-SN-10-532 156

Report No.(s): PB2008-105463; No Copyright; Avail.: CASI: A03, Hardcopy

In one aspect, the present invention provides a cylindrical meanderline coil that can significantly improve the performance and usefulness of nuclear magnetic resonance (NMR) catheter radiofrequency (RF) coils by shaping the spatial dimensions of the volume of excitation and reception of signal. This can provide improved accuracy in defining the volume of excitation and reception of the subject or specimen, and increase the signal to noise ratio of a received signal. In another aspect, the invention provides an intravascular catheter having a coil at its tip for generating and/or detecting magnetic excitations. A preamplifier coupled to the catheter in proximity of the coil allows amplifying signals generated and/or detected by the coil. Although in one application, a coil and/or a catheter of the invention can be employed, for example, for MR spectroscopy or imaging of biological tissue, such as atherosclerotic plaques arterial walls in the human body, the invention provides similar advantages in any situation where a magnetic resonance or other magnetic induction signal is to be received from a thin cylindrical shell or sector of a cylindrical shell.

NTIS

*Catheterization; Imaging Techniques; Medical Equipment; Nuclear Magnetic Resonance; Patent Applications; Spectroscopy*

**20080047905** Fermi National Accelerator Lab., Batavia, IL, USA; Purdue Univ., West Lafayette, IN USA

#### **Top Physics at the Tevatron Collider**

Margaroli, F.; January 2007; 5 pp.; In English

Report No.(s): DE2007-918716; FERMILAB-CONF-07-571-E; No Copyright; Avail.: National Technical Information Service (NTIS)

The top quark has been discovered in 1995 at the CDF and DO experiments located in the Tevatron ring at the Fermilab laboratory. After more than a decade the Tevatron collider, with its center-of-mass energy collisions of 1.96 TeV, is still the only machine capable of producing such exceptionally heavy particle. Here I present a selection of the most recent CDF and DO measurements performed analyzing approx. 1 fb<sup>-1</sup> of integrated luminosity.

NTIS

*Particle Accelerators; Quarks*

**20080047906** Stanford Linear Accelerator Center, CA, USA; Los Alamos National Lab., NM USA

#### **Sweet Spot Supersymmetry and Composite Messengers**

Ibe, M.; Kitano, R.; Oct. 2007; 12 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-918967; SLAC/PUB-12893; LA-UR-07-7067; No Copyright; Avail.: Department of Energy Information Bridge

Sweet spot supersymmetry is a phenomenologically and cosmologically perfect framework to realize a supersymmetric world at short distance. We discuss a class of dynamical models of supersymmetry breaking and its mediation whose low-energy effective description falls into this framework. Hadron fields in the dynamical models play a role of the messengers of the supersymmetry breaking. As is always true in the models of the sweet spot supersymmetry, the messenger scale is predicted to be 10(5) GeV approx. or  $< M\text{-mess approx. or } < 10(10) \text{ GeV}$ . Various values of the effective number of messenger fields  $N(\text{sub mess})$  are possible depending on the choice of the gauge group.

NTIS

*Cosmology; Invariance; Supersymmetry*

**20080047910** Fermi National Accelerator Lab., Batavia, IL, USA

#### **Using the Quadrupole Moment Frequency Response of Bunched Beam to Measure its Transverse Emittance**

Tan, C. Y.; January 2007; 50 pp.; In English

Report No.(s): DE2007-919077; FERMILAB-TM-2397-AD; No Copyright; Avail.: National Technical Information Service (NTIS)

The quadrupole moment measured with a quadrupole pickup has been used to measure the transverse emittance of the beam. Unfortunately, the poor S/N ratio in the measurement makes it difficult to produce good and consistent emittance results. One way to enhance the S/N is to kick the beam with a quadrupole kicker and then measure its quadrupole frequency response (QFR) with a quadrupole pickup. This paper will show that if the bunched beam is extremely short, the quadrupole tunes are

well decoupled and far apart, and the quadrupole tune spread is smaller than the synchrotron tune, then the emittance can be extracted from the QFR.

NTIS

*Emittance; Frequency Response; Quadrupoles*

**20080047917** Stanford Linear Accelerator Center, CA, USA

**Beam-Ion Instability in PEP-II**

Heifets, S.; Kulikov, A.; Wang, M. H.; Wienands, U.; Nov. 2007; 30 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-919416; SLAC-PUB-12959-V3; No Copyright; Avail.: National Technical Information Service (NTIS)

The instability in the PEP-II electron ring has been observed while reducing the effects in the ring summarizing existing theories of the beam-ion interaction, comparing them with observations, effect on luminosity in the saturation regime. Considering the gap instability we suggest that the instability is triggered by the beam-ion instability, and discuss other mechanisms pertinent to the instability.

NTIS

*Ion Beams; Storage Rings (Particle Accelerators)*

**20080047918** European Organization for Nuclear Research, Geneva, Switzerland; Stanford Linear Accelerator Center, CA, USA; High Energy Accelerator Research Organization, Ibaraki, Japan

**Physics Case of Super Flavour Factory**

Browder, T.; Ciuchini, M.; Gershon, T.; Hazumi, M.; Hurth, T.; Oct. 2007; 20 pp.; In English

Report No.(s): DE2007-919433; CERN-PH-TH/2007-162; SLAC/PUB-12817, KEK/TH-1173; No Copyright; Avail.: National Technical Information Service (NTIS)

We summarize the physics case of a high-luminosity e+e- flavour factory collecting an integrated luminosity of 50 - 75 ab-1. Many New Physics sensitive measurements involving B and D mesons and t leptons, unique to a Super Flavour Factory, can be performed with excellent sensitivity to new particles with masses up to 100 (or even 1000) TeV. Flavour- and CP-violating couplings of new particles that may be discovered at the LHC can be measured in most scenarios, even in unfavourable cases assuming minimal flavour violation. Together with the LHC, a Super Flavour Factory, following either the SuperKEKB or the SuperB proposal, could be soon starting the project of reconstructing the New Physics Lagrangian.

NTIS

*Industrial Plants; Luminosity*

**20080048122** National Inst. of Standards and Technology, Gaithersburg, MD USA

**NIST Calibration Uncertainties of Liquid-in-Glass Thermometers over the Range from -20 Degrees Celsius to 400 Degrees Celsius**

Vaughn, C. D.; Strouse, G. F.; January 2007; 6 pp.; In English

Report No.(s): PB2008-105795; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The National Institute of Standards and Technology (NIST) Industrial Thermometer Calibration Laboratory (ITCL) is responsible for calibrating several different types of industrial thermometers. One of those types is a liquid-in-glass (LiG) thermometer, which includes both mercury (partial and total immersion) and organic (total immersion) filled models. Over the past two years, improvements in both calibration equipment and software used in the ITCL has led to a new assessment of the uncertainties assigned to the calibration of LiG thermometers covering the temperature range from 20 degrees C to 400 degrees C. In total, eighteen thermometers from three different manufacturers, six of which are mercury-filled partial immersion, twelve of which are mercury-filled total immersion, and two of which are organic-filled total immersion models, were used for the determination of LiG thermometer calibration uncertainties over the range from -20 degrees C to 400 degrees C in the NIST ITCL.

NTIS

*Calibrating; Glass; Standards; Thermometers*

**20080048208** National Inst. of Standards and Technology, Gaithersburg, MD USA

**Investigation of the Non-Uniqueness of the ITS-90 in the Range 660 Degrees C to 962 Degrees C**

Furukawa, G. T.; Strouse, G. F.; January 2007; 6 pp.; In English

Report No.(s): PB2008-105794; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Preliminary results are reported on the non-uniqueness of the ITS-90 using high temperature SPRTs (HTSPRTs) in the

range 660 degrees C to 962 degrees C. To achieve temperature stability and uniformity of the test HTSPRTs, the method employs the thermal isolation of the Inconel metal comparison block inside a sealed potassium heat pipe controlled to -0.01 K. Eleven HTSPRTs of three designs from five manufacturers were tested. In addition to measurements near the calibration temperatures 663.3 degrees C and 966.6 degrees C to test the temperature uniformity of the comparison block, measurements were made at 703.3 degrees C, 724.4 degrees C, 753.2 degrees C, 801.7 degrees C, 847.5 degrees C, and 913.7 degrees C.  
NTIS

*Calibrating; Melting Points; Standardization; Standards; Temperature Measurement; Uniqueness*

**20080048213** Brookhaven National Lab., Upton, NY USA

**Brookhaven National Laboratory's Annual Report of Laboratory Directed Research & Development Program Activities for FY 2005**

Dec. 2005; 240 pp.; In English

Contract(s)/Grant(s): DE-AC02-98CH10886

Report No.(s): DE2007-878907; BNL-52351-2005; No Copyright; Avail.: Department of Energy Information Bridge

The Brookhaven National (BNL) Laboratory Directed Research and Development (LDRD) Program report its status to the U.S. Department of Energy (DOE) annually in March, as required by DOE order 413.2A, January 8, 2001, and the LDRD Annual Report guidance, updated February 12, 1999. In FY 2005 the LDRD Program continued to obtain its funds through the Laboratory overhead pool and operates under the authority of DOE Order 413.2A. The LDRD Annual Report contains summaries of all research activities funded during Fiscal Year 2005. The Project Summaries with their accomplishments described in this report reflect the above goals and objectives.

NTIS

*Research and Development; Laboratories*

**20080048221** Glasgow Univ., Scotland, UK

**Measurement of the Neutron Electric Form Factor at  $Q(\text{sup } 2) \text{ equals } 0.8 \text{ (GeVbackslashc) sup } 2$**

Glazier, D.; January 2003; 143 pp.; In English

Report No.(s): DE2007-917709; Copyright; Avail.: National Technical Information Service (NTIS)

Nucleon form factors allow a sensitive test for models of the nucleon. Recent experiments utilising polarisation observables have resulted, for the first time, in a model-independent determination of the neutron electric form factor  $G_n^E$ . This method employed an 80% longitudinally polarised, high intensity (10 uA) electron beam (883 MeV) that was quasi-elastically scattered off a liquid deuterium target in the reaction  $D(e, e'n)p$ . A neutron polarimeter was designed and installed to measure the ratio of transverse-to-longitudinal polarisation using neutron scattering asymmetries. This ratio allowed a determination of the neutron elastic form factor,  $G_n^E$ , free of the previous large systematic uncertainties associated with the deuterium wave function. The experiment took place in the A1 experimental hall at MAMI taking advantage of a high resolution magnetic spectrometer. A detailed investigation was carried out into the performance of the neutron polarimeter.

NTIS

*Form Factors; Neutrons*

**20080048222** Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA

**Overview of the RRR Nb Specifications and the Evolution of SRF Technology**

Myneni, G. R.; May 2007; 30 pp.; In English

Report No.(s): DE2007-908631; No Copyright; Avail.: National Technical Information Service (NTIS)

Maury Tigners classical review paper, 'RF Superconductivity For Accelerators Is It A Hollow Promise' summarizes the pioneering work that was carried out from mid 1960s to late 1970s and is a must reading for all the new comers in to SRF world. The specifications of high purity niobium for SRF cavities seem to have evolved between 1979 and 1987. Fine grain high purity niobium has been the material of choice for SRF cavities for the past two decades. The current high RRR niobium material specifications will be reviewed from the historical context. The specification discussions include grain size, ductility, yield strength, thermal conductivity and residual resistance ratio. The effect of each of these material characteristic on the process and performance of the cavities will be explored. The recent progress on the single crystal - large grain niobium technology and its potential impact on the cost and performance of ILC cavities will be discussed. The possible relaxation of specifications, such as residual resistance ratio and Tantalum content will be presented from the perspective of reducing the

cavity fabrication costs for industrial applications. Further, a summary of the low temperature mechanical properties of polycrystalline niobium will also be presented.

NTIS

*Cavities; Accelerators*

**20080048226** Princeton Univ., NJ, USA

**Search for Muon Neutrino to Electron Neutrino Oscillations at  $\delta(m)^2 > e V^2$**

Patterson, R. B.; Nov. 2007; 269 pp.; In English

Report No.(s): DE2007-917855; No Copyright; Avail.: National Technical Information Service (NTIS)

No abstract available

*Electron Oscillations; Muons; Neutrinos*

**20080048229** Arizona Univ., Tucson, AZ, USA

**Time-Dependent Neutral Particle Transport Benchmarks in Two and Three Dimensions (Final Report, August 15, 2004-June 14, 2007)**

Ganapol, B. D.; January 2007; 15 pp.; In English

Contract(s)/Grant(s): DE-FG07-04ID14587

Report No.(s): DE2007-918692; No Copyright; Avail.: National Technical Information Service (NTIS)

The main objective of NEER grant DE-FG07-04ID14587 was to generate highly accurate 2D and 3D time-dependent neutral particle intensity maps from 3D pulsed wire sources through integration of the analytical representation of a time-dependent point source. These maps would then serve as benchmark solutions for time-dependent transport methods developer. During the three years of this grant, we have shown that, in principle, any 3D wire source in an infinite medium can be simulated in this way. Year 1 was primarily concerned with the theory for 1D and 2D sources. The solution approach is rather novel in that the multidimensional solutions are based entirely on a 1D solution. In particular, a time-dependent point source is integrated over the wire source. For this reason, the point source solution had to be efficiently programmed to be as fast and accurate as possible, since it was to be at the center of a time consuming integration. The original point source solution was based on a multiple collision formulation which, by any measure, was entirely too slow for the intended use. Thus, the solution methodology was changed to a double transform inversion, which gives the multiple collision series in summed form. One inversion could be performed analytically while the other required numerical quadrature. A new concept was then used in the numerical quadrature. In particular, since the inversion was essentially a Laplace transform inversion, the integrand, while real, was set in the complex plane. The evaluation proceeded by evaluating the integral through complex computer arithmetic giving its numerical value explicitly rather than first finding the integrand analytically. This proved to be an extremely efficient method of computation. With the help of then graduate student Roberto Furfaro, the 1D solution was tested against previous solutions developed some thirty years ago to ensure proper programming and extreme accuracy. At the end of Year 1 and during Year 2, numerical implementation of the integration over the wire source configuration was initiated.

NTIS

*Neutral Particles; Time Dependence; Wire*

**20080048310** National Inst. of Standards and Technology, Gaithersburg, MD USA

**NIST Industrial Thermometer Calibration Laboratory**

Vaughn, C. D.; Strouse, G. F.; January 2007; 6 pp.; In English

Report No.(s): PB2008-105796; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The NIST Industrial Thermometer Calibration (ITC) Laboratory provides calibrations of industrial thermometers over the range from 196 degrees C to 550 degrees C. The different types of thermometers include liquid-in-glass (LiG), thermistors, thermocouples (<200 degrees C), and industrial platinum resistance thermometers (IPRTs). Calibrations are performed by both comparison with a standard platinum resistance thermometer (SPRT) calibrated on the International Temperature Scale of 1990 and by a limited number of fixed-points. The comparison baths are liquid nitrogen (196 degrees C), alcohol (100 degrees C to 1 degrees C), water (0.5 degrees C to 95 degrees C), oil (95 degrees C to 275 degrees C), and salt (275 degrees C to 550 degrees C). The fixed points used are the melting point of ice (0 degrees C), the triple point of water (0.01 degrees C), and the melting point of gallium (29.7646 degrees C). The temperature measurement system for the reference SPRT it is a commercially-available ac resistance ratio bridge, for the IPRTs and thermistors it is a dc voltmeter with a constant current source, for the thermocouples it is a dc voltmeter, and for the LiGs it is a digital video camera. All of these temperature measurement systems are integrated via three computer-controlled data acquisition systems that semi-automate calibrations.

This paper presents the methods, equipment, and uncertainties associated with the calibration of industrial thermometers in the ITC Laboratory.

NTIS

*Calibrating; Standards; Thermometers*

**20080048311** National Inst. of Standards and Technology, Gaithersburg, MD USA

**Investigation of the ITS-90 Subrange Inconsistencies for 25.5 Ohm SPRTs**

Strouse, G. F.; January 2007; 5 pp.; In English

Report No.(s): PB2008-105798; No Copyright; Avail.: CASI: [A01](#), Hardcopy

The International Temperature scale of 1990 provides greater flexibility than the International Practical Temperature Scale of 1968, Amended edition 1975, through the use of more fixed points and more temperature subranges. The present investigation examined the ranges of 83.8058 K to 273.16 K and 273.15K to 933.473 K for 25.5 ohm standard platinum resistance thermometers.

NTIS

*Calibrating; Platinum; Resistance Thermometers; Standards*

**20080048312** National Inst. of Standards and Technology, Gaithersburg, MD USA

**NIST Assessment of ITS-90 Non-Uniqueness for 25.5 ohm SPRTs at Gallium Indium, and Cadmium Fixed Points**

Strouse, G. F.; January 2007; 5 pp.; In English

Report No.(s): PB2008-105800; No Copyright; Avail.: CASI: [A01](#), Hardcopy

The use of temperature subranges in the definition of the international Temperature Scale of 1990 (ITS-90) permits standard platinum resistance thermometers (SPRTs) to be measured at defining fixed points of a particular subrange as well as at fixed points not utilized in that subrange. These redundant fixed points allow analysis of the non-uniqueness of the scale. Specifically, with 25.5 ohm SPRTs at gallium, indium, and cadmium fixed points have been made and examined to determine the non-uniqueness of the ITS-90 at the three redundant fixed points does not contribute significantly to the total error associated with the calibration of an SPRT.

NTIS

*Cadmium; Calibrating; Gallium; Indium; Standardization; Standards; Temperature Measurement; Temperature Scales; Uniqueness*

**20080048313** National Inst. of Standards and Technology, Gaithersburg, MD USA

**NIST Implementation and Realization of the ITS-90 Over the Range 83K to 1235 K: Reproducibility, Stability, and Uncertainties**

Strouse, G. F.; January 2007; 7 pp.; In English

Report No.(s): PB2008-105801; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The National Institute of Standards and Technology is using thermometric fixed points to realize the international Temperature Scale of 1990 (ITS-90) and disseminate the temperature scale through the calibration of standard platinum resistance thermometers over the range of 83.8058 K to 1234.93 K. This work involved the optimization of experimental techniques and measurement procedures to reduce uncertainty in the data. The realization of the scale allows for an in-depth investigation of reproducibility and stability of the fixed points used to define the various temperature subranges of the ITS-90. Additionally, propagation of errors associated with the ITS-90 is discussed.

NTIS

*Calibrating; Stability; Standardization; Standards; Temperature Measurement; Temperature Scales*

**20080048314** National Inst. of Standards and Technology, Gaithersburg, MD USA

**Non-Uniqueness of the ITS-90 from 13.8033 K to 24.55461 K**

Meyer, C. W.; Strouse, G. F.; Tew, W. L.; January 2007; 6 pp.; In English

Report No.(s): PB2008-105816; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The International Temperature Scale of 1990 (ITS-90) is defined in the region 3.0 K to 24.5561 K by an interpolating constant volume gas thermometer (ICVGT) that is calibrated at three specified fixed points. From 13.8033 K to 1234.93 K the ITS-90 is defined by means of standard platinum resistance thermometers (SPRTs) calibrated at specified fixed points. Two of the fixed points at which SPRTs are calibrated, at 17.035 K + or - 0.010 K and 20.270K + or - 0.010 K, may be realized by using either of two different types of thermometry, yielding two SPRT definitions. Therefore, from 13.8033 K to 24.5561

K the possibility exists for non-uniqueness due to the overlap of three equally valid definitions (one ICVGT and two SPRT) that do not necessarily agree. The NIST apparatus for realizing the ITS-90 below 85 K includes an ICVGT that uses 4He as the working gas and fixed point cells which are used to calibrate the ICVGT and SPRTs below 85 K. We present here a determination of the non-uniqueness of the ITS-90 from 13.8033 K to 24.5561 K by means of direct comparisons of temperatures determined by the three valid definitions. Over this interval, total uncertainties ( $k=2$ ) in the ICVGT determinations range from 0.16 mK to 0.21 mK, and those from the SPRT determinations range from 0.15 mK to 0.48 mK. The maximum non-uniqueness observed is 1.55 mK + or - 0.54 mK, which occurs at 15 K.

NTIS

*Calibrating; Standardization; Standards; Temperature Measurement; Temperature Scales; Uniqueness*

**20080048346** National Inst. of Standards and Technology, Gaithersburg, MD USA

**Wavelength-Modulation Laser Hygrometer for Ultrasensitive Detection of Water Vapor in Semiconductor Gases**

Hovde, D. C.; Hodges, J. T.; Scace, G. E.; Silver, J. A.; January 2008; 11 pp.; In English

Report No.(s): PB2008-105920; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Measuring local concentrations of water vapor at mole fractions near nanomole-per-mole levels is important in many industrial applications, especially the fabrication of semiconductors. Sensitive methods and instruments for measuring water vapor include atmospheric-pressure ionization mass spectrometry, chilled-mirror hygrometers, electrolytic sensors, mechanical microbalances, and capacitance sensors.

NTIS

*Detection; Hygrometers; Lasers; Modulation; Semiconductors (Materials); Water; Water Vapor*

**20080048349** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Note on Semi-Discrete Conservation Laws and Conservation of Wave Action by Multisymplectic Runge-Kutta Box Schemes**

Frank, J. E.; Jan. 2006; 12 pp.; In English

Report No.(s): PB2008-106025; MAS-E0603; Copyright; Avail.: National Technical Information Service (NTIS)

In this note we show that multisymplectic Runge-Kutta box schemes, of which the Gauss-Legendre methods are the most important, preserve a discrete conservation law of wave action. The result follows by loop integration over an ensemble of flow realizations, and the local energy-momentum conservation law for continuous variables in semi-discretizations.

NTIS

*Conservation; Conservation Laws; Runge-Kutta Method; Wave Equations*

**20080048380** National Inst. of Standards and Technology, Gaithersburg, MD, USA

**NIST Physics Laboratory Annual Report 2004**

January 2008; 68 pp.; In English

Report No.(s): PB2009-102524; No Copyright; Avail.: National Technical Information Service (NTIS)

The mission of the NIST Physics Laboratory is to support U.S. industry, government, and the scientific community by providing measurement services and research for electronic, optical, and radiation technology. The Laboratory provides the foundation for metrology of optical and ionizing radiation, time and frequency, and fundamental quantum processes.

NTIS

*Atomic Physics; Research and Development*

**20080048414** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Performance Analysis of Effective Range and Orientation of UHF Passive RFID**

Roque, Paul N.; Mar 2008; 66 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489805; AFIT/GCO/ENG/08-06; No Copyright; Avail.: Defense Technical Information Center (DTIC) ONLINE: <http://hdl.handle.net/100.2/ADA489805>

The purpose of this research is to characterize the performance of UHF passive RFID tags. Factors of importance are the impact of tag orientation and distance from the RFID reader. Within this study, a comprehensive literature review of RFID technology is presented as well as the methodology used for the research. Furthermore, an analysis of RFID tag experiments is discussed and the results reviewed. To accomplish this task, two main objectives have been established as goals for the study. The first objective is to determine an optimum tag orientation within the RFID reader's normal read range. Once the optimum tag orientation is determined, the orientation is used to perform range variation tests. The end goal of these tests is

to find the maximum range at which the tags are readable under normal conditions using standard equipment. Grasping an idea of RFID tag boundaries contributes to the security and privacy of the technology. This is extremely important as RFID tags are becoming the logistical tool of choice for Department of Defense (DoD) supply chains. This fundamental study creates a foundation that may support both offensive and defensive oriented research. By understanding tag weaknesses and strengths, users of the technology can make sound decisions that lead to the protection of valuable information and assets.

DTIC

*Radio Frequencies; Reliability Analysis; Ultrahigh Frequencies*

**20080048517** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Bit Error Rate Minimizing Channel Shortening Equalizers for Single Carrier Cyclic Prefixed Systems**

Martin, Richard K; Vanbleu, Koen; Ysebaert, Geert; Apr 2007; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A490147; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Single carrier cyclic prefixed (SCCP) communications are a close relative of multicarrier communications. Both types of systems are robust to multipath, provided that the channel delay spread is shorter than the guard interval between transmitted blocks. If this condition is not met, a channel shortening equalizer can be used to shorten the channel to the desired length. Previous work on channel shortening has largely been in the context of digital subscriber lines, a wireline system that allows bit allocation, thus it has focused on maximizing the bit rate for a given bit error rate (BER). We propose and evaluate a channel shortener that attempts to directly minimize the BER for an SCCP system. The problem is shown to be analytically distinct from the analogous problem in multicarrier systems.

DTIC

*Bit Error Rate; Equalizers (Circuits)*

## 71 ACOUSTICS

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution*. For aircraft noise see also *02 Aerodynamics* and *07 Aircraft Propulsion and Power*.

**20080047421** NASA Glenn Research Center, Cleveland, OH, USA

**Separating Turbofan Engine Noise Sources Using Auto and Cross Spectra from Four Microphones**

Miles, Jeffrey Hilton; AIAA Journal; January 2008; Volume 46, No. 1, pp. 61-74; In English; 12th AIAA/CEAS Aeroacoustics Conference, 8-10 May 2008, Cambridge, MA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.18.03

Report No.(s): Paper 2580; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047421>; <http://dx.doi.org/10.2514/1.25177>

The study of core noise from turbofan engines has become more important as noise from other sources such as the fan and jet were reduced. A multiple-microphone and acoustic-source modeling method to separate correlated and uncorrelated sources is discussed. The auto- and cross spectra in the frequency range below 1000 Hz are fitted with a noise propagation model based on a source couplet consisting of a single incoherent monopole source with a single coherent monopole source or a source triplet consisting of a single incoherent monopole source with two coherent monopole point sources. Examples are presented using data from a Pratt & Whitney PW4098 turbofan engine. The method separates the low-frequency jet noise from the core noise at the nozzle exit. It is shown that at low power settings, the core noise is a major contributor to the noise. Even at higher power settings, it can be more important than jet noise. However, at low frequencies, uncorrelated broadband noise and jet noise become the important factors as the engine power setting is increased.

Author

*Engine Noise; Jet Aircraft Noise; Sound Generators; Turbofan Engines; Noise Propagation; Microphones; Monopoles; Coherent Radiation*

**20080047422** NASA Glenn Research Center, Cleveland, OH, USA

**Time Delay Analysis of Turbofan Engine Direct and Indirect Combustion Noise Sources**

Miles, Jeffrey Hilton; May 08, 2008; 6 pp.; In English; AARC Turbine Noise Workshop, 8-0 May 2008, Vancouver, BC, Canada; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.18.03

Report No.(s): AIAA-2008-50; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047422>

The core noise components of a dual spool turbofan engine were separated by the use of a coherence function. A source



location technique based on adjusting the time delay between the combustor pressure sensor signal and the far-field microphone signal to maximize the coherence and remove as much variation of the phase angle with frequency as possible was used. The discovery was made that for the 130o microphone a 90.027 ms time shift worked best for the frequency band from 0 to 200 Hz while a 86.975 ms time shift worked best for the frequency band from 200 to 400 Hz. Hence, the 0 to 200 Hz band signal took more time than the 200 to 400 Hz band signal to travel the same distance. This suggests the 0 to 200 Hz coherent cross spectral density band is partly due to indirect combustion noise attributed to entropy fluctuations, which travel at the flow velocity, interacting with the turbine. The signal in the 200 to 400 Hz frequency band is attributed mostly to direct combustion noise. Results are presented herein for engine power settings of 48, 54, and 60 percent of the maximum power setting

Author

*Turbofan Engines; Time Lag; Engine Noise; Pressure Sensors; Far Fields; Microphones; Combustion*

**20080047434** NASA Glenn Research Center, Cleveland, OH, USA

#### **State of Jet Noise Prediction-NASA Perspective**

Bridges, James E.; October 07, 2008; 42 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.17.03; Copyright; Avail.: CASI: [A03](#), Hardcopy

This presentation covers work primarily done under the Airport Noise Technical Challenge portion of the Supersonics Project in the Fundamental Aeronautics Program. To provide motivation and context, the presentation starts with a brief overview of the Airport Noise Technical Challenge. It then covers the state of NASA's jet noise prediction tools in empirical, RANS-based, and time-resolved categories. The empirical tools, requires seconds to provide a prediction of noise spectral directivity with an accuracy of a few dB, but only for axisymmetric configurations. The RANS-based tools are able to discern the impact of three-dimensional features, but are currently deficient in predicting noise from heated jets and jets with high speed and require hours to produce their prediction. The time-resolved codes are capable of predicting resonances and other time-dependent phenomena, but are very immature, requiring months to deliver predictions without unknown accuracies and dependabilities. In toto, however, when one considers the progress being made it appears that aeroacoustic prediction tools are soon to approach the level of sophistication and accuracy of aerodynamic engineering tools.

Author

*Aircraft Noise; Jet Aircraft Noise; Noise Prediction; Supersonics; Aeroacoustics*

**20080047436** NASA Glenn Research Center, Cleveland, OH, USA

#### **Acting on Lessons Learned: A NASA Glenn Acoustics Branch Perspective**

Koch, L. Danielle; April 02, 2008; 19 pp.; In English; Quiet, Efficient Fans for Spaceflight Workshop, 2 Apr. 2008, Cleveland, OH, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 439906.04.01.02.03; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047436>

Lessons learned from the International Space Station have indicated that early attention to acoustics will be key to achieving safer, more productive environments for new long duration missions. Fans are known to be dominant noise sources, and reducing fan noise poses challenges for fan manufacturers and systems engineers. The NASA Glenn Acoustics Branch has considered ways in which expertise and capabilities traditionally used to understand and mitigate aircraft engine noise can be used to address small fan noise issues in Exploration and Information Technology applications. Many could benefit if NASA can capture what is known about small fan aero and acoustic performance in a 'Guide for the Design, Selection, and Installation of Fans for Spaceflight Applications.' A draft outline for this document will be offered as a useful starting point for brainstorming ideas for the various smaller, near-term research projects that would need to be addressed first.

Author

*Acoustic Properties; Aeroacoustics; Aerodynamic Noise; Noise Reduction; Lessons Learned; International Space Station*

**20080047437** NASA Glenn Research Center, Cleveland, OH, USA

#### **Jet Mixing Noise Scaling Laws SHJAR Data Vs. Predictions**

Khavaran, Abbas; Bridges, James; September 23, 2008; 38 pp.; In English; Acoustic Technical Working Group, 23-24 Sep. 2008, Williamsburg, VA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.18.03; Copyright; Avail.: CASI: [A03](#), Hardcopy

High quality jet noise spectral data measured at the anechoic dome at the NASA Glenn Research Center is used to examine a number of jet noise scaling laws. Configurations considered in the present study consist of convergent as well as

convergent-divergent axisymmetric nozzles. The spectral measurements are shown in narrow band and cover 8193 equally spaced points in a typical Strouhal number range of (0.01 10.0). Measurements are reported as lossless (i.e. atmospheric attenuation is added to as-measured data), and at 24 equally spaced angles (50deg to 165deg) on a 100-diameter arc. Following the work of Viswanathan [Ref. 1], velocity power laws are derived using a least square fit on spectral power density as a function of jet temperature and observer angle. The goodness of the fit is studied at each angle, and alternative relationships are proposed to improve the spectral collapse when certain conditions are met. On the application side, power laws are extremely useful in identifying components from various noise generation mechanisms. From this analysis, jet noise prediction tools can be developed with physics derived from the different spectral components.

Author

*Jet Mixing Flow; Jet Aircraft Noise; Noise Generators; Noise Prediction; Scaling Laws; Spectrum Analysis; Acoustic Properties; Aeroacoustics; Aerodynamic Noise*

**20080047439** NASA Glenn Research Center, Cleveland, OH, USA

**Supersonics Project: Airport Noise Technical Challenge**

Bridges, James E.; September 23, 2008; 26 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.17.03; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047439>

This presentation gives an overview of the work being done under the Airport Noise Technical Challenge portion of the Supersonics Project in the Fundamental Aeronautics Program. The objective of the Challenge is to provide technology (e.g. low noise nozzle concepts) and engineering tools required for a viable supersonic aircraft. To accomplish this we have activities divided into Prediction, Diagnostics, and Engineering elements. Each of the tasks reviewed here have potential applications to work being done at other flight regimes and other aircraft and are of interest to the Acoustics Technical Working Group.

