



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

**Scientific and Technical
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Scientific and Technical Aerospace Reports

STAIR

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- **SPECIAL PUBLICATION.** Scientific, technical, or historical information from NASA programs, projects, and missions, often concerned with subjects having substantial public interest.
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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.

STAR includes citations to R&D results reported in:

- NASA, NASA contractor, and NASA grantee reports
- Reports issued by other U.S. Government agencies, domestic and foreign institution, universities, and private firms
- Translations
- NASA-owned patents and patent applications
- Other U.S. Government agency and foreign patents and patent applications
- Domestic and foreign dissertations and theses

The NASA STI Program

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.

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NASA Center for AeroSpace Information (CASI)

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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>.

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The U.S. Congress established the **Federal Depository Library Program** to ensure access for the American public to U.S. Government information. The program acquires and disseminates information products from all three branches of the U.S. Government to nearly 1,300 Federal depository libraries nationwide. The libraries maintain these information products as part of their existing collections and are responsible for assuring that the public has free access to the information. Locate the Federal depository libraries at <http://www.gpoaccess.gov/index.html>.

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.

20080039302 Fish and Richardson, P.C., Minneapolis, MN, USA

Aerodynamic Focusing of Nanoparticle or Cluster Beams

Wang, X., Inventor; McMurry, P. H., Inventor; Kruijs, F. E., Inventor; 9 Nov 05; 46 pp.; In English

Contract(s)/Grant(s): DMI-0103169

Patent Info.: Filed 9 Nov 05; US-Patent-Appl-SN-11-269 932

Report No.(s): PB2008-103588; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Guidelines for designing lenses or systems for aerodynamic focusing of nanoparticle or cluster beams. The design process may involve obtaining a relationship between particle size, operating pressure and aperture size, and selecting the operating pressure to provide continuum flow of an aerosol beam through the aerodynamic lens. Particles having diameters less than 30 nanometer may be focused. Simulation techniques for evaluating designed lenses are also disclosed.

NTIS

Focusing; Lenses; Nanoparticles; Patent Applications

20080039580 Carlson, Gaskey and Olds, P.C., Birmingham, MI, USA

Heat Transferring Cooling Features for an Airfoil

Pietraszkiewicz, E. F., Inventor; Botnick, C., Inventor; Coons, T., Inventor; 9 Nov 04; 11 pp.; In English

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

Patent Info.: Filed 9 Nov 04; US-Patent-Appl-SN-10-984 216

Report No.(s): PB2008-103495; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A turbine blade airfoil assembly includes a cooling air passage. The cooling air passage includes a plurality of impingement openings that are isolated from at least one adjacent impingement opening. The cooling air passage is formed and cast within a turbine blade assembly through the use of a single core. The single core forms the features required to fabricate the various separate and isolated impingement openings. The isolation and combination of impingement openings provides for the augmentation of convection and film cooling and provide the flexibility to tailor airflow on an airfoil to optimize thermal performance of an airfoil.

NTIS

Airfoils; Cooling; Heat Transfer; Patent Applications

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.

20080040108 Air Force Research Lab., Wright-Patterson AFB, OH USA

A Joined-Wing Flight Experiment

Blair, Maxwell; Robinson, Jason; McClelland, William A; Bowman, Jason C; Feb 2008; 213 pp.; In English

Contract(s)/Grant(s): Proj-A03H

Report No.(s): AD-A483055; AFRL-RB-WP-TR-2008-3101; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report summarizes several design and analysis studies surrounding the flight test of a 7% geometric scale of a

notional high-altitude, long-endurance (HALE) variant that targeted the AFRL SensorCraft mission. Established procedures were modified to accommodate low-cost testing with giant-scale radio-controlled technology as an approach to reduce high risk associated with new technologies, such as the joined-wing concept. The flight test vehicle reported here was rigid. The second successful flight ended in deep stall due to under-powered design. Minimal data was extracted from the flight test. Significant experience was gained. This report motivates and describes the next step toward low-cost aeroelastic scaling of joined-wing concepts where geometric non-linear structures is a key component.

DTIC

Aerodynamics; Aircraft Design; Wings

20080040151 NASA Langley Research Center, Hampton, VA, USA

Estimation of Supersonic Stage Separation Aerodynamics of Winged-Body Launch Vehicles Using Response Surface Methods

Erickson, Gary E.; Deloach, Richard; September 14, 2008; 34 pp.; In English; 26th Congress of International Council of the Aeronautical Sciences (ICAS 2008), 14-19 Sep. 2008, Anchorage, AK, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 136905.02.04.04.01.04; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040151>

A collection of statistical and mathematical techniques referred to as response surface methodology was used to estimate the longitudinal stage separation aerodynamic characteristics of a generic, bimese, winged multi-stage launch vehicle configuration using data obtained on small-scale models at supersonic speeds in the NASA Langley Research Center Unitary Plan Wind Tunnel. The simulated Mach 3 staging was dominated by multiple shock wave interactions between the orbiter and booster vehicles throughout the relative spatial locations of interest. This motivated a partitioning of the overall inference space into several contiguous regions within which the separation aerodynamics were presumed to be well-behaved and estimable using cuboidal and spherical central composite designs capable of fitting full second-order response functions. The primary goal was to approximate the underlying overall aerodynamic response surfaces of the booster vehicle in belly-to-belly proximity to the orbiter vehicle using relatively simple, lower-order polynomial functions that were piecewise-continuous across the full independent variable ranges of interest. The quality of fit and prediction capabilities of the empirical models were assessed in detail, and the issue of subspace boundary discontinuities was addressed. The potential benefits of augmenting the central composite designs to full third order using computer-generated D-optimality criteria were also evaluated. The usefulness of central composite designs, the subspace sizing, and the practicality of fitting low-order response functions over a partitioned inference space dominated by highly nonlinear and possibly discontinuous shock-induced aerodynamics are discussed.

Author

Stage Separation; Supersonic Speed; Aerodynamic Characteristics; Launch Vehicle Configurations; Shock Wave Interaction; Control Surfaces; Wind Tunnels; Statistical Analysis

03

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.

20080039729 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Aircraft Maintenance Organizational Structure Changes: An Antecedent Model

Durand, Jeffrey M; Mar 2008; 87 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482854; AFIT/GLM/ENS/08-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482854>

Air Force leadership has ordered the development of an Enterprise Resource Planning (ERP) system called the Expeditionary Combat Support System (ECSS). When the system is implemented, many current jobs and positions will be streamlined, restructured, or removed, while some will certainly be created to handle the new requirements associated with ECSS. The structure of the Air Force is certain to change with the implementation of ECSS. The Air Force has used many maintenance organizational structures since its inception in 1947. This study analyzes past organizational structures to define

key factors that affect organizational change. A case study methodology was applied to the following eight periods of maintenance-related organizational change: Hobson Plan and the Period of Uncertainty (1947-1955), Centralized Maintenance (1956-1966), Vietnam and the Move toward Decentralization (1966-1972), Post-Vietnam Centralization (1972-1976), Production-Oriented Maintenance (1976-1978), Combat-Oriented Maintenance (1978-1991), Objective Wing Organization (1991-2002), and Combat Wing Organization (2002-2007). Strategic initiatives, information and maintenance-related technology advances, change and project management practices were evaluated for relational affect. The researcher found that the strongest relational variables leading to organizational structure change were force-size change, budget change, and major conflict occurrence or cessation.