Author

*Aircraft Noise; Low Noise; Diagnosis; Acoustics*

**20080047444** NASA Glenn Research Center, Cleveland, OH, USA

**Collaborative Research on the Ultra High Bypass Ratio Engine Cycle to Reduce Noise, Emissions, and Fuel Consumption**

Hughes, Christopher; May 29, 2008; 30 pp.; In English; UTIAS-MITACS International Workshop on Aviation and Climate Change May 29-30, 2008; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.18.04; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047444>

A pictorial history of NASA development of advanced engine technologies for reducing environmental emissions and increasing performance from the 1970s to present is presented. The goals of the Subsonic Fixed Wing Program portion of the NASA Fundamental Aeronautics Program are addressed, along with the areas of investigation currently being pursued by the Ultra High Bypass Partnership Element of the Subsonic Fixed Wing Program to meet the goals. Ultra High Bypass cycle research collaboration successes with Pratt & Whitney are presented.

Author

*Bypass Ratio; Engine Noise; Noise Reduction; Fixed Wings; Fuel Consumption*

**20080047445** NASA Glenn Research Center, Cleveland, OH, USA

**Overview of the Orion Vibroacoustic Test Capability at NASA Glenn Research Center**

Hughes, William O.; Hozman, Aron D.; McNelis, Mark E.; Otten, Kim D.; May 07, 2008; 23 pp.; In English; Overview of the Orion Vibroacoustic Test Capability at NASA Glenn Research Center, 7 May 2008, Cleveland, OH, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 644423.10.34.03.03.03.03; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047445>

In order to support the environmental test needs for our new Orion and Constellation program, NASA is developing unique world-class test facilities. To optimize this testing of spaceflight hardware while minimizing transportation issues, a one-stop, under one roof test capability is being developed at the Space Power Facility at the NASA Glenn Research Center's Plum Brook Station. This facility will provide the capability to perform the following environmental testing: (1) reverberation acoustic testing, (2) mechanical base-shake sine testing, (3) modal testing, (4) thermal-vacuum testing, and (5) EMI/EMC

(electromagnetic interference and compatibility) testing. An overview of this test capability will be provided in this presentation, with special focus on the two new vibroacoustic test facilities currently being designed and built, the Reverberant Acoustic Test Facility (RATF) and the Mechanical Vibration Facility (MVF). Testing of the engineering developmental hardware and qualification hardware of the Orion (Crew Exploration Vehicle) will commence shortly after the facilities are commissioned.

Author

*Environmental Tests; Vibrational Stress; Acoustics; Electromagnetic Compatibility; Test Facilities*

**20080047512** Massachusetts Inst. of Tech., Cambridge, MA USA

**Echolocation-Based Foraging by Harbor Porpoises and Sperm Whales, Including Effects on Noise and Acoustic Propagation**

DeRuiter, Stacy L; Sep 2008; 332 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489203; MIT/WHOI-2008-11; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489203>

This thesis provides quantitative descriptions of toothed whale echolocation and foraging behavior, including assessment of the effects of noise on foraging behavior and the potential influence of ocean acoustic propagation conditions on biosonar detection ranges and whale noise exposure. Chapter 2 details the application of a modified version of the Dtag to study harbor porpoise echolocation. Study results indicate how porpoises vary the rate and level of their echolocation clicks during prey capture events and show that, unlike bats, porpoises continue their echolocation buzz after prey capture. Chapters 3-4 emphasize the importance of applying realistic models of ocean acoustic propagation in marine mammal studies. These chapters illustrate that geometric spreading approximations sometimes provide inaccurate predictions of communication/target detection ranges or noise exposure levels, especially if refraction in the water column or multi-path acoustic propagation are significant. Finally, in Chapter 5, I describe two methods for statistical analysis of whale behavior data, a rotation test and a semi-Markov chain model. I use the test for changes in sperm whale foraging behavior in response to airgun noise exposure. Test results indicate that, despite the low-level exposures in the study, some whales altered their foraging behavior in response to airgun exposure.

DTIC

*Acoustic Propagation; Animals; Harbors; Marine Biology; Noise Propagation; Porpoises; Whales*

**20080047678** NASA Glenn Research Center, Cleveland, OH, USA

**Large-scale Simulations and Detailed Flow Field Measurements for Turbomachinery Aeroacoustics**

VanZante, Dale; March 10, 2008; 33 pp.; In English; Graduate Seminar, 10 Mar. 2008, OH, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.18.03; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047678>

The presentation is a review of recent work in highly loaded compressors, turbine aeroacoustics and cooling fan noise. The specific topics are: the importance of correct numerical modeling to capture blade row interactions in the Ultra Efficient Engine Technology Proof-of-Concept Compressor, the attenuation of a detonation pressure wave by an aircraft axial turbine stage, current work on noise sources and acoustic attenuation in turbines, and technology development work on cooling fans for spaceflight applications. The topic areas were related to each other by certain themes such as the advantage of an experimentalist's viewpoint when analyzing numerical simulations and the need to improve analysis methods for very large numerical datasets.

Author

*Aeroacoustics; Turbomachinery; Noise Reduction; Axial Flow Turbines; Flow Distribution; Acoustic Attenuation; Aerodynamic Noise; Compressors*

**20080047679** NASA Glenn Research Center, Cleveland, OH, USA

**A Numerical Investigation of Turbine Noise Source Hierarchy and Its Acoustic Transmission Characteristics: Proof-of-Concept Progress**

VanZante, Dale; Envia, Edmane; September 23, 2008; 24 pp.; In English; Acoustics Technical Working Group Meeting, 23-24 Sep. 2008, Williamsburg, VA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561681.02.08.03.18.02; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047679>

A CFD-based simulation of single-stage turbine was done using the TURBO code to assess its viability for determining

acoustic transmission through blade rows. Temporal and spectral analysis of the unsteady pressure data from the numerical simulations showed the allowable Tyler-Sofrin modes that are consistent with expectations. This indicated that high-fidelity acoustic transmission calculations are feasible with TURBO.

Author

*Computational Fluid Dynamics; Acoustic Propagation; Noise Generators; Spectrum Analysis; Sound Transmission*

**20080047681** NASA Glenn Research Center, Cleveland, OH, USA

**Review of Aircraft Engine Fan Noise Reduction**

VanZante, Dale; April 02, 2008; 23 pp.; In English; Quiet, Efficient Fans for Spaceflight Workshop, 2-34Apr. 2008, Cleveland, OH, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 439906.04.01.02.03; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047681>

Aircraft turbofan engines incorporate multiple technologies to enhance performance and durability while reducing noise emissions. Both careful aerodynamic design of the fan and proper installation of the fan into the system are requirements for achieving the performance and acoustic objectives. The design and installation characteristics of high performance aircraft engine fans will be discussed along with some lessons learned that may be applicable to spaceflight fan applications.

Author

*Noise Reduction; Turbofan Engines; Aerodynamic Noise; Engine Noise; Fighter Aircraft; Aerodynamics*

**20080047683** NASA Glenn Research Center, Cleveland, OH, USA

**A Numerical Investigation of Turbine Noise Source Hierarchy and Its Acoustic Transmission Characteristics**

VanZante, Dale; Envia, Edmane; May 08, 2008; 22 pp.; In English; Turbine Noise Workshop, 8-9 May 2008, Vancouver, Canada; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 526282.01.03.02.01.09; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047683>

Understanding the relative importance of the various turbine noise generation mechanisms and the characteristics of the turbine acoustic transmission loss are essential ingredients in developing robust reduced-order models for predicting the turbine noise signature. A computationally based investigation has been undertaken to help guide the development of a turbine noise prediction capability that does not rely on empiricism. The investigation relies on highly detailed numerical simulations of the unsteady flowfield inside a modern high-pressure turbine (HPT). The simulations are developed using TURBO, which is an unsteady Reynolds-averaged Navier-Stokes (URANS) code capable of multi-stage simulations. The purpose of this study is twofold. First, to determine an estimate of the relative importance of the contributions to the coherent part of the acoustic signature of a turbine from the three potential sources of turbine noise generation, namely, blade-row viscous interaction, potential field interaction, and entropic source associated with the interaction of the blade rows with the temperature nonuniformities caused by the incomplete mixing of the hot fluid and the cooling flow. Second, to develop an understanding of the turbine acoustic transmission characteristics and to assess the applicability of existing empirical and analytical transmission loss models to realistic geometries and flow conditions for modern turbine designs. The investigation so far has concentrated on two simulations: (1) a single-stage HPT and (2) a two-stage HPT and the associated inter-turbine duct/strut segment. The simulations are designed to resolve up to the second harmonic of the blade passing frequency tone in accordance with accepted rules for second order solvers like TURBO. The calculations include blade and vane cooling flows and a radial profile of pressure and temperature at the turbine inlet. The calculation can be modified later to include the combustor pattern factor at the turbine inlet to include that contribution to turbine noise. We shall present preliminary analysis of the results obtained so far in order to assess the validity of such an approach and to seek feedback on improving the approach. This work addresses both Area 1 (Turbine Tone Noise) and Area 5 (Influence of the Turbine on Combustor Noise) topics.

Author

*Noise Prediction; Acoustic Propagation; Mathematical Models; Noise Generators; Sound Transmission; Flow Distribution; Turbine Blades*

**20080047721** NASA Johnson Space Center, Houston, TX, USA

**Acoustics inside the Space Shuttle Orbiter and International Space Station**

Goodman, Jerry R.; [2009]; 1 pp.; In English; SAE 2009 Noise and Vibration Conference, 19-21 May 2009, Saint Charles, IL, USA; No Copyright; Avail.: Other Sources; Abstract Only

The acoustics environment in enclosed habitable space vehicles and modules is important to mission safety, crew health,

and efficient operations. Noise is unwanted sound and its presence can interfere with crew communications and crew sleep, create habitability concerns, hearing loss or other health concerns. This paper covers these concerns, and lessons learned from Space Shuttle and International Space Station (ISS) efforts on internal acoustics. Included in lessons learned is the need for attention to acoustics as a design discipline in interior space vehicle design and development, and in the design and integration of hardware into vehicles or ISS modules. A good set of acoustics requirements is needed for control of the vehicle or module systems, for all of the hardware used within them, and the composite, resultant acoustics of all-systems operating. The role that Shuttle and ISS payloads and Government Furnished Equipment had in the overall acoustics situation is discussed. Acoustic limits need to be 'designed into' vehicles/modules to be most effective and create the least impacts. To ensure the internal acoustics is acceptable, appropriate noise control needs to be applied, especially early in vehicle/module design, when noise sources are selected and at the start of preliminary design. Noise control efforts applied in Space Shuttle and ISS Programs are described, including analyses, testing, and noise control treatments applied. It is very important that program management understand the need to address acoustics to ensure a safe and operationally acceptable end product and to be supportive of acoustics requirements and implementing effective noise control.

Author

*International Space Station; Acoustics; Auditory Defects; Space Shuttle Orbiters; Space Shuttle Payloads; Noise Reduction*

**20080047951** Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, The Hague, Netherlands

**Description of TNO Multistatic Tracking Algorithm, Part I, Theory**

deTheije, P. A. M.; September 2008; 40 pp.; In English; Original contains color illustrations

Report No.(s): TNO-DV-2007-A587; TD2007-0269; Copyright; Avail.: Other Sources

This report reviews the main characteristics, properties and limitations of multistatic tracking algorithms. Using simulations, we have derived order-of-magnitude accuracies that are needed in four fundamental system parameters (sound speed, time synchronisation, sonar position, receiver orientation) in order to have proper data association. Next, we present a set of performance metrics that can be used to assess the gain that can be obtained by including a tracking algorithm in the processing chain.

Author

*Algorithms; Tracking (Position); Sonar; Targets*

**20080047955** Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Soesterberg, Netherlands

**Sound Exposure Level of F-16 Crew Chiefs using Custom Molded Communications Earplugs**

Houben, M. M. J.; Verhave, J. A.; October 2008; 19 pp.; In Dutch; Original contains color illustrations

Report No.(s): TNO-DV-2008-A395; TD2008-0169; Copyright; Avail.: Other Sources

Because of the noisy environment, F-16 crew chiefs at Air Base Volkel use communications earplugs (CEPs). CEPs are earplugs that incorporate a miniature loudspeaker through which the intercom can be presented to the user unattenuated while the earplugs do attenuate environmental sounds. In a previous study, we developed a method to assess the sound exposure level of CEP users. Not only was the attenuated F 16 noise taken into account, but also the sound exposure resulting from communication through the CEP. The latter was accounted for through the CEP's sensitivity - the relation between electric power level to the CEP and perceived sound level. Those measurements were all on CEPs with foam earplugs. In the current study, we extended it to custom molded earplugs (CME). The results show that the CME has a higher sound attenuation compared to the foam earplug in the frequency range of 250 Hz to 1 kHz only, resulting in a slight decrease in sound exposure of 2 dB. Furthermore, the CEP with foam earplug and the CEP with CME do not differ in electric to acoustic sensitivity. The estimated per-day dose, based on recordings of crew chiefs that use the CEP with CME, is 74 dB(A).

Author

*Aircraft Noise; F-16 Aircraft; Ear Protectors; Acoustic Attenuation; Noise Reduction; Frequency Ranges*

**20080048150** California Inst. of Tech., Pasadena, CA, USA

**Progress in Acoustic Transmission of Power through Walls**

Sherrit, Stewart; Coty, Benjamin; Bao, Xiaoqi; Bar-Cohen, Yoseph; Badescu, Mircea; Chang, Zensheu; NASA Tech Briefs, September 2008; September 2008, pp. 43; In English; See also [20080048125](#)

Report No.(s): NPO-44928; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3154>

A document presents updated information on implementation of the wireless acoustic-electric feed-through (WAEF) concept, which was reported in Using Piezoelectric Devices To Transmit Power Through Walls (NPO-41157), NASA Tech

Briefs, Vol. 32, No. 6 (June 2008), page 70. To recapitulate: In a basic WAEF setup, a transmitting piezoelectric transducer on one side of a wall is driven at resonance to excite ultrasonic vibrations in the wall. A receiving piezoelectric transducer on the opposite side of the wall converts the vibrations back to an ultrasonic AC electric signal, which is then detected and otherwise processed in a manner that depends on the modulation (if any) applied to the signal and whether the signal is used to transmit power, data, or both. The present document expands upon the previous information concerning underlying physical principles, advantages, and potential applications of WAEF. It discusses the design and construction of breadboard prototype piezoelectric transducers for WAEF. It goes on to present results of computational simulations of performance and results of laboratory tests of the prototypes. In one notable test, a 100-W light bulb was lit by WAEF to demonstrate the feasibility of powering a realistic load.

Author

*Acoustic Propagation; Piezoelectric Transducers; Sound Transmission; Walls; Piezoelectricity*

## 72

### ATOMIC AND MOLECULAR PHYSICS

Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see 73 *Nuclear Physics*.

**20080047959** NASA Goddard Space Flight Center, Greenbelt, MD, USA; Colorado Univ., Boulder, CO, USA

#### **Electron Impact Ionization: A New Parameterization for 100 eV to 1 MeV Electrons**

Fang, Xiaohua; Randall, Cora E.; Lummerzheim, Dirk; Solomon, Stanley C.; Mills, Michael J.; Marsh, Daniel; Jackman, Charles H.; Wang, Wenbin; Lu, Gang; [2008]; 8 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNX06AC05G; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1029/2008JA013384>

Low, medium and high energy electrons can penetrate to the thermosphere (90-400 km; 55-240 miles) and mesosphere (50-90 km; 30-55 miles). These precipitating electrons ionize that region of the atmosphere, creating positively charged atoms and molecules and knocking off other negatively charged electrons. The precipitating electrons also create nitrogen-containing compounds along with other constituents. Since the electron precipitation amounts change within minutes, it is necessary to have a rapid method of computing the ionization and production of nitrogen-containing compounds for inclusion in computationally-demanding global models. A new methodology has been developed, which has parameterized a more detailed model computation of the ionizing impact of precipitating electrons over the very large range of 100 eV up to 1,000,000 eV. This new parameterization method is more accurate than a previous parameterization scheme, when compared with the more detailed model computation. Global models at the National Center for Atmospheric Research will use this new parameterization method in the near future.

Author

*Electron Impact; Atmospheric Ionization; Parameterization; Electrons*

**20080048525** Rochester Inst. of Tech., NY USA

#### **Statistical Modeling of Radiometric Error Propagation in Support of Hyperspectral Imaging Inversion and Optimized Ground Sensor Network Design**

Klempner, Scott; Sep 4, 2008; 326 pp.; In English; Original contains color illustrations

Report No.(s): AD-A490176; AFIT-CI-09-0034; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A method is presented that attempts to isolate the relative magnitudes of various error sources present in common algorithms for inverting the effects of atmospheric scattering and absorption on solar irradiance and determine in what ways, if any, operational ground truth measurement systems can be employed to reduce the overall error in retrieved reflectance factor. Error modeling and propagation methodology is developed for each link in the imaging chain, and representative values are determined for the purpose of exercising the model and observing the system behavior in response to a wide variety of inputs. Three distinct approaches to model-based atmosphere inversion are compared in a common reflectance error space, where each contributor to the overall error in retrieved reflectance is examined in relation to the others. The modeling framework also allows for performance predictions resulting from the incorporation of operational ground truth measurements. Regimes were identified in which uncertainty in water vapor and aerosols were each found to dominate error contributions to final retrieved reflectance. Cloud cover was also shown to be a significant contributor, while state-of-the-industry hyperspectral sensors were confirmed to not be error drivers. Accordingly, instruments for measuring water vapor,

aerosols, and downwelled sky radiance were identified as key to improving reflectance retrieval beyond current performance by current inversion algorithms.

DTIC

*Communication Networks; Design Analysis; Error Analysis; Errors; Imagery; Imaging Techniques; Inversions; Mathematical Models; Radiometers; Statistical Analysis*

## 73

### NUCLEAR PHYSICS

Includes nuclear particles; and reactor theory. For space radiation see *93 Space Radiation*. For atomic and molecular physics see *72 Atomic and Molecular Physics*. For elementary particle physics see *77 Physics of Elementary Particles and Fields*. For nuclear astrophysics see *90 Astrophysics*.

**20080047915** Argonne National Lab., IL, USA

#### **Advanced Burner Reactor Preliminary NEPA Data Study**

Briggs, L. L.; Cahalan, J. E.; Deitrich, L. W.; Fanning, T. H.; Grandy, C.; Sep. 21, 2007; 87 pp.; In English

Contract(s)/Grant(s): DE-AC02-06CH11357

Report No.(s): DE2007-919338; ANL-AFCI-183; No Copyright; Avail.: Department of Energy Information Bridge

The Global Nuclear Energy Partnership (GNEP) is a new nuclear fuel cycle paradigm with the goals of expanding the use of nuclear power both domestically and internationally, addressing nuclear waste management concerns, and promoting nonproliferation. A key aspect of this program is fast reactor transmutation, in which transuranics recovered from light water reactor spent fuel are to be recycled to create fast reactor transmutation fuels. The benefits of these fuels are to be demonstrated in an Advanced Burner Reactor (ABR), which will provide a representative environment for recycle fuel testing, safety testing, and modern fast reactor design and safeguard features. Because the GNEP programs will require facilities which may have an impact upon the environment within the meaning of the National Environmental Policy Act of 1969 (NEPA), preparation of a Programmatic Environmental Impact Statement (PEIS) for GNEP is being undertaken by Tetra Tech, Inc. The PEIS will include a section on the ABR. In support of the PEIS, the Nuclear Engineering Division of Argonne National Laboratory has been asked to provide a description of the ABR alternative, including graphics, plus estimates of construction and operations data for an ABR plant. The compilation of this information is presented in the remainder of this report. Currently, DOE has started the process of engaging industry on the design of an Advanced Burner Reactor. Therefore, there is no specific, current, vendor-produced ABR design that could be used for this PEIS data call package. In addition, candidate sites for the ABR vary widely as to available water, geography, etc. Therefore, ANL has based its estimates for construction and operations data largely on generalization of available information from existing plants and from the environmental report assembled for the Clinch River Breeder Reactor Plant (CRBRP) design (CRBRP, 1977).

NTIS

*Burners; Environment Management; Fast Nuclear Reactors; Nuclear Reactors; Transmutation*

**20080048231** California Univ., Davis, CA, USA

#### **NEER/Development of a Large-Field Cold Neutron Source. (Final Report, August 1, 2005-July 1, 2006)**

Elizondo, N.; Oct. 2007; 26 pp.; In English

Contract(s)/Grant(s): DE-FG07-03ID14499

Report No.(s): DE2007-918693; No Copyright; Avail.: Department of Energy Information Bridge

By comparison with thermal neutrons, cold neutrons are attenuated to a greater extent by elements such as H, O, N, B, Cd, Gd and to a lesser extent by metals such as Be, Al, Fe, Zr, Sn, W, Bi, Pb. Such unique nuclear properties to interact with materials enable to provide better non-destructive inspections. There are only a few cold neutron sources based on research reactors in the U.S. (Texas, 1 MW; NIST, 20 MW) These cold neutron beams are typically few inches in diameter and primarily used for basic scientific research. Our development of a filtered cold neutron source offers the possibility of a much larger field, approximately up to 20 in diameter, besides competitive source quality. The attempt of such a cold neutron source will be unprecedented in the U.S. and the completed project would offer a great opportunity to accomplish more sophisticated tasks in the automotive, aerospace, and materials science areas, which were unable to investigate with our current neutron radiography facilities. There is a great need in the aerospace industry for a technique of this type to investigate large and thick castings, which cannot be inspected by X-ray radiography. This is particularly true when the material causing the problem is a low atomic weight element such as hydrogen. NASA's Solid Rocket Booster program has a number of large and thick structural members that would benefit from our intended development of a large-field cold neutron source for inspections. The

increased sensitivity of cold neutrons to the presence of hydrogen (total neutron cross section about 30 barns at 0.1 eV to about 80 barns at 0.005 eV) provides a better method for finding very low levels of hydrogen embrittlement in jet engine blades. The U.S. Air Force and commercial airline companies would benefit from identifying this serious problem if our intended development would be made. The automotive industry would also benefit from our development to inspect the internal workings of thick transmission cases for low atomic weight materials, which can only be enhanced by inspections with cold neutrons.

NTIS

*Cold Neutrons; Neutron Sources; Reactor Technology*

**20080048374** Government Accountability Office, Washington, DC, USA

**Nuclear Safety: Department of Energy Needs to Strengthen Its Independent Oversight of Nuclear Facilities and Operations**

Oct. 2008; 117 pp.; In English

Report No.(s): PB2009-102427; GAO-09-61; No Copyright; Avail.: CASI: [A06](#), Hardcopy

The Department of Energy (DOE) oversees contractors that operate more than 200 high-hazard nuclear facilities, where an accident could have serious consequences for workers and the public. DOE is charged with regulating the safety of these facilities. A key part of DOE's self-regulation is the Office of Health, Safety and Security (HSS), which develops, oversees, and helps enforce nuclear safety policies. This is the only DOE safety office intended to be independent of the program offices, which carry out mission responsibilities. This report examines (1) the extent to which HSS meets GAO's elements of effective independent nuclear safety oversight and (2) the factors contributing to any identified shortcomings with respect to these elements. GAO reviewed relevant DOE policies, interviewed officials and outside safety experts, and surveyed DOE sites to determine the number and status of nuclear facilities. GAO also assessed oversight practices against the criteria for independent oversight GAO developed based on a series of reports on DOE nuclear safety and discussions with nuclear safety experts. GAO recommends the Secretary of Energy take actions to address HSS's shortcomings in independent oversight of nuclear safety. DOE disagreed with the reports' conclusions, but generally agreed with three of GAO's five recommended actions.

NTIS

*Nuclear Power Plants; Radiation Protection; Policies; Procedures*

## 74 OPTICS

Includes light phenomena and the theory of optical devices; for specific optical devices see also *35 Instrumentation and Photography*. For lasers see *36 Lasers and Masers*.

**20080047289** Savannah River National Lab., Aiken, SC, USA

**AFM Characterization of Laser Induced Damage on CDZnTe Crystal Surfaces**

Hawkins, S.; Teague, L.; Duff, M.; Villa-Aleman, E.; Jun. 10, 2008; 18 pp.; In English

Contract(s)/Grant(s): DE-AC09-96SR18500

Report No.(s): DE2008-934525; WSRC-STI-2008-00301; No Copyright; Avail.: National Technical Information Service (NTIS)

Semi-conducting CdZnTe (or CZT) crystals can be used in a variety of detector-type applications. CZT shows great promise for use as a gamma radiation spectrometer. However, its performance is adversely affected by point defects, structural and compositional heterogeneities within the crystals, such as twinning, pipes, grain boundaries (polycrystallinity), secondary phases and in some cases, damage caused by external forces. One example is damage that occurs during characterization of the surface by a laser during Raman spectroscopy. Even minimal laser power can cause Te-enriched areas on the surface to appear. The Raman spectra resulting from measurements at moderate intensity laser power show large increases in peak intensity that is attributed to Te. Atomic Force Microscopy (AFM) was used to characterize the extent of damage to the CZT crystal surface following exposure to the Raman laser. AFM data reveal localized surface damage in the areas exposed to the Raman laser beam. The degree of surface damage to the crystal is dependent on the laser power, with the most observable damage occurring at high laser power.

NTIS

*Crystal Structure; Crystal Surfaces; Damage; Laser Damage; Lasers*



**20080047755** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

**White-light Interferometry using a Channeled Spectrum: II. Calibration Methods, Numerical and Experimental Results**

Zhai, Chengxing; Milman, Mark H.; Regehr, Martin W.; Best, Paul K.; Applied Optics; November 9, 2007; ISSN 0005-6935; Volume 46, No. 32, pp. 7906-7923; In English; Original contains color illustrations; Copyright; Avail.: Other Sources  
ONLINE: <http://hdl.handle.net/2014/41006>; <http://dx.doi.org/10.1364/AO.46.007906>

In the companion paper, [Appl. Opt. 46, 5853 (2007)] a highly accurate white light interference model was developed from just a few key parameters characterized in terms of various moments of the source and instrument transmission function. We develop and implement the end-to-end process of calibrating these moment parameters together with the differential dispersion of the instrument and applying them to the algorithms developed in the companion paper. The calibration procedure developed herein is based on first obtaining the standard monochromatic parameters at the pixel level: wavenumber, phase, intensity, and visibility parameters via a nonlinear least-squares procedure that exploits the structure of the model. The pixel level parameters are then combined to obtain the required 'global' moment and dispersion parameters. The process is applied to both simulated scenarios of astrometric observations and to data from the microarcsecond metrology testbed (MAM), an interferometer testbed that has played a prominent role in the development of this technology.

Author

*Calibrating; Visibility; Metrology; Interferometry; Algorithms; Astrometry*

**20080047825** Air Force Research Lab., Kirkland AFB, NM USA

**Noise Reduction in Support-Constrained Multi-Frame Blind-Deconvolution Restoration as a Function of the Number of Data Frames and the Support Constraint Sizes**

Matson, Charles L; Haji, Alim; Jun 1, 2007; 5 pp.; In English; Original contains color illustrations  
Contract(s)/Grant(s): Proj-2311

Report No.(s): AD-A489530; AFRL-RD-PS-TP-2008-1011; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We show that the amount of relative noise reduction in multi-frame blind deconvolution image restorations is greatest for just a few data frames and is a more complicated function of the support constraint sizes.

DTIC

*Image Enhancement; Image Reconstruction; Noise Reduction; Restoration*

**20080047990** California Inst. of Tech., Pasadena, CA, USA

**On-Orbit Multi-Field Wavefront Control with a Kalman Filter**

Lou, John; Sigrist, Norbert; Basinger, Scott; Redding, David; NASA Tech Briefs, October 2008; October 2008, pp. 35; In English; See also [20080047981](#)

Report No.(s): NPO-45793; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3313>

A document describes a multi-field wavefront control (WFC) procedure for the James Webb Space Telescope (JWST) on-orbit optical telescope element (OTE) fine-phasing using wavefront measurements at the NIRCcam pupil. The control is applied to JWST primary mirror (PM) segments and secondary mirror (SM) simultaneously with a carefully selected ordering. Through computer simulations, the multi-field WFC procedure shows that it can reduce the initial system wavefront error (WFE), as caused by random initial system misalignments within the JWST fine-phasing error budget, from a few dozen micrometers to below 50 nm across the entire NIRCcam Field of View, and the WFC procedure is also computationally stable as the Monte-Carlo simulations indicate. With the incorporation of a Kalman Filter (KF) as an optical state estimator into the WFC process, the robustness of the JWST OTE alignment process can be further improved. In the presence of some large optical misalignments, the Kalman state estimator can provide a reasonable estimate of the optical state, especially for those degrees of freedom that have a significant impact on the system WFE. The state estimate allows for a few corrections to the optical state to push the system towards its nominal state, and the result is that a large part of the WFE can be eliminated in this step. When the multi-field WFC procedure is applied after Kalman state estimate and correction, the stability of fine-phasing control is much more certain. Kalman Filter has been successfully applied to diverse applications as a robust and optimal state estimator. In the context of space-based optical system alignment based on wavefront measurements, a KF state estimator can combine all available wavefront measurements, past and present, as well as measurement and actuation error statistics to generate a Maximum-Likelihood optimal state estimator. The strength and flexibility of the KF algorithm make

it attractive for use in real-time optical system alignment when WFC alone cannot effectively align the system.

Author

*James Webb Space Telescope; Optical Equipment; Control Systems Design; Kalman Filters; Aerospace Engineering*

**20080047999** California Inst. of Tech., Pasadena, CA, USA

**Whispering Gallery Mode Resonator with Orthogonally Reconfigurable Filter Function**

Maleki, Lute; Matsko, Andrey; Strelakov, Dmitry; Savchenkov, Anatoliy; NASA Tech Briefs, October 2008; October 2008, pp. 27; In English; See also [20080047981](#)

Report No.(s): NPO-44948; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3299>

An optical resonator has been developed with reconfigurable filter function that has resonant lines that can be shifted precisely and independently from each other, creating any desirable combination of resonant lines. This is achieved by changing the axial distribution of the effective refractive index of the resonator, which shifts the resonant frequency of particular optical modes, leaving all the rest unchanged. A reconfigurable optical filter is part of the remote chemical detector proposed for the Mars mission (Planetary Instrument Definition and Development Program PIDDP), but it is also useful for photonic communications devices.

Author

*Optical Resonators; Whispering Gallery Modes; Reconfigurable Hardware; Optical Filters*

**20080048007** California Inst. of Tech., Pasadena, CA, USA

**Bimaterial Thermal Compensators for WGM Resonators**

Savchenkov, Anatoliy; Yu, Nan; Maleki, Lute; Iltchenko, Vladimir; Strelakov, Dmitry; NASA Tech Briefs, October 2008; October 2008, pp. 28-29; In English; See also [20080047981](#); Original contains color illustrations

Report No.(s): NPO-44441; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3300>

Bimaterial thermal compensators have been proposed as inexpensive means of preventing (to first order) or reducing temperature-related changes in the resonance frequencies of whispering-gallery-mode (WGM) optical resonators. A bimaterial compensator would apply, to a WGM resonator, a pressure that would slightly change the shape of the resonator and thereby change its resonance frequencies. Through suitable choice of the compensator dimensions and materials, it should be possible to make the temperature dependence of the pressure-induced frequency shift equal in magnitude and opposite in sign to the temperature dependence of the frequency shift of the uncompensated resonator so that, to first order, a change in temperature would cause zero net change in frequency.

Derived from text

*Compensators; Whispering Gallery Modes; Materials; Optical Resonators*

**20080048020** California Inst. of Tech., Pasadena, CA, USA

**An ATP System for Deep-Space Optical Communication**

Lee, Shinhak; Irtuzm Gerardi; Alexander, James; NASA Tech Briefs, October 2008; October 2008, pp. 22; In English; See also [20080047981](#)

Report No.(s): NPO-41736; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3289>

An acquisition, tracking, and pointing (ATP) system is proposed for aiming an optical-communications downlink laser beam from deep space. In providing for a direction reference, the concept exploits the mature technology of star trackers to eliminate the need for a costly and potentially hazardous laser beacon. The system would include one optical and two inertial sensors, each contributing primarily to a different portion of the frequency spectrum of the pointing signal: a star tracker (<10 Hz), a gyroscope (<50 Hz), and a precise fluid-rotor inertial angular-displacement sensor (sometimes called, simply, 'angle sensor') for the frequency range >50 Hz. The outputs of these sensors would be combined in an iterative averaging process to obtain high-bandwidth, high-accuracy pointing knowledge. The accuracy of pointing knowledge obtainable by use of the system was estimated on the basis of an 8-cm-diameter telescope and known parameters of commercially available star trackers and inertial sensors: The single-axis pointing-knowledge error was found to be characterized by a standard deviation of 150 nanoradians - below the maximum value (between 200 and 300 nanoradians) likely to be tolerable in deep-space optical communications.

Author

*Optical Communication; Target Acquisition; Frequency Distribution; Displacement; Star Trackers; Laser Beams*

**20080048029** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Range Imaging without Moving Parts**

Blair, J. Bryan; Scott, V. Stanley, III; Ramos-Izquierdo, Luis; NASA Tech Briefs, December 2008; December 2008, pp. 29; In English; See also [20080048022](#)

Report No.(s): GSC-15184-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

Range-imaging instruments of a type now under development are intended to generate the equivalent of three-dimensional images from measurements of the round-trip times of flight of laser pulses along known directions. These instruments could also provide information on characteristics of targets, including roughnesses and reflectivities of surfaces and optical densities of such semi-solid objects as trees and clouds. Unlike in prior range-imaging instruments based on times of flight along known directions, there would be no moving parts; aiming of the laser beams along the known directions would not be accomplished by mechanical scanning of mirrors, prisms, or other optical components. Instead, aiming would be accomplished by using solid-state devices to switch input and output beams along different fiber-optic paths. Because of the lack of moving parts, these instruments could be extraordinarily reliable, rugged, and long-lasting. An instrument of this type would include an optical transmitter that would send out a laser pulse along a chosen direction to a target. An optical receiver coaligned with the transmitter would measure the temporally varying intensity of laser light reflected from the target to determine the distance and surface characteristics of the target. The transmitter would be a combination of devices for generating precise directional laser illumination. It would include a pulsed laser, the output of which would be coupled into a fiber-optic cable with a fan-out and solid-state optical switches that would enable switching of the laser beam onto one or more optical fibers terminated at known locations in an array on a face at the focal plane of a telescope. The array would be imaged by the telescope onto the target space. The receiver optical system could share the aforementioned telescope with the transmitter or could include a separate telescope aimed in the same direction as that of the transmitting telescope. In either case, light reflected from the target would be focused by the receiver optical system onto an array of optical fibers matching the array in the transmitter. These optical fibers would couple the received light to one or more photodetector(s). Optionally, the receiver could include solid-state optical switches for choosing which optical fiber(s) would couple light to the photodetector(s). This instrument architecture is flexible and can be optimized for a wide variety of applications and levels of performance. For example, it is scalable to any number of pixels and pixel resolutions and is compatible with a variety of ranging and photodetection methodologies, including, for example, ranging by use of modulated (including pulsed and encoded) light signals. The use of fixed arrays of optical fibers to generate controlled illumination patterns would eliminate the mechanical complexity and much of the bulk of optomechanical scanning assemblies. Furthermore, digital control of the selection of the fiber-optic pathways for the transmitted beams could afford capabilities not seen in previous three-dimensional range-imaging systems. Instruments of this type could be specialized for use as, for example, proximity detectors, three-dimensional robotic vision systems, airborne terrain-mapping systems, and inspection systems.

Author

*Range-finding; Imaging Techniques; Robotics; Optical Communication; Pulsed Lasers; Luminous Intensity; Computer Vision; Optical Equipment*

**20080048099** NASA Marshall Space Flight Center, Huntsville, AL, USA

**HERO: A Balloon-Borne Hard-X-Ray Focusing Telescope**

Ramsey, Brian; July 13, 2008; 1 pp.; In English; 37th COSPAR Scientific Assembly, 13 - 20 Jul. 2008, Montreal, Canada; No Copyright; Avail.: Other Sources; Abstract Only

HERO, for High Energy Replicated Optics, is an evolutionary balloon payload featuring hard-x-ray grazing-incidence nickel optics. The HERO payload is designed to perform high-sensitivity, fine spatial resolution observations of galactic and extragalactic sources in an energy range that is as yet unexplored with grazing-incidence optics. A proof-of-concept flight with just 6 x-ray mirrors was completed in 2001 and captured the first focused hard-x-ray images galactic sources. Since that time, the payload has been greatly expanded and now features 100, in-house-fabricated mirror shells with an attendant large increase in sensitivity. In its current form, HERO was flown in 2007, from Fort Sumner, NM, and is scheduled to fly again in September 2009, from Alice Springs, NT. Full details of the HERO payload will be provided in this presentation together with a discussion of the challenges of flying moderate resolution x-ray optics from a balloon platform.

Author

*Balloon-Borne Instruments; X Ray Telescopes; X Ray Optics; X Ray Imagery; Payloads; Spaceborne Telescopes; X Ray Astronomy*

**20080048127** California Inst. of Tech., Pasadena, CA, USA

**Improved Gas Filling and Sealing of an HC-PCF**

Poberezhskiy, Ilya; Meras, Patrick; Chang, Daniel; Spiers, Gary; NASA Tech Briefs, September 2008; September 2008, pp. 15-16; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): NPO-45193; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3116>

An improved packaging approach has been devised for filling a hollow-core photonic-crystal fiber (HC-PCF) with a gas, sealing the HC-PCF to retain the gas, and providing for optical connections and, optionally, a plumbing fitting for changing or augmenting the gas filling. Gas-filled HC-PCFs can be many meters long and have been found to be attractive as relatively compact, lightweight, rugged alternatives to conventional gas-filled glass cells for use as molecular-resonance frequency references for stabilization of lasers in some optical-metrology, lidar, optical-communication, and other advanced applications. Prior approaches to gas filling and sealing of HC-PCFs have involved, variously, omission of any attempt to connectorize the PCF, connectorization inside a vacuum chamber (an awkward and expensive process), or temporary exposure of one end of an HC-PCF to the atmosphere, potentially resulting in contamination of the gas filling. Prior approaches have also involved, variously, fusion splicing of HC-PCFs with other optical fibers or other termination techniques that give rise to Fresnel reflections of about 4 percent, which results in output intensity noise.

Derived from text

*Optical Fibers; Sealing; Photonics; Gas Flow; Crystals; Hermetic Seals*

**20080048131** California Inst. of Tech., Pasadena, CA, USA

**Improving the Optical Quality Factor of the WGM Resonator**

Savchenkov, Anatoliy; Matsko, Andrey; Ilchenko, Vladimir; NASA Tech Briefs, September 2008; September 2008, pp. 32-33; In English; See also [20080048125](#)

Report No.(s): NPO-45053; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3161>

Resonators usually are characterized with two partially dependent values: finesse (F) and quality factor (Q). The finesse of an empty Fabry-Perot (FP) resonator is defined solely by the quality of its mirrors and is calculated as  $F = \pi R / (1 - R)$ . The maximum up-to-date value of reflectivity R approximately equal to  $1 - 1.6 \times 10^{-6}$  is achieved with dielectric mirrors. An FP resonator made with the mirrors has finesse  $F = 1.9 \times 10^6$ . Further practical increase of the finesse of FP resonators is problematic because of the absorption and the scattering of light in the mirror material through fundamental limit on the reflection losses given by the internal material losses and by thermodynamic density fluctuations on the order of parts in  $10^9$ . The quality factor of a resonator depends on both its finesse and its geometrical size. A one-dimensional FP resonator has  $Q = 2FL / \lambda$ , where L is the distance between the mirrors and  $\lambda$  is the wavelength. It is easy to see that the quality factor of the resonator is unlimited because L is unlimited. F and Q are equally important. In some cases, finesse is technically more valuable than the quality factor. For instance, buildup of the optical power inside the resonator, as well as the Purcell factor, is proportional to finesse. Sometimes, however, the quality factor is more valuable. For example, inverse threshold power of intracavity hyperparametric oscillation is proportional to  $Q^2$  and efficiency of parametric frequency mixing is proportional to  $Q^3$ . Therefore, it is important to know both the maximally achievable finesse and quality factor values of a resonator. Whispering gallery mode (WGM) resonators are capable of achieving larger finesse compared to FP resonators. For instance, fused silica resonators with finesse  $2.3 \times 10^6$  and  $2.8 \times 10^6$  have been demonstrated. Crystalline WGM resonators reveal even larger finesse values,  $F = 6.3 \times 10^6$ , because of low attenuation of light in the transparent optical crystals. The larger values of F and Q result in the enhancement of various nonlinear processes. Low-threshold Raman lasing, optomechanical oscillations, frequency doubling, and hyperparametric oscillations based on these resonators have been recently demonstrated. Theory predicts a possibility of nearly  $10^{14}$  room-temperature optical Q-factors of optical crystalline WGM resonators, which correspond to finesse levels higher than  $10^9$ . Experiments have shown numbers a thousand times lower than that. The difference occurs due to media imperfections. To substantially reduce the optical losses caused by the imperfections, a specific, multi-step, asymptotic processing of the resonator is implemented. The technique has been initially developed to reduce microwave absorption in dielectric resonators. One step of the process consists of mechanical polishing performed after high temperature annealing. Several steps repeat one after another to lead to significant reduction in optical attenuation and, as a result, to the increase of Q-factor as well as finesse of the resonator which demonstrates a CaF<sub>2</sub> WGM resonator with F greater than  $10^7$  and Q greater than  $10^{11}$ .

Author

*Whispering Gallery Modes; Optical Resonators; Q Factors*

**20080048146** California Inst. of Tech., Pasadena, CA, USA

**Delaying Trains of Short Light Pulses in WGM Resonators**

Matsko, Andrey; Ilchenko, Vladimir; Strelakov, Dmitry; Savchenkov, Anatoliy; Maleki, Lute; NASA Tech Briefs, September 2008; September 2008, pp. 35; In English; See also [20080048125](#); Original contains black and white illustrations

Report No.(s): NPO-44956; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3160>

Suitably configured whispering-gallery-mode (WGM) optical resonators have been proposed as delay lines for trains of short light pulses. Until now, it has been common practice to implement an optical delay line as a coiled long optical fiber, which is bulky and tends to be noisy. An alternative has been to implement an optical delay line as a coupled-resonator optical waveguide (a chain of coupled optical resonators), which is compact but limits the width of the pulse spectrum to the width of an optical resonance and thereby places a lower limit on the duration of a pulse. In contrast, a delay line according to the proposal could be implemented as a single WGM resonator, and the pulses delayed by the resonator could be so short that their spectral widths could greatly exceed the spectral width of any single resonance. The proposal emerged from theoretical and experimental studies of the propagation of a pulse train in a WGM resonator. An important element of the theoretical study was recognition that the traditional definition of group velocity in effect, the velocity of a single pulse comprising a packet of waves propagating in a medium, the responsivity of which is a monotonous function of frequency does not necessarily apply in the case of a WGM resonator or other medium having a spectrum consisting of discrete resonance peaks at different frequencies. A new definition of group velocity, applicable to a train of pulses propagating in such a medium, was introduced and found to lead to the discovery of previously unknown features of propagation. Notably, it was found that in a micro-sphere optical resonator that supports a suitable combination of WGM modes, the group velocity for a train of light pulses could be positive, zero, or negative. A positive group velocity could be so small that the delay could be much longer than the ring-down time of the resonator; a delay of such great length is impossible for a single pulse interacting with either a linearly responding lossless resonator or a coupled-resonator optical waveguide.

Author

*Optical Resonators; Optical Waveguides; Delay Lines; Optical Resonance; Spectra*

**20080048163** Science Systems and Applications, Inc., Bay Saint Louis, MS, USA

**Hyperspectral Fluorescence and Reflectance Imaging Instrument**

Ryan, Robert E.; O'Neal, S. Duane; Lanoue, Mark; Russell, Jeffrey; NASA Tech Briefs, September 2008; September 2008, pp. 32; In English; See also [20080048125](#)

Report No.(s): SSC-00254.; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3146>

The system is a single hyperspectral imaging instrument that has the unique capability to acquire both fluorescence and reflectance high-spatial-resolution data that is inherently spatially and spectrally registered. Potential uses of this instrument include plant stress monitoring, counterfeit document detection, biomedical imaging, forensic imaging, and general materials identification. Until now, reflectance and fluorescence spectral imaging have been performed by separate instruments. Neither a reflectance spectral image nor a fluorescence spectral image alone yields as much information about a target surface as does a combination of the two modalities. Before this system was developed, to benefit from this combination, analysts needed to perform time-consuming post-processing efforts to co-register the reflective and fluorescence information. With this instrument, the inherent spatial and spectral registration of the reflectance and fluorescence images minimizes the need for this post-processing step. The main challenge for this technology is to detect the fluorescence signal in the presence of a much stronger reflectance signal. To meet this challenge, the instrument modulates artificial light sources from ultraviolet through the visible to the near-infrared part of the spectrum; in this way, both the reflective and fluorescence signals can be measured through differencing processes to optimize fluorescence and reflectance spectra as needed. The main functional components of the instrument are a hyperspectral imager, an illumination system, and an image-plane scanner. The hyperspectral imager is a one-dimensional (line) imaging spectrometer that includes a spectrally dispersive element and a two-dimensional focal plane detector array. The spectral range of the current imaging spectrometer is between 400 to 1,000 nm, and the wavelength resolution is approximately 3 nm. The illumination system consists of narrowband blue, ultraviolet, and other discrete wavelength light-emitting-diode (LED) sources and white-light LED sources designed to produce consistently spatially stable light. White LEDs provide illumination for the measurement of reflectance spectra, while narrowband blue and UV LEDs are used to excite fluorescence. Each spectral type of LED can be turned on or off depending on the specific remote-sensing process being performed. Uniformity of illumination is achieved by using an array of LEDs and/or an integrating sphere or other diffusing surface. The image plane scanner uses a fore optic with a field of view large enough to provide an entire scan line on the image plane. It builds up a two-dimensional image in pushbroom fashion as the target is scanned across the image

plane either by moving the object or moving the fore optic. For fluorescence detection, spectral filtering of a narrowband light illumination source is sometimes necessary to minimize the interference of the source spectrum wings with the fluorescence signal. Spectral filtering is achieved with optical interference filters and absorption glasses. This dual spectral imaging capability will enable the optimization of reflective, fluorescence, and fused datasets as well as a cost-effective design for multispectral imaging solutions. This system has been used in plant stress detection studies and in currency analysis.

Author

*Finite Difference Theory; Light Emitting Diodes; Optical Filters; Remote Sensing; Spectral Reflectance; Field of View; Spatial Resolution*

**20080048237** Dougherty (J. Charles), Little Rock, AR, USA

**Beam Steering for Optical Target Identification and Tracking Without Gimbals or Scanning Mirrors**

Chalfant, C. H., Inventor; Orlando, F. J., Inventor; Gregory, J. T., Inventor; O'Neal, C. B., Inventor; Tidwell, T. L., Inventor; 12 Sep 05; 12 pp.; In English

Contract(s)/Grant(s): AF-F29601-02-C-0021

Patent Info.: Filed Filed 12 Sep 05; US-Patent-Appl-SN-11-224 628

Report No.(s): PB2008-105849; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A targeting and tracking apparatus and method for optical transceivers is disclosed. The tracking function is performed internally by way of translating an internal optical fiber in the focal plane of the transceiver telescope using miniature motorized translation systems and/or micro-electro-mechanical systems (MEMS). The optical design of the transceiver provides a wide field of view and a pointing and tracking field of regard that is directly proportional to the translation of the optical fiber in the focal plane of the telescope. The apparatus and method can eliminate the need for external gimbaling systems and scanning mirrors, and replace the gimbaled optical beam steering function with motorized translation systems and/or MEMS that consumes very little power.

NTIS

*Beam Steering; Gimbals; Laser Targets; Mirrors; Optical Measuring Instruments; Patent Applications; Target Acquisition; Target Recognition; Tracking (Position); Transmitter Receivers*

**20080048244** Maine and Asmus, Nashua, NH, USA; BAE Systems and Technology, Nashua, NH, USA

**Resonant Cavity Enhanced Multi-Quantum Well Light Modulator and Detector**

Alavi, K., Inventor; Pellegrino, J., Inventor; Maloney, P. G., Inventor; Koch, F. E., Inventor; 17 Feb 05; 10 pp.; In English  
Contract(s)/Grant(s): F33615-02-C-1252 (CDRL A001)

Patent Info.: Filed Filed 17 Feb 05; US-Patent-Appl-SN-11-060 191

Report No.(s): PB2008-105851; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Multi-quantum well (MQW) spatial light modulator devices are disclosed that are capable of achieving reasonable quantum efficiencies and high contrast ratios in order to close an optical communication link by resolving the logical on or off state. The device both modulates and detects light through the use of the quantum well design and resonant cavity enhancement. Based on the materials (e.g., InGaAs/InAlAs) and their band structures, this device can be configured to communicate in the eye-safe wavelength range (e.g., 1550 + or - 20 nm). The device can be fabricated using standard photolithographic processes such as molecular beam epitaxy (MBE) and inductively coupled plasma (ICP) reactive ion etching (RIE).

NTIS

*Cavity Resonators; Communication Equipment; Light Modulators; Modulation; Optical Communication; Patent Applications; Quantum Wells; Reflectors*

**20080048315** National Inst. of Standards and Technology, Gaithersburg, MD, USA

**Quantitative Absorption Measurements Using Cavity-Ringdown Spectroscopy with Pulsed Lasers**

Looney, J. P.; Hodges, R. T.; van Zee, R. D.; January 2007; 13 pp.; In English

Report No.(s): PB2008-105817; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The theory and implementation of quantitative gas phase absorption measurements based on cavity-ringdown spectroscopy with pulsed lasers is discussed. The response of ringdown cavities is modeled using an eigenmode description of the cavity fields, and expressions for a number of measureable quantities are given in terms of experimental parameters.

Results for long and short ringdown cavities are presented and compared, and it is shown that absolute, high-resolution absorption line shapes can be obtained using a pulsed laser and a short cavity.

NTIS

*Absorption Spectroscopy; Cavities; Pulsed Lasers; Spectroscopy*

**20080048316** National Inst. of Standards and Technology, Gaithersburg, MD, USA

**Laser Bandwidth Effects in Quantitative Cavity Ring-Down Spectroscopy**

Hodges, J. T.; Looney, J. P.; van Zee, R. D.; Oct. 2006; 5 pp.; In English

Report No.(s): PB2008-105820; No Copyright; Avail.: CASI: [A01](#), Hardcopy

We have investigated the effects of laser bandwidth on quantitative cavity ring-down spectroscopy using the rR transitions of the  $b(v=0) \leftarrow X(v=0)$  band of molecular oxygen. It is found that failure to account properly for the laser bandwidth leads to systematic errors in the number densities determined from measured ring-down signals. When the frequency-integrated expression for the ring-down signal is fitted and measured laser line shapes are used, excellent agreement between measured and predicted number densities is found. The theory and implementation of quantitative gas phase absorption measurements based on cavity-ringdown spectroscopy with pulsed lasers is discussed. The response of ringdown cavities is modeled using an eigenmode description of the cavity fields, and expressions for a number of measurable quantities are given in terms of experimental parameters. Results for long and short ringdown cavities are presented and compared, and it is shown that absolute, high-resolution absorption line shapes can be obtained using a pulsed laser and a short cavity.

NTIS

*Absorption Spectroscopy; Bandwidth; Cavities; Laser Beams; Laser Cavities; Spectroscopy*

**20080048340** Johns Hopkins Univ., Laurel, MD, USA

**Method and Apparatus for Single-Photon Source and Quantum Memory**

Pittman, T. B., Inventor; Franson, J. D., Inventor; Jacobs, B. C., Inventor; 27 Mar 06; 29 pp.; In English

Contract(s)/Grant(s): N0001-491-J1485

Patent Info.: Filed Filed 27 Mar 06; US-Patent-Appl-SN-11-390 028

Report No.(s): PB2008-104838; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An optical switch and optical storage loop are used as the basis of a single-photon source and a quantum memory for photonic qubits. To operate as a single-photon source, the techniques include a source of a pair of photons, such as a parametric down-conversion crystal, which is known to emit photons in pairs. The detection of one member of the pair activates the switch, which re-routes the other member into the storage loop. The stored photon is then known to be circulating in the loop, and can be switched out of the loop at a later time chosen by the user, providing a single photon for potential use in a variety of quantum information processing applications. To operate as a quantum memory for photonic qubits, a single-photon in an arbitrary initial polarization state is coherently stored in the loop, and coherently switched out of the loop when needed.

NTIS

*Loops; Optical Memory (Data Storage); Patent Applications; Photons; Switches*

**20080048358** Iandiorio and Teska., Waltham, MA, USA

**Open Lattice Mirror Structure and Method of Making Same**

Warren, P. A., Inventor; 21 Nov 05; 12 pp.; In English

Contract(s)/Grant(s): AF-F29601-02-C-0149

Patent Info.: Filed Filed 21 Nov 05; US-Patent-Appl-SN-11-284 499

Report No.(s): PB2008-106047; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method of making a mirror structure includes assembling a supporting isogrid framework, assembling an isogrid back plane, interconnecting the supporting isogrid framework with the isogrid back plane by a truss core, and disposing an optical surface on the supporting isogrid framework.

NTIS

*Mirrors; Patent Applications*

**20080048359** Queen (Benjamin T, II) and Pietragallo, Bosick and Gordon, Pittsburgh, PA, USA

**System for Confined Optical Power Delivery and Enhanced Optical Transmission Efficiency**

Sendur, I. K., Inventor; Peng, C., Inventor; 11 Feb 05; 9 pp.; In English

Contract(s)/Grant(s): NIST-70NANB1H3056

Patent Info.: Filed 11 Feb 05; US-Patent-Appl-SN-11-055 864

Report No.(s): PB2008-106050; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A system for confined optical power delivery and enhanced optical transmission efficiency includes a waveguide defining an aperture, a focusing element, and a coupling layer positioned between the waveguide and the focusing element. The waveguide may be, for example, in the form of a ridge waveguide. The focusing element is formed of a material having a refractive index that is greater than a refractive index of the coupling layer. The focusing element may be, for example, a solid immersion lens or a solid immersion mirror.

NTIS

*Confinement; Fiber Optics; Light Transmission; Patent Applications; Transmission Efficiency*

**20080048518** Air Force Research Lab., Rome, NY USA

### **Characterization of an Electro-Absorption Modulator Design With High-Dynamic Range for Broadband Analog Applications**

Bussjager, Rebecca; Erdmann, Reinhard; Michalak, Richard; Cook, Paul; McKeon, Brian; Zmuda, Henry; Tan, Songsheng; Stoffel, Nancy; Schick, Charles; McDonald, Terrance; Yu, Paul; Shubin, Ivan; Xie, Xiaobo; Mar 2008; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-SEMI

Report No.(s): AD-A490148; AFRL-RY-RS-TP-2008-8; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An electro-absorption modulator (EAM) is designed to optimize dynamic range performance over 20 GHz bandwidth. The single stripe waveguide enables an extremely compact and integrated package to be fabricated with single mode fiber pigtailed. The transfer function's shape permits suppression of higher order intermodulation products, yielding a spur-free dynamic range exceeding that of Mach-Zehnder designs. A dilute optical core diverts energy flow from absorbing layers into a low loss waveguide; the 20 dBm optical power tolerance is significantly higher than that of commercially available electro-absorption devices. The tunable performance over 20GHz is characterized and applications are discussed. New approaches to the broadband impedance matching requirements are calculated and the impact on system performance is assessed.

DTIC

*Analog Data; Broadband; Dynamic Range; Fiber Optics; Modulators; Systems Engineering*

## 75

### PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

**20080047529** Naval Research Lab., Washington, DC USA

### **Electron Temperature Derived from Measurements of Complex Plasma Impedance**

Walker, D N; Fernsler, R F; Blackwell, D D; Amatucci, W E; Oct 20, 2008; 32 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489386; NRL/MR/6750--08-9141; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489386>

In earlier work, using a network analyzer, we have shown the existence of collisionless resistance (CR) in the sheath of spherical probe when driven by a small RF signal. For any position in the sheath, the CR was shown to be inversely proportional to the plasma density gradient there; but to exist only when the applied frequency corresponds to the plasma frequency ( $\omega_{pe}$ ), or density, at that position. We have recently begun a study of the low-to-intermediate frequency response of the probe to the RF signal. At sufficiently low frequencies, the CR is beyond cutoff, i.e., since the earlier work shows that the existence of CR depends on the plasma density gradient, there is a cutoff which is proportional to the applied bias level and which will occur at the plasma frequency at the surface of the probe. Since electron density at the probe surface decreases as a function of applied (negative) bias, the CR will extend to lower frequencies as the magnitude of negative bias increases. Therefore, to eliminate both CR and ion current contributions, the frequencies we consider are much greater than the ion plasma frequency ( $\omega_{pi}$ ), but less than the plasma frequency at the probe surface ( $\omega_{pe}(r_0)$ ), where  $r_0$  is the probe radius. We show that, in this frequency regime, the complex impedance measurements made with



a network analyzer can be used to determine electron temperature. We present an overview of the theory used along with comparisons to data sets made using three stainless steel spherical probes of different sizes in different experimental environments and different plasma parameter regimes. We compare the results of the temperature measurements to those made by conventional Langmuir probe sweeps; the method shown here requires not curve fitting as is the usual procedure with Langmuir probes when a Maxwell Boltzmann electron distribution function is assumed.

DTIC

*Electrical Impedance; Electron Density (Concentration); Electron Energy; Impedance; Plasma Density; Plasma Diagnostics; Plasmas (Physics); Temperature Gradients; Temperature Measurement*

**20080047789** Strub and Pokotylo, Tinton Falls, NJ, USA

**Portable Arc-Seeded Microwave Plasma Torch**

Kuo, S. P., Inventor; 19 Mar 04; 21 pp.; In English

Contract(s)/Grant(s): AFOSR-F49620-01-1-0392

Patent Info.: Filed 19 Mar 04; US-Patent-Appl-SN-10-804 601

Report No.(s): PB2008-105467; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Arc plasma torch generated by a torch module installed on the bottom wall in the narrow section of a tapered S-band rectangular cavity, is used to seed microwave discharge where the microwave electric field is maximum. This tapered cavity is designed to support TE(sub 103) mode. With seeding, only low Q cavity and moderate microwave power (time average power of 700 W) are needed. The microwave-enhanced discharge increases the size, cycle energy, and duty cycle of the seeding arc-torch plasma considerably. This torch can be run stably without introducing gas flow or run just using airflow. Adding airflow can increase not only the size of the torch plasma but also its cycle energy, which may reach a plateau of about 12 J/per cycle for the airflow rate exceeding 0.393 l/s. This microwave plasma torch may have a radius of about 1.25 cm or more, a height of about 5 cm, and a peak electron density exceeding  $5 \times 10^{13} \text{ cm}^{-3}$ . This torch may produce an abundance of reactive atomic oxygen, and therefore may be used in applications for rapidly destroying a broad spectrum of chemical and biological warfare (CBW) agents.

NTIS

*Microwaves; Patent Applications; Plasma Torches; Plasmas (Physics); Torches*

**20080047798** Air Force Research Lab., Edwards AFB, CA USA

**A High-Order Scheme for Collisional-Radiative and Non-Equilibrium Plasma (Preprint)**

Kapper, Michael; Cambier, Jean-Luc; Aug 22, 2008; 20 pp.; In English

Contract(s)/Grant(s): Proj-2304

Report No.(s): AD-A489563; AFRL-RZ-ED-TP-2008-361; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper we describe a new 3rd-order algorithm for solving the transport equations of plasma in highly non-equilibrium conditions. The plasma is described as a two-temperature, single fluid with the kinetics of collisional and radiative excitation and ionization, and reverse processes. This Collisional-Radiative model is currently limited to atomic plasma and does not include radiative transport. We describe in detail some special techniques for level grouping, scale separation of slow (transported) and fast (quasi-steady-state) level kinetics, and a non-linear transformation of the transported equations of the electronic levels to achieve the desired accuracy. The implementation and testing of the various coupling and relaxation processes are described. The fluid transport is computed using a 3rd-order variant of the MP5 monotonicity-preserving upwind advection scheme. The code is implemented in Java and parallelized through domain decomposition and hierarchical multi-threading; approach and performance are also briefly discussed. The numerical model is validated on various standard test cases, and applied to the simulation of ionizing shock front propagation in Argon. This problem shows a high sensitivity to the kinetics ladder of ionization and population of the excited states, leading to fluctuations of the location of the electron avalanche at the end of the induction zone behind the shock. We show that the collisional-radiative kinetics can reproduce the corrugations of the shock front observed in the experiment.

DTIC

*Kinetics; Mathematical Models; Plasmas (Physics)*

**20080048067** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Nonlinear Electron Motion in a Coherent Wave Packet**

Khazanov, George; Tel'nikhin, Alexander; Kronberg, Tatiana; [2007]; 9 pp.; In English; Original contains black and white illustrations

Report No.(s): APS/123-QED; Copyright; Avail.: Other Sources

Map equations are derived, with which nonlinear electron motion in a coherent whistler wave packet is investigated. All solutions of these equations belong to a certain strange attractor and describe chaotic motion with the stable means. The class of solutions determined the intermittent dynamics as the control parameter of the wave-particle system increases above the appropriate a critical value is found. An application of the results to the problem of the stability of Earth's radiation belts is considered.

Author

*Charged Particles; Electron Mobility; Particle Motion; Wave Packets; Terrestrial Radiation*

**20080048086** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Can Coupled Particle Transport in Space and Astrophysical Plasmas Support Steady-State (Turing) Structures?**

Barghouty, A. F.; El-Nemr, K. W.; Baird, J. K.; [2008]; 10 pp.; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

Energetic (suprathermal), charged particles in hot, magnetized plasma are known to be intimately coupled to the plasma for their acceleration and transport. For many space and astrophysical applications the dynamics is described by a set of coupled Fokker-Planck equations. In a collisionless plasma, particle-particle coupling can be effected in a number of ways. This paper explores effects of particle-particle coupling via nonlinear source terms on the characteristics of these particles. By exploiting a coupled, nonlinear reactive-diffusive system, we demonstrate the possible existence of Turing structures in a two-particle Fokker-Planck model. In this model, diffusion in energy space is taken to be due to scattering in a turbulent magnetic field, while systematic energy losses and gains are generic. The analogy suggests that patterns can emerge with a strong dependence on the magnetic turbulence but a rather weak one on the coupled particles attributes. We believe this heuristic, but rather suggestive application of Turing morphogenesis theory to models of energetic particles in space, has the potential to help explain some observed structures in energetic particles' characteristics.

Author

*Charged Particles; Particle Acceleration; Fokker-Planck Equation; Steady State; Collisionless Plasmas; High Temperature Plasmas; Space Plasmas; Astrophysics; Diffusivity*

**20080048094** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Validation of the Plasma Densities and Temperatures from the ISS Floating Potential Measurement Unit**

Coffey, Victoria N.; Wright, Kenneth, Jr.; Minow, Joseph I.; Schneider, T.; Vaughn, J.; Craven, P.; Koontz, Steven L.; Parker, Linda, N.; Bui, Them; [2008]; 24 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Validation of the Floating Potential Measurement Unit (FPMU) plasma density and temperature measurements is an important step in the process of evaluating International Space Station spacecraft charging issues including vehicle arcing and hazards to crew during extravehicular activities. The highest potentials observed on Space Station are due to the combined  $V \times B$  effects on a large spacecraft and the collection of ionospheric electron and ion currents by the 160 V US solar array modules. The ionospheric plasma environment is needed for input to the ISS spacecraft charging models used to predict the severity and frequency of occurrence of ISS charging hazards. Validation of these charging models requires comparing their predictions with measured FPMU values. The FPMU measurements themselves must also be validated for use in manned flight safety work. This paper presents preliminary results from a comparison of densities and temperatures derived from the FPMU Langmuir probes and Plasma Impedance Probe with the independent density and temperature measurements from a space-borne ultraviolet imager, a ground based incoherent scatter radar, and ionosonde sites.