DTIC

Command and Control; Logistics; Logistics Management; Maintenance

20080039814 Massachusetts Inst. of Tech., Cambridge, MA USA

RM Methods for Multiple Fare Structure Environments

Kayser, Matthew R; Jun 2008; 116 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482941; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The rapid growth of Low Cost Carriers (LCC) and their simplified fare structures has created 'semi-restricted' fare structures where lower classes are undifferentiated except for price, while higher fare classes are still differentiated by various advance purchase and booking restrictions. The problem this causes is two-fold: (1) traditional revenue management systems, which operate based on the assumption of demand independence, will see demand 'spiral down' into the lowest booking classes as passengers buy the lowest available fare in the absence of fare restrictions; (2) airlines must maximize network revenues across two different fare structures, a more-restricted structure used on markets without an LCC presence, and the semi-restricted structure for markets where LCC competition exists. This thesis describes methods of dealing with these two problems: Hybrid Forecasting (HF), which forecasts 'product-oriented' demand using traditional forecasting methods while simultaneously forecasting 'price-oriented' demand for those passengers who will buy the lowest available fare; and Fare Adjustment (FA), which is used at the booking limit optimizer level to account for the sell-up potential of passengers. FA allows the airline to deal with multiple fare structures separately. The goal of this thesis is to provide a comprehensive summary of results when an airline uses HF and FA simultaneously in two different multiple fare structure, competitive networks. An alternate FA formulation also will be introduced and tested in these competitive environments. Results from the Passenger Origin-Destination Simulator (PODS) demonstrate that in a more restrictive network, HF and FA used in conjunction with one another achieve revenue increases of approximately 2-4% above traditional forecasting methods. In an environment with a fully unrestricted fare structure for LCC markets, HF and FA together generate revenue gains of over 20% above traditional methods.

DTIC

Airline Operations; Commercial Aircraft; Financial Management; Forecasting; Inventory Controls; Revenue

20080039828 Federal Aviation Administration, Oklahoma City, OK USA

Vitreous Fluid and/or Urine Glucose Concentrations in 1,335 Civil Aviation Accident Pilot Fatalities

Botch, Sabra R; Chaturvedi, Arvind K; Canfield, Dennis V; Forster, Estrella M; May 2008; 14 pp.; In English

Report No.(s): AD-A482969; DOT/FAA/AM-08/11; No Copyright; Avail.: Defense Technical Information Center (DTIC)

For aviation accident investigations at the Civil Aerospace Medical Institute (CAMI), vitreous fluid and urine samples from pilot fatalities are analyzed for glucose, and in those cases wherein glucose levels are elevated, blood hemoglobin A1c (HbA1c) is measured. These analyses are conducted to monitor diabetic pilots to ensure that their disease was in control at the time of accidents and to discover other pilots with undiagnosed and unreported diabetes. In this study, the prevalence of elevated glucose concentrations in fatally injured civilian pilots is evaluated. Glucose and HbA1c are measured by hexokinase and latex immunoagglutination inhibition methodologies, respectively. The former was adopted at the beginning of 1998, while the latter in the middle of 2001. The analytical results are electronically stored in the CAMI Toxicology Database. This database was searched for pilots from whom samples were received during 1998-2005 and whose vitreous fluid and/or urine glucose concentrations were measured. HbA1c levels and information on diabetic pilots were also retrieved. The probable cause and contributing factors of the associated accidents were obtained from the National Transportation Safety Board's (NTSB's) Aviation Accident Database. Out of 1,335 pilots involving 363 vitreous fluid, 365 urine, and 607 vitreous fluid and urine analyses, 43 pilots had elevated glucose in vitreous fluid (> 125 mg/dL) and/or in urine (> 100 mg/dL). Of the 20 pilots whose blood samples were analyzed, 9 had > 6% HbA1c-4 were known diabetics (HbA1c: 7.1; 8.3; 10.8; and 12.4%), and 5 were not known diabetics (HbA1c: 6.2; 8.2; 8.3; 8.6; and 13.0%). Urinary glucose levels were elevated in all 13 known

hyperglycemic pilots. One pilot had a history of renal glycosuria (low renal threshold). The disease of the 13 diabetic pilots was not in control at the time of accidents.

DTIC

Aircraft Accidents; Civil Aviation; Glucose; Pilots; Toxicology; Urine

20080039829 Federal Aviation Administration, Oklahoma City, OK USA

Infrared Radiation Transmittance and Pilot Vision Through Civilian Aircraft Windscreens

Nakagawara, Van B; Montgomery, Ronald W; Marshall, Wesley J; Jun 2008; 18 pp.; In English

Report No.(s): AD-A482971; DOT/FAA/AM-08/15; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In support of a Department of Homeland Security project, the Federal Aviation Administration's Civil Aerospace Medical Institute measured the optical transmittance properties of aircraft windscreens. This paper focuses on windscreen transmittance in the infrared (IR) spectral region (780 - 4000 nm) of the electromagnetic spectrum. Transmission measurements were performed on eight aircraft windscreens. Three windscreens were from large commercial jets (MD 88, Airbus A320, and Boeing 727/737); two from commercial, propeller-driven passenger planes (Fokker 27 and the ATR 42); one from a small private jet (Raytheon Aircraft Corporation Hawker Horizon); and two from small general aviation (GA), single-engine, propeller-driven planes (Beech Bonanza and Cessna 182). The two GA aircraft windscreens were plastic (polycarbonate); the others were multilayer (laminated) composite glass. The average transmittance for both glass laminate and plastic windscreens in the IR-A region (780 - 1400 nm) varied considerably (47.5% - 11.7%), with glass windscreens consistently attenuating more IR than plastic windscreens. The average difference in transmittance between the two materials fluctuated (27.3% - 15.9%) throughout the first half of the IR-B spectrum (1400 - 3000 nm) up to approximately 2200 nm when transmittance dropped below 7%. The average transmittance for glass and plastic windscreens became negligible beyond 2800 nm. Aircraft windscreens provide a level of protection from potential ocular and skin hazards due to prolonged or intense exposure to IR radiation. The amount of protection is dependent on the type of windscreen material, the wavelength of the radiation, and angle of incidence. On average, laminated glass windscreens attenuate more IR than plastic.

DTIC

Civil Aviation; Infrared Radiation; Pilots; Transmittance; Vision; Windshields

20080039831 Federal Aviation Administration, Oklahoma City, OK USA

Understanding the Human Factors Associated With Visual Flight Rules Flight Into Instrument Meteorological Conditions

Detwiler, Cristy; Holcomb, Kali; Hackworth, Carla; Shappell, Scott; May 2008; 20 pp.; In English

Report No.(s): AD-A482973; DOT/FAA/AM-08/12; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Visual Flight Rules (VFR) into Instrument Meteorological Conditions (IMC) accidents are a major concern in the aviation industry. More than 70% of the fatal weather-related accidents involved General Aviation (GA) pilots operating under visual flight rules (VFR) that continued into IMC. The purpose of this study was to pair GA accident causal factors that had been classified with the Human Factors Analysis and Classification System (HFACS) categories and traditional demographic data in an effort to present a more complete picture of VFR flight into IMC accidents. To accomplish this, GA accidents associated with VFR flight into IMC were examined to determine if there were any causal factors that set these accidents apart from the rest of GA (RoGA) accidents. GA accident data (14 CFR Part 91) from 1990-2004 were analyzed. The dataset was divided into accidents that had VFR into IMC (VFR-IMC; N = 609) cited as a cause or factor versus the rest of the GA accidents (RoGA; N = 18,528). Analyses were performed examining the human error associated with these accidents.

DTIC

Aircraft Accidents; Human Factors Engineering; Visual Flight Rules; Weather

20080040152 NASA Langley Research Center, Hampton, VA, USA

Wake Turbulence Mitigation for Arrivals (WTMA)

Williams, Daniel M.; Lohr, Gary W.; Trujillo, Anna C.; September 14, 2008; 10 pp.; In English; 26th Congress of International Council of the Aeronautical Sciences (ICAS 2008), 14-19 Sep. 2008, Anchorage, AK, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 305295.02.07.07.20; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040152>

The preliminary Wake Turbulence Mitigation for Arrivals (WTMA) concept of operations is described in this paper. The WTMA concept provides further detail to work initiated by the Wake Vortex Avoidance System Concept Evaluation Team and

is an evolution of the Wake Turbulence Mitigation for Departure concept. Anticipated benefits about reducing wake turbulence separation standards in crosswind conditions, and candidate WTMA system considerations are discussed.

Author

Wakes; Wind Direction; Vortex Avoidance; Turbulence; Air Traffic Control; Instrument Approach

20080040153 NASA Langley Research Center, Hampton, VA, USA

Information Requirements for Supervisory Air Traffic Controllers in Support of a Wake Vortex Departure System

Lohr, Gary W.; Williams, Daniel M.; Trujillo, Anna C.; September 14, 2008; 10 pp.; In English; 26th Congress of International Council of the Aeronautical Sciences (ICAS 2008), 14-19 Sep. 2008, Anchorage, AK, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 305295.02.07.07.20; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040153>

Closely Space Parallel Runway (CSPR) configurations are capacity limited for departures due to the requirement to apply wake vortex separation standards from traffic departing on the adjacent parallel runway. To mitigate the effects of this constraint, a concept focusing on wind dependent departure operations has been developed, known as the Wake Turbulence Mitigation for Departures (WTMD). This concept takes advantage of the fact that crosswinds of sufficient velocity blow wakes generated by aircraft departing from the downwind runway away from the upwind runway. Consequently, under certain conditions, wake separations on the upwind runway would not be required based on wakes generated by aircraft on the downwind runway, as is currently the case. It follows that information requirements, and sources for this information, would need to be determined for airport traffic control tower (ATCT) supervisory personnel who would be charged with decisions regarding use of the procedure. To determine the information requirements, data were collected from ATCT supervisors and controller-in-charge qualified individuals at Lambert-St. Louis International Airport (STL) and George Bush Houston Intercontinental Airport (IAH). STL and IAH were chosen as data collection sites based on the implementation of a WTMD prototype system, operating in shadow mode, at these locations. The 17 total subjects (STL: 5, IAH: 12) represented a broad-base of air traffic experience. Results indicated that the following information was required to support the conduct of WTMD operations: current and forecast weather information, current and forecast traffic demand and traffic flow restrictions, and WTMD System status information and alerting. Subjects further indicated that the requisite information is currently available in the tower cab with the exception of the WTMD status and alerting. Subjects were given a demonstration of a display supporting the prototype systems and unanimously stated that the WTMD status information they felt important was represented. Overwhelmingly, subjects felt that approving, monitoring and terminating the WTMD procedure could be integrated into their supervisory workload.

Author

Wakes; Vortices; Air Traffic Controllers (Personnel); Wind Direction; Air Traffic Control; Turbulence; Air Traffic

20080040179 NASA Langley Research Center, Hampton, VA, USA

A Performance Assessment of an Airborne Separation Assistance System Using Realistic Complex Traffic Flows

Smith, Jeremy C.; Bussink, Frank J. L.; September 14, 2008; 17 pp.; In English; 8th AIAA Aviation Technology, Integration, and Operations (ATIO) Conference, 14-19 Sep. 2008, Anchorage, AK, USA; Original contains black and white illustrations

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

Report No.(s): Paper 129513; Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper presents the results from a study that investigates the performance of a tactical Airborne Separation Assistance System (ASAS) in en route airspace, under varying demand levels, with realistic traffic flows. The ASAS concept studied here allows flight crews of equipped aircraft to perform separation from other air traffic autonomously. This study addresses the tactical aspects of an ASAS using aircraft state data (i.e. position and velocity) to detect and resolve projected conflicts. In addition, use of a conflict prevention system helps ASAS-equipped aircraft avoid maneuvers that may cause new conflicts. ASAS-capable aircraft are equipped with satellite-based navigation and Automatic Dependent Surveillance Broadcast (ADS-B) for transmission and receipt of aircraft state data. In addition to tactical conflict detection and resolution (CD&R), a complete, integrated ASAS is likely to incorporate a strategic CD&R component with a longer look-ahead time, using trajectory intent information. A system-wide traffic flow management (TFM) component, located at the FAA command center helps aircraft to avoid regions of excessive traffic density and complexity. A Traffic Alert and Collision Avoidance System (TCAS), as used today is the system of last resort. This integrated approach avoids sole reliance on the use of the tactical CD&R studied here, but the tactical component remains a critical element of the complete ASAS. The focus of this paper is to determine to what extent the proposed tactical component of ASAS alone can maintain aircraft separation at demand levels up to three times that of current traffic. The study also investigates the effect of mixing ASAS-equipped aircraft with

unequipped aircraft (i.e. current day) that do not have the capability to self-separate. Position and velocity data for unequipped aircraft needs to be available to ASASequipped. Most likely, for this future concept, state data would be available from instrument flight rules (IFR) aircraft, equipped with at least ADS-B transmission capability. The objective is to reduce the number of losses of separation to a minimum and investigate the limits of tactical-only CD&R. Thus, the objective is not, expressly, to achieve zero losses of separation with tactical ASAS because this is one component of an integrated ASAS.

Author

Air Traffic; Collision Avoidance; Flight Safety; Air Traffic Control; Air Navigation; Flight Paths; Aircraft Safety

20080040180 NASA Langley Research Center, Hampton, VA, USA

Operational Improvements From the In-Trail Procedure in the North Atlantic Organized Track System

Chartrand, Ryan C.; Bussink, Frank J. L.; Graff, Thomas J.; Murdoch, Jennifer L.; Jones, Kenneth M.; September 14, 2008; 19 pp.; In English; 8th AIAA Aviation Technology, Integration, and Operations (ATIO) Conference, 14-19 Sep. 2008, Anchorage, AK, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 411931.02.51.07.01.03; Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper explains the computerized batch processing experiment examining the operational impacts of the introduction of Automatic Dependent Surveillance-Broadcast (ADS-B) equipment and the In-Trail Procedure (ITP) to the North Atlantic Organized Track System (NATOTS). This experiment was conducted using the Traffic Manager (TMX), a desktop simulation capable of simulating airspace environments and aircraft operations. ADS-B equipment can enable the use of new ground and airborne procedures, such as the ITP. The ITP is among the first of these new procedures, which will make use of improved situation awareness in the local surrounding airspace of ADS-B equipped aircraft to enable more efficient oceanic flight level changes. The data collected were analyzed with respect to multiple operationally relevant parameters including fuel burn, request approval rates, and the distribution of fuel savings. This experiment showed that through the use of ADS-B or ADS-B and the ITP that operational improvements and benefits could be achieved.

Author

Air Traffic; Flight Paths; Flight Altitude; Air Traffic Control; Collision Avoidance; Flight Control; Pilot Support Systems; Altitude Control; Spacing

20080040181 NASA Langley Research Center, Hampton, VA, USA

Impact of Pilot Delay and Non-Responsiveness on the Safety Performance of Airborne Separation

Consiglio, Maria; Hoadley, Sherwood; Wing, David; Baxley, Brian; Allen, Bonnie Danette; September 14, 2008; 11 pp.; In English; 8th AIAA Aviation Technology, Integration, and Operations (ATIO) Conference, 14-19 Sep. 2008, Anchorage, AK, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 411931.02.51.07.01; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040181>

Assessing the safety effects of prediction errors and uncertainty on automationsupported functions in the Next Generation Air Transportation System concept of operations is of foremost importance, particularly safety critical functions such as separation that involve human decision-making. Both ground-based and airborne, the automation of separation functions must be designed to account for, and mitigate the impact of, information uncertainty and varying human response. This paper describes an experiment that addresses the potential impact of operator delay when interacting with separation support systems. In this study, we evaluated an airborne separation capability operated by a simulated pilot. The experimental runs are part of the Safety Performance of Airborne Separation (SPAS) experiment suite that examines the safety implications of prediction errors and system uncertainties on airborne separation assistance systems. Pilot actions required by the airborne separation automation to resolve traffic conflicts were delayed within a wide range, varying from five to 240 seconds while a percentage of randomly selected pilots were programmed to completely miss the conflict alerts and therefore take no action. Results indicate that the strategicAirborne Separation Assistance System (ASAS) functions exercised in the experiment can sustain pilot response delays of up to 90 seconds and more, depending on the traffic density. However, when pilots or operators fail to respond to conflict alerts the safety effects are substantial, particularly at higher traffic densities.