Author

*Temperature Measurement; Plasma Density; Spacecraft Charging; Solar Arrays; Plasmas (Physics); Manned Space Flight; International Space Station; Extravehicular Activity; Impedance Probes*

Includes condensed matter physics, crystallography, and superconductivity. For related information see also 33 *Electronics and Electrical Engineering*; and 36 *Lasers and Masers*.

**20080047401** George Washington Univ., Washington, DC USA

**Implementation of Simulation Program for Modeling the Effective Resistivity of Nanometer Scale Film and Line Interconnects**

Yarimbayik, A. E.; Zaghoul, M. E.; Schafft, H. A.; Allen, R. A.; Blackburn, D. L.; Feb. 2006; 21 pp.; In English  
Report No.(s): PB2009-102237; NISTIR-7234; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A computer program that simulates the impact of the size effect on the effective resistivity of line and film conductors is described. Flowcharts and the program code are provided as appendices.

NTIS

*Conductors; Electrical Resistivity; Scattering; Simulation; Thin Films*

**20080047668** NASA Glenn Research Center, Cleveland, OH, USA; Case Western Reserve Univ., Cleveland, OH, USA

**New Techniques in Characterization of Ferroelectric Materials**

Sehirlioglu, Alp; February 24, 2008; 30 pp.; In English; Original contains color and black and white illustrations  
Contract(s)/Grant(s): NNC07TA77T; WBS 984764.02.07.03.16.04; Copyright; Avail.: CASI: [A03](#), Hardcopy

Two new techniques have been developed to characterize Pb(Mg<sub>1/3</sub>Nb<sub>2/3</sub>)O<sub>3</sub>-PbTiO<sub>3</sub> (PMN-PT) based ferroelectric single crystals: (i) electro-thermal imaging, and (ii) single crystal x-ray diffraction in the transmission mode. (i) Electro-thermal imaging is a remote sensing technique that can detect the polarization direction and poling state of a whole crystal slice. This imaging technique utilizes an IR camera to determine the field induced temperature change and does not require any special or destructive sample preparation. In the resulting images it is possible to distinguish regions of 180 deg domains. This powerful technique can be used remotely during poling to determine the poling state of the crystal to avoid over-poling that can result in inferior properties and/or cracking of the crystals. Electro-thermal imaging produced the first direct observations of polarization rotation. Under bipolar field, the domains near the corners were the first to switch direction. As the field increased above the coercive field, domains at the center part of the crystals switched direction. (ii) X-ray diffraction in the transmission mode has long been used in structure determination of organic crystals and proteins; however, it is not used much to characterize inorganic systems. 0.7Pb(Mg<sub>1/3</sub>Nb<sub>2/3</sub>)O<sub>3</sub>-0.3PbTiO<sub>3</sub> single crystals were examined by this XRD technique for the first time, and a never-before-seen super-lattice was revealed with a doubling of the unit cell in all three directions, giving a cell volume eight times that of a traditional perovskite unit cell. The significance of the super-lattice peaks increased with poling, indicating a structural contribution to ordering. Lack of such observations by electron diffraction in the transmission electron microscope examinations suggests the presence of a bulk effect.

Author

*Ferroelectric Materials; Single Crystals; Characterization; X Ray Diffraction; Remote Sensing; Imaging Techniques*

**20080047904** Fermi National Accelerator Lab., Batavia, IL, USA

**Searches for Higgs and BSM at the Tevatron**

Duperrin, A.; Oct. 2007; 10 pp.; In English

Report No.(s): DE2007-918713; FERMILAB-CONF-07-566-E; No Copyright; Avail.: National Technical Information Service (NTIS)

This paper presents an overview of recent experimental direct searches for Higgs-boson and beyond-the-standard-model (BSM) physics shown in the plenary session at the SUSY07 conference. The results reported correspond to an integrated luminosity of up to 2 fb<sup>-1</sup> of Run II data from pp collisions collected by the CDF and DO experiments at the Fermilab Tevatron Collider. Searches covered include: the standard model (SM) Higgs boson (including sensitivity projections), the minimal supersymmetric extension of the standard model (MSSM), charged Higgs bosons and extended Higgs models, supersymmetric decays that conserve R-parity, gauge-mediated supersymmetric breaking models, long-lived particles, leptoquarks, extra gauge bosons, extra dimensions, and finally signature-based searches. Given the excellent performance of the collider and the continued productivity of the experiments, the Tevatron physics potential looks very promising for discovery in the coming larger data sets. In particular, the Higgs boson could be observed if its mass is light or near 160 GeV.

NTIS

*Higgs Bosons; Particle Accelerators*

**20080047919** Stanford Linear Accelerator Center, CA, USA; Los Alamos National Lab., NM USA

### **Minimal Direct Gauge Mediation**

Ibe, M.; Kitano, R.; Nov. 2007; 4 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-919442; SLAC/PUB-12967; LAUR-07-7160; No Copyright; Avail.: Department of Energy Information Bridge

Models with gauge mediated supersymmetry breaking with a very small gravitino mass,  $m_{3/2} < O(10)\text{GeV}$ , are an attractive possibility since it does not cause any cosmological or astrophysical problems. It is, however, difficult to construct a consistent model with such a light gravitino. In this letter, we propose a simple (and possibly the simplest) model with  $m_{3/2} < O(10)\text{eV}$ , where not only the supersymmetry breaking but also the masses of the messenger particles are generated by the effects of the strong dynamics of a gauge interaction.

NTIS

*Gravitinos; Measuring Instruments; Supersymmetry; Astrophysics*

**20080048132** Eloret Corp., CA, USA

### **Directed Growth of Carbon Nanotubes Across Gaps**

Delzeit, Lance; Meyyapan, Meyya; NASA Tech Briefs, September 2008; September 2008, pp. 8; In English; See also [20080048125](#); Original contains color and black and white illustrations

Report No.(s): ARC-14985-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3069>

An experiment has shown that when single-walled carbon nanotubes (SWNTs) are grown by chemical vapor deposition in the presence of an electric field of suitable strength, the nanotubes become aligned along the electric field. In an important class of contemplated applications, one would exploit this finding in fabricating nanotube transistors; one would grow SWNTs across gaps between electrodes that would serve, subsequently, as source and drain contacts during operation of the transistors. In preparation for the experiment, a multilayer catalyst comprising a 20-nm-thick underlayer of iridium (platinum group), a 1-nm-thick middle layer of iron, and a 0.2-nm-thick outer layer of molybdenum was ion-beam sputtered onto a quartz substrate. A 25 micrometers-diameter iron wire was used as a shadow mask during the sputtering to create a 25 micrometers gap in the catalyst. Then electrical leads were connected to the catalyst areas separated by the gap so that these catalyst areas would also serve as electrodes. The substrate as thus prepared was placed in a growth chamber that consisted of a quartz tube of 1-in. (2.54-cm) diameter enclosed in a furnace. SWNTs of acceptably high quantity and quality were grown in 10 minutes with methane at atmospheric pressure flowing through the chamber at a rate of 1,000 standard cubic centimeters per minute at a temperature of 900 C. To prevent oxidation of the SWNTs, the chamber was purged with 99.999-percent pure argon before and after growth, and the chamber was cooled to less than 300 C before opening it to the atmosphere after growth. When no voltage was applied across the gap, the SWNTs grew in random directions extending out from the edges of the catalyst at the gap. When a potential of 10 V was applied between the catalyst/electrode areas to create an electric field across the gap, the SWNTs grew across the gap, as shown in the figure.

Author

*Carbon Nanotubes; Nanostructure Growth; Gaps; Semiconductors (Materials)*

**20080048191** NASA Glenn Research Center, Cleveland, OH, USA

### **Nematic Cells for Digital Light Deflection**

Pishnyak, Oleg; Golovin, Andrii; Laventovich, Oleg; Kreminska, Liubov; Winker, Bruce; Pouch, John; Miranda, Felix; NASA Tech Briefs, September 2008; September 2008, pp. 17-18; In English; See also [20080048125](#)

Report No.(s): LEW-18215-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3158>

Smectic A (SmA) materials can be used in non-mechanical, digital beam deflectors (DBDs) as fillers for passive birefringent prisms based on decoupled pairs of electrically controlled, liquid crystalline polarization rotators, like twisted nematic (TN) cells and passive deflectors. DBDs are used in free-space laser communications, optical fiber communications, optical switches, scanners, and in-situ wavefront correction.

Author

*Birefringence; Deflection; Liquid Crystals; Light (Visible Radiation)*

**20080048223** Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA

**Introduction Talk on SRF Issues About Materials and Surfaces**

Ciovati, S.; May 2007; 24 pp.; In English

Report No.(s): DE2007-908662; No Copyright; Avail.: National Technical Information Service (NTIS)

No abstract available

*Radio Frequencies; Superconducting Cavity Resonators*

77

**PHYSICS OF ELEMENTARY PARTICLES AND FIELDS**

Includes quantum mechanics; theoretical physics; and statistical mechanics. For related information see also *72 Atomic and Molecular Physics*, *73 Nuclear Physics*, and *25 Inorganic, Organic and Physical Chemistry*.

**20080047502** Naval Postgraduate School, Monterey, CA USA

**The Pattern and Dynamics of the Meridional Overturning Circulation in the Upper Ocean**

Edwards, Erick L; Sep 2008; 121 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489129; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489129>

The physics of the Meridional Overturning Circulation (MOC) and interhemispheric heat transport is explored with an emphasis on the upper and central ocean. Sea surface temperature and wind stress are considered in the context of their ability to influence the MOC pattern and their relative significance is quantified. Most calculations in this study use an idealized rectangular basin which makes it easier to identify the key dynamic processes and explain interaction. Volumetric and advective heat transport stream functions are used to analyze interhemispheric exchanges of mass and energy. Data concerning the effects of equatorially-asymmetric wind stress and surface heat flux forcing are used to construct expressions which explicitly define the relationships between wind stress, surface heat flux, interhemispheric volume flow, and heat transport. The relative importance of wind stress and surface heat flux to the overall values of transport is discussed in light of climatology. The meridional overturning circulation in the upper ocean is found to be the dominant factor in interhemispheric heat transport and in the maintenance of the Earth's climate despite its extremely small contribution to total meridional-vertical circulations in the entire ocean basin. This study suggests that the previous emphasis on deep overturning in the abyssal region and small-scale mixing as the dominant factors in the meridional overturning circulation should be reconsidered and the role of wind stress and surface heat fluxes more thoroughly investigated as determining factors of MOC strength and maintenance. This study explores possible mechanisms responsible for climate shift which could result in long-term changes to weather patterns and ocean conditions altering important factors in the Navy's operating environment. Thus, long-term Navy planning must include an appreciation for possible changes in the forcing mechanisms responsible for the meridional overturning circulation.

DTIC

*Heat Flux; Heat Transfer; Ocean Currents; Oceans; Shear Stress; Wind Shear*

**20080047573** Army Engineer Research and Development Center, Vicksburg, MS USA

**Thermal Performance of Microencapsulated Phase Change Material Survey**

Alvarado, Jorge L; Jones, Barclay G; Marsh, Charles P; Kessler, David A; Sohn, Chang W; Feickert, Carl A; Phetteplace, Gary E; Crowley, Eric D; Franks, Ryan J; Carlson, Thomas A; Mar 2008; 85 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-008BE4

Report No.(s): AD-A489460; ERDC-TR-08-4; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The efficiency of a pumped heat-transfer system can be greatly increased by incorporating a phase-change material (PCM). Because PCMs have greater thermal capacity than the carrier fluid, owing to their latent heat of phase change, they can increase the amount of heat transfer at equivalent volumetric flow in a heat exchanging environment. These materials tend to clog heat-transfer and distribution pipes, but previous research has indicated that the problem may be solved by encapsulating the PCMs. This report documents an investigation of the thermophysical properties of PCMs enclosed in micro-scale capsules. The study also addressed microcapsule durability against abrasion and chemicals, and the relation of fluid temperature and particle volume fraction on viscosity. The results of this research show that the total heat capacity of microencapsulated PCM (MPCM) slurries is enhanced significantly, even when using low volume fractions. MPCM slurries

have potential to decrease costs and improve energy efficiency for all pumped cooling applications.

DTIC

*Heat Transfer; Slurries; Surveys; Temperature Effects; Thermodynamic Properties; Thermophysical Properties*

**20080047813** Air Force Research Lab., Wright-Patterson AFB, OH USA

**The Effect of Dissolved Air on the Cooling Performance of a Partially Confined FC-72 Spray**

Puterbaugh, Rebekah L; Yerkes, Kirk L; Thomas, Scott K; Jul 2008; 107 pp.; In English

Contract(s)/Grant(s): Proj-3145

Report No.(s): AD-A489408; AFRL-RZ-WP-TP-2008-2230; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this thesis is to investigate the heat transfer performance of a partially confined FC-72 spray with varying dissolved air concentrations. An experimental test rig consisting of a spray chamber coupled to a fluid delivery loop system was used to obtain temperature, pressure, and critical heat flux (CHF) data. A downward facing nozzle within the spray chamber allowed the FC-72 fluid to be sprayed onto an upward facing, thick-film, resistor heater. The heater was mounted onto a glass post, with a sump system to allow removal of excess fluid. Type-E thermocouples were imbedded in the post to obtain temperature data. The parametric ranges for experimental testing were as follows: volume-percent concentration of dissolved air,  $5 < C < 18\%$ , chamber pressure,  $6.90 \times 10^4 < P < 8.27 \times 10^4$  N/m<sup>2</sup> ( $10 < P < 12$  psia), subcooling,  $2 < \Delta T < 12$  degrees C, volumetric flow rate,  $6.31 < V < 10.5$  cm<sup>3</sup>/s ( $6.0 < V < 10.0$  gph). Test data were obtained for comparison of CHF with varying C while controlling the spray chamber pressure. No significant variation in heat transfer performance was observed. The applicability of Henry's law to the current system was investigated, and air concentration measurements using Henry's law were compared with those obtained using a direct sample method.

DTIC

*Air Cooling; Confinement; Cooling; Heat Transfer; Sprayers*

**20080047848** Air Force Research Lab., Wright-Patterson AFB, OH USA

**The Effect of Variable Gravity on the Cooling Performance of a 16-Nozzle Spray Array**

Elston, Levi J; Yerkes, Kirk L; Thomas, Scott K; McQuillen, John; Sep 2008; 261 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-3145

Report No.(s): AD-A489402; AFRL-RZ-WP-TP-2008-2199; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this thesis was to investigate the cooling performance of a 16-nozzle spray array, using FC-72 as the working fluid, in variable gravity conditions with additional emphasis on fluid management and flow stability. A flight test experiment was modified to accommodate a 16-nozzle spray array, which was then tested in the parabolic flight trajectory environment of NASA's C-9 reduced gravity aircraft. The 16-nozzle array was designed to cool a 25.4 by 25.4 [mm] area on a thick film resistive heater used to simulate electronic components. Data was taken and reduced as a result of flight tests conducted over the course of two flight weeks (each week consisting of four flights, each flight consisting of 40 to 60 parabolas). The flight tests were conducted in order to examine gravity effects on spray cooling performance and to evaluate a novel liquid-vapor separator design. The mass flow rate through the 16-nozzle spray array ranged from  $13.1 < m < 21.3$  [g/s] for the spray cooling analysis and  $14 < m < 35$  [g/s] for the separator evaluation. The heat flux at the thick film resistor ranged from  $2.9 < q < 25$  [W/cm<sup>2</sup>], the subcooling of the working fluid.

DTIC

*Cooling; Electronic Equipment; Gravitation; Gravitational Effects; Heat Transfer; Sprayers*

**20080048405** Army Engineer Research and Development Center, Vicksburg, MS USA

**Thermal Performance of Microencapsulated Phase Change Material Slurry**

Alvarado, Jorge L; Jones, Barclay G; Marsh, Charles P; Kessler, David A; Sohn, Chang W; Feickert, Carl A; Phetteplace, Gary E; Crowley, Eric D; Franks, Ryan J; Carlson, Thomas A; Mar 2008; 85 pp.; In English; Original contains color illustrations  
Report No.(s): AD-A489758; ERDC-TR-08-4; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489758>

The efficiency of a pumped heat-transfer system can be greatly increased by incorporating a phase-change material (PCM). Because PCMs have greater thermal capacity than the carrier fluid, owing to their latent heat of phase change, they can increase the amount of heat transfer at equivalent volumetric flow in a heat exchanging environment. These materials tend

to clog heat-transfer and distribution pipes, but previous research has indicated that the problem may be solved by encapsulating the PCMs. This report documents an investigation of the thermophysical properties of PCMs enclosed in micro-scale capsules. The study also addressed microcapsule durability against abrasion and chemicals, and the relation of fluid temperature and particle volume fraction on viscosity. The results of this research show that the total heat capacity of microencapsulated PCM (MPCM) slurries is enhanced significantly, even when using low volume fractions. MPCM slurries have potential to decrease costs and improve energy efficiency for all pumped cooling applications.

DTIC

*Crystallization; Encapsulating; Heat Measurement; Heat Transfer; Slurries; Temperature Effects*

## 80

### SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula. For specific topics in these areas see categories 81 through 85.

**20080048074** Universities Space Research Association, Huntsville, AL, USA; NASA Marshall Space Flight Center, Huntsville, AL, USA

#### **Validation and Demonstration of the Prescott Spatial Growth Model in Metropolitan Atlanta, Georgia**

Estes, Maurice G, Jr.; Crosson, Willilam L.; Johnson, Hoyt, III; Quattrochi, Dale A.; [2007]; 20 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Projecting the quantity and spatial distribution of urban growth is essential to effectively plan for the delivery of city services and to evaluate potential environmental impacts. Viable future growth scenarios are essential to effectively plan for potential impacts on air and water resources among others. The major drivers of growth in large urban areas are increasing population, employment opportunities, the transportation network and quality of life attractors such as a favorable climate and recreation opportunities. The spatial distribution of urban growth is dictated by the amount and location of developable land, topography, energy and water resources, transportation network, climate change, and the existing land use configuration. The Prescott Spatial Growth Model (PSGM) is a tool that can be applied at the parcel level or more coarse spatial scales and can accommodate a wide range of user inputs to develop any number of growth rules, each of which are weighted depending on growth assumptions. In this paper, the PSGM is described, including data inputs, how rule sets are developed and the decision process for allocation of future development to available land use categories. 'Blind' and 'guided' forecasts for the Atlanta region were performed for the 1980-2000 period to evaluate the performance of the model in the quantity and spatial distribution of urban growth. Quantitative comparisons of both the blind and guided forecasts with actual land use on a county basis were used in model assessment and are shown herein. Strong relationships were found between existing land use and the guided forecast. These results indicate that errors in population and employment forecasts have a substantial impact on the ability of a growth model to simulate urban land use changes. Given accurate projections of population and employment, the agreement between forecast and observed land use is quite good, and the spatial patterns of development very realistic.

Author

*Populations; Land Use; Recreation; Topography; Cities; Climate Change; Water Resources; Forecasting; Transportation Networks*

## 81

### ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

**20080047374** Commander Submarine Force Atlantic, Norfolk, VA USA

#### **Trimming More Than Just the Fat: Utilizing a Requirements Integration and Prioritization Process (RIPP) to Guide the Blade**

Parashak, Paul; Eberly, Diane B; Jun 2007; 31 pp.; In English; Original contains color illustrations

Report No.(s): AD-A488451; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA488451>

Requirements Integration and Prioritization Process \* PROBLEM \* Aid the Undersea Enterprise Resource Sponsor (OPNAV) in prioritizing for the Program Objective Memorandum or Program Review builds \* Maintain current capability and readiness \* Enhance future submarine force capability \* ENVIRONMENT \* Stable or reduced budget authority \* Rising costs

\* Meet customer demand signal \* RESULT \* Look for programs / mission areas to divest.

DTIC

*Requirements; Cost Effectiveness; Risk Assessment; Decision Making*

**20080047954** Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Soesterberg, Netherlands

**Job Oriented Training: [A Guide to] Serious Gaming**

vanderHulst, A. H.; Muller, T. J.; Roos, C. L.; September 2008; 39 pp.; In Dutch; Original contains color illustrations

Report No.(s): TNO-DV-2008-A340; TD2008-0142; Copyright; Avail.: Other Sources

Job Oriented Training implies that, from day one, students are confronted with a series of realistic scenarios that gradually increase in complexity. There is no part-task training, from the very beginning the students perform the integral tasks; i.e. they analyze the current situation, they create a tactical plan and command and control the execution of that plan. The scenarios provide distinct and confronting feedback, thus making clear whether the tactics applied were effective or not. The scenarios are designed to elicit tactical mistakes to trigger discussion among them so they start understanding what a tactic means in practice. As peers, they reflect upon the experiences encountered, resulting in a common understanding where their performance needs improvement. This document provides an instructors manual for the application of JOT to Serious Gaming.

Author

*Education; Occupation; Training Simulators; Personnel Development*

**20080048012** Brown (Richard Lee), USA

**Root Source Analysis/ValuStream[Trade Mark] - A Methodology for Identifying and Managing Risks**

Brown, Richard Lee; NASA Tech Briefs, October 2008; October 2008, pp. 31; In English; See also [20080047981](#)

Report No.(s): MFS-32316-1; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3309>

Root Source Analysis (RoSA) is a systems engineering methodology that has been developed at NASA over the past five years. It is designed to reduce costs, schedule, and technical risks by systematically examining critical assumptions and the state of the knowledge needed to bring to fruition the products that satisfy mission-driven requirements, as defined for each element of the Work (or Product) Breakdown Structure (WBS or PBS). This methodology is sometimes referred to as the ValuStream method, as inherent in the process is the linking and prioritizing of uncertainties arising from knowledge shortfalls directly to the customer's mission driven requirements. RoSA and ValuStream are synonymous terms. RoSA is not simply an alternate or improved method for identifying risks. It represents a paradigm shift. The emphasis is placed on identifying very specific knowledge shortfalls and assumptions that are the root sources of the risk (the why), rather than on assessing the WBS product(s) themselves (the what). In so doing RoSA looks forward to anticipate, identify, and prioritize knowledge shortfalls and assumptions that are likely to create significant uncertainties/ risks (as compared to Root Cause Analysis, which is most often used to look back to discover what was not known, or was assumed, that caused the failure). Experience indicates that RoSA, with its primary focus on assumptions and the state of the underlying knowledge needed to define, design, build, verify, and operate the products, can identify critical risks that historically have been missed by the usual approaches (i.e., design review process and classical risk identification methods). Further, the methodology answers four critical questions for decision makers and risk managers: 1. What's been included? 2. What's been left out? 3. How has it been validated? 4. Has the real source of the uncertainty/ risk been identified, i.e., is the perceived problem the real problem? Users of the RoSA methodology have characterized it as a true bottoms up risk assessment.

Derived from text

*Systems Engineering; Risk Management; Methodology; Project Management*

**82**

**DOCUMENTATION AND INFORMATION SCIENCE**

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer program documentation see *61 Computer Programming and Software*.

**20080047236** Department of Defense, Washington, DC USA

**From the DoD CIO: The Net-Centric Information Enterprise**

Grimes, John G; Jul 2006; 4 pp.; In English

Report No.(s): AD-A488329; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA488329>

Defense transformation hinges on the recognition that information is one of our greatest sources of power. Information



can be leveraged to allow decision makers at all levels to make better decisions faster and act sooner. Ensuring timely and trusted information is available where it is needed, when it is needed, and to those who need it most is the heart of the capability needed to conduct Net-Centric Operations.

DTIC

*Warfare; Computer Networks*

**20080047481** Naval Postgraduate School, Monterey, CA USA

**The Human Terrain System: Achieving a Competitive Advantage Through Enhanced ‘Population-Centric’ Knowledge Flows**

Schaner, Eric X; Sep 2008; 103 pp.; In English; Original contains color illustrations

Report No.(s): AD-A488992; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA488992>

The USA military must fundamentally evolve its strategy and capabilities to better meet the unconventional challenges that define the post 9/11 era. Two principal requirements of this evolution are: (1) adopting a population centric strategy for counterinsurgency and nation building, and (2) developing capabilities that better integrate U.S. forces and Host Nation civilians, leadership, and security forces. This thesis shows how a new Army initiative called the Human Terrain System (HTS) advances the U.S. Army toward achieving these requirements by embedding Human Terrain Teams (HTTs) within U.S. Army units performing counterinsurgency and nation building in Iraq and Afghanistan. The research uses the case study method to analyze a currently deployed Human Terrain Team. The analysis leverages Knowledge Flow Theory to explain how the HTT creates, shares, and harnesses relevant cultural knowledge to improve the competitive performance of the host unit and advance the adoption of a population centric strategy. The thesis concludes that the embedded HTT concept is valid and necessary in counterinsurgency and nation building contexts. The thesis recommends developing a sufficient pool of career military social scientists to serve as future candidate participants, and integrating a knowledge management mechanism and policy into the HTS framework.

DTIC

*Information Management; Terrain*

**20080047492** Army Training and Doctrine Command, Fort Leavenworth, KS USA

**Massing Effects in the Information Domain: A Case Study in Aggressive Information Operations**

Metz, Thomas F; Garrett, Mark W; Hutton, James E; Bush, Timothy W; Jun 2006; 12 pp.; In English

Report No.(s): AD-A489043; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489043>

In 1995, the Department of the Army, Forces Command, and the Training and Doctrine Command began a joint venture called Force XXI, the focus of which was to understand how information-age technology could improve the U.S. Army’s warfighting capabilities. The Task Force XXI (TFXXI) and Division XXI Advanced Warfighting Experiments (AWE) were the capstone events of this venture. Over 70 initiatives were reviewed in the TFXXI AWE, which culminated at Fort Irwin, California, in March 1997 with the 1st Brigade Combat Team, 4th Infantry Division’s National Training Center rotation. At the heart of this experiment was near real-time location knowledge of friendly units down to individual vehicles and in some cases, individual Soldiers. The experiment proved that ‘Where I am and where my buddies are’ is powerful information for combat leaders. Leaders at all echelons became convinced that information-age technology would help our Soldiers, leaders, and formations become much more capable. There are five disciplines which make up the Army’s doctrinal IO: psychological operations (PSYOP), deception, operational security (OPSEC), electronic warfare (EW), and computer network operations (CNO). The author relates how these five disciplines were used in Operation Al-Fajr in Iraq, when he was commander of Multi-National Corps-Iraq (MNC-I). MNF-I, MNC-I and MNF-W were successful in massing effects in the information domain in Operation Al-Fajr for three reasons: they articulated an achievable end-state; they took pains to integrate, synchronize, and execute with discipline all of the elements of combat power (leadership, movement and maneuver, intelligence) and all of the tools available in the information domain (traditional IO, PA, engagement, and political actions); and they were able to effectively bridge the firewall between IO and PA to achieve their desired end-state without violating the rules of either discipline.

DTIC

*News Media; Public Relations; Warfare*

**20080047501** Naval Postgraduate School, Monterey, CA USA

**An Ontological Approach to Developing Information Operations Applications for Use on the Semantic Web**

Clarke, Timothy L; Sep 2008; 147 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489120; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489120>

Information Operations (IO) have the potential to alter the landscape of modern warfare through the sustained application of a broad spectrum of kinetic and non-kinetic effects. Operations of this type offer the benefit of reducing the scope of direct conflict by shaping the perceptions of a potential adversary. The complexity and diversity of IO makes it an ideal beneficiary of software applications, but current systems have yet to truly leverage domain expertise in systems development. By expressing IO capabilities in a formal ontology suitable for use on the Semantic Web, conditions are set such that computational power can more efficiently be leveraged to better define required capabilities and more reliably predict effects. The purpose of this thesis is to identify gaps in existing IO software applications, demonstrate how IO capabilities may be represented in a software ontology, and develop a process by which an IO ontology may be adapted for use on the Semantic Web. These objectives are accomplished by examining leading IO applications, demonstrating a process for converting the IO problem domain into an ontology using the Protege 3.3 Ontology Editor, and assessing the suitability of the ontology for use on the Semantic Web.

DTIC

*Computer Programs; Warfare*

**20080047507** Joint Chiefs of Staff, Washington, DC USA

**The Decisive Weapon: A Brigade Combat Team Commander's Perspective on Information Operations**

Baker, Ralph O; Jun 2006; 21 pp.; In English

Report No.(s): AD-A489185; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489185>

Duty in Iraq has a way of debunking myths and countering ivory tower theories with hard facts on the ground. I admit that while I was preparing to serve in Iraq as a brigade commander, I was among the skeptics who doubted the value of integrating information operations (IO) into my concept of operations. Most of the officers on my combat team shared my doubts about the relative importance of information operations. Of course, in current Army literature there is a great deal of discussion about IO theory. There is significantly less practical information, however, that details how theory can be effectively translated into practice by tactical units. My purpose in writing this article is to provide commanders the insights I gleaned from my experience. Soon after taking command of my brigade, I quickly discovered that IO was going to be one of the two most vital tools (along with human intelligence) I would need to be successful in a counterinsurgency (COIN) campaign. COIN operations meant competing daily to favorably influence the perceptions of the Iraqi population in our area of operations (AO). I quickly concluded that, without IO, I could not hope to shape and set conditions for my battalions or my Soldiers to be successful. It certainly did not take long to discover that the traditional tools in my military kit bag were insufficient to successfully compete in this new operational environment. As a brigade commander, I was somewhat surprised to find myself spending 70 percent of my time working and managing my intelligence and IO systems and a relatively small amount of my time directly involved with the traditional maneuver and fire support activities. This was a paradigm shift for me. The reality I confronted was far different from what I had professionally prepared for over a lifetime of conventional training and experience.

DTIC

*Combat; Public Relations; Warfare*

**20080047566** George Mason Univ., Fairfax, VA USA

**DTB Project: A Behavioral Model for Detecting Insider Threats**

Costa, Paulo C; Barbara, Daniel; Laskey, Kathryn B; Wright, Edward J; Alghamdi, Ghazi; Mirza, Sepideh; Revankar, Mehul; Shackelford, Thomas; Jan 2008; 3 pp.; In English

Contract(s)/Grant(s): NBCHC030059

Report No.(s): AD-A489403; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper describes the Detection of Threat Behavior (DTB) project, a joint effort being conducted by George Mason University (GMU) and Information Extraction and Transport, Inc. (IET). DTB uses novel approaches for detecting insiders in tightly controlled computing environments. Innovations include a distributed system of dynamically generated document-centric intelligent agents for document control, object-oriented hybrid logic-based and probabilistic modeling to characterize and detect illicit insider behaviors, and automated data collection and data mining of the operational environment to

continually learn and update the underlying statistical and probabilistic nature of characteristic behaviors. To evaluate the DTB concept, the authors are conducting a human subjects experiment, which they also will include in their discussion.

DTIC

*Access Control; Crime; Detection; Information Retrieval; Numerical Control; Security*

**20080047587** Office of the Deputy Under Secretary of Defense, Rosslyn, VA USA

**Technology Readiness Assessments for IT and IT-Enabled Systems**

Gold, Robert; Jakubek, David; May 2005; 7 pp.; In English

Report No.(s): AD-A489519; No Copyright; Avail.: Defense Technical Information Center (DTIC)

To ensure that the Department of Defense (DoD) is approving Milestone B decisions for programs that are technologically mature, the director of Defense Research and Engineering (DDR&E) implemented Technology Readiness Assessments (TRA) as a DoD 5000 requirement. With the continued and growing dependence of major DoD systems on information technologies, the TRA Deskbook is being updated to address the unique aspects of computer systems, hardware, and software technologies for embedded systems, business management information systems, net-reliant systems (e.g., command and control), and infrastructure systems (e.g., net-centric enterprise services). The DDR&E tasked the Institute for Defense Analysis, assisted by representatives from DoD services and agencies, to develop the revised guidelines. This article summarizes the revised guidelines, including the new Software Technology Readiness levels, and provides examples in applying the updated guidelines to major defense acquisitions.

DTIC

*Computer Networks; Defense Program; Information Systems; Military Technology; Procurement; Technology Assessment*

**20080047608** RAND Corp., Santa Monica, CA USA

**Measuring the Strategic Value of the Armed Forces Health Longitudinal Technology Application (AHLTA)**

Bigelow, James H; Harris, Katherine M; Hillestad, Richard; Jan 2008; 122 pp.; In English

Contract(s)/Grant(s): W74V8H-06-C-0002

Report No.(s): AD-A489619; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Military Health System (MHS) has more than 9 million eligible beneficiaries, including active duty service members and their families, retirees and their families, and Guard and Reserve members serving on active duty and their families. The MHS provides health care through its own facilities and personnel (direct care); it also purchases care from civilian providers (purchased care). In January 2004, the MHS's Clinical Information Technology Program Office (CITPO) began implementation of the Armed Forces Health Longitudinal Technology Application (AHLTA), DoD's global electronic health record. AHLTA will ultimately be used by all providers in the military's direct care system at the point of care. It will also promote population health, conduct medical surveillance, support clinical decision making, and support force health protection for deployed service members. As of December 2006, AHLTA was being used to document virtually all outpatient care delivered at fixed MHS facilities. The objective of this project was to help MHS develop an analytic framework and define specific outcome measures for assessing and reporting the efficiency, safety, and health benefits of AHLTA as it becomes fully deployed. This monograph describes the framework the authors recommend that DoD adopt in measuring AHLTA's contribution to MHS performance. To develop the framework, they reviewed AHLTA's current and planned capabilities, reviewed the literature on the measured benefits of health information technology, consulted with senior MHS leaders to understand the dimensions of performance that the leadership deemed important and how the leadership anticipated that AHLTA would affect those dimensions, identified and assessed performance measures in current use by civilian health systems for their applicability to MHS strategic objectives, and suggested new approaches for measuring MHS strategic objectives where civilian measures are lacking.

DTIC

*Armed Forces; Computer Storage Devices; Data Management; Health; Management Information Systems; Medical Services; Military Operations; Records Management; Technology Utilization*

**20080047779** Geological Survey, Reston, VA USA

**CHIPS: A New Way to Monitor Colonias Along the USA -Mexico Border**

Parcher, J. W.; Humberson, D. G.; January 2007; 32 pp.; In English

Report No.(s): PB2008-105610; OFR2007-1230; No Copyright; Avail.: National Technical Information Service (NTIS)

Colonias, which are unincorporated border settlements in the USA, have emerged in rural areas without the governance and services normally provided by the local government. By 2001, more than 1,400 colonias were identified in Texas.

Cooperation with the U.S. Geological Survey (USGS) to improve colonia Geographic Information System (GIS) boundaries and develop the Colonia Health, Infrastructure, and platting status tool (CHIPS).

NTIS

*Geographic Information Systems; United States*

**20080047783** Congressional Research Service, Washington, DC, USA

**CRS Report for Congress. Data Mining and Homeland Security: An Overview. Updated December 5, 2007**

Seifert, J. W.; Dec. 05, 2007; 41 pp.; In English

Report No.(s): PB2008-105625; RL31798; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Data mining has become one of the key features of many homeland security initiatives. Often used as a means for detecting fraud, assessing risk, and product retailing, data mining involves the use of data analysis tools to discover previously unknown, valid patterns and relationships in large data sets. In the context of homeland security, data mining can be a potential means to identify terrorist activities, such as money transfers and communications, and to identify and track individual terrorists themselves, such as through travel and immigration records. While data mining represents a significant advance in the type of analytical tools currently available, there are limitations to its capability. One limitation is that although data mining can help reveal patterns and relationships, it does not tell the user the value or significance of these patterns. These types of determinations must be made by the user. A second limitation is that while data mining can identify connections between behaviors and/or variables, it does not necessarily identify a causal relationship. Successful data mining still requires skilled technical and analytical specialists who can structure the analysis and interpret the output.

NTIS

*Data Bases; Data Mining; Data Processing; Information Retrieval; Intelligence; Security*

**20080047793** Government Accountability Office, Washington, DC, USA

**Legal Services Corporation: Improved Internal Controls Needed in Grants Management and Oversight**

Dec. 2007; 41 pp.; In English

Report No.(s): PB2008-105090; GAO-08-37; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The Legal Services Corporation (LSC) was created as a private nonprofit to support legal assistance for low-income people to resolve their civil legal matters and relies heavily on federal appropriations. In 2006, LSC distributed most of its \$327 million in grants to support such assistance. Effective internal controls over grants and oversight of grantees are critical to LSC's mission. GAO was asked to determine whether LSC's internal controls over grants management and oversight processes provide reasonable assurance that grant funds are used for their intended purposes. GAO analyzed key records and interviewed agency officials to obtain an understanding of LSC's internal control framework, including the monitoring and oversight of grantees, and performed limited reviews of internal controls and compliance at 14 grantees. GAO found weaknesses in LSC's internal controls over grants management and oversight of grantees that negatively affect LSC's ability to provide assurance that grant funds are being used for their intended purposes in compliance with applicable laws and regulations. Effective internal controls over grants and grantee oversight are critical to LSC as its very mission and operations rely extensively on grantees to provide legal services to people who otherwise could not afford to pay for adequate legal counsel. GAO also found poor fiscal practices and improper and potentially improper expenditures at grantees it visited.

NTIS

*Income; Laws; Procedures*

**20080047811** Office of Inspector General, Arlington, VA USA

**Audit Report on Inappropriate Use of Proprietary Data Markings by the Logistics Civil Augmentation Program (LOGCAP) Contractor**

Oct 26, 2006; 16 pp.; In English

Report No.(s): AD-A489534; SIGIR-06-035; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This review was announced on July 24, 2006, with the overall objective of determining whether the U.S. government is receiving the services paid for under Logistics Civil Augmentation Program (LOGCAP) Task Order 130 and whether the support provided is reasonable, efficient, and cost-effective. During our review we noted that the LOGCAP contractor, Kellogg Brown and Root Services, Inc. (KBR), continuously marked all information provided to the government as 'Proprietary Data'. In addition, the contractor initially refused to provide us with requested data in its native format (Excel spreadsheet or Access database), because KBR claimed the actual spreadsheets or databases contained specific proprietary information relating to how KBR conducts its business. The purpose of this interim review was to provide an assessment of whether KBR is following

applicable Federal Acquisition Regulation (FAR) direction on classifying proprietary data and is complying with contract provisions regarding information.

DTIC

*Augmentation; Classifications; Contractors; Logistics*

**20080047817** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Armada: A Reference Model for an Evolving Database System**

Groffen, F. E.; Kersten, M. L.; Manegold, S.; May 2006; 20 pp.; In English

Report No.(s): PB2008-105173; INS-E0603; Copyright; Avail.: National Technical Information Service (NTIS)

The current database deployment palette ranges from networked sensor-based devices to large data/compute Grids. Both extremes present common challenges for distributed DBMS technology. The local storage per device/node/site is severely limited compared to the total data volume being managed and the local processing power is too limited to handle a high query load. In this paper, we propose Armada: a novel reference model for a distributed database architecture to facilitate evolutionary growth. Participating systems can autonomously decide to take responsibility in the distributed data management task. The system adapts to varying workloads and supports dynamic system re-sizing, e.g., growing and shrinking of the system at large. Armada uses lineage trails to capture the metadata and history. Lineage trails from the basis to direct updates to the proper sites, break queries into multi-stage plans, and provides a reference point for site consistency. The lineage trails are managed in a purely distributed way, each Armada site is responsible for their persistency and long term availability. They provide a minimal, but sufficient basis to handle all distributed query processing tasks. The analysis of the Armada reference architecture depicts a path for innovative research at many levels of a DBMS.

NTIS

*Data Base Management Systems; Data Bases*

**20080047821** Department of Defense, Washington, DC USA

**Department of Defense: DOD Freedom of Information Act Handbook**

Dec 28, 2007; 13 pp.; In English

Report No.(s): AD-A489500; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This handbook is intended to assist you in making Freedom of Information Act (FOIA) requests for Department of Defense (DoD) records. It will get you started and provide you with a brief description of your rights and the manner in which DoD will respond to your requests. The information contained herein is not intended to be definitive or exhaustive. The FOIA, which is known by its legal cite as 5 U.S.C. section 552, along with the DoD Regulation, governs how requests will be processed within the DoD. DoD Regulation 5400.7-R, 'Department of Defense Freedom of Information Act Program,' can be found at Part 286 of Chapter 32 of the Code of Federal Regulations, which is available in most libraries. Due to its size and complexity, the DoD's FOIA program is decentralized among the several DoD components, which operate their own FOIA offices and respond directly to the public for their own records. If you desire records from these components, please write to them directly. This handbook answers the following Frequently Asked Questions: What is the FOIA?; Who can file a FOIA request?; Who is subject to the FOIA and what type of information can be requested?; What is a record?; How do I file a FOIA request?; Can I ask for expedited processing?; What are the reasons for not releasing a record?; What are the FOIA exemptions?; Can I appeal a denial?; How long will it take for my request to be processed?; and Do I have to pay for a FOIA request?

DTIC

*Defense Program; Handbooks; Information Retrieval; Information Transfer; Law (Jurisprudence)*

**20080047855** Office of Inspector General, Arlington, VA USA

**Special Inspector General for Iraq Reconstruction, April 30, 2005, Report to Congress**

Bowen, Jr, Stuart W; Apr 30, 2005; 116 pp.; In English

Report No.(s): AD-A489218; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489218>

The Office of the Special Inspector General for Iraq Reconstruction (SIGIR) moved into its second year of operation with the release of four new audit reports, an expanded professional staff, and an innovative audit plan that will provide continued oversight of Iraq reconstruction. This Quarterly Report includes a summary of SIGIR operations, as well as a review of the activities of other agencies with oversight responsibility for Iraq reconstruction. The U.S. Mission Iraq is responsible for leading reconstruction efforts and setting reconstruction priorities, but at least 12 U.S. government agencies have or had direct

responsibility for some portion of the \$18.4 billion Iraq Relief and Reconstruction Fund (IRRF)<sup>1</sup>. The decentralization of responsibility and management complicates efforts to evaluate how U.S. appropriated funds are being used in Iraq. The SIGIR has the following concerns about: whether U.S. government organizations can generate a reliable, consolidated view of all activities funded by the IRRF, whether U.S. government organizations can implement reliable estimates of the costs to complete current reconstruction projects, whether systems that are used to track reconstruction projects can produce reports that tie these projects to the contracts that fund them, whether contract data from IRRF-funded contracts is accessible, reliable, and complete, whether contract of officials are able to verify that work is completed satisfactorily before issuing payment To support a more complete look at the state of Iraq reconstruction, the SIGIR has an initiative to acquire data that details what has been and will be built in Iraq, how much has been and will be spent, and the benefit that Iraqis have received from U.S. funding. The SIGIR Iraq Reconstruction Information System (SIRIS) is at the heart of this new initiative.

DTIC

*Congressional Reports; Data Bases; International Relations; Iraq; Organizations*

**20080047885** Office of Inspector General, Arlington, VA USA

**Special Inspector General for Iraq Reconstruction, Report to Congress, October 30, 2006**

Bowen, Jr, Stuart W; Oct 30, 2006; 532 pp.; In English

Report No.(s): AD-A489354; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489354>

Congress created SIGIR to provide independent oversight of U.S. funds used for the reconstruction of Iraq by: promoting economy, efficiency, and effectiveness in the administration of programs and operations, preventing and detecting waste, fraud, and abuse in such programs and operations, keeping the Secretary of State, Secretary of Defense, Congress, and American taxpayers informed about problems, deficiencies, and recommendations for corrective action relating to the administration of programs and operations.

DTIC

*Congressional Reports; Iraq; United States*

**20080047886** Office of Inspector General, Arlington, VA USA

**SIGIR Quarterly and Semiannual Report to the USA Congress**

Bowen, Jr, Stuart W; Jan 2006; 247 pp.; In English

Report No.(s): AD-A489355; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489355>

**HIGHLIGHTS:** SIGIR January 2006 Quarterly Report and Semiannual Report. A Year of Transition. 2006 will be a year of transition in Iraq reconstruction. To aid in that effort, SIGIR is announcing an audit to review overall transition planning. The audit will answer whether the USA has effectively planned to sustain what it has built in Iraq. SIGIR is concerned about whether there are sufficient resources to support capacity development for national and local government officials, operations and maintenance, infrastructure security, development of strategic cities, and private sector development.

DTIC

*Congressional Reports; Logistics Management; Security; United States*

**20080047887** Office of Inspector General, Arlington, VA USA

**SIGIR Quarterly Report to the USA Congress**

Bowen, Jr, Stuart W; Oct 30, 2005; 115 pp.; In English

Report No.(s): AD-A489357; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489357>

SIGIR is encouraged by the progress that the U.S. Ambassador to Iraq and his reconstruction team continue to make across the reconstruction front. By exerting strategic control over reconstruction planning, the Ambassador and the Iraq Reconstruction Management Office (IRMO) have improved project and program management by better allocating roles and responsibilities and by improving overall program coordination. In August 2005, during his ninth trip to Iraq, the Inspector General continued to promote progress on the critical issues currently confronting the reconstruction program: the reconstruction gap, sustainment, reliable cost-to-complete estimates, integrated information systems, direct contracting, coordinated program leadership, and anticorruption.

DTIC

*Congressional Reports; Leadership; Management Information Systems; United States*

**20080047892** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Facet (/facet'): A Browser for Heterogeneous Semantic Web Repositories**

Hildebrand, M.; Van Ossenburg, J. R.; Hardman, L.; Jun. 2006; 18 pp.; In English

Report No.(s): PB2008-105174; INS-E0604; Copyright; Avail.: National Technical Information Service (NTIS)

Facet browsing has become popular as a user-friendly interface to data repositories. We extend facet browsing of Semantic Web data in four ways. First, users are able to select and navigate through facets of resources of any type and to make selections based on properties of other, semantically related, types. Second, we address a disadvantage of hierarchy-based navigation by adding a keyword search interface that dynamically makes semantically relevant suggestions. Third, the interface of our browser, 'facet', allows the inclusion of facet-specific display options that go beyond the hierarchical navigation that characterizes current facet browsing. Fourth, the browser works on any RDFS dataset without any additional configuration. These properties make 'facet' an ideal tool for Semantic Web developers that need an instant interface to their complete dataset. The automatic facet configuration generated by the system can then be further refined to configure it as a tool for end users. The implementation is based on current Web standards and open source software. The new functionality we provide is motivated using a scenario from the cultural heritage domain.

NTIS

*Data Bases; Flat Surfaces; Heterogeneity*

**20080047894** Center for Mathematics and Computer Science, Amsterdam, Netherlands

**Flexible and Efficient IR Using Array Databases**

Cornacchia, R.; Heman, S.; Zukowski, M.; De Vries, A. P.; Boncz, P. A.; Jan. 2007; 30 pp.; In English

Report No.(s): PB2008-105179; INS-E0701; Copyright; Avail.: National Technical Information Service (NTIS)

The Matrix Framework is a recent proposal by IR researchers to flexibly represent all important information retrieval models in a single multi-dimensional array framework. Computational support for exactly this framework is provided by the array database system SRAM (Sparse Relational Array Mapping) that works on top of a DBMS. Information retrieval models can be specified in its comprehension-based array query language, in a way that directly corresponds to the underlying mathematical formulas. SRAM efficiently stores sparse arrays in (compressed) relational tables and translates and optimizes array queries into relational queries. In this work, we describe a number of array query optimization rules and demonstrate their effect on text retrieval in the TREC TeraByte track (TREC-TB) efficiency task, using the Okapi BM25 model as our example. It turns out that these optimization rules enable SRAM to automatically translate the BM25 array queries into the relational equivalent of inverted list processing including compression, score materialization and quantization, such as employed by custom-built IR systems. The use of the high-performance MonetDB/X100 relational backend, that provides transparent database compression, allows the system to achieve very fast response times with good precision and low resource usage.

NTIS

*Data Bases; Information Retrieval; Query Languages; Data Processing*

**20080047911** California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

**Petascale Systems Integration for Large Scale Facilities. Report of a Workshop. Held in San Francisco, California on May 15-16, 2007**

Hitchcock, D.; Helland, B.; Kramer, W. T. C.; May 2007; 32 pp.; In English; Petascale Systems Integration for Large Scale Facilities. Report of a Workshop., May 15 - 16, 2007, San Francisco, California

Report No.(s): DE2007-919272; LBNL-63538; No Copyright; Avail.: National Technical Information Service (NTIS)

There are significant issues regarding Large Scale System integration that are not being addressed in other forums such as current research portfolios or vendor user groups. Unfortunately, the issues in the area of large-scale system integration often fall into a netherworld; not research, not facilities, not procurement, not operations, not user services. Taken together, these issues along with the impact of sub-optimal integration technology means the time required to deploy, integrate and stabilize large scale system may consume up to 20 percent of the useful life of such systems. Improving the state of the art for large scale systems integration has potential to increase the scientific productivity of these systems. Sites have significant expertise, but there are no easy ways to leverage this expertise among them. Many issues inhibit the sharing of information, including available time and effort, as well as issues with sharing proprietary information. Vendors also benefit in the long run from the solutions to issues detected during site testing and integration. There is a great deal of enthusiasm for making large scale system integration a full-fledged partner along with the other major thrusts supported by funding agencies in the definition, design, and use of a petascale systems. Integration technology and issues should have a full seat at the table as petascale and exascale initiatives and programs are planned. The workshop attendees identified a wide range of issues and

suggested paths forward. Pursuing these with funding opportunities and innovation offers the opportunity to dramatically improve the state of large scale system integration.

NTIS

*Large Scale Integration; San Francisco (CA); Systems Integration; Systems Engineering*

**20080047921** New Mexico State Univ., Las Cruces, NM, USA; Texas A&M Univ., College Station, TX, USA  
**Phase II, Final Project Report, Paso del Norte Watershed Council, Coordinated Water Resources Database, and GIS Project**

Brown, C.; Sheng, Z.; Bourdon, M.; Oct. 2007; 96 pp.; In English

Contract(s)/Grant(s): USDA-2003-34461-13278

Report No.(s): PB2008-105183; NM-WRRI-341; TWRI-TR-307; No Copyright; Avail.: CASI: [A05](#), Hardcopy

The Coordinated Water Resources Database and GIS Project was developed to provide improved access to regional water resources data in the Paso del Norte region for regional water stakeholders to make timely decisions in water operations and flood control. Tasks accomplished in Phase II include the complete migration of the Project Website and related databases to the ArcIMS software, which provides a better spatial query capacity. The database was enhanced by incorporating more gauge stations, limited groundwater data (well information, water levels, water quality, and pumpage) and other new data, and strengthened data sharing by implementing FGDC classic metadata. Protocols were explored for data sharing and spatial queries and opportunities for more active participation of volunteer regional data providers in the Project. The linkage of the PdNWC database with future groundwater and surface water model development was also assessed. Based on the experiences gained in the Project, the following recommendations for future Project work include: (1) Continued compilation of new data sources not yet included in the Project to enhance data sharing; (2) Installation of additional new monitoring stations and equipment and inclusion of these monitoring sites in future ArcIMS map products to fill data gaps and provide additional real-time data; (3) Strengthening the links with the Upper Rio Grande Water Operations Model (URGWOM) being advanced by the USACE. Special focus will be given to serving DEM and orthophoto data recently transferred from the USACE to NMWRRI and enhancing direct Web linkages with USACE and URGWOM project activities to improve model development capacity and enhance sharing of modeling results; (4) Development and implementation of a user needs survey focusing on new data sets of interest, enhanced access mechanisms, and other suggestions to improve the Project Website; (5) Development and making available online for download a Microsoft Access database of Project water resource data to provide search and query functions; (6) Development of an online help tutorial that would support online searches of the database, making the site easier for end users to navigate and utilize; and (7) Continuity in the exploration of future funding opportunities for Project activities, especially through linkages with other regional data compilation and modeling projects.

NTIS

*Data Bases; Geographic Information Systems; Water Quality; Water Resources; Watersheds*

**20080048022** NASA, Washington, DC, USA

**NASA Tech Briefs, December 2008**

December 2008; 34 pp.; In English; See also 20080048023 - 20080048065; Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Topics covered include: Crew Activity Analyzer; Distributing Data to Hand-Held Devices in a Wireless Network; Reducing Surface Clutter in Cloud Profiling Radar Data; MODIS Atmospheric Data Handler; Multibeam Altimeter Navigation Update Using Faceted Shape Model; Spaceborne Hybrid-FPGA System for Processing FTIR Data; FPGA Coprocessor for Accelerated Classification of Images; SiC JFET Transistor Circuit Model for Extreme Temperature Range; TDR Using Autocorrelation and Varying-Duration Pulses; Update on Development of SiC Multi-Chip Power Modules; Radio Ranging System for Guidance of Approaching Spacecraft; Electromagnetically Clean Solar Arrays; Improved Short-Circuit Protection for Power Cells in Series; Electromagnetically Clean Solar Arrays; Logic Gates Made of N-Channel JFETs and Epitaxial Resistors; Improved Short-Circuit Protection for Power Cells in Series; Communication Limits Due to Photon-Detector Jitter; System for Removing Pollutants from Incinerator Exhaust; Sealing and External Sterilization of a Sample Container; Converting EOS Data from HDF-EOS to netCDF; HDF-EOS 2 and HDF-EOS 5 Compatibility Library; HDF-EOS Web Server; HDF-EOS 5 Validator; XML DTD and Schemas for HDF-EOS; Converting from XML to HDF-EOS; Simulating Attitudes and Trajectories of Multiple Spacecraft; Specialized Color Function for Display of Signed Data; Delivering Alert Messages to Members of a Work Force; Delivering Images for Mars Rover Science Planning; Oxide Fiber Cathode Materials for Rechargeable Lithium Cells; Electrocatalytic Reduction of Carbon Dioxide to Methane; Heterogeneous Superconducting Low-Noise Sensing Coils; Progress toward Making Epoxy/Carbon-Nanotube Composites; Predicting Properties of Unidirectional-Nanofiber Composites; Deployable Crew Quarters; Nonventing, Regenerable, Lightweight Heat Absorber;



Miniature High-Force, Long-Stroke SMA Linear Actuators; ‘Bootstrap’ Configuration for Multistage Pulse-Tube Coolers; Reducing Liquid Loss during Ullage Venting in Microgravity; Ka-Band Transponder for Deep-Space Radio Science; Replication of Space-Shuttle Computers in FPGAs and ASICs; Demisable Reaction-Wheel Assembly; Spatial and Temporal Low-Dimensional Models for Fluid Flow; Advanced Land Imager Assessment System; Range Imaging without Moving Parts.  
Derived from text

*Autocorrelation; Carbon Nanotubes; Circuit Protection; Contaminants; Document Markup Languages; Electrochemical Cells; Extremely High Frequencies; Field-Programmable Gate Arrays; Infrared Spectra; Microgravity; MODIS (Radiometry); Transistor Circuits; Superconductivity*

**20080048026** NASA Goddard Space Flight Center, Greenbelt, MD, USA

#### **Converting from XML to HDF-EOS**

Ullman, Richard; Bane, Bob; Yang, Jingli; NASA Tech Briefs, December 2008; December 2008, pp. 18; In English; See also [20080048022](#)

Report No.(s): GSC-15017-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3443>

A computer program recreates an HDF-EOS file from an Extensible Markup Language (XML) representation of the contents of that file. This program is one of two programs written to enable testing of the schemas described in the immediately preceding article to determine whether the schemas capture all details of HDF-EOS files.

Derived from text

*Computer Programs; Document Markup Languages; Data Conversion Routines*

**20080048050** NASA Goddard Space Flight Center, Greenbelt, MD, USA

#### **XML DTD and Schemas for HDF-EOS**

Ullman, Richard; Yang, Jingli; NASA Tech Briefs, December 2008; December 2008, pp. 17-18; In English; See also [20080048022](#)

Report No.(s): GSC-15016-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3442>

An Extensible Markup Language (XML) document type definition (DTD) standard for the structure and contents of HDF-EOS files and their contents, and an equivalent standard in the form of schemas, have been developed.

Derived from text

*Document Markup Languages; Earth Observing System (EOS); Data Structures*

**20080048060** NASA Goddard Space Flight Center, Greenbelt, MD, USA

#### **Specialized Color Function for Display of Signed Data**

Kalb, Virginia; NASA Tech Briefs, December 2008; December 2008, pp. 18; In English; See also [20080048022](#)

Report No.(s): GSC-15128-1; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3446>

This Mathematica script defines a color function to be used with Mathematica’s plotting modules for differentiating data attaining both positive and negative values. Positive values are shown as shades of blue, and negative values are shown in red. The intensity of the color reflects the absolute value of the data value.

Derived from text

*Color; Shades; Plotting; Computer Graphics; Applications Programs (Computers)*

**20080048107** Department of Justice, Washington, DC, USA

#### **Certificate Based Access Control (CBAC) Operation and User Guide**

Apr. 04, 2003; 28 pp.; In English

Report No.(s): PB2008-104556; NCJ-210415; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Certificate Based Access Control (CBAC), formerly known as Palladium, is a complete privilege management software system, to address the need for a central access control system. CBAC technology allows state and local criminal justice agencies to share information with complete confidence and control. CBAC is a platform-independent access control system that enables agencies to share information while maintaining control of their data. Applications incorporating CBAC allow agencies to control their data based on role definitions and individual user attributes found in digital certificates. By utilizing policy-defined rule-sets, agencies transcend the traditional username, login access control paradigm. Administrators create and

maintain rule-sets through a web-based graphical user interface. Creating or modifying access rule-sets is simple, enabling agencies to stay up-to-date with policy decisions.

NTIS

*Access Control; Computer Systems Programs; Management Information Systems*

**20080048115** NASA Marshall Space Flight Center, Huntsville, AL, USA

### **MAPTIS-II**

Allison, Peter; [2008]; 2 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources  
The Materials and Processes Technical Information System, (MAPTIS), is a NASA-wide materials database established for the purpose of recording and disseminating information about materials to insure the safe selection of materials for spaceflight. All candidate materials for space flight hardware are tested to identify usability and safety issues (toxicity, flammability, corrosion). These test results are collected, verified, and disseminated throughout the Agency via secure databases. A comprehensive collection of databases, MAPTIS, contains information on almost 40,000 materials, including materials test data, materials properties, and design allowables. MAPTIS is sponsored by the Materials and Processes Laboratory at NASA's Marshall Space Flight Center. Historically, the lineage of MAPTIS can be traced to the Apollo I accident. At that time, although materials selection was important, the danger of using certain materials in a 100 percent oxygen atmosphere was poorly understood. The Corporation, NASA Marshall Space Flight Center Microgravity Laboratory (IML1 & 2), Gravity Probe-B, Hubble Space Telescope, Spacelab, James Webb Space Telescope and the Constellation Project, an initiative to support the International Space Station by developing the ARES Launch Vehicles and Orion Crew Exploration Vehicle, as well as the continued exploration of the Moon and beyond.

Author

*Microgravity; James Webb Space Telescope; International Space Station; Information Systems; Crew Exploration Vehicle; Gravity Probe B; Information Dissemination; Space Flight; Flammability*

**20080048124** Arizona State Univ., Tempe, AZ USA

### **Combining Police and Probation Information Resources to Reduce Burglary: Testing a Crime Analysis Problem Solving Approach**

Griffin, M.; Hepburn, J.; Webb, V.; Jan. 2005; 68 pp.; In English

Contract(s)/Grant(s): 99-IJ-CX-0059

Report No.(s): PB2008-105785; No Copyright; Avail.: CASI: [A04](#), Hardcopy

This research report describes the joint effort of the Phoenix Police Department (PPD) and the Maricopa County Adult Probation Department (APD) to develop a shared database for use, with GIS mapping, as a crime analysis tool within a formal problem-solving process to reduce crime. The project as originally designed included three components: (1) Construction of a shared database and integration of selected data from the two departments; (2) Collaboration of the departments in a formal, systematic problem-solving process aimed at reducing regional instances of burglary; and (3) Documentation of the above components and an evaluation of their impact on crime, using a quasi-experimental research design.

NTIS

*Crime; Information Management; Police; Prevention; Problem Solving*

**20080048215** Oak Ridge Inst. for Science and Education, TN USA

### **Health Physics Enrollments and Degrees Survey, 2006 Data**

January 2007; 4 pp.; In English

Report No.(s): DE2007-908418; No Copyright; Avail.: Department of Energy Information Bridge

This annual survey collects 2006 data on the number of health physics degrees awarded as well as the number of students enrolled in health physics academic programs. Thirty universities offer health physics degrees; all responded to the survey.

NTIS

*Health Physics; Radiation Protection; Surveys*

**20080048272** Dillon and Yudell, LLP, Austin, TX, USA

### **System and Method to Improve Hardware Pre-Fetching Using Translation Hints**

Shafi, H., Inventor; 13 Jan 05; 15 pp.; In English

Contract(s)/Grant(s): NBCH30390004

Patent Info.: Filed 13 Jan 05; US-Patent-Appl-SN-11-034 552

Report No.(s): PB2008-105870; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A system and method for improving hardware-controlled pre-fetching within a data processing system. A collection of address translation entries are pre-fetched and placed in an address translation cache. This translation pre-fetch mechanism cooperates with the data and/or instruction hardware-controlled pre-fetch mechanism to avoid stalls at page boundaries, which improves the latter's effectiveness at hiding memory latency.

NTIS

*Data Processing Equipment; Patent Applications; Translating*

**20080048322** Westat, Inc., Rockville, MD, USA

**Findings of the Web Basic Pilot Evaluation**

Sep. 2007; 254 pp.; In English

Report No.(s): PB2008-104693; No Copyright; Avail.: National Technical Information Service (NTIS)

This report summarizes the findings of the evaluation of the Web Basic Pilot program, a modified version of the Basic Pilot program one of the three pilot programs originally mandated by the Illegal Immigration Reform and Immigrant Responsibility Act of 1996 (IIRIRA). These pilot programs were developed to test alternative types of electronic verification systems before considering the desirability and nature of implementing any larger scale employment verification programs. On the basis of findings from prior evaluations, the pilot programs other than the Basic Pilot were terminated. The current Basic Pilot program, referred to in this report as the Web Basic Pilot, incorporates a number of recommended enhancements from the evaluations of the initial pilot programs.

NTIS

*Computer Programs; World Wide Web; Proving*

**20080048367** Department of Homeland Security, Washington, DC, USA

**Progress Made in Strengthening DHS (Department of Homeland Security) Information Technology Management, But Challenges Remain**

Sep. 2008; 46 pp.; In English

Report No.(s): PB2009-101991; OIG-08-91; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The Department of Homeland Security, Office of Inspector General, was established by the Homeland Security Act of 2002 (Public Law 107-296) by amendment to the Inspector General Act of 1978. This is one of a series of audit, inspection, and special reports prepared as part of our oversight responsibilities to promote economy, efficiency, and effectiveness within the department. This report addresses the strengths and weaknesses of Information Technology management activities as carried out by the departments Office of the Chief Information Officer. It is based on interviews with employees and officials of relevant agencies and institutions, direct observations, and a review of applicable documents.

NTIS

*Information Systems; Security; Public Law*

**20080048375** Government Accountability Office, Washington, DC, USA

**Health Information Technology: More Detailed Plans Needed for the Centers for Disease Control and Prevention's Redesigned BioSense Program**

Nov. 2008; 85 pp.; In English

Report No.(s): PB2009-102432; GAO-09-100; No Copyright; Avail.: CASI: [A05](#), Hardcopy

In 2003, the Centers for Disease Control and Prevention (CDC), an agency within the Department of Health and Human Services (HHS), developed an electronic syndromic surveillance system called BioSense that uses health-related data to identify patterns of disease symptoms prior to specific diagnoses. In late 2007, CDC began to redesign the program to improve collaboration with stakeholders and address identified management weaknesses. Pursuant to House Report 110-231, GAO evaluated the BioSense program, focusing on the cost and timeline estimates and performance measures and benchmarks for implementing the program, among other objectives. To accomplish this, GAO analyzed relevant program documentation and interviewed CDC officials responsible for developing and implementing BioSense. GAO is recommending that CDC develop reliable cost and timeline estimates and outcome-based performance measures for implementing the redesigned BioSense

program. In written comments on a draft of this report, HHS stated it welcomed the conclusions and recommendations and provided updated information about current efforts intended to address the recommendations.