Author

Air Transportation; Human Reactions; Flight Safety; Collision Avoidance; Flight Management Systems; Pilot Performance; Pilot Support Systems; Human-Computer Interface

20080040182 NASA Langley Research Center, Hampton, VA, USA

Pilot In-Trail Procedure Validation Simulation Study

Bussink, Frank J. L.; Murdoch, Jennifer L.; Chamberlain, James P.; Chartrand, Ryan; Jones, Kenneth M.; September 14, 2008; 8 pp.; In English; 8th AIAA Aviation Technology, Integration, and Operations (ATIO) Conference, 14-19 Sep. 2008, Anchorage, AK, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 411931.02.51.07.01.03; Copyright; Avail.: CASI: [A02](#), Hardcopy

A Human-In-The-Loop experiment was conducted at the National Aeronautics and Space Administration (NASA) Langley Research Center (LaRC) to investigate the viability of the In-Trail Procedure (ITP) concept from a flight crew perspective, by placing participating airline pilots in a simulated oceanic flight environment. The test subject pilots used new onboard avionics equipment that provided improved information about nearby traffic and enabled them, when specific criteria were met, to request an ITP flight level change referencing one or two nearby aircraft that might otherwise block the flight level change. The subject pilots subjective assessments of ITP validity and acceptability were measured via questionnaires and discussions, and their objective performance in appropriately selecting, requesting, and performing ITP flight level changes was evaluated for each simulated flight scenario. Objective performance and subjective workload assessment data from the experiment's test conditions were analyzed for statistical and operational significance and are reported in the paper. Based on these results, suggestions are made to further improve the ITP.

Author

Pilot Performance; Pilot Support Systems; Flight Management Systems; Human-Computer Interface; In-Flight Simulation; Flight Safety

20080040707 NASA Langley Research Center, Hampton, VA, USA

Development and Application of an Integrated Approach toward NASA Airspace Systems Research

Barhydt, Richard; Fong, Robert K.; Abramson, Paul D.; Koenke, Ed; September 14, 2008; 14 pp.; In English; 8th AIAA Aviation Technology, Integration, and Operations (ATIO) Conference, 14-19 Sep. 2008, Anchorage, AK, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 4119310207070101; Copyright; Avail.: CASI: [A03](#), Hardcopy

The National Aeronautics and Space Administration's (NASA) Airspace Systems Program is contributing air traffic management research in support of the 2025 Next Generation Air Transportation System (NextGen). Contributions support research and development needs provided by the interagency Joint Planning and Development Office (JPDO). These needs generally call for integrated technical solutions that improve system-level performance and work effectively across multiple domains and planning time horizons. In response, the Airspace Systems Program is pursuing an integrated research approach and has adapted systems engineering best practices for application in a research environment. Systems engineering methods aim to enable researchers to methodically compare different technical approaches, consider system-level performance, and develop compatible solutions. Systems engineering activities are performed iteratively as the research matures. Products of this approach include a demand and needs analysis, system-level descriptions focusing on NASA research contributions, system assessment and design studies, and common system-level metrics, scenarios, and assumptions. Results from the first systems engineering iteration include a preliminary demand and needs analysis; a functional modeling tool; and initial system-level metrics, scenario characteristics, and assumptions. Demand and needs analysis results suggest that several advanced concepts can mitigate demand/capacity imbalances for NextGen, but fall short of enabling three-times current-day capacity at the nation's busiest airports and airspace. Current activities are focusing on standardizing metrics, scenarios, and assumptions, conducting system-level performance assessments of integrated research solutions, and exploring key system design interfaces.

Author

Aerospace Systems; Airspace; Management Planning; Systems Engineering; Air Traffic

20080040745 NASA Langley Research Center, Hampton, VA, USA

Simulation Results for Airborne Precision Spacing along Continuous Descent Arrivals

Barmore, Bryan E.; Abbott, Terence S.; Capron, William R.; Baxley, Brian T.; September 14, 2008; 13 pp.; In English; 8th AIAA Aviation Technology, Integration, and Operations (ATIO) Conference, 14-19 Sep. 2008, Anchorage, AK, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 411931.02.61.07.01; Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper describes the results of a fast-time simulation experiment and a high-fidelity simulator validation with merging streams of aircraft flying Continuous Descent Arrivals through generic airspace to a runway at Dallas-Ft Worth. Aircraft made small speed adjustments based on an airborne-based spacing algorithm, so as to arrive at the threshold exactly at the assigned

time interval behind their Traffic-To-Follow. The 40 aircraft were initialized at different altitudes and speeds on one of four different routes, and then merged at different points and altitudes while flying Continuous Descent Arrivals. This merging and spacing using flight deck equipment and procedures to augment or implement Air Traffic Management directives is called Flight Deck-based Merging and Spacing, an important subset of a larger Airborne Precision Spacing functionality. This research indicates that Flight Deck-based Merging and Spacing initiated while at cruise altitude and well prior to the Terminal Radar Approach Control entry can significantly contribute to the delivery of aircraft at a specified interval to the runway threshold with a high degree of accuracy and at a reduced pilot workload. Furthermore, previously documented work has shown that using a Continuous Descent Arrival instead of a traditional step-down descent can save fuel, reduce noise, and reduce emissions. Research into Flight Deck-based Merging and Spacing is a cooperative effort between government and industry partners.

Author

Aircraft Approach Spacing; Approach Control; Computerized Simulation; Air Traffic Control; Descent Trajectories; Aircraft Safety

04

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.

20080039643 NASA Dryden Flight Research Center, Edwards, CA, USA

Large Unmanned Aircraft System Operations in the National Airspace System - the NASA 2007 Western States Fire Missions

Buoni, Gregory P.; Howell, Kathleen M.; September 14, 2008; 17 pp.; In English; 8th AIAA Aviation Technology, Integration, and Operations Conference, 14-19 Sep. 2008, Anchorage, AK, USA; Original contains color illustrations; No Copyright;

Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039643>

The National Aeronautics and Space Administration (NASA) Dryden Flight Research Center (DFRC) Ikhana (ee-kah-nah) project executed the 2007 Western States Fire Missions over several of the western USA using an MQ-9 unmanned aircraft system (UAS) in partnership with the NASA Ames Research Center, the USA Forest Service, and the National Interagency Fire Center. The missions were intended to supply infrared imagery of wildfires to firefighters on the ground within 10 minutes of data acquisition. For each of the eight missions, the NASA DFRC notified the Federal Aviation Administration (FAA) of specific flight plans within three or fewer days of the flight. The FAA Certificate of Waiver or Authorization (commonly referred to as a COA) process was used to obtain access to the USA National Airspace System. Significant time and resources were necessary to develop the COA application, perform mission planning, and define and approve emergency landing sites. Unique aspects of flying unmanned aircraft created challenges to mission operations. Close coordination with FAA headquarters and air traffic control resulted in safe and successful missions that assisted firefighters by providing near-real-time imagery of selected wildfires.

Author

National Airspace System; Forest Fires; Pilotless Aircraft; Infrared Imagery; Mission Planning; Real Time Operation; NASA Programs; Air Traffic Control; Emergency Landing

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.