NTIS

*Diseases; Health; Information Systems*

**20080048386** Office of Thrift Supervision, Washington, DC, USA

**Office of Thrift Supervision Strategic Plan (2003-2008)**

Aug. 26, 2003; 31 pp.; In English

Report No.(s): PB2009-102819; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The thrift industry plays a major role in nurturing the American dream of home ownership. Financing the purchase of homes has been the focus of thrift institutions throughout their history. Thrifts continue to do an excellent job of promoting homeownership by making residential mortgage financing readily available. Housing is one of the principal drivers of the American economy and accounts for more than 20 percent of annual gross domestic product (GDP). Thrifts are major players in this arena and make a significant contribution toward our nations GDP. As of December 2002, thrift investments related to residential mortgages accounted for 67.5 percent of industry assets, While mortgages are the driving and stabilizing force for most thrifts, the federal thrift charter has evolved and now offers considerable flexibility to serve other market niches. Thrifts can offer a full range of lending products, including small business and other commercial, farm, construction, land development, credit card, education, and auto loans. OTS begins this strategic planning period with a healthy and robust thrift industry. As of June 2003, there were 947 thrifts with total assets of \$1.06 trillion. Approximately 99.5 percent of the industry was well capitalized, and no thrift was less than adequately capitalized.

NTIS

*Personnel Management; Management Planning*

**20080048387** Office of Thrift Supervision, Washington, DC, USA

**Office of Thrift Supervision OMB FY 2008 Budget and Performance Plan**

Jan. 2008; 22 pp.; In English

Report No.(s): PB2009-102820; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Established by Congress as a bureau of the Department of the Treasury on August 9, 1989, the Office of Thrift Supervision (OTS) charters, examines, supervises, and regulates federal savings associations insured by the Federal Deposit Insurance Corporation (FDIC). OTSs primary statutory authority is the Home Owners Loan Act originally enacted in 1933. OTS also examines, supervises, and regulates state-chartered savings associations insured by the FDIC and provides for the registration, examination, and regulation of savings and loan holding companies (SLHCs) and other affiliates.

NTIS

*Personnel Management; Insurance (Contracts)*

**20080048403** Woods Hole Oceanographic Inst., MA USA

**A Study on the Feasibility of Creating a Web-Accessible Marine Mammal Sound Library Based upon the Collections at the Woods Hole Oceanographic Institution**

Daher, Mary Ann; Sep 2008; 116 pp.; In English

Contract(s)/Grant(s): N00244-07-1-0014

Report No.(s): AD-A489743; NPS-OC-08-005; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489743>

A universally accessible web-based marine mammal call library using the recordings collected over the years by William Schevill and William Watkins creates an opportunity for scientific studies requiring dependable reference datasets of sounds produced by a species in a defined geographic region during specific seasons. The Woods Hole Oceanographic Institution Bioacoustics Lab, begun in the 1950s under the direction of Schevill and Watkins, possesses approximately 2000 analog recordings of more than 90 species of marine animals. Metadata, organized and stored in stand-alone PCs, already exists for each of these recordings. In addition, these recordings are backed up by a reference library of more than 9000 selected marine animal papers (Watkins et al. 1990). This study presents an assessment of the contents of this marine mammal acoustic collection, recommendations for species-specific reference datasets, and potential architecture and costs for a web-based library.

DTIC

*Acoustics; Animals; Collection; Libraries; Marine Biology; Marine Mammals; Oceanography*

**20080048428** Army Test and Evaluation Command, Alexandria, VA USA

**Information Assurance Test and Evaluation Process: An ATEC Perspective**

Hill, Dwayne T; Jun 2008; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A489858; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA489858>

The purpose of this briefing is to provide information about the current ATEC methodology for conducting Information Assurance (IA) assessments and to describe challenges to correctly characterizing system IA capabilities.

DTIC

*Evaluation; System Effectiveness*

**20080048506** Library of Congress, Washington, DC USA

**The Specialty Metal Provision and the Berry Amendment: Issues for Congress**

Grasso, Valerie B; Oct 28, 2008; 24 pp.; In English

Report No.(s): AD-A490085; CRS-RL33751; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Congress took action in the FY2007 National Defense Authorization Act (P.L. 109-364) to move the specialty metal provision from the Berry Amendment (Title 10, USA Code [U.S.C.] 2533a) into a separate section of Title 10 (10 U.S.C. 2533b). Section 843 of P.L. 109-364 directed the Secretary of Defense to establish a Strategic Materials Protection Board to determine, analyze, and recommend strategies to ensure the domestic availability of materials designated as critical to national security. The Board met in July 2007 and issued a report in September 2007. In July 2008, the Department of Defense (DOD) proposed to amend the Defense Federal Acquisition Regulation Supplement (DFARS) to implement Section 842 of the FY2007 National Defense Authorization Act and Sections 804 and 884 of the FY2008 National Defense Authorization Act, P.L. 110-181. The FY2008 National Defense Authorization Act (P.L. 110-181) contained several provisions which may impact the procurement of specialty metal. Section 803 required the Strategic Materials Protection Board to perform an assessment of the viability of domestic producers of strategic materials; Section 804 changed the requirement that DOD procure all specialty metal from domestic sources. This provision does not apply to contracts or subcontracts for the acquisition of commercially available off-the-shelf items (with certain exceptions), as defined in the Office of Federal Procurement Policy Act, Section 35(c); and Section 884 requires DOD to publish a notice on the Federal Business Opportunities website before making any nonavailability determinations that would apply to multiple contracts.

DTIC

*Government Procurement; Personnel; United States*

**20080048513** Vector Research, Inc., Arlington, VA USA

**Department of Defense Guide for Managing Information Technology (IT) as an Investment and Measuring Performance, Version 1.0**

Alexander, Samuel; Volles, Eric; Levene, Neal; Miller, Bruce; Cohen, Paul; Feb 10, 1997; 144 pp.; In English

Report No.(s): AD-A490127; XD-ASD(C3I); No Copyright; Avail.: Defense Technical Information Center (DTIC)

This guide summarizes the Department of Defense (DoD) position on Information Technology (IT) performance measurement and presents a framework for managing information technology programs as investments rather than as acquisitions. DoD's goal is to, within the framework of Government Performance and Results Act (GPRA), the Information Technology Management and Results Act (ITMRA) and other relevant management legislation, establish performance measures as an integral part of the Information Technology (IT) investment process. It is designed to assist DoD in its transition to a performance-based organization.

DTIC

*Data Management; Defense Program; Information Systems*

**20080048532** Carnegie-Mellon Univ., Pittsburgh, PA USA

**Using Context to Assist in Personal File Retrieval**

Soules, Craig A; Aug 25, 2006; 111 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0433

Report No.(s): AD-A490204; CMU-CS-06-147; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Personal data is growing at ever-increasing rates, fueled by a growing market for personal computing solutions and the dramatic growth of available storage space on these platforms. Users, no longer limited in what they can store, are now faced with the problem of organizing their data so that they can find it again later. Unfortunately, as data sets grow, the complexity

of organizing these sets also grows. This problem has driven a sudden growth in search tools aimed at the personal computing space, designed to assist users in locating data within their disorganized file space. Despite the sudden growth in this area, local file search tools are often inaccurate. These inaccuracies have been a long-standing problem for file data, as evidenced by the downfall of attribute-based naming systems that often relied on content analysis to provide meaningful attributes to files for automated organization. While file search tools have lagged behind, search tools designed for the world wide web have found wide-spread acclaim. Interestingly, despite significant increases in non-textual data on the web (e.g., images, movies), web search tools continue to be effective. This is because the web contains key information that is currently unavailable within file systems: 'context.' By capturing context information (e.g., the links describing how data on the web is inter-related), web search tools can significantly improve the quality of search over content analysis techniques alone. This work describes Connections, a context-enhanced search tool that utilizes temporal locality among file accesses to provide inter-file relationships to the local file system. Once identified, these inter-file relationships provide context information, similar to that available in the world wide web. Connections leverages this context to improve the quality of file search results. User studies with Connections see improvements in both precision and recall over content-only search.

DTIC

*Classifications; Computer Programs; Computer Storage Devices; Information Retrieval; Metadata*

## 85

### TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION

Includes aerospace technology transfer; urban technology; surface and mass transportation. For related information see also *03 Air Transportation and Safety*, *16 Space Transportation and Safety*, and *44 Energy Production and Conversion*. For specific technology transfer applications see also the category where the subject is treated.

**20080048209** NASA Marshall Space Flight Center, Huntsville, AL, USA

#### **Sensor Applications and Data Validation**

Wiley, John; July 15, 2008; 72 pp.; In English; National Science Foundation Workshop, 15 Jul. 2008, Normal, AL, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A04](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080048209>

The mechanical configuration of automobiles have changed marginally while improvements in sensors and control have dramatically improved engine efficiency, reliability and useful life. The aviation industry has also taken advantage of sensors and control systems to reduce operational costs. Sensors and high fidelity control systems fly planes at levels of performance beyond human capability. Sophisticated environmental controls allow a greater level of comfort and efficiency in our homes. Sensors have given the medical field a better understanding of the human body and the environment in which we live.

Author

*Environmental Control; Aircraft Industry; Operating Costs*

## 88

### SPACE SCIENCES (GENERAL)

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through 93*.

**20080047934** NASA Goddard Space Flight Center, Greenbelt, MD, USA

#### **The Global GNSS, SLR, VLBI, and DORIS Networks and their Support of GGOS: IGS+ILRS+IVS+IDS**

Noll, Carey; December 15, 2008; 1 pp.; In English; American Geophysical Conference, 15-19 Dec. 2008, San Francisco, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

The global network of the International GNSS Service (IGS), the International Laser Ranging Service (ILRS), the International VLBI Service for Geodesy and Astrometry (IVS), and the International DORIS Service (IDS) are part of the ground-based infrastructure for GGOS. The observations obtained from these global networks provide for the determination and maintenance of the International Terrestrial Reference Frame (ITRF), an accurate set of positions and velocities that provides a stable coordinate system allowing scientists to link measurements over space and time. Many of these sites offer co-location of two or more techniques. Co-location provides integration of technique-specific networks into the ITRF as well as an assessment/validation of the quality and accuracy of the resulting measurements. As of fall 2008, these networks consisted of 410 GNSS sites, 42 laser ranging sites, 45 VLBI sites, and 58 DORIS sites. This poster will illustrate the global coverage of these networks, highlighting inter-technique co-locations, and show the importance of these networks 60 the

underlying goals of GGOS including providing the observational basis to maintain a stable, accurate, global reference frame.  
Author  
*Astrometry; Tracking Networks; Very Long Base Interferometry; Satellite Laser Ranging; Laser Ranging; Geodesy; Coordinates*

**89**  
**ASTRONOMY**

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

**20080047301** Universidad Nacional Autonoma de Mexico, Mexico City, Mexico

**Recycling Matter in the Universe. X-Ray observations of SBS1150+599A (PN 6135.9+55.9)**

Tovmassian, Gagik; Tomsick, John; Napiwotzki, Ralf; Yungelson, Lev; Stasinska, Grazyna; Pena, Miriam; Richer, Michael; AIP Conference Proceedings. Astrophysics of Compact Objects: International Conference on Astrophysics of Compact Objects; January 2008; Volume 968, Issue 1, pp. 62-65; In English; Original contains color and black and white illustrations  
Contract(s)/Grant(s): NNX07AQ12G; Copyright; Avail.: Other Sources  
ONLINE: <http://dx.doi.org/10.1063/1.2840455>

We present X-ray observations of the close binary nucleus of the planetary nebula SBS 1150+599A obtained with the XMM-Newton satellite. Only one component of the binary can be observed in optical-UV. New X-ray observations show that the previously invisible component is a very hot compact star. This finding allows us to deduce rough values for the basic parameters of the binary. With a high probability the total mass of the system exceeds Chandrasekhar limit and makes the SBS1150+599A one of the best candidate for a supernova type Ia progenitor.

Author

*X Ray Sources; Symbiotic Stars; Recycling; Supernovae; Planetary Nebulae; Hot Stars*

**20080047448** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**LISA Beyond Einstein: From the Big Bang to Black Holes. LISA Technology Development at GSFC**

Thorpe, James Ira; July 13, 2008; 21 pp.; In English; 37th COSPAR Scientific Assembly, 13-20 Jul. 2008, Montreal, Canada; Original contains color and black and white illustrations  
Contract(s)/Grant(s): NNH06CC03B; No Copyright; Avail.: CASI: A03, Hardcopy  
ONLINE: <http://hdl.handle.net/2060/20080047448>

This viewgraph presentation reviews the work that has been ongoing at the Goddard Space Flight Center (GSFC) in the development of the technology to be used in the Laser Interferometer Space Antenna (LISA) spacecrafts. The prime focus of LISA technology development efforts at NASA/GSFC has been in LISA interferometry. Specifically efforts have been made in the area of laser frequency noise mitigation. Laser frequency noise is addressed through a combination of stabilization and common-mode rejection. Current plans call for two stages of stabilization, pre-stabilization to a local frequency reference and further stabilization using the constellation as a frequency reference. In order for these techniques to be used simultaneously, the pre-stabilization step must provide an adjustable frequency offset. This presentation reports on a modification to the standard modulation/demodulation technique used to stabilize to optical cavities that generates a frequency-tunable reference from a fixed length cavity. This technique requires no modifications to the cavity itself and only minor modifications to the components. The measured noise performance and dynamic range of the laboratory prototype meet the LISA requirements.  
CASI

*Laser Outputs; LISA (Observatory); Astronomical Interferometry; Laser Interferometry; Interferometry; Frequency Stability*

**20080047505** Naval Observatory, Flagstaff, AZ USA

**The Variable Stars of the DRACO DWARF Spheroidal Glaxay: Revisited**

Kinemuchi, K; Harris, H C; Smith, Horace A; Silbermann, N A; Snyder, L A; LaCluyz, A P; Clark, C L; Nov 2008; 20 pp.; In English  
Report No.(s): AD-A489155; No Copyright; Avail.: Defense Technical Information Center (DTIC)  
ONLINE: <http://hdl.handle.net/100.2/ADA489155>

We present a CCD survey of variable stars in the Draco dwarf spheroidal galaxy. This survey, which has the largest areal coverage since the original variable star survey by Baade & Swope, includes photometry for 270 RR Lyrae (RRL) stars, 9 anomalous Cepheids (ACs), 2 eclipsing binaries, and 12 slow, irregular red variables, as well as 30 background QSOs.

Twenty-six probable double-mode RRL stars were identified. Observed parameters, including mean V and I magnitudes, V amplitudes, and periods, have been derived. Photometric metallicities of the ab-type RRL stars were calculated according to the method of Jurcsik & Kovacs, yielding a mean metallicity of  $[Fe/H] = 2.19 \pm 0.03$ . The well-known Oosterhoff intermediate nature of the RRL stars in Draco is reconfirmed, although the double-mode RRL stars, with one exception, have properties similar to those found in Oosterhoff type II globular clusters. The period luminosity relation of the ACs is rediscussed with the addition of the new Draco ACs.

DTIC

*Dwarf Stars; Galaxies; Variable Stars*

**20080047686** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Understanding Black Hole X-ray Binaries: The Case of Cygnus X-1**

Pottschmidt, Katja; June 30, 2008; 1 pp.; In English; National Space Science and Technology Center, 30 Jun. 2008, Huntsville, AL, USA

Contract(s)/Grant(s): NNG06EO90A; Copyright; Avail.: Other Sources; Abstract Only

Black Hole X-ray Binaries are known to display distinct emission states that differ in their X-ray spectra, their X-ray timing properties (on times scales less than 1 s) and their radio emission. In recent years monitoring observations, specially with NASA's Rossi X-ray Timing Explorer (RXTE), have provided us with detailed empirical modeling of the phenomenology of the different states as well as a unification scheme of the long term evolution of black holes, transient and persistent, in terms of these states. Observations of the persistent High Mass X-ray Binary (HMXB) Cygnus X-1 have been at the forefront of learning about black hole states since its optical identification through a state transition in 1973. In this talk I will present in depth studies of several different aspects of the accretion process in this system. The main data base for these studies is an ongoing RXTE and Ryle radio telescope bi-weekly monitoring campaign that started in 1997. I will discuss high-resolution timing results, especially power spectra, which first gave rise to the Lorentzian description now widely used for black hole and neutron star binaries, and time lags, which we found to be especially well suited to identify state transitions. The evolution of spectral, timing, and radio parameters over years will be shown, including the rms-flux relation and the observation of a clearly correlated radio/x-ray flare. We also observed Cygnus X-1 with INTEGRAL, which allowed us to extend timing and spectral studies to higher energies, with XMM, which provided strong constraints on the parameters of the 6.4 keV iron fluorescence line, and with Chandra, which provided the most in depth study to date of the stellar wind in this system. Models based on the physical conditions in the accretion region are still mainly concentrated on the one or other of the observational areas but they are expanding: as an example I will review results from a jet model for the quantitative description of the radio through X-ray spectra. I will conclude with an outlook on a truly multi-instrument observing campaign of Cygnus X-1 that was performed in 2008 April in order to better constrain the jet models mentioned above (and provide a unique data set for cross-calibration).

Author

*Black Holes (Astronomy); X Ray Binaries; X Ray Sources*

**20080047690** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Ultraviolet Imaging of the Cen-A Jet**

Neff, Susan; July 08, 2008; 1 pp.; In English; Radio Galaxies in the Chandra Era, 7-11 Jul. 2008, Boston, MA, USA; No Copyright; Avail.: Other Sources; Abstract Only

We present GALEX ultraviolet (125-300nm) images of Centaurus A over a 1.1 degree field. We detect UV emission from young stars and shocks at the interface between the outer jet and an HI cloud, at locations where the inner jet bends or is disrupted, and in the central disk. Although some of these star-forming regions were previously imaged with HST, not all have been. We also detect faint, diffuse UV emission from several regions where young stars are not obviously present. New radio images of the Northern Middle Lobe of Cen A may also be presented, depending on the progress of data reduction.

Author

*Centaurus Constellation; Jets; Ultraviolet Radiation; Ultraviolet Emission; Ultraviolet Astronomy; Spaceborne Astronomy; Radio Galaxies*

**20080047778** Geological Survey, Reston, VA USA

**Abstracts of the Annual Meeting of Planetary Geologic Mappers, Tucson, AZ 2007**

Bleamaster, L. F.; Gregg, T. K. P.; Tanaka, K. L.; Saunders, R. S.; January 2007; 74 pp.; In English

Report No.(s): PB2008-105596; OFR2007-1233; No Copyright; Avail.: National Technical Information Service (NTIS)

Two quadrangles in the Niobe Planitia region have been mapped as part of the Venus geologic mapping effort. Shimiti



Tessera (V-11) and Vellamo Planitia (V-12) are adjacent quadrangles located in the northern hemisphere of Venus. V-11 extends from 25DG to 50DG N and 90DG to 120DG E and V-12 extends from 25DG to 50DG N and 120DG to 150DG E. NTIS

*Abstracts; Planetary Geology; Planetary Mapping*

**20080047920** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Monitoring the Black Hole Binary GRS 1758-258 with INTEGRAL and RXTE**

Pottschmidt, Katja; Chernyakova, M.; Lubinski, P.; Migliari, S.; Smith, D.; Zdziarski, A. A.; Tomsick, J.; Bezayiff, N.; Kreykenbohm, I.; Kretschmar, P.; Kalemci, E.; September 08, 2008; 1 pp.; In English; 7th INTEGRAL Workshop, 8-11 Sep. 2008, Copenhagen, Denmark

Contract(s)/Grant(s): NNG06EO90A; Copyright; Avail.: Other Sources; Abstract Only

The microquasar GRS 1758-258 is one of only three persistent black hole binaries that spend most of their time in the hard spectral state, the other two being Cyg X-1 and 1E 1741.7-2942. It therefore provides the rare opportunity for an extensive long term study of this important black hole state which is associated with strong variability and radio jet emission. INTEGRAL has been monitoring the source since the first Galactic Center Deep Exposure season in spring 2003 during two 2-3 months long Galactic Center viewing epochs each year, amounting to 11 epochs including spring of 2008. With the exception of the last epoch quasi-simultaneous RXTE monitoring observations are available as well. Here we present an analysis of the epoch averaged broad band spectra which display considerable long term variability, most notably the occurrence of two soft/off states, extreme examples for the hysteretic behavior of black hole binaries. The hard source spectrum and long exposures allow us to extend the analysis for several epochs to approximately 500 keV using PICsIT data and address the question of the presence of a non-thermal Comptonization component.

Author

*Black Holes (Astronomy); Quasars*

**20080047940** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**The Detectability of Exo-Earths and Super-Earths via Resonant Signatures in Exozodiacal Clouds**

Stark, Christopher C.; Kuchner, Marc; [2008]; 33 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Directly imaging extrasolar terrestrial planets necessarily means contending with the astrophysical noise of exozodiacal dust and the resonant structures created by these planets in exozodiacal clouds. Using a custom tailored hybrid symplectic integrator we have constructed 120 models of resonant structures created by exo-Earths and super-Earths on circular orbits interacting with collisionless steady-state dust clouds around a Sun-like star. Our models include enough particles to overcome the limitations of previous simulations that were often dominated by a handful of long-lived particles, allowing us to quantitatively study the contrast of the resulting ring structures. We found that in the case of a planet on a circular orbit, for a given star and dust source distribution, the morphology and contrast of the resonant structures depend on only two parameters: planet mass and  $(\text{square root})ap/\text{Beta}$ , where  $ap$  is the planet's semi-major axis and  $\text{Beta}$  is the ratio of radiation pressure force to gravitational force on a grain. We constructed multiple-grain-size models of 25,000 particles each and showed that in a collisionless cloud, a Dohnanyi crushing law yields a resonant ring whose optical depth is dominated by the largest grains in the distribution, not the smallest. We used these models to estimate the mass of the lowest-mass planet that can be detected through observations of a resonant ring for a variety of assumptions about the dust cloud and the planet's orbit. Our simulations suggest that planets with mass as small as a few times Mars' mass may produce detectable signatures in debris disks at  $ap$  greater than or approximately equal to 10 AU.

Author

*Extrasolar Planets; Planet Detection; Zodiacal Dust; Planetary Mass*

**20080047958** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Gravitational Radiation Characteristics of Nonspinning Black-Hole Binaries**

Kelly, B. J.; Baker, J. G.; Boggs, W. D.; Centrella, J. M.; vanMeter, J. R.; McWilliams, S. T.; [2008]; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): 05-BEFS-05-0044; 06-BEFS06-19; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047958>

We present a detailed descriptive analysis of the gravitational radiation from binary mergers of non-spinning black holes, based on numerical relativity simulations of systems varying from equal-mass to a 6:1 mass ratio. Our analysis covers

amplitude and phase characteristics of the radiation, suggesting a unified picture of the waveforms' dominant features in terms of an implicit rotating source, applying uniformly to the full wavetrain, from inspiral through ringdown. We construct a model of the late-stage frequency evolution that fits the  $l = m$  modes, and identify late-time relationships between waveform frequency and amplitude. These relationships allow us to construct a predictive model for the late-time waveforms, an alternative to the common practice of modelling by a sum of quasinormal mode overtones. We demonstrate an application of this in a new effective-one-body-based analytic waveform model.

Author

*Black Holes (Astronomy); Binary Stars; Gravitational Waves; Rotation; Mathematical Models; Mass Ratios; Harmonics*

**20080047971** National Space Science and Technology Center, Huntsville, AL, USA

**Discovery of Long Period Pulsations in the Enigmatic High-Mass X-Ray Binary 4U 2206+54**

Finger, Mark H.; Wilson, Colleen; Patel, Sandeep K.; [2008]; 11 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNX08AG12G; Copyright; Avail.: Other Sources

4U 2206+54 is a high mass X-ray binary which has been suspected to contain a neutron star accreting from the wind of its companion BD +53 2790. However, there has been no confirmed detection of X-ray pulsations, and while several authors have reported hints of a cyclotron line in the energy spectra near 30 keV, none have reported significant detections. We present a reanalysis of BeppoSAX observations of 4U 2206+54, and an analysis of new Suzaku observations which both show strong pulsation at periods near 5500 s, which we believe to be the rotation period of a neutron star.

Author

*Neutron Stars; X Ray Binaries; A Stars; Energy Spectra; Unsteady Flow; Cyclotrons*

**20080047973** University Coll., London, UK; NASA Marshall Space Flight Center, Huntsville, AL, USA

**Spectral Morphology of the X-Ray Emission from Jupiter's Aurorae**

Branuardi-Raymont, G.; Elsner, R. F.; Galand, M.; Grodent, D.; Cravens, T. E.; Ford, P.; Gladstone, G. R.; Waite, J. H., Jr.; [2008]; 30 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

Simultaneous Chandra X-ray and Hubble Space Telescope FUV observations of Jupiter's aurorae carried out in February 2003 have been re-examined to investigate the spatial morphology of the X-ray events in different energy bands. The data clearly show that in the Northern auroral region (in the main auroral oval and the polar cap) events with energy  $> 2$  keV are located at the periphery of those with energy  $< 2$  keV and coincide with FUV bright features. In addition, X-ray spectra extracted from the areas where the two event distributions are concentrated possess different shapes. We associate the  $> 2$  keV events with the electron bremsstrahlung component recently revealed by XMM-Newton in the spectra of Jupiter's aurorae, and the  $< 2$  keV emission with the product of ion charge exchange, now established as the likely mechanism responsible for the soft X-ray Jovian aurora. We suggest that the same population of energetic electrons may be responsible for both, the X-ray bremsstrahlung and the FUV emission of Jupiter's aurorae. Comparison of the  $> 2$  keV X-ray and FUV powers measured during the observations shows that they are broadly consistent with the predicted emissions from a population of energetic electrons precipitating in the planet's atmosphere, thus supporting our interpretation.

Author

*Auroras; Jupiter (Planet); X Ray Spectra; Ion Charge; Hubble Space Telescope; Bremsstrahlung; Electron Precipitation*

**20080047980** NASA Marshall Space Flight Center, Huntsville, AL, USA

**GRB 051022: Physical Parameters and Extinction of a Prototype Dark Burst**

Rol, Evert; van der Horst, Alexander; Wiersema, Klaas; Patel, Sandeep K.; Levan, Andrew; Nysewander, Melissa; Kouveliotou, Chryssa; Wijers, Ralph A.M.; Tanvir, Nial; Reichart, Dan; Fruchter, Andrew S.; Graham, John; Ovaldsen, Jan-Erik; Jaunsen, Andreas O.; Jonker, Peter; van Ham, Wilbert; Hjorth, Jens; Starling, Rhanna L.C.; O'Brien, Paul T.; Fynbo, Johan; Burrows, David N.; Strom, Richard; July 02, 2007; 18 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

GRB 051022 was undetected to deep limits in early optical observations, but precise astrometry from radio and X-ray showed that it most likely originated in a galaxy at  $z$  approx. 0.8. We report radio, optical, near infrared and X-ray observations of GRB 051022. Using the available X-ray and radio data, we model the afterglow and calculate the energetics of the afterglow, finding it to be an order of magnitude lower than that of the prompt emission. The broad-band modeling also allows us to precisely define various other physical parameters and the minimum required amount of extinction, to explain the absence of an optical afterglow. Our observations suggest a high extinction, at least 2.3 magnitudes in the infrared (J) and at

least 5.4 magnitudes in the optical (U) in the host-galaxy restframe. Such high extinctions are unusual for GRBs, and likely indicate a geometry where our line of sight to the burst passes through a dusty region in the host that is not directly co-located with the burst itself.

Author

*Afterglows; Infrared Radiation; Visual Observation; X Rays; Astrometry; Line of Sight*

**20080048066** Indian Space Research Organization, Trivandrum, India; NASA Marshall Space Flight Center, Huntsville, AL, USA

**X-Ray Emission from Planets and Comets: Relationship with Solar X-Rays and Solar Wind**

Bhardwaj, Anil; Elsner, Ronald F.; Gladstone, G. Randall; Branduardi-Raymont, Graziella; Dennerl, Konrad; Lisse, Carey M.; Cravens, Thomas E.; Waite, J. Hunter, Jr.; Oestgaard, Nikolai; Petrinec, Steven M.; Wargelin, Bradford J.; Robertson, Ina; Beiersdorfer, Peter; Snowden, Steven L.; Kharchenko, Vasili; [2008]; 15 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Scattering of solar X-ray radiation mainly produces the non-auroral X-ray emissions from Jupiter, Saturn, and Earth, those from the disk of Mars, Venus, and Moon, and from the rings of Saturn. Recently X-ray flares are observed from the low-latitude disk of giant planets Jupiter and Saturn in the energy range of 0.2-2 keV. These flares are found to occur in tandem with the occurrence of solar X-ray flare, when light travel time delay is accounted, suggesting that X-rays from these planets can be used to study flaring on the hemisphere of the Sun invisible to near-Earth space weather satellites. Also by proper modeling of the observed planetary X-rays the solar soft X-ray flux can be derived. X-ray flares are also observed recently from Mars in direct response to solar flares. The X-ray emission from comets, the heliosphere, the geocorona, and the Martian and Venusian halo are all largely driven by charge exchange collision between highly ionized minor heavy ions in the solar wind and gaseous neutral species in the bodies' atmosphere or exosphere - a process known as solar wind charge exchange (SWCX). In particular, the cometary X-ray spectrum can be used to derive abundances of high-charge state ions of O, C, Ne as well as the speed of the solar wind. Thus cometary X-rays can provide a diagnostic of the solar wind properties even at far off distances from the Earth. This paper provides a brief overview of X-rays from some of the solar system bodies and their connection with solar X-rays and solar wind, and how planetary and cometary X-rays can be used to study the solar X-ray radiation and solar wind properties.

Author

*Charged Particles; Auroras; X Rays; Comets; Solar Wind; Solar X-Rays; Gas Giant Planets*

**20080048075** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Ring of Fire: Spitzer Detects an Infrared Bubble around the Magnetar SGR 1900+14**

Wachter, S.; Ramirez-Ruiz, E.; Dwarkadas, V. V.; Kouveliotou, C.; Granot, J.; Patel, S. K.; [2008]; 14 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NSF AST-0319261; Copyright; Avail.: Other Sources

Magnetars'2 are a special class of roughly a dozen slowly (approx. 5-12 s) rotating neutron stars with extremely high magnetic fields ( $> 10^{14}$  G), at least an order of magnitude larger than those of the 'normal' radio pulsars. The potential evolutionary links and differences between these two types of objects are still unknown; recent studies, however, have provided circumstantial evidence connecting magnetars with very massive star progenitors. Here we report on the discovery with the Spitzer Space Telescope of an infrared elliptical ring or shell surrounding the magnetar SGR 1900+14. The appearance and energetics of the ring are difficult to interpret within the current framework of the progenitor's stellar mass loss or the subsequent supernova remnant evolution. We suggest instead that a dust-free cavity was produced in the magnetar environment by the giant flare emitted by the source in August 1998. Thus the ring around SGR1900+14 is the first evidence for feedback between the magnetar and its environment at wavelengths other than radio. Unraveling its formation unambiguously establishes the association of SGR1900+14 with a cluster of massive stars, thereby cementing the link between magnetars and massive star progenitors. Our results impact our understanding of the evolutionary path and deaths of massive stars, and constrain the energetics and anisotropy of the giant flare from SGR 1900+14.