20080039219 Army Research Inst. for the Behavioral and Social Sciences, Orlando, FL USA

Training to Operate a Simulated Micro-Unmanned Aerial Vehicle With Continuous or Discrete Manual Control

Durlach, Paula J; Neumann, John L; Billings, Deborah R; May 2008; 76 pp.; In English

Contract(s)/Grant(s): Proj-A790

Report No.(s): AD-A482410; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482410>

This report investigates the effects of continuous vs. discrete control methods and the number of simultaneous camera

views on operator performance during training to manually control a simulated micro-unmanned aerial vehicle (MAV). Seventy-two participants were trained to operate a MAV in a simulated environment, to designated criterion levels. They were then given training missions during which performance was measured. Eight conditions were investigated, formed by crossing three 2-level factors: input device (mouse vs. game controller), input control display (discrete vs. continuous), and number of simultaneous camera views (one vs. two). Superior performance was observed when a continuous input method (e.g., multiple degrees of freedom) was provided for continuous MAV functions (e.g. maneuvering in space) and a discrete input method (e.g., single action) was provided for discrete MAV functions (e.g., command to hover). Under these conditions, mission times were shorter, collisions were fewer, and more targets were photographed. Effects of video game experience and spatial ability were also investigated. Recommendations for the design of unmanned vehicle controls were discussed.

DTIC

Drone Vehicles; Education; Human-Computer Interface; Manual Control; Pilotless Aircraft; Remote Control; Simulation

20080039297 Shimokaji and Associates P.C., Irvine, CA, USA

Pressurized Sonobuoy Deployment System

Pitzer, J. W., Inventor; Olsen, M., Inventor; 15 Oct 04; 17 pp.; In English

Patent Info.: Filed 15 Oct 04; US-Patent-Appl-SN-10-966 201

Report No.(s): PB2008-103585; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A jet aircraft with integrated, rotary sonobuoy launch system has storage racks for a number of sonobuoys in sonobuoy launch containers; and one or more launcher units in its cabin. Each launcher unit has a pressure shell with a door allowing loading of sonobuoys in sonobuoy launch containers from the storage racks. With the door closed, the inside of the shell can be depressurized for launching a sonobuoy by opening a gate valve that connects the interior of the shell to the exterior of the aircraft. With the gate valve closed, the shell can be pressurized so that the door can be opened and sonobuoys reloaded. A control system can be used to rotate a rotary launcher inside each pressure shell so that a selected sonobuoy is moved to a launch position above the gate valve and a launch tube, and a pneumatic system can be used to launch the sonobuoy.

NTIS

Deployment; Jet Aircraft; Launching; Patent Applications; Sonobuoys

20080039368 Test Wing (0412th), Edwards AFB, CA USA

Limited Evaluation of Handling Qualities for a Supersonic Tailless Air Vehicle (Project HAVE STAV)

Speares, Steven W; Cook, Nathan L; Domsalla, Matthew R; Porter, Jason B; Quashnock, James W; Neff, Brian J; Dec 2007; 80 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482575; AFFTC-TIM-07-07; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report presents the results of Project HAVE STAV, a limited evaluation of the handling qualities for a Supersonic Tailless Air Vehicle (STAV). This test program used the Calspan-operated Total In-Flight Simulator to test the powered approach handling qualities of a Northrop Grumman STAV model. The test team developed an optimized control system prior to flight testing. The handling qualities were determined using the STAV model coupled with either the baseline or optimized control system. The USAF Test Pilot School, Class 07A, conducted six flight test sorties totaling ten hours at Niagara Falls International Airport, New York, from 10 to 13 Sep 2007. Flight testing included a series of precision and lateral offset landing tasks, which were accomplished at different crosswind conditions. All test objectives were met.

DTIC

Controllability; Evaluation; Flight Simulators; System Effectiveness; Tailless Aircraft; Test Vehicles

20080039412 Air Force Research Lab., Wright-Patterson AFB, OH USA

Quantifying the Effect Of Fuselage Cross-Sectional Shape on Structural Weight (PREPRINT)

Falugi, Michael A; Mar 2007; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-A0AE

Report No.(s): AD-A482710; AFRL-RB-WP-TP-2007-3100; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Analytical trade studies were set up and are being performed to quantify the effect of fuselage cross-sectional shape on structural weight for a cargo transport aircraft. The target vehicle design reflects various geometry, aerodynamic and inertia loads, internal pressurization, and other requirements associated with a medium-sized military transport configuration. Several elliptical cross-sections and at least one cross section containing one or more flat (LO-friendly) outer mold line segments are being evaluated. Aerodynamic loading on the fuselage is being accounted for in the trades. FEM generation and analysis

includes automated structural sizing for the cargo compartment portion of the fuselage using HyperSizer. The results of this study will be used to influence decisions regarding the shape preferences for potential fuselage design candidates. The models that are created can also be used to support additional in-house trade studies to look at new structural materials and design concept candidates for transport fuselage primary structure.

DTIC

Fuselages; Shapes; Structural Weight; Transport Aircraft

20080039672 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Damage Detection Analysis Using Lamb Waves in Restricted Geometry for Aerospace Applications

Underwood, Roman T; Mar 2008; 83 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482728; AFIT/GAE/ENY/08-M29; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482728>

A goal of structural health monitoring (SHM) is to increase aircraft readiness through condition based maintenance (i.e. servicing an aircraft only when it is known to be necessary). The lead zirconate titanate (PZT) is a commonly used piezoelectric transducer that has shown potential to detect damage in aircraft structures without time consuming manual inspections. But many locations identified by the USAF for SHM have restricted geometries, presenting difficulties using the PZT transducers successfully. One known fatigue location in an aircraft bulkhead has been selected as a basis to evaluate some of the challenges of using PZT transducers for SHM. The goal of this research is use analytical and experimental investigations to detect fatigue cracks in plates representing the restricted geometry of the aircraft bulkhead. This research shows that detecting closed fatigue cracks can be more challenging than detecting open cracks, but that opening the cracks using an applied static load presents new challenges.

DTIC

Aerospace Engineering; Crack Propagation; Damage; Damage Assessment; Detection; Lamb Waves

20080039707 Library of Congress, Washington, DC USA

Homeland Security: Unmanned Aerial Vehicles and Border Surveillance

Bolkcom, Christopher; Nunez-Neto, Blas; May 13, 2008; 7 pp.; In English

Report No.(s): AD-A482803; CRS-RS21698; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482803>

Within the Department of Homeland Security (DHS), Customs and Border Protection (CBP) is the lead agency charged with securing our nation's borders. While CBP is charged with overall border enforcement, within the bureau a distinction is made concerning border enforcement at and between ports of entry (POE). At POE, CBP officers are responsible for conducting immigrations, customs, and agricultural inspections on individuals presenting themselves for entry into the USA. Between POE, the USA Border Patrol (USBP) is charged with detecting and preventing the entry of terrorists, weapons of mass destruction, and unauthorized aliens into the country, and interdicting drug smugglers and other criminals. Congress has expressed a great deal of interest in using Unmanned Aerial Vehicles (UAVs) to surveil the USA' international land border. This report examines the strengths and limitations of deploying UAVs along the borders and related issues for Congress. This report will be updated as events warrant.

DTIC

Cost Effectiveness; Drone Vehicles; Pilotless Aircraft; Remotely Piloted Vehicles; Surveillance; System Effectiveness

20080039712 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

A Secure Group Communication Architecture for a Swarm of Autonomous Unmanned Aerial Vehicles

Phillips, Adrian N; Mar 2008; 128 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482818; AFIT/GCE/ENG/08-09; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482818>

This thesis investigates the application of a secure group communication architecture to a swarm of autonomous unmanned aerial vehicles (UAVs). A multicast secure group communication architecture for the low earth orbit (LEO) satellite environment is evaluated to determine if it can be effectively adapted to a swarm of UAVs and provide secure, scalable, and efficient communications. The performance of the proposed security architecture is evaluated with two other commonly used architectures using a discrete event computer simulation developed using MatLab. Performance is evaluated in terms of the scalability and efficiency of the group key distribution and management scheme when the swarm size, swarm mobility,

multicast group join and departure rates are varied. The metrics include the total keys distributed over the simulation period, the average number of times an individual UAV must rekey, the average bandwidth used to rekey the swarm, and the average percentage of battery consumed by a UAV to rekey over the simulation period. The proposed security architecture can successfully be applied to a swarm of autonomous UAVs using current technology. The proposed architecture is more efficient and scalable than the other tested and commonly-used architectures. Over all the tested configurations, the proposed architecture distributes 55.2 - 94.8% fewer keys, rekeys 59.0 - 94.9% less often per UAV, uses 55.2 - 87.9% less bandwidth to rekey, and reduces the battery consumption by 16.9 - 85.4%.

DTIC

Architecture (Computers); Autonomy; Computerized Simulation; Drone Vehicles; Pilotless Aircraft; Telecommunication

20080039724 Library of Congress, Washington, DC USA

Proposed Termination of Joint Strike Fighter (JSF) F136 Alternate Engine

Murch, Anthony; Bolcom, Christopher; Jun 2, 2008; 28 pp.; In English

Report No.(s): AD-A482842; CRS-RL33390; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482842>

The Department of Defense's (DOD) FY2009 budget proposes to cancel the F136 alternate engine for the F-35 Joint Strike Fighter (JSF), a program that was initiated by Congress in the FY1996 Defense Authorization Act, and which has received consistent congressional support since its inception. DOD also proposed terminating the F136 in both its FY2007 and FY2008 budgets; however, Congress rejected both of these proposals. In FY1996, defense authorization conferees (H.Rept. 104-450, Sec. 213) expressed their concern over a lack of engine competition in the JSF program and directed DOD to ensure that the program 'provides for adequate engine competition.' (p.706)1. In FY1998, authorization conferees (H.Rept. 105-340, Sec. 213) directed DOD to certify that 'the Joint Strike Fighter Program contains sufficient funding to carry out an alternate engine development program that includes flight qualification of an alternate engine in a joint strike fighter airframe.' (p.33) Since its inception in 1997, both DOD and Congress have funded \$2.1 billion for the Joint Strike Fighter alternate engine program. The alternate engine program is expected to need an additional \$1.3 billion through 2013 to complete the development of the F136 engine. Some have criticized DOD and the Air Force for being short-sighted with its proposal to terminate the F136 alternate engine. Critics of the decision, not to mention OSD and the Air Force itself during testimony before Congress, note that it was driven more by immediate budget pressures on the department rather than long term pros and cons of the F136 engine program. Others applaud this decision, and say that single source engine production contracts have been the norm, not the exception. Long-term engine affordability, they claim, is best achieved by procuring engines through multiyear contracts from a single source.

DTIC

Fighter Aircraft; Jet Aircraft; Jet Engines; Warfare

20080039739 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Optimal Guidance of a Relay MAV for ISR Support Beyond Line-of-Sight

Hansen, John H; Mar 2008; 61 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-JON; Proj-95

Report No.(s): AD-A482870; AFIT/GAE/ENG/08-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482870>

This thesis developed guidance laws to optimally position a relay Micro-UAV (MAV) to provide an operator with real-time Intelligence, Surveillance, and Reconnaissance (ISR) by relaying communication and video signals when there is no line-of-sight between the operator at the base and the rover MAV performing the ISR mission. The ISR system consists of two MAVs, the Relay and the Rover, and a Base. The Relay strives to position itself to minimize the radio frequency (RF) power required for maintaining communications between the Rover and the Base, while the Rover performs the ISR mission, which may maximize the required RF power. The optimal control of the Relay MAV then entails the solution of a differential game. Applying Pontryagin's Maximum Principle yields a nonlinear Two-Point Boundary Value Problem (TPBVP). Suboptimal solutions are also analyzed to aid in solving the TPBVP which yields the solution of the differential game. One suboptimal approach is based upon the geometry of the ISR system. Another suboptimal approach envisions a stationary Rover and solves for the optimal path for the Relay. Both suboptimal approaches showed that the optimal path for the Relay is to head straight toward the midpoint between the Rover and the Base.

DTIC

Line of Sight; Optimal Control

20080039836 Federal Aviation Administration, Oklahoma City, OK USA

Laser Illumination of Aircraft by Geographic Location for a 3-Year Period (2004-2006)

Nakagawara, Van B; Montgomery, Ron W; Wood, Kathy J; Jun 2008; 18 pp.; In English

Report No.(s): AD-A482979; DOT/FAA/AM-08/14; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Incidents involving laser illumination of aircraft in the National Airspace System have raised concerns within the aviation community for more than a decade. The principal concern is the visual effect laser illumination may have on flight crew performance during terminal operations, such as landing and departure maneuvers, when operational activities are extremely critical. This 3-year study examines the frequency and rate of aviation-related laser incidents by year and location. Incident reports of civilian aircraft illuminated by high-intensity lights have been collected from various sources and entered into a database maintained by the Vision Research Team at the Civil Aerospace Medical Institute. Reported incidents of laser exposure of civilian aircraft in the USA for a 3-year period (January 1, 2004 to December 31, 2006) were collated and analyzed. A total of 832 incidents during the study period took place within the USA in the nine FAA-designated regions. For the period, total laser incident rates per 100,000 flight operations ranged from zero in the Alaskan region to 0.86 in the Western Pacific Region. Of the 202 airports where laser incidents occurred, there were 20 (9.9%) that reported 10 or more laser incidents during the study period. The majority of airports (52.6%) with 10 or more laser incidents reported a higher number of incidents in 2005 than in 2006. Laser illumination incidents that could compromise aviation safety and threaten flight crew vision performance occur with some regularity within the contiguous USA. While the study data indicate the Western Pacific Region had a significantly higher prevalence rate than the other FAA regions, analysis was complicated by incident clusters that occurred randomly at various airports.

DTIC

Aircraft; Laser Beams; Lasers; Position (Location)

20080039843 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

A Novel Communications Protocol Using Geographic Routing for Swarming UAVs Performing a Search Mission

Lidowski, Robert L; Mar 2008; 126 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482997; AFIT/GCS/ENG/08-14; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research develops the UAV Search Mission Protocol (USMP) for swarming UAVs and determines the protocol's effect on search mission performance. It is hypothesized that geographically routing USMP messages improves search performance by providing geography-dependent data to locations where it impacts search decisions. It is also proposed that the swarm can use data collected by the geographic routing protocol to accurately determine UAV locations and avoid sending explicit location updates. The hypothesis is tested by developing several USMP designs that are combined with the Greedy Perimeter Stateless Routing (GPSR) protocol and a search mission swarm logic into a single network simulation. The test designs use various transmission power levels, sensor types and swarm sizes. The simulation collects performance metrics for each scenario, including measures of distance traveled, UAV direction changes, number of searches and search concentration. USMP significantly improves mission performance over scenarios without inter-UAV communication. However, protocol designs that simply broadcast messages improve search performance by 83% in total searches and 20% in distance traveled compared to geographic routing candidates. Additionally, sending explicit location updates generates 3%-6% better performance per metric versus harvesting GPSR's location information.

DTIC

Broadcasting; Communication Networks; Drone Vehicles; Geographic Information Systems; Global Positioning System; Protocol (Computers); Swarming; Wireless Communication

20080039851 New South Wales Univ., Sydney, Australia

Multi-Fidelity Analysis for Human-in-the-Loop Search and Tracking

Furukawa, Tomonari; Jun 2008; 42 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA48690714099

Report No.(s): AD-A483020; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The aim of this project is to achieve multi-fidelity analysis for the multi-objective control of a team of unmanned aerial vehicles (UAVs) with humans in the loop of the estimation and control framework. The successful participation of humans in the loop for dynamically changing environments depends heavily on the reliability of data measured and information constructed by the UAVs. The multi-fidelity analysis proposed in the project enables real-time adjustment for computationally heavy search and tracking operations and further extracts quantities from the adjustment in the form of reliability.

DTIC

Computer Vision; Drone Vehicles

20080039868 Army Aviation Technical Test Center, Fort Rucker, AL USA

Test Operations Procedure (TOP) 7-3-057 Pitot-Static System Calibrations

Apr 10, 2008; 35 pp.; In English; Original contains color illustrations

Report No.(s): AD-A483064; TOP-7-3-057; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This Test Operations Procedure (TOP) describes the test requirements, objectives, responsibilities, and techniques/methodologies required to perform pitot-static system calibrations. This TOP is used for rotary-wing and fixed-wing aircraft. The TOP will facilitate test planning, execution, and data collection using two techniques (trailing device and pace) and the equipment required to complete pitot-static system calibrations. Variations in platform requirements are discussed within this TOP. These guidelines, along with platform specific capabilities and requirements, will enable the tester to develop a comprehensive testing strategy.

DTIC

Calibrating; Flight Tests; Rotary Wing Aircraft; Statics

20080040187 NASA Langley Research Center, Hampton, VA, USA

Probabilistic Analysis and Design of a Raked Wing Tip for a Commercial Transport

Mason Brian H.; Chen, Tzi-Kang; Padula, Sharon L.; Ransom, Jonathan B.; Stroud, W. Jefferson; September 10, 2008; 20 pp.;

In English; 12th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference, 10-12 Sep. 2008, Victoria, Canada; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 659877.02.07.03.89J0.03

Report No.(s): Paper Number 5824; Copyright; Avail.: CASI: [A03](#), Hardcopy

An approach for conducting reliability-based design and optimization (RBDO) of a Boeing 767 raked wing tip (RWT) is presented. The goal is to evaluate the benefits of RBDO for design of an aircraft substructure. A finite-element (FE) model that includes eight critical static load cases is used to evaluate the response of the wing tip. Thirteen design variables that describe the thickness of the composite skins and stiffeners are selected to minimize the weight of the wing tip. A strain-based margin of safety is used to evaluate the performance of the structure. The randomness in the load scale factor and in the strain limits is considered. Of the 13 variables, the wing-tip design was controlled primarily by the thickness of the thickest plies in the upper skins. The report includes an analysis of the optimization results and recommendations for future reliability-based studies.

Author

Aircraft Design; Design Analysis; Design Optimization; Wing Tips; Airfoil Profiles; Finite Element Method

20080040693 NASA Dryden Flight Research Center, Edwards, CA, USA

Multidisciplinary Design, Analysis, and Optimization Tool Development using a Genetic Algorithm

Pak, Chan-gi; Li, Wesley; September 15, 2008; 20 pp.; In English; 26th ICAS Congress Conference, 14 - 19 Sep. 2008, Anchorage, Alaska, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A03](#),

Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040693>

Multidisciplinary design, analysis, and optimization using a genetic algorithm is being developed at the National Aeronautics and Space Administration Dryden Flight Research Center to automate analysis and design process by leveraging existing tools such as NASTRAN, ZAERO and CFD codes to enable true multidisciplinary optimization in the preliminary design stage of subsonic, transonic, supersonic, and hypersonic aircraft. This is a promising technology, but faces many challenges in large-scale, real-world application. This paper describes current approaches, recent results, and challenges for MDAO as demonstrated by our experience with the Ikhana fire pod design.

Author

Algorithms; Computational Fluid Dynamics; Design Analysis; Genetic Algorithms; Multidisciplinary Design Optimization; Aircraft Design

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.

20080039319 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Demonstration of a Balloon Borne Arc-Second Pointer Design

DeWeese, Keith D.; Ward, Philip R.; July 16, 2006; 10 pp.; In English; 36th COSPAR Scientific Assembly, 16 - 23 Jul. 2006, Beijing, China; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039319>

Many designs for utilizing stratospheric balloons as low-cost platforms on which to conduct space science experiments have been proposed throughout the years. A major hurdle in extending the range of experiments for which these vehicles are useful has been the imposition of the gondola dynamics on the accuracy with which an instrument can be kept pointed at a celestial target. A significant number of scientists have sought the ability to point their instruments with jitter in the arc-second range. This paper presents the design and analysis of a stratospheric balloon borne pointing system that is able to meet this requirement. The test results of a demonstration prototype of the design with similar ability are also presented. Discussion of a high fidelity controller simulation for design analysis is presented. The flexibility of the flight train is represented through generalized modal analysis. A multiple controller scheme is utilized for coarse and fine pointing. Coarse azimuth pointing is accomplished by an established pointing system, with extensive flight history, residing above the gondola structure. A pitch-yaw gimbal mount is used for fine pointing, providing orthogonal axes when nominally on target. Fine pointing actuation is from direct drive dc motors, eliminating backlash problems. An analysis of friction nonlinearities and a demonstration of the necessity in eliminating static friction are provided. A unique bearing hub design is introduced that eliminates static friction from the system dynamics. A control scheme involving linear accelerometers for enhanced disturbance rejection is also presented. Results from a linear analysis of the total system and the high fidelity simulation are given. Results from a generalized demonstration prototype are presented. Commercial off-the-shelf (COTS) hardware was used to demonstrate the efficacy and performance of the pointer design for a mock instrument. Sub-arcsecond pointing ability from a ground hang test setup is shown from the testing results. This paper establishes that the proposed control strategy can be made robustly stable with significant design margins. Also demonstrated is the efficacy of the proposed system in rejecting disturbances larger than those considered realistic. The system is implemented and demonstrates sub arc second pointing ability using COTS hardware. Finally, we see that sub arc-second pointing stability can be achieved for a large instrument pointing at an inertial target.

Author

Design Analysis; Stratosphere; Pointing Control Systems; High Altitude Balloons; Vibration; Balloon-Borne Instruments; Astronomical Observatories

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.

20080039494 Beulick (John S.), Saint Louis, MO, USA

Gas Turbine Engine and Method of Assembling Same

Henry, J. L., Inventor; 29 Oct 04; 7 pp.; In English

Contract(s)/Grant(s): MDA972-01-3-002; F33615-01-C-2184

Patent Info.: Filed Filed 29 Oct 04; US-Patent-Appl-SN-10-976 382

Report No.(s): PB2008-103124; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A method of assembling a gas turbine engine that includes rotatably coupling a first low-pressure turbine rotor to a high-pressure turbine, rotatably coupling a second low pressure turbine rotor to the first low-pressure turbine rotor, and rotatably coupling the second low-pressure turbine rotor to a turbine rear-frame such that a weight of the high-pressure turbine is transmitted to the turbine rear-frame.

NTIS

Gas Turbine Engines; Patent Applications; Assembling

20080039499 Devault (Krieg) , LLP, Indianapolis, IN, USA

Dual Counterweight Balancing System

Roever, D. M., Inventor; Norris, C. J., Inventor; 20 Oct 04; 15 pp.; In English

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

Patent Info.: Filed Filed 20 Oct 04; US-Patent-Appl-SN-10-969 309

Report No.(s): PB2008-103141; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A system for balancing a rotatable gas turbine engine component. The system includes two balance rings that are coupled to the component by mating splines on the respective item. Each of the rings has a mass asymmetry that is indexable relative to the primary component to achieve the imbalance correction.