Author

*Magnetars; Star Clusters; Supernova Remnants; Stellar Mass; A Stars; Bubbles; Stellar Rotation; Pulsars; Neutron Stars*

**20080048077** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Chandra X-ray Observatory Observations of the Globular Cluster M71**

Elsner, Ronald F.; Heinke, Craig O.; Cohn, Haldan N.; Lugger, Phyllis M.; Maxwell, James E.; Stairs, Ingrid H.; Ransom, Scott M.; Hessels, Jason W. T.; Becker, Werner; Huang, Regina H. H.; Edmonds, Peter D.; Grindlay, Jonathan E.; Bogdanov, Slavko; Ghosh, Kajal; Weisskopf, Martin C.; [2008]; 45 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

We observed the nearby, low-density globular cluster M71 (NGC 6838) with the Chandra X-ray Observatory to study its faint X-ray populations. Five X-ray sources were found inside the cluster core radius, including the known eclipsing binary millisecond pulsar (MSP) PSR J1953+1846A. The X-ray light curve of the source coincident with this MSP shows marginal evidence for periodicity at the binary period of 4.2 h. Its hard X-ray spectrum and luminosity resemble those of other eclipsing binary MSPs in 47 Tuc, suggesting a similar shock origin of the X-ray emission. A further 24 X-ray sources were found within the half-mass radius, reaching to a limiting luminosity of  $1.7 \times 10^{30}$  ergs/s (0.3-8 keV). From a radial distribution analysis, we find that  $18 \pm 5$  of these 29 sources are associated with M71, somewhat more than predicted, and that  $11 \pm 5$  are background sources, both galactic and extragalactic. We find tentative evidence that the faint X-ray sources in M71 are similar in mass to the visible stars, but that the brightest sources may be more massive. M71 appears to have more X-ray sources between  $L_x = 10^{30} - 10^{31}$  ergs/s than expected by extrapolating from other studied clusters using either mass or collision frequency. We explore the spectra and variability of these sources, and describe the results of ground-based optical counterpart searches. Analysis of HST imaging for further counterpart searches will be published separately.

Author

*Eclipsing Binary Stars; Globular Clusters; X Ray Astrophysics Facility; Periodic Variations; Imaging Techniques; Pulsars; Stellar Mass; X Ray Sources*

**20080048087** NASA Marshall Space Flight Center, Huntsville, AL, USA; Tata Inst. of Fundamental Research, Mumbai, India

**SDSS J091949.16+342304.0 - An Einstein Ring System Lensed by Very Low Redshift Galaxy**

Ghosh, Kajal K.; Narasimha, D.; [2008]; 16 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

We report the serendipitous discovery of an 'Einstein Ring' in the optical band from the Sloan Digital Sky Survey (SDSS) data and associated four images of a background source. The lens galaxy appears to be a very nearby dwarf spheroidal at a redshift of  $0.0375 \pm 0.002$ . The lensed quasar is at a redshift of  $0.6842 \pm 0.0014$  and its multiple images are distributed almost 360deg around the lens nearly along a ring of radius approx.  $6.0'$ . Single component lens models require a mass of the galaxy of almost  $10^{12}$  stellar Mass within  $6.0'$  from the lens centre. With the available data we are unable to determine the exact position, orientation and flux of the quasar and the galaxy, though there appears evidence for a double or multiple merging image of the quasar. We have also detected strong radio and X-ray emissions from this system. It is indicative that this ring system may be embedded in a group or cluster of galaxies. This unique ring, by virtue of the closeness of the lens galaxy, offers possible probe to some of the key issues like mass-to-light ratio of intrinsically faint galaxies, existence of large scale magnetic fields in elliptical galaxies etc.

Author

*Stellar Magnetic Fields; Astronomical Models; Elliptical Galaxies; Galactic Clusters; Red Shift; Ring Galaxies*

**20080048088** NASA Marshall Space Flight Center, Huntsville, AL, USA

**UGC 7069: The Biggest Ring Galaxy**

Ghosh, Kajal K.; Mapelli, Michela; [2008]; 5 pp.; In English; Original contains poor quality, truncated or crooked pages; Copyright; Avail.: Other Sources

We find that the ring galaxy UGC 7069 is the largest galaxy known to date. In this paper, we present a multiwavelength study of this galaxy (combining radio, 2MASS, optical and ultraviolet data). The ring of UGC 7069, whose diameter measures  $\sim 115$  kpc, is also warped at its edges. The nucleus appears double peaked and hosts a possible LINER. The ultraviolet data indicate a strong blue color and suggest that UGC 7069 is a starburst galaxy. We also present N-body simulation results, which indicate that galaxy collisions can produce such huge rings. Large inclination angles between the target and the intruder galaxy may account for the formation of warped rings. Multiwavelength observations are highly essential to constrain our simulation results, which will address the formation and evolution of such a rare galaxy.

Author

*Ring Galaxies; Collisions; Many Body Problem; Starburst Galaxies*

**20080048113** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Magnetogram Measures of Total Nonpotentiality for Prediction of Solar Coronal Mass Ejections from Active Regions of any Degree of Magnetic Complexity**

Falconer, D. A.; Moore, R. L.; Gary, G. A.; [2008]; 18 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

For investigating the magnetic causes of coronal mass ejections (CMEs) and for forecasting the CME:productivity of active regions, in previous work we have gauged the total nonpotentiality of a whole active region by either of two measures, L(sub SSM) and L(sub SGM), two measures of the magnetic field along the main neutral line in a vector magnetogram of the active region. This previous work was therefore restricted to nominally bipolar active regions, active regions that have a clearly identifiable main neutral line. In the present paper, we show that our work can be extended to include multipolar active regions of any degree of magnetic complexity by replacing L(sub SSM) and L(sub SGM) by their generalized counterparts, WL(sub SS) and WL(sub SG), which are corresponding integral measures covering all neutral lines in an active region instead of only the main neutral line. In addition, we show that for active regions within 30 heliocentric degrees of disk center, WL(sub SG) can be adequately measured from line-of-sight magnetograms instead of vector magnetograms. This approximate measure of active-region total nonpotentiality, L-WL(sub SG), with the extensive set of 96-minute-cadence full-disk line-of-sight magnetograms from SOHO/MDI, can be used to study the evolution of active-region total nonpotentiality leading to the production of CMEs.

Author

*Solar Corona; Magnetic Fields; Coronal Mass Ejection; Line of Sight*

**20080048116** NASA Marshall Space Flight Center, Huntsville, AL, USA

**The NASA Lunar Impact Monitoring Program**

Suggs, Robert M.; Cooke, William J.; Suggs, Ronnie J.; Swift, Wesley R.; Hollon, Nicholas; [2007]; 9 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

NASA's Meteoroid Environment Office has implemented a program to monitor the Moon for meteoroid impacts from the Marshall Space Flight Center. Using off-the-shelf telescopes and video equipment, the moon is monitored for as many as 10 nights per month, depending on weather. Custom software automatically detects flashes which are confirmed by a second telescope, photometrically calibrated using background stars, and published on a website for correlation with other observations. Hypervelocity impact tests at the Ames Vertical Gun Range facility have begun to determine the luminous efficiency and ejecta characteristics. The purpose of this research is to define the impact ejecta environment for use by lunar spacecraft designers of the Constellation manned lunar program. The observational techniques and preliminary results will be discussed.

Author

*Meteorite Collisions; Lunar Programs; Impact Tests; Hypervelocity Impact; Meteoroid Concentration; Ejecta*

**20080048206** Radiation Monitoring Devices, Inc., USA

**Hard-X-Ray/Soft-Gamma-Ray Imaging Sensor Assembly for Astronomy**

Myers, Richard A.; NASA Tech Briefs, September 2008; September 2008, pp. 29; In English; See also [20080048125](#)

Report No.(s): GSC-14853-1; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3145>

An improved sensor assembly has been developed for astronomical imaging at photon energies ranging from 1 to 100 keV. The assembly includes a thallium-doped cesium iodide scintillator divided into pixels and coupled to an array of high-gain avalanche photodiodes (APDs). Optionally, the array of APDs can be operated without the scintillator to detect photons at energies below 15 keV. The array of APDs is connected to compact electronic readout circuitry that includes, among other things, 64 independent channels for detection of photons in various energy ranges, up to a maximum energy of 100 keV, at a count rate up to 3 kHz. The readout signals are digitized and processed by imaging software that performs 'on-the-fly' analysis. The sensor assembly has been integrated into an imaging spectrometer, along with a pair of coded apertures (Fresnel zone plates) that are used in conjunction with the pixel layout to implement a shadow-masking technique to obtain relatively high spatial resolution without having to use extremely small pixels. Angular resolutions of about 20 arc-seconds have been measured. Thus, for example, the imaging spectrometer can be used to (1) determine both the energy spectrum of a distant x-ray source and the angular deviation of the source from the nominal line of sight of an x-ray telescope in which the spectrometer is mounted or (2) study the spatial and temporal development of solar flares, repeating - ray bursters, and other

phenomena that emit transient radiation in the hard-x-ray/soft- $\gamma$ -ray region of the electromagnetic spectrum.

Author

*Imaging Techniques; Gamma Rays; X Ray Sources; Imaging Spectrometers; Astronomy; Electromagnetic Spectra; High Resolution; High Gain*

**20080048286** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**The James Webb Space Telescope and its Potential for Exoplanet Science**

Clampin, Mark; December 04, 2008; 1 pp.; In English; The University of Exeter - Presentation, 4 Dec. 2008, Devon, UK; No Copyright; Avail.: Other Sources; Abstract Only

The James Webb Space Telescope (JWST) is a large aperture (6.5 meter), cryogenic space telescope with a suite of near and mid-infrared instruments covering the wavelength range of 0.6 microns to 28 microns. JWST's primary science goal is to detect and characterize the first galaxies. It will also study the assembly of galaxies, star formation, and the formation and evolution of planetary systems. Recent progress in hardware development for the observatory will be presented, including a discussion of the status of JWST's optical system and Beryllium mirror fabrication, progress with sunshield prototypes, and recent changes in the integration and test configuration. We also review the expected scientific performance of the observatory for observations of exosolar planets by means of transit imaging and spectroscopy and direct imaging. We also review the recent discovery of Fomalhaut B and implications for debris disk imaging and exoplanet detection with JWST.

Author

*James Webb Space Telescope; Cryogenics; Imaging Techniques; Extrasolar Planets; Spectroscopy; Star Formation; Planet Detection*

## 90

### ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

**20080047393** Fermi National Accelerator Lab., Batavia, IL, USA

**Neutrinos and Cosmology: a Lifetime Relationship**

Serpico, P. D.; Jun. 01, 2008; 9 pp.; In English

Contract(s)/Grant(s): DE-AC02-76CH03000

Report No.(s): DE2008-934560; FERMILAB-CONF-08-144-A; No Copyright; Avail.: Department of Energy Information Bridge

We consider the example of neutrino decays to illustrate the profound relation between laboratory neutrino physics and cosmology. Two case studies are presented: In the first one, we show how the high precision cosmic microwave background spectral data collected by the FIRAS instrument on board of COBE, when combined with Lab data, have greatly changed bounds on the radiative neutrino lifetime. In the second case, we speculate on the consequence for neutrino physics of the cosmological detection of neutrino masses even as small as (approx.) 0.06 eV, the lower limit guaranteed by neutrino oscillation experiments. We show that a detection at that level would improve by many orders of magnitude the existing limits on neutrino lifetime, and as a consequence on some models of neutrino secret interactions.

NTIS

*Cosmology; Neutrinos; Particle Decay; Cosmic Microwave Background Radiation; Emission Spectra*

**20080047568** Naval Observatory, Washington, DC USA

**The Physical Basis of the Leap Second**

McCarthy, Dennis D; Hackman, Christine; Nelson, Robert A; Oct 7, 2008; 4 pp.; In English

Report No.(s): AD-A489427; No Copyright; Avail.: Defense Technical Information Center (DTIC)

International Atomic Time (TAI) is the internationally recognized timescale based on the second of the Systeme International d'Unites produced by the Bureau International des Poids et Mesures using data from timing laboratories around the world. TAI is an atomic timescale without steps. Coordinated Universal Time, the basis of civil time, is derived from TAI but is currently defined such that it is maintained within 0.9 s of Universal Time (UT1), the measure of time defined by the Earth's rotation angle, through the insertion of 1 s increments called leap seconds. The difference between UT1 and TAI that motivates the use of leap seconds is related to the tidal deceleration of the Earth's rotation. However, a recent paper by Deines and Williams claims that the divergence is caused by a relativistic time dilation effect. The purpose of this paper is to explain

the physical basis of the leap second and to point out that leap seconds are unrelated to relativity.

DTIC

*Deceleration; Relativity; Rotation; Time Measurement; Universal Time*

**20080047685** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Stellar Imager - Observing the Universe in High Definition**

Carpenter, Kenneth; [2009]; 1 pp.; In English; 2008 International Year of Astronomy, 4-8 Jan. 2009, Long Beach, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

Stellar Imager (SI) is a space-based, UV Optical Interferometer (UVOI) with over 200x the resolution of HST. It will enable 0.1 milli-arcsec spectral imaging of stellar surfaces and the Universe in general and open an enormous new 'discovery space' for Astrophysics with its combination of high angular resolution, dynamic imaging, and spectral energy resolution. SI's goal is to study the role of magnetism in the Universe and revolutionize our understanding of: 1) Solar/Stellar Magnetic Activity and their impact on Space Weather, Planetary Climates, and Life, 2) Magnetic and Accretion Processes and their roles in the Origin and Evolution of Structure and in the Transport of Matter throughout the Universe, 3) the close-in structure of Active Galactic Nuclei and their winds, and 4) Exo-Solar Planet Transits and Disks. The SI mission is targeted for the mid 2020's - thus significant technology development in the upcoming decade is critical to enabling it and future spacebased sparse aperture telescope and distributed spacecraft missions. The key technology needs include: 1) precision formation flying of many spacecraft, 2) precision metrology over km-scales, 3) closed-loop control of many-element, sparse optical arrays, 4) staged-control systems with very high dynamic ranges (nm to km-scale). It is critical that the importance of timely development of these capabilities is called out in the upcoming Astrophysics and Heliophysics Decadal Surveys, to enable the flight of such missions in the following decade. SI is a 'Landmark/Discovery Mission' in 2005 Heliophysics Roadmap and a candidate UVOI in the 2006 Astrophysics Strategic Plan. It is a NASA Vision Mission ('NASA Space Science Vision Missions' (2008), ed. M. Allen) and has also been recommended for further study in the 2008 NRC interim report on missions potentially enabled enhanced by an Ares V' launch, although an incrementally-deployed version could be launched using smaller rockets.

Author

*Interferometers; Astrophysics; Spaceborne Telescopes; High Resolution; Image Resolution*

**20080047687** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Observing Mergers of Nonspinning Black Hole Binaries with LISA**

McWilliams S.; Baker, John G.; Boggs, William D.; Centrella, Joan; Kelly Bernard J.; Thorpe, J. Ira; vanMeter, James R.; June 14, 2008; 1 pp.; In English; 7th International LISA Symposium/Space Science Institute of Catalonia (IEEC), 14-20 Jun. 2008, Barcelona, Spain

Contract(s)/Grant(s): NNH06CC03B; Copyright; Avail.: Other Sources; Abstract Only

Recent advances in the field of numerical relativity now make it possible to calculate the final, most powerful merger phase of binary black hole coalescence. We present the application of nonspinning numerical relativity waveforms to the search for and precision measurement of black hole binary coalescences using LISA. In particular, we focus on the advances made in moving beyond the equal mass, nonspinning case into other regions of parameter space, focusing on the case of nonspinning holes with ever-increasing mass ratios. We analyze the available unequal mass merger waveforms from numerical relativity, and compare them to two models, both of which use an effective one body treatment of the inspiral, but which use fundamentally different approaches to the treatment of the merger-ringdown. We confirm the expected mass ratio scaling of the merger, and investigate the changes in waveform behavior and their observational impact with changing mass ratio. Finally, we investigate the potential contribution from the merger portion of the waveform to measurement uncertainties of the binary's parameters for the unequal mass case.

Author

*Black Holes (Astronomy); Coalescing; Astrophysics; Gravitational Waves; Relativity; Numerical Analysis*

**20080047688** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Black Hole Mergers as Probes of Structure Formation**

Alicea-Munoz, Emily; May 12, 2008; 1 pp.; In English; 11th Eastern Gravity Meeting (EM11), 12-13 May 2008, University Park, PA, USA

Contract(s)/Grant(s): NNH06CC03B; Copyright; Avail.: Other Sources; Abstract Only

Observations of gravitational waves from massive black hole (MBH) mergers can provide us with important clues about

the era of structure formation in the early universe. Previous research in this field has been limited to calculating merger rates of MBHs using different models where many assumptions are made about the specific values of physical parameters of the mergers, resulting in merger rate estimates that span 5 to 6 orders of magnitude. We develop a semi-analytical, phenomenological model that includes plausible combinations of several physical parameters involved in the mergers, which we then turn around to determine how well LISA observations will be able to enhance our understanding of the universe during the critical  $z$  approximately equal to 5-30 structure formation era. We do this by generating synthetic LISA observable data (masses, redshifts, merger rates), which are then analyzed using a Markov Chain Monte Carlo (MCMC) method. This allows us to constrain the physical parameters of the mergers.

Author

*Black Holes (Astronomy); Gravitational Waves; Galactic Structure*

**20080047689** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Simulating Gravitational Wave Emission from Massive Black Hole Binaries**

Centrella, Joan; June 15, 2008; 1 pp.; In English; CSIRO Conference, 15-20 Jun. 2008, Sydney, Australia; No Copyright; Avail.: Other Sources; Abstract Only

The final merger of two black holes releases a tremendous amount of energy and is one of the brightest sources in the gravitational wave sky. Observing these sources with gravitational wave detectors requires that we know the radiation waveforms they emit. Since these mergers take place in regions of very strong gravitational fields, we need to solve Einstein's equations of general relativity on a computer in order to calculate these waveforms. For more than 30 years, scientists have tried to compute these waveforms using the methods of numerical relativity. The resulting computer codes have been plagued by instabilities, causing them to crash well before the black holes in the binary could complete even a single orbit. In the past few years, this situation has changed dramatically, with a series of amazing breakthroughs. This talk will focus on the recent advances that are revealing these waveforms, highlighting their astrophysical consequences and the dramatic new potential for discovery that arises when merging black holes will be observed using gravitational waves.

Author

*Black Holes (Astronomy); Gravitational Waves; Gravitational Fields; Computerized Simulation; Relativity; Astrophysics*

**20080047692** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**The Primordial Inflation Polarization Explorer (PIPER)**

Chuss, David T.; November 10, 2008; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

The Primordial Inflation Polarization Explorer (PIPER) is a balloon-borne experiment designed to search for the polarized imprint of gravitational waves from cosmic inflation. The discovery of such a signal would provide direct evidence for inflation, and its characterization would provide a means to explore energy scales orders of magnitude larger than any conceivable particle accelerator. PIPER will consist of two cryogenic telescopes—one for each of the Q and U Stokes parameters. Each will use a variable-delay polarization modulator (VPM) as its first element. This architecture is designed to minimize both T->B and E->B systematics. The detectors will be four 32x40 arrays of BUG detectors, utilizing transition-edge sensors and time-domain multiplexing. Each flight will observe approximately 25% of the sky at a single frequency. Additional flights will increase the frequency coverage.

Author

*Balloons; Spaceborne Experiments; Gravitational Waves; Polarization; Cosmology; Galactic Evolution; Astrophysics*

**20080047693** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**A New Technique using Electron Velocity Data from the Four Cluster Spacecraft to Explore Magnetofluid Turbulence in the Solar Wind**

Goldstein, Melvyn L.; Gurgiolo, C.; Fazakerley, A.; Lahiff, A.; December 12, 2008; 1 pp.; In English; American Geophysical Union Conference, 13-25 Dec. 2008, San Francisco, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

It is now possible in certain circumstances to use velocity moments computed from the Plasma Electron and Current Experiment (PEACE) on the four Cluster spacecraft to determine a number of turbulence properties of the solar wind, including direct measurements of the vorticity and compressibility. Assuming that the four spacecraft are not co-planar and that there is only a linear variation of the plasma variables across the volume defined by the four satellites, one can estimate



the curl of the fluid velocity, i.e., the vorticity. From the vorticity it is possible to explore directly intermittent regions in the solar wind where dissipation is likely to be enhanced. In addition, one can estimate directly the Taylor microscale.

Author

*Magnetohydrodynamic Turbulence; Electron Distribution; Velocity Distribution; Solar Wind; Space Plasmas*

**20080047746** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Quantifying the Effect of Component Covariances in CMB Extraction from Multi-frequency Data**

Phillips, Nicholas G.; July 14, 2008; 1 pp.; In English; CMB Component Separation and the Physics of Foregrounds, 14-18 Jul. 2008, Pasadena, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

Linear combination methods provide a global method for component separation of multi-frequency data. We present such a method that allows for consideration of possible covariances between the desired cosmic microwave background signal and various foreground signals that are also present. We also recover information on the foregrounds including the number of foregrounds, their spectra and templates. In all this, the covariances, which we would only expect to vanish 'in the mean' are included as parameters expressing the fundamental uncertainty due to this type of cosmic variance. When we make the reasonable assumption that the CMB is Gaussian, we can compute both a mean recovered CMB map and also an RMS error map. The mean map coincides with WMAP's Internal Linear Combination map.

Author

*Cosmic Microwave Background Radiation; Data Processing; Covariance; Data Reduction; Extraction; Computational Astrophysics*

**20080047748** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**WMAP - A Portrait of the Early Universe**

Wollack, Edward J.; November 21, 2008; 1 pp.; In English; International Conference on Recent Advances in Microwave Theory and Application, 21-24 Nov. 2008, Jaipur, India; No Copyright; Avail.: CASI: A01, Hardcopy  
ONLINE: <http://hdl.handle.net/2060/20080047748>

A host of astrophysical observations suggest that early Universe was incredibly hot, dense, and homogeneous. A powerful probe of this time is provided by the relic radiation which we refer to today as the Cosmic Microwave Background (CMB). Images produced from this light contain the earliest glimpse of the Universe after the 'Big Bang' and the signature of the evolution of its contents. By exploiting these clues, constraints on the age, mass density, and geometry of the early Universe can be derived. A brief history of the evolution of the microwave radiometer systems and map making approaches used in advancing these aspects our understanding of cosmological will be reviewed. In addition, an overview of the results from NASA's Wilkinson Microwave Anisotropy (WMAP) will be presented.

Author

*Microwave Anisotropy Probe; Galactic Evolution; Astronomical Maps*

**20080047753** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Scandium and Chromium in the Strontium Filament in the Homunculus of eta Carinae**

Gull, T.R.; Melendez, M.; Baustista, M.A.; Ballance, C.; Hartman, H.; Lodders, K.; Martinez, M.; [2008]; 11 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

We continue a systematic study of chemical abundances of the Strontium Filament found in the ejecta of eta Carinae. To this end we interpret the emission spectrum of Sc II and Cr II using multilevel non-LTE models of these systems. Since the atomic data for these ions was previously unavailable, we carry out ab initio calculations of radiative transition rates and electron impact excitation rate coefficients. The observed spectrum is emitted from a mostly neutral region with electron density of the order of  $10^{17} \text{ cm}^{-3}$  and a temperature between 6000 and 7000 K. These conditions are consistent with our previous diagnostics from [Ni II], [Ti II], and [Sr II]. The observed spectrum indicates an abundance of Sc relative Ni that more than 40 times the solar values, while the Cr/Ni abundance ratio is roughly solar. Various scenarios of depletion and dust destruction are suggested to explain such abnormal abundances.

Author

*Chromium; Scandium; Strontium; Massive Stars; Blue Stars; Ejecta*

**20080047928** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**How Very Massive Metal-Free Stars Start Cosmological Reionization**

Wise, John H.; Abel, Tom; *The Astrophysical Journal*; Sep. 2008; Volume 684, pp. 1-17; In English; Original contains color and black and white illustrations

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ONLINE: <http://dx.doi.org/10.1086/590050>

The initial conditions and relevant physics for the formation of the earliest galaxies are well specified in the concordance cosmology. Using ab initio cosmological Eulerian adaptive mesh refinement radiation hydrodynamical calculations, we discuss how very massive stars start the process of cosmological reionization. The models include nonequilibrium primordial gas chemistry and cooling processes and accurate radiation transport in the case B approximation using adaptively ray-traced photon packages, retaining the time derivative in the transport equation. Supernova feedback is modeled by thermal explosions triggered at parsec scales. All calculations resolve the local Jeans length by at least 16 grid cells at all times and as such cover a spatial dynamic range of approx.10(exp 6). These first sources of reionization are highly intermittent and anisotropic and first photoionize the small-scale voids surrounding the halos they form in, rather than the dense filaments they are embedded in. As the merging objects form larger, dwarf-sized galaxies, the escape fraction of UV radiation decreases and the H II regions only break out on some sides of the galaxies, making them even more anisotropic. In three cases, SN blast waves induce star formation in overdense regions that were formed earlier from ionization front instabilities. These stars form tens of parsecs away from the center of their parent DM halo. Approximately five ionizing photons are needed per sustained ionization when star formation in 10(exp 6) stellar Mass halos is dominant in the calculation. As the halos become larger than approx.10(exp 7) Stellar Mass, the ionizing photon escape fraction decreases, which in turn increases the number of photons per ionization to 15-50, in calculations with stellar feedback only. Radiative feedback decreases clumping factors by 25% when compared to simulations without star formation and increases the average temperature of ionized gas to values between 3000 and 10,000 K.

Author

*Galactic Evolution; Dwarf Galaxies; Stellar Mass; Radiation Transport; Massive Stars; Ionized Gases; Grid Refinement (Mathematics); Gas Cooling; Dynamic Range; Star Formation; Halos*

**20080047930** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**The Cosmic Microwave Background Radiation - A Unique Window on the Early Universe**

Hinshaw, Gary F.; October 12, 2008; 1 pp.; In English; 400th Anniversary of Lipperhey's Invention of the Telescope, 12-15 Oct. 2008, Beijing, China; No Copyright; Avail.: Other Sources; Abstract Only

The cosmic microwave background radiation is the remnant heat from the Big Bang. It provides us with a unique probe of conditions in the early universe, long before any organized structures had yet formed. The anisotropy in the radiation's brightness yields important clues about primordial structure and additionally provides a wealth of information about the physics of the early universe. Within the framework of inflationary dark matter models, observations of the anisotropy on sub-degree angular scales reveals the signatures of acoustic oscillations of the photon-baryon fluid at a redshift of approximately 1100. Data from the first five years of operation of the Wilkinson Microwave Anisotropy Probe (WMAP) satellite provide detailed full-sky maps of the cosmic microwave background temperature and polarization anisotropy. Together, the data provide a wealth of cosmological information, including the age of the universe, the epoch when the first stars formed, and the overall composition of baryonic matter, dark matter, and dark energy. The results also provide constraints on the period of inflationary expansion in the very first moments of time. WMAP, part of NASA's Explorers program, was launched on June 30, 2001. The WMAP satellite was produced in a partnership between the Goddard Space Flight Center and Princeton University. The WMAP team also includes researchers at Johns Hopkins University; the Canadian Institute of Theoretical Astrophysics; University of Texas; Oxford University; University of Chicago; Brown university; University of British Columbia; and University of California, Los Angeles.

Author

*Cosmic Microwave Background Radiation; Anisotropy; Microwave Anisotropy Probe; Galactic Structure; Galactic Evolution; Astrophysics; Big Bang Cosmology*

**20080047931** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Energy and Mass Transport of Magnetospheric Plasmas during the November 2003 Magnetic Storm**

Fok, Mei-Ching; Moore, Thomas; October 27, 2008; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

Intensive energy and mass transport from the solar wind across the magnetosphere boundary is a trigger of magnetic

storms. The storm on 20-21 November 2003 was elicited by a high-speed solar wind and strong southward component of interplanetary magnetic field. This storm attained a minimum Dst of -422 nT. During the storm, some of the solar wind particles enter the magnetosphere and eventually become part of the ring current. At the same time, the fierce solar wind powers strong outflow of H<sup>+</sup> and O<sup>+</sup> from the ionosphere, as well as from the plasmasphere. We examine the contribution of plasmas from the solar wind, ionosphere and plasmasphere to the storm-time ring current. Our simulation shows, for this particular storm, ionospheric O<sup>+</sup> and solar wind ions are the major sources of the ring current particles. The polar wind and plasmaspheric H<sup>+</sup> have only minor impacts. In the storm main phase, the strong penetration of solar wind electric field pushes ions from the geosynchronous orbit to L shells of 2 and below. Ring current is greatly intensified during the earthward transport and produces a large magnetic depression in the surface field. When the convection subsides, the deep penetrating ions experience strong charge exchange loss, causing rapid decay of the ring current and fast initial storm recovery. Our simulation reproduces very well the storm development indicated by the Dst index.

Author

*Solar Wind; Mass Transfer; Energy Transfer; Magnetic Storms; Interplanetary Magnetic Fields; Magnetohydrodynamics*

**20080047935** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Coronal Heating and the Need for High-Resolution Observations**

Klimchuk, James A.; November 15, 2008; 1 pp.; In English; Solar-C Science Definition Meeting, 15-22 Nov. 2008, Tokyo, Japan; No Copyright; Avail.: Other Sources; Abstract Only

Despite excellent progress in recent years in understanding coronal heating, there remain many crucial questions that are still unanswered. Limitations in the observations are one important reason. Both theoretical and observational considerations point to the importance of small spatial scales, impulsive energy release, strong dynamics, and extreme plasma nonuniformity. As a consequence, high spatial resolution, broad temperature coverage, high temperature fidelity, and sensitivity to velocities and densities are all critical observational parameters. Current instruments lack one or more of these properties, and this has led to considerable ambiguity and confusion. In this talk, I will discuss recent ideas about coronal heating and emphasize that high spatial resolution observations, especially spectroscopic observations, are needed to make major progress on this important problem.

Author

*Coronas; Heating; High Resolution; Temperature Effects; Spatial Resolution; High Temperature; Plasmas (Physics)*

**20080047936** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Observational and Theoretical Challenges to Wave or Turbulence Accelerations of the Fast Solar Wind**

Roberts, D. Aaron; December 14, 2008; 1 pp.; In English; American Geophysical Union 2008 Fall Meeting, 14-20 Dec. 2008, San Francisco, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

We use both observations and theoretical considerations to show that hydromagnetic waves or turbulence cannot produce the acceleration of the fast solar wind and the related heating of the open solar corona. Waves do exist as shown by Hinode and other observations, and can play a role in the differential heating and acceleration of minor ions but their amplitudes are not sufficient to power the wind, as demonstrated by extrapolation of magnetic spectra from Helios and Ulysses observations. Dissipation mechanisms invoked to circumvent this conclusion cannot be effective for a variety of reasons. In particular, turbulence does not play a strong role in the corona as shown by both eclipse observations of coronal striations and theoretical considerations of line-tying to a nonturbulent photosphere, nonlocality of interactions, and the nature of kinetic dissipation. In the absence of wave heating and acceleration, the chromosphere and transition region become the natural source of open coronal energization. We suggest a variant of the velocity filtration approach in which the emergence and complex churning of the magnetic flux in the chromosphere and transition region continuously and ubiquitously produces the nonthermal distributions required. These particles are then released by magnetic carpet reconnection at a wide range of scales and produce the wind as described in kinetic approaches. Since the carpet reconnection is not the main source of the energization of the plasma, there is no expectation of an observable release of energy in nanoflares.

Author

*Solar Wind; Magnetohydrodynamic Waves; Magnetohydrodynamic Turbulence; Plasma Acceleration; Solar Wind Velocity; Solar Corona; Plasma Heating*

**20080047939** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Eta Carinae across the 2003.5 Minimum: Analysis in the Visible and Near Infrared Spectral Region**

Nielsen, K. E.; Kober, G. Vieira; Weis, K.; Gull, T.; Stahl, O.; Bomans, D. J.; [2008]; 35 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

We present analysis of the visible through near infrared spectrum of eta Car and its ejecta obtained during the 'eta Car

Campaign with the Ultraviolet Visual Echelle Spectrograph (UVES) at the ESO Very Large Telescope (VLT)'. This is a part of larger effort to present a complete eta Car spectrum, and extends the previously presented analyses with the Hubble Space Telescope/Space Telescope Imaging Spectrograph (HST/STIS) in the UV (1240-3159 Å) to 10,430 Å. The spectrum in the mid and near UV is characterized by the ejecta absorption. At longer wavelengths, stellar wind features from the central source and narrow emission lines from the Weigelt condensations dominate the spectrum. However, narrow absorption lines from the circumstellar shells are present. This paper provides a description of the spectrum between 3060 and 10,430 Å, including line identifications of the ejecta absorption spectrum, the emission spectrum from the Weigelt condensations and the P-Cygni stellar wind features. The high spectral resolving power of VLT/UVES enables equivalent width measurements of atomic and molecular absorption lines for elements with no transitions at the shorter wavelengths. However, the ground based seeing and contributions of nebular scattered radiation prevent direct comparison of measured equivalent widths in the VLT/UVES and HST/STIS spectra. Fortunately, HST/STIS and VLT/UVES have a small overlap in wavelength coverage which allows us to compare and adjust for the difference in scattered radiation entering the instruments apertures. This paper provide a complete online VLT/UVES spectrum with line identifications and a spectral comparison between HST/STIS and VLT/UVES between 3060 and 3160 Å.