NTIS

Balancing; Gas Turbine Engines; Patent Applications

20080039665 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Direct Initiation Through Detonation Branching in a Pulsed Detonation Engine

Hausman, Alexander R; Mar 2008; 93 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482719; AFIT/GAE/ENY/08-M17; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482719>

Pulsed Detonation Engines are currently limited in operating frequency to the order of 40 Hz due to lengthy ignition and deflagration to detonation transition (DDT) times. An experimental study is conducted to determine the requirements necessary to eliminate these constraints through the concept of direct initiation. A branched detonation crossover setup is constructed and the operational requirements are determined. This research demonstrates the ability to directly initiate a detonation in a vacant tube from a detonation obtained through detonation branching. Using a hydrogen-air mixture, a tail-to-head detonation branching is achieved in which a detonation is seen to propagate from a spark ignited detonation tube, through a crossover tube and across a 1:2 diameter expansion ratio into a vacant second detonation tube. This effectively eliminates the ignition and DDT times associated with the conventional operation of the second tube. The closed-end pressure trace of a transferred detonation as deemed successful through wave speed measurements is analyzed and further solidifies the findings.

DTIC

Detonation; Pulse Detonation Engines; Pulsejet Engines

20080040783 NASA Glenn Research Center, Cleveland, OH, USA

An Investigation of Noise Reduction for the 3BB Nozzle with a Pylon Using External Flaps

Zaman, K. B. M. Q.; July 2008; 23 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.17.04

Report No.(s): NASA/TM-2008-215288; E-16562; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040783>

Flaps (or half wedges) attached to the sides of a pylon are shown to result in a small but clear noise benefit. Noise radiated towards the ground is reduced apparently through a deflection and thickening of the fan stream underneath. Based on results from the current as well as concurrent investigations at the University of California at Irvine, it is recommended that further tests in a larger facility simulating realistic engine conditions be considered.

Author

Jet Aircraft Noise; Aircraft Engines; Noise Reduction; Nozzles; Pylons

RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, runways, hangars, and aircraft repair and overhaul facilities; wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems. For airport ground operations see *03 Air Transportation and Safety*. For astronomical facilities see *14 Ground Support Systems and Facilities (Space)*.

20080039788 Defence Science and Technology Organisation, Salisbury, Australia

The Installation Requirements and Procedures for the Omnidirectional Ground Plane Corner Reflector

Triggs, R; Sep 1986; 23 pp.; In English

Report No.(s): AD-A482900; ERL-0383-MA; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A new type of radar enhancement device, the Ground Plane Corner Reflector (GPCR), has been developed and patented by the Electronics Research Laboratory (ERL) at the Defence Research Centre Salisbury (DRCS), South Australia. This manual describes the requirements and procedures recommended for installing a GPCR system on an airfield.

DTIC

Installing; Landing Sites; Radar Beacons; Radar Corner Reflectors

20080039847 Army Command and General Staff Coll., Fort Leavenworth, KS USA

Evaluating Point-of-Sale Alternatives within Naval Aviation

Davidson, Daniel D; Jun 13, 2008; 89 pp.; In English; Original contains color illustrations

Report No.(s): AD-A483003; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Base Realignment and Closure Commission (BRAC) 2005 decision resulted in the consolidation of Naval Air Depots (NADEPs) and non-deployable Aircraft Intermediate Maintenance Departments (AIMDs) to form six Fleet Readiness Centers (FRCs). The intent behind this consolidation is to avoid redundant maintenance procedures, supply overhead charges and reduce aviation maintenance costs. The Department of Defense (DoD) estimates FRCs will yield \$3.7 billion in net savings over 20 years. This is more savings than any other of the 2005 BRAC recommendations. This consolidation presents the opportunity to examine potentially significant changes within current NADEP, AIMD and supply support processes in order to gain the efficiencies that are required to yield the expected savings. This thesis models three Point-of-Sale (POS) alternatives to improve cost wise readiness (CWR). A POS is described as the location where a financial transaction occurs. CWR in very simple terms is dollar-for-dollar readiness. The POS alternatives are to maintain the status quo (do nothing), move the transaction closer to the customer (the Squadron), or move the transaction closer to the supplier (the Original Equipment Manufacturer). The question as to which POS alternative is the most effective and efficient arises as a result of the consolidation.

DTIC

Alternatives; Estimates; Maintenance; Military Aviation

20080040678 NASA Glenn Research Center, Cleveland, OH, USA

Altitude Wind Tunnel at NASA Glenn Research Center: An Interactive History

2008; In English; Original contains color and black and white illustrations

Report No.(s): NASA/SP-2008-4608; No Copyright; Avail.: CASI: [C01](#), CD-ROM

When constructed in the Early 1940s, the Altitude Wind Tunnel (AWT) at NASA Glenn Research Center was the nation's only wind tunnel capable of studying full scale engines under realistic flight conditions. It played a significant role in the development of the first U.S. jet engines as well as technologies such as the afterburner and variable-area nozzle. In the late 1950s, the tunnels interior components were removed so that hardware for Project Mercury could be tested in altitude conditions. In 1961, a portion of the tunnel was converted into one of the country's first large vacuum tanks and renamed the Space Power Chamber (SPC). SPC was used extensively throughout the 1960s for the Centaur rocket program. This multimedia piece allows one to interactively learn about the Altitude Wind Tunnel facility. and the research performed there. The piece contains: (1) A chronological history of the AWT from its construction during World War II and the testing of early jet engines, through the Mercury and Centaur programs of the 1960s and up to the final use of the building for the Microwave Systems laboratory. (2) Photographic surveys of the facility in it wind tunnel, vacuum tank and final configurations. (3) Browseable gallery of over 200 captioned photographs and video clips.(4) A nine minute documentary of the AWT produced by NASA in 1961 (5) Links to over 70 reports and publications related to AWT research and the history of the NACA.

Derived from text

Flight Conditions; Microwave Equipment; Vacuum Chambers; Wind Tunnels; High Altitude; Histories

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*.

20080039640 NASA Glenn Research Center, Cleveland, OH, USA

Transient Thermal Model and Analysis of the Lunar Surface and Regolith for Cryogenic Fluid Storage

Christie, Robert J.; Plachta, David W.; Yasan, Mohammad M.; August 2008; 20 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC06BA07B; WBS 439906.04.01.02.01

Report No.(s): NASA/TM-2008-215300; E-16569; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039640>

A transient thermal model of the lunar surface and regolith was developed along with analytical techniques which will be used to evaluate the storage of cryogenic fluids at equatorial and polar landing sites. The model can provide lunar surface and subsurface temperatures as a function of latitude and time throughout the lunar cycle and season. It also accounts for the presence of or lack of the undisturbed fluff layer on the lunar surface. The model was validated with Apollo 15 and Clementine data and shows good agreement with other analytical models.

Author

Cryogenic Fluid Storage; Lunar Surface; Regolith; Thermal Analysis; Surface Temperature

20080039669 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Evaluation of Nanocomposites as Lightweight Electronic Enclosures for Satellites' Applications

Harder, Benjamin T; Jun 2008; 98 pp.; In English

Report No.(s): AD-A482724; AFIT/GMS/ENY/08-J01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482724>

The USA military is exploring the use of nanocomposite materials for satellite structural applications. Current composite spacecraft structures are nonconductive and must have expensive shielding materials applied in order to protect the spacecraft from catastrophic damage that can be caused by electromagnetic interference (EMI) and/or electrostatic discharge (ESD) which are characteristics of the space environment. Conductive nanocomposites are being developed for spacecraft structures that will provide ESD and EMI shielding protection without the need for expensive secondary shielding materials. This thesis studied one such material consisting of M55J/RS-3 composite combined with nickel nanostrands™. Four different configurations were tested for their ultimate tensile strength (UTS) and EMI shielding properties before and after exposure to the space environment. The four configurations tested were a baseline panel consisting of M55J/RS-3 and three configurations