Author

*Massive Stars; Blue Stars; Ejecta; Infrared Spectra; Absorption Spectra; Emission Spectra*

**20080047941** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Correlations of the IR Luminosity and Eddington Ratio with a Hard X-ray Selected Sample of AGN**

Mushotzky, Richard F.; Winter, Lisa M.; McIntosh, Daniel H.; Tueller, Jack; [2008]; 12 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAG5-13102; Copyright; Avail.: CASI: [A03](#), Hardcopy

We use the SWIFT Burst Alert Telescope (BAT) sample of hard x-ray selected active galactic nuclei (AGN) with a median redshift of 0.03 and the 2MASS J and K band photometry to examine the correlation of hard x-ray emission to Eddington ratio as well as the relationship of the J and K band nuclear luminosity to the hard x-ray luminosity. The BAT sample is almost unbiased by the effects of obscuration and thus offers the first large unbiased sample for the examination of correlations between different wavelength bands. We find that the near-IR nuclear J and K band luminosity is related to the BAT (14 - 195 keV) luminosity over a factor of 10(exp 3) in luminosity ( $L(\text{sub IR}) \approx 10^3 L(\text{sub BAT})^{1.25}$ ) and thus is unlikely to be due to dust. We also find that the Eddington ratio is proportional to the x-ray luminosity. This new result should be a strong constraint on models of the formation of the broad band continuum.

Author

*Near Infrared Radiation; Seyfert Galaxies; Swift Observatory; Active Galactic Nuclei; Superhigh Frequencies; Luminosity; Red Shift*

**20080047974** NASA Marshall Space Flight Center, Huntsville, AL, USA

**An Imaging X-Ray Polarimeter for the Study of Galactic and Extragalactic X-Ray Sources**

Weisskopf, Martin C.; Bellazzini, Ronaldo; Costa, Enrico; Ramsey, Brian D.; O'Dell, Stephen L.; Elsner, Ronald F.; Tennant, Allyn F.; Pavlov, George G.; Matt, Giorgio; Kaspi, Victoria M.; Coppi, Paolo S.; Wu, Kinway; Seigmund, Oswald H. W.; [2008]; 12 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Technical progress in X-ray optics and in polarization-sensitive X-ray detectors, which our groups pioneered, enables a scientifically powerful, dedicated space mission for imaging X-ray polarimetry. This mission is sufficiently sensitive to measure X-ray (linear) polarization for a broad range of cosmic sources--primarily those involving neutron stars, stellar black holes, and supermassive black holes (active galactic nuclei). We describe the technical basis, the mission concept, and the physical and astrophysical questions such a mission would address.

Author

*X Ray Detectors; Polarimeters; Active Galactic Nuclei; Black Holes (Astronomy); Imaging Techniques; Linear Polarization; Neutron Stars; X Ray Sources; X Ray Optics; Astrophysics*

**20080048073** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Production of Magnetic Turbulence by Cosmic Rays Drifting Upstream of Supernova Remnant Shocks**

Niemiec, Jacek; Stroman, Thomas; Pohl, Martin; Nishikawa, Ken-Ichi; [2008]; 34 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

We present results of two- and three-dimensional Particle-In-Cell simulations of magnetic-turbulence production by

isotropic cosmic-ray ions drifting upstream of supernova remnant shocks. The studies aim at testing recent predictions of a strong amplification of short-wavelength non-resonant wave modes and at studying the subsequent evolution of the magnetic turbulence and its backreaction on cosmic ray trajectories. We confirm the generation of the turbulent magnetic field due to the drift of cosmic-ray ions in the upstream plasma, but show that an oblique filamentary mode grows more rapidly than the non-resonant parallel modes found in analytical theory. The growth rate of the field perturbations is much slower than is estimated for the parallel plane-wave mode using a quasilinear analytical approach, and the amplitude of the turbulence saturates at about  $(\delta B/B) \approx 1$ . The backreaction of the magnetic turbulence on the particles leads to an alignment of the bulk-flow velocities of the cosmic rays and the background medium. This is an essential characteristic of cosmic-ray modified shocks: the upstream flow speed is continuously changed by the cosmic rays. The deceleration of the cosmic-ray drift and the simultaneous bulk acceleration of the background plasma account for the saturation of the instability at moderate amplitudes of the magnetic field. Previously published MHD simulations have assumed a constant cosmic-ray current, which excludes a backreaction of the generated magnetic field on cosmic rays, and thus the saturation of the field amplitude is artificially suppressed. This may explain the continued growth of the magnetic field in the MHD simulations. We speculate that the parallel plane-wave mode found in analytical treatments very quickly leads to filamentation, which we observe in our PIC modeling and is also apparent in the MHD simulations. . . Subject headings: acceleration of particles, cosmic rays, methods: numerical, shock waves, supernova remnants, turbulence

Author

*Magnetohydrodynamics; Turbulence; Supernova Remnants; Cosmic Rays; Flow Velocity; Plane Waves*

**20080048097** NASA Marshall Space Flight Center, Huntsville, AL, USA

#### **Radiation from Relativistic Jets**

Nishikawa, K.-I.; Mizuno, Y.; Hardee, P.; Sol, H.; Medvedev, M.; Zhang, B.; Nordlund, A.; Frederiksen, J. T.; Fishman, G. J.; Preece, R.; April 22, 2008; 8 pp.; In English; Workshop on Blazar Variability Across the Electromagnetic Spectrum, 22-25 Aug. 2008, Palaiseau, France; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNG05GK73G; NNX07AJ88G; NNX08AG83G; NNX07AJ50G; NNX08AL39G; NSF AST-0506719; Copyright; Avail.: CASI: [A02](#), Hardcopy

Nonthermal radiation observed from astrophysical systems containing relativistic jets and shocks, e.g., gamma-ray bursts (GRBs), active galactic nuclei (AGNs), and Galactic microquasar systems usually have power-law emission spectra. Recent PIC simulations of relativistic electron-ion (electron-positron) jets injected into a stationary medium show that particle acceleration occurs within the downstream jet. In the presence of relativistic jets, instabilities such as the Buneman instability, other two-streaming instability, and the Weibel (filamentation) instability create collisionless shocks, which are responsible for particle (electron, positron, and ion) acceleration. The simulation results show that the Weibel instability is responsible for generating and amplifying highly nonuniform, small-scale magnetic fields. These magnetic fields contribute to the electron's transverse deflection behind the jet head. The 'jitter' radiation from deflected electrons in small-scale magnetic fields has different properties than synchrotron radiation which is calculated in a uniform magnetic field. This jitter radiation, a case of diffusive synchrotron radiation, may be important to understand the complex time evolution and/or spectral structure in gamma-ray bursts, relativistic jets, and supernova remnants.

Author

*Astrophysics; Nonthermal Radiation; Relativistic Plasmas; Plasma Jets; Plasma Physics; Particle Acceleration; Emission Spectra*

**20080048102** NASA Marshall Space Flight Center, Huntsville, AL, USA

#### **Do Ultraluminous X-ray Sources Exist in Dwarf Galaxies?**

Swartz, Douglas A.; Soria, Roberto; Tennant, Allyn F.; [2008]; 6 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAS8-03060; GO6-7081A; Copyright; Avail.: Other Sources

A thorough search for ultraluminous X-ray source candidates within the Local Volume is made. The search spatially matches potential ULXs detected in X-ray images or cataloged in the literature with galaxies tabulated in the Catalog of Neighboring Galaxies compiled by Karachentsev et al. The specific ULX frequency (occurrence rate per unit galaxy mass) is found to be a decreasing function of host galaxy mass for host masses above approximately  $10^{8.5} M_{\odot}$ . There is too little mass in galaxies below this point to determine whether this trend continues to lower galaxy mass. No ULXs have yet been detected in lower mass galaxies. Systematic differences between dwarf and giant galaxies that may explain an abundance

of ULXs in dwarf galaxies and what they may imply about the nature of ULXs are discussed.

Author

*Dwarf Galaxies; X Ray Sources; Luminosity; Astrophysics*

**20080048121** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Relativistic Particle-In-Cell Simulation Studies of Prompt and Early Afterglows from GRBs**

Nishikawa, K.-I.; Hardee, P.; Mizuno, Y.; Medvedev, M.; Zhang, B.; Hartmann, D. H.; Fishman, G. J.; [2008]; 19 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNG05GK73G; NNX07AJ88G; NSF AST-0506719; NSF AST-0506666; Copyright; Avail.: Other Sources

Nonthermal radiation observed from astrophysical systems containing relativistic jets and shocks, e.g., gamma-ray bursts (GRBs), active galactic nuclei (AGNs), and microquasars commonly exhibit power-law emission spectra. Recent PIC simulations of relativistic electron-ion (or electron-positron) jets injected into a stationary medium show that particle acceleration occurs within the downstream jet. In collisionless, relativistic shocks, particle (electron, positron, and ion) acceleration is due to plasma waves and their associated instabilities (e.g., the Weibel (filamentation) instability) created in the shock region. The simulations show that the Weibel instability is responsible for generating and amplifying highly non-uniform, small-scale magnetic fields. These fields contribute to the electron's transverse deflection behind the jet head. The resulting 'jitter' radiation from deflected electrons has different properties compared to synchrotron radiation, which assumes a uniform magnetic field. Jitter radiation may be important for understanding the complex time evolution and/or spectra in gamma-ray bursts, relativistic jets in general, and supernova remnants.

Author

*Nonthermal Radiation; Gamma Ray Bursts; Active Galactic Nuclei; Relativistic Particles; Power Spectra; Emission Spectra; Quasars; Electron-Positron Plasmas; Particle Acceleration; Weibel Instability*

**20080048253** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Magnetohydrodynamic Effects in Propagating Relativistic Jets: Reverse Shock and Magnetic Acceleration**

Mizuno, Y.; Zhang, B.; Giacomazzo, B.; Nishikawa, K.-I.; Hardee, P.; Nagataki, S.; Hartmann, H.; [2008]; 12 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNG05GK73G; NNX07AJ88G; NNX07AJ83G; NNG05GB67G; NNG06GH62G; NSF AST-0506719; Copyright; Avail.: Other Sources

We solve the Riemann problem for the deceleration of an arbitrarily magnetized relativistic flow injected into a static unmagnetized medium in one dimension. We find that for the same initial Lorentz factor, the reverse shock becomes progressively weaker with increasing magnetization (the Poynting-to-kinetic energy flux ratio), and the shock becomes a rarefaction wave when  $\sigma$  exceeds a critical value,  $\sigma_{\text{sub } c}$ , defined by the balance between the magnetic pressure in the flow and the thermal pressure in the forward shock. In the rarefaction wave regime, we find that the shocked region is accelerated to a Lorentz factor that is significantly larger than the initial value. This novel acceleration mechanism is due to the strong magnetic pressure in the flow. We discuss the implications of these results for models of gamma-ray bursts and active galactic nuclei.

Author

*Magnetohydrodynamics; Active Galactic Nuclei; Cauchy Problem; Gamma Ray Bursts; Kinetic Energy; Magnetization; Shock Waves*

91

**LUNAR AND PLANETARY SCIENCE AND EXPLORATION**

Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance*.

**20080047372** NASA Glenn Research Center, Cleveland, OH, USA

**Analysis of Thermal and Reaction Times for Hydrogen Reduction of Lunar Regolith**

Hegde, U.; Balasubramaniam, R.; Gokoglu, S.; February 10, 2008; 8 pp.; In English; STAIF-2008, 10-14 Feb. 2008, Albuquerque, NM, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NCC3-975; WBS 387498.04.01.04.03; Copyright; Avail.: CASI: A02, Hardcopy

System analysis of oxygen production by hydrogen reduction of lunar regolith has shown the importance of the relative

time scales for regolith heating and chemical reaction to overall performance. These values determine the sizing and power requirements of the system and also impact the number and operational phasing of reaction chambers. In this paper, a Nusselt number correlation analysis is performed to determine the heat transfer rates and regolith heat up times in a fluidized bed reactor heated by a central heating element (e.g., a resistively heated rod, or a solar concentrator heat pipe). A coupled chemical and transport model has also been developed for the chemical reduction of regolith by a continuous flow of hydrogen. The regolith conversion occurs on the surfaces of and within the regolith particles. Several important quantities are identified as a result of the above analyses. Reactor scale parameters include the void fraction (i.e., the fraction of the reactor volume not occupied by the regolith particles) and the residence time of hydrogen in the reactor. Particle scale quantities include the particle Reynolds number, the Archimedes number, and the time needed for hydrogen to diffuse into the pores of the regolith particles. The analysis is used to determine the heat up and reaction times and its application to NASA's oxygen production system modeling tool is noted.

Author

*Regolith; Lunar Rocks; Chemical Reactions; Continuum Flow; Heat Transfer*

**20080047431** NASA Glenn Research Center, Cleveland, OH, USA

**Mars Exploration Rovers: 4 Years on Mars**

Landis, Geoffrey A.; January 18, 2008; 93 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 361426.07.03; No Copyright; Avail.: CASI: A05, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047431>

This January, the Mars Exploration Rovers 'Spirit' and 'Opportunity' are starting their fifth year of exploring the surface of Mars, well over ten times their nominal 90-day design lifetime. This lecture discusses the Mars Exploration Rovers, presents the current mission status for the extended mission, some of the most results from the mission and how it is affecting our current view of Mars, and briefly presents the plans for the coming NASA missions to the surface of Mars and concepts for exploration with robots and humans into the next decade, and beyond.

Author

*Mars Exploration; Mars Surface; Roving Vehicles*

**20080047456** NASA Glenn Research Center, Cleveland, OH, USA

**Lunar Dust Mitigation Technology Development**

Hyatt, Mark J.; Deluane, Paul B.; February 11, 2008; 25 pp.; In English; 6th Space Technology and Applications International Forum: Space Colonization, 11 Feb. 2008, Cleveland, OH, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047456>

NASA's plans for implementing the Vision for Space Exploration include returning to the moon as a stepping stone for further exploration of Mars, and beyond. Dust on the lunar surface has a ubiquitous presence which must be explicitly addressed during upcoming human lunar exploration missions. While the operational challenges attributable to dust during the Apollo missions did not prove critical, the comparatively long duration of impending missions presents a different challenge. Near term plans to revisit the moon places a primary emphasis on characterization and mitigation of lunar dust. Comprised of regolith particles ranging in size from tens of nanometers to microns, lunar dust is a manifestation of the complex interaction of the lunar soil with multiple mechanical, electrical, and gravitational effects. The environmental and anthropogenic factors effecting the perturbation, transport, and deposition of lunar dust must be studied in order to mitigate its potentially harmful effects on exploration systems. This paper presents the current perspective and implementation of dust knowledge management and integration, and mitigation technology development activities within NASA's Exploration Technology Development Program. This work is presented within the context of the Constellation Program's Integrated Lunar Dust Management Strategy. The Lunar Dust Mitigation Technology Development project has been implemented within the ETDP. Project scope and plans will be presented, along with a perspective on lessons learned from Apollo and forensics engineering studies of Apollo hardware. This paper further outlines the scientific basis for lunar dust behavior, its characteristics and potential effects, and surveys several potential strategies for its control and mitigation both for lunar surface operations and within the working volumes of a lunar outpost.

Author

*Lunar Dust; Man Environment Interactions; Space Exploration; Lunar Surface; Lunar Soil; Gravitational Effects; Dust; Regolith*

**20080047658** NASA Johnson Space Center, Houston, TX, USA

**Crew Exploration Vehicle Environmental Control and Life Support Development Status**

Lewis, John F.; Barido, Richard; Carrasquillo, Robyn; Cross, Cindy; Peterson, Laurie; Tuan, George; [2009]; 1 pp.; In English; ICES 2009, 12-16 Jul. 2009, Savannah, GA, USA

Contract(s)/Grant(s): 604746.02.22.09.02.02.10; Copyright; Avail.: Other Sources; Abstract Only

The Crew Exploration Vehicle (CEV) is the first crew transport vehicle to be developed by the National Aeronautics and Space Administration (NASA) in the last thirty years. The CEV is being developed to transport the crew safely from the Earth to the Moon and back again. This year, the vehicle continued to go through design refinements to reduce weight, meet requirements, and operate reliably. The design of the Orion Environmental Control and Life Support (ECLS) system, which includes the life support and active thermal control systems, is progressing through the design stage. This paper covers the Orion ECLS development from April 2008 to April 2009.

Author

*Life Support Systems; Crew Exploration Vehicle; Temperature Control; Transport Vehicles; Moon*

**20080047665** NASA Johnson Space Center, Houston, TX, USA

**An Assessment of Dust Effects on Planetary Surface Systems to Support Exploration Requirements**

Wagner, Sandy; August 20, 2004; 23 pp.; In English; Original contains color illustrations

Report No.(s): CTSD-AIM-0029; JSC-62198; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080047665>

Apollo astronauts learned first hand how problems with dust impact lunar surface missions. After three days, lunar dust contamination on EVA suit bearings led to such great difficulty in movement that another EVA would not have been possible. Dust clinging to EVA suits was transported into the Lunar Module. During the return trip to Earth, when micro gravity was reestablished, the dust became airborne and floated through the cabin. Crews inhaled the dust and it irritated their eyes. Some mechanical systems aboard the spacecraft were damaged due to dust contamination. Study results obtained by Robotic Martian missions indicate that Martian surface soil is oxidative and reactive. Exposures to the reactive Martian dust will pose an even greater concern to the crew health and the integrity of the mechanical systems. As NASA embarks on planetary surface missions to support its Exploration Vision, the effects of these extraterrestrial dusts must be well understood and systems must be designed to operate reliably and protect the crew in the dusty environments of the Moon and Mars. The AIM Dust Assessment Team was tasked to identify systems that will be affected by the respective dust, how they will be affected, associated risks of dust exposure, requirements that will need to be developed, identified knowledge gaps, and recommended scientific measurements to obtain information needed to develop requirements, and design and manufacture the surface systems that will support crew habitation in the lunar and Martian outposts.

Author

*Planetary Surfaces; Extravehicular Activity; Lunar Dust; Contamination; Lunar Surface; Spacecrews; Robotics; Mars Surface*

**20080047907** Stanford Linear Accelerator Center, CA, USA; Pennsylvania State Univ., University Park, PA, USA

**Supermassive Black Hole Growth and Merger Rates from Cosmological N-body Simulations**

Micic, M.; Holley-Bockelmann, K.; Sigurdsson, S.; Abel, T.; Mar. 22, 2007; 12 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-918971; SLAC-PUB-12931; No Copyright; Avail.: National Technical Information Service (NTIS)

Understanding how seed black holes grow into intermediate and supermassive black holes (IMBHs and SMBHs, respectively) has important implications for the duty-cycle of active galactic nuclei (AGN), galaxy evolution, and gravitational wave astronomy. Most studies of the cosmological growth and merger history of black holes have used semianalytic models and have concentrated on SMBH growth in luminous galaxies. Using high resolution cosmological N-body simulations, we track the assembly of black holes over a large range of final masses from seed black holes to SMBHs over widely varying dynamical histories. We used the dynamics of dark matter halos to track the evolution of seed black holes in three different gas accretion scenarios.

NTIS

*Black Holes (Astronomy); Cosmology; Many Body Problem; Simulation*



**20080047968** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Lunar Dust Charging by Photoelectric Emissions**

Abbas, M. M.; Tankosic, D.; Craven, P. D.; Spann, J. F.; LeClair, A.; West, E. A.; Planetary and Space Science; May 2007; Volume 55, No. 7-8, pp. 953-965; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1016/j.pss.2006.12.007>

The lunar surface is covered with a thick layer of sub-micron/micron size dust grains formed by meteoritic impact over billions of years. The fine dust grains are levitated and transported on the lunar surface, as indicated by the transient dust clouds observed over the lunar horizon during the Apollo 17 mission. Theoretical models suggest that the dust grains on the lunar surface are charged by the solar ultraviolet (UV) radiation as well as the solar wind. Even without any physical activity, the dust grains are levitated by electrostatic fields and transported away from the surface in the near vacuum environment of the Moon. The current dust charging and levitation models, however, do not fully explain the observed phenomena. Since the abundance of dust on the Moon's surface with its observed adhesive characteristics has the potential of severe impact on human habitat and operations and lifetime of a variety of equipment, it is necessary to investigate the charging properties and the lunar dust phenomena in order to develop appropriate mitigating strategies. Photoelectric emission induced by the solar UV radiation with photon energies higher than the work function (WF) of the grain materials is recognized to be the dominant process for charging of the lunar dust, and requires measurements of the photoelectric yields to determine the charging and equilibrium potentials of individual dust grains. In this paper, we present the first laboratory measurements of the photoelectric efficiencies and yields of individual sub-micron/micron size dust grains selected from sample returns of Apollo 17 and Luna-24 missions as well as similar size dust grains from the JSC-1 simulants. The measurements were made on a laboratory facility based on an electrodynamic balance that permits a variety of experiments to be conducted on individual sub-micron/micron size dust grains in simulated space environments. The photoelectric emission measurements indicate grain size dependence with the yield increasing by an order of magnitude for grains of sub-micron to several micron size radii, at which it reaches asymptotic values. The yield for large size grains is found to be more than an order of magnitude higher than the bulk measurements on lunar fines reported in the literature.

Author

*Lunar Dust; Photoelectric Emission; Charging; Electrodynamics; Aerospace Environments; Lunar Surface*

**20080048148** California Inst. of Tech., Pasadena, CA, USA

**Simulating the Phoenix Landing Radar System**

Chen, Curtis W.; NASA Tech Briefs, September 2008; September 2008, pp. 46; In English; See also [20080048125](#); Original contains color illustrations

Report No.(s): NPO-44431; Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://www.techbriefs.com/component/content/article/3184>

A computer program called phxlrsim simulates the behavior of the radar system used as an altimeter and velocimeter during the entry, descent, and landing phases of the Phoenix lander spacecraft. The simulation includes modeling of internal functions of the radar system, the spacecraft trajectory, and the terrain. The computational models incorporate representations of nonideal hardware effects in the radar system and effects of radar speckle (coherent scatter of radar signals from terrain).

Author

*Phoenix Mars Lander; Computer Programs; Computerized Simulation; Mathematical Models; Spacecraft Landing*

**92**

**SOLAR PHYSICS**

Includes solar activity, solar flares, solar radiation and sunspots. For related information see [93 Space Radiation](#).

**20080047694** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**The Virtual Wave Observatory (VWO)**

Fung, Shing F.; December 14, 2008; 1 pp.; In English; 2008 AGU Fall Meeting, Special Session: Heliophysics Research Using Virtual Observatories, 15 Dec. 2008, San Francisco, CA, USA; No Copyright; Avail.: Other Sources; Abstract

Only

Heliophysics wave data are currently not easily searchable by computers, making identifying pertinent wave data features for analyses and cross comparisons difficult and laborious. Since wave data analysis requires specialized knowledge about waves, which spans the spectrum of microphysics to macrophysics, researchers having varied expertise cannot easily use wave

data. To resolve these difficulties and to allow wave data to contribute more fully to Heliophysics research, we are developing a Virtual Wave Observatory (VWO) whose goal is to enable all Heliophysics wave data to become searchable, understandable and usable by the Heliophysics community. The VWO objective is to enable search of multiple and distributed wave data (from both active and passive measurements). This presentation provides an overview of the VWO, a new VxO component within the emerging distributed Heliophysics data and model environment.

Author

*Solar Physics; Solar Observatories; Plasma Waves; Data Retrieval; Data Processing*

**20080047923** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Modifying the Heliophysics Data Policy to Better Enable Heliophysics Research**

Hayes, Jeffrey; Roberts, D. Aaron; Bredekamp, Joseph; December 14, 2008; 1 pp.; In English; 2008 Fall American Geophysical Union Meeting, 14-20 Dec. 2008, San Francisco, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

The Heliophysics (HP) Science Data Management Policy, adopted by HP in June 2007, has helped to provide a structure for the HP data lifecycle. It provides guidelines for Project Data Management Plans and related documents, initiates Resident Archives to maintain data services after a mission ends, and outlines a route to the unification of data finding, access, and distribution through Virtual observatories. Recently we have filled in missing pieces that assure more coherence and a home for the VxOs (through the 'Heliophysics Data and Model Consortium'), and provide greater clarity with respect to long term archiving. In particular, the new policy which has been vetted with many community members, details the 'Final Archives' that are to provide long-term data access. These are distinguished from RAs in that they provide little additional service beyond servicing data, but critical to their success is that the final archival materials include calibrated data in useful formats such as one finds in CDAWeb and various ASCII or FITS archives. Having a clear goal for legacy products, to be detailed as part of the Mission Archives Plans presented at Senior Reviews, will help to avoid the situation so common in the past of having archival products that preserve bits well but not readily usable information. We hope to avoid the need for the large numbers of 'data upgrade' projects that have been necessary in recent years.

Author

*Solar Physics; Research; Data Management*

**20080047933** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**The Whole Heliosphere Interval: Campaign Summaries and Early Results**

Thompson, Barbara J.; Gibson, Sarah E.; Kozyra, Janet U.; November 09, 2008; 1 pp.; In English; American Geophysical Union Chapman Conference on Universal Heliophysical Processes, 9-14 Nov. 2008, Savannah, GA, USA; Copyright; Avail.: Other Sources; Abstract Only

The Whole Heliosphere Interval (WHI) is an internationally coordinated observing and modeling effort to characterize the 3-dimensional interconnected solar-heliospheric-planetary system - a.k.a. the 'heliophysical' system. The heart of the WHI campaign is the study of the interconnected 3-D heliophysical domain, from the interior of the Sun, to the Earth, outer planets, and into interstellar space. WHI observing campaigns began with the 3-0 solar structure from solar Carrington Rotation 2068, which ran from March 20 - April 16, 2008. Observations and models of the outer heliosphere and planetary impacts extended beyond those dates as necessary; for example, the solar wind transit time to outer planets can take months. WHI occurs during solar minimum, which optimizes our ability to characterize the 3-D heliosphere and trace the structure to the outer limits of the heliosphere. A summary of some of the key results from the WHI first workshop in August 2008 will be given.

Author

*Heliosphere; Interstellar Space; Solar Activity Effects; Solar System; Solar Wind; Gas Giant Planets*

**20080047937** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**Services, Perspective and Directions of the Space Physics Data Facility**

McGuire, Robert E.; Bilitza, Dieter; Candey, Reine A.; Chimiak, Reine A.; Cooper, John F.; Fung, Shing F.; Harris, Bernard T.; Johnson, Rita C.; King, Joseph H.; Kovalick, Tamara; Leckner, Howard A.; Liu, Michael H.; Papitashvili, Natalia E.; Roberts, D. Aaron; December 15, 2008; 1 pp.; In English; American Geophysical Union Meeting, 15-20 Dec. 2008, San Francisco, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

The multi-mission data and orbit services of NASA's Space Physics Data Facility (SPDF) project offer unique capabilities supporting science of the Heliophysics Great Observatory and that are highly complementary to other services now evolving in the international heliophysics data environment. The VSPO (Virtual Space Physics Observatory) service is an active portal

to a wide range of distributed data sources. CDAWeb (Coordinated Data Analysis Web) offers plots, listings and file downloads for current data from many missions across the boundaries of missions and instrument types. CDAWeb now includes extensive new data from STEREO and THEMIS, plus new ROCSAT IPEI data, the latest data from all four TIMED instruments and high-resolution data from all DE-2 experiments. SSCWeb, Helioweb and our 3D Animated Orbit Viewer (TIPSOD) provide position data and identification of spacecraft and ground conjunctions. OMNI Web, with its new extension to 1- and 5-minute resolution, provides interplanetary parameters at the Earth's bow shock. SPDF maintains NASA's CDF (Common Data Format) standard and a range of associated tools including format translation services. These capabilities are all now available through web services based APIs, one element in SPDF's ongoing work to enable heliophysics community development of Virtual discipline Observatories (e.g. VITMO). We will demonstrate our latest data and capabilities, review the lessons we continue to learn in what science users need and value in this class of services, and discuss our current thinking to the future role and appropriate focus of the SPDF effort in the evolving and increasingly distributed heliophysics data environment.

Author

*Solar Physics; Astrophysics; Data Processing; Data Acquisition*

**20080048089** NASA Marshall Space Flight Center, Huntsville, AL, USA

**Recovering Photospheric Velocities from Vector Magnetograms by using a Three-Dimensional, Fully Magnetohydrodynamic (MHD) Model**

Wang, A. H.; Wu, S. T.; Liu, Yang; Hathaway, D.; [2008]; 1 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

We introduce a numerical simulation method for recovering the photospheric velocity field from the vector magnetograms. The traditional method is local correlation tracking (LCT) which is based on measuring the relative displacements of features in blocks of pixels between successive white-light images or magnetograms. Within this method, there are a variety of implementations. One of recently developed implementations is induction local correlation tracking (ILCT) as described by Welsch et al. (2004). They employ the normal component of magnetic induction equation as a constraint to assure consistent solutions. Our numerical method uses the fully three-dimensional MHD equations to recover the photospheric velocity field with individual vector magnetograms. We compare our method to the ILCT method using NOAA AR8210 as an example. The differences and similarities are discussed in detail.

Author

*Magnetic Signatures; Solar Magnetic Field; Correlation Detection; Magnetic Induction; Velocity Distribution*

**20080048212** NASA Marshall Space Flight Center, Huntsville, AL, USA

**A Semi-Empirical Model for Forecasting Relativistic Electrons at Geostationary Orbit**

Lyatsky, Wladislaw; Khazanov, George V.; [2008]; 10 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

We used numerical integration of the particle balance equation for predicting the relativistic electron fluxes at geostationary orbit. The model includes a source and losses. Similar to some earlier prediction models, we used as input parameters only solar wind data. As the source, we used the solar wind coupling function that is a best-fit combination of solar wind parameters responsible for the generation of geomagnetic disturbances. The loss function was derived from recent findings showing an important role played by solar wind density in decaying the relativistic electrons. The relativistic electron fluxes, predicted (for one day ahead) from our model, show the high correlation with the actual electron fluxes 'measured with GOES 10 and 12 spacecraft. We tested the model for four year period from 2004 until present. The correlation coefficient between predicted and actual values of relativistic electron fluxes for whole four year period as well as for each of these four years is about 0.9. The high and stable correlation between the computed and actual electron fluxes shows that the reliable forecasting the relativistic electrons at geostationary orbit is possible.

Author

*Mathematical Models; Relativistic Particles; Solar Wind; Wind Measurement; Geosynchronous Orbits; Forecasting; Numerical Integration; High Energy Electrons*

93  
**SPACE RADIATION**

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *51 Life Sciences*; on human beings see *52 Aerospace Medicine*. For theory see *73 Nuclear Physics*.

**20080047750** NASA Goddard Space Flight Center, Greenbelt, MD, USA

**The Effects of Low Dose-Rate Ionizing Radiation on the Shapes of Transients in the LM124 Operational Amplifier**  
Buchner, Stephen; McMorrow, Dale; Roche, Nicholas; Dusseau, Laurent; Pease, Ron L.; [2008]; 8 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

Shapes of single event transients (SETs) in a linear bipolar circuit (LM124) change with exposure to total ionizing dose (TID) radiation. SETs shape changes are a direct consequence of TID-induced degradation of bipolar transistor gain. A reduction in transistor gain causes a reduction in the drive current of the current sources in the circuit, and it is the lower drive current that most affects the shapes of large amplitude SETs.

Author

*Ionizing Radiation; Traveling Ionospheric Disturbances; Exposure; Degradation; Bipolar Transistors*

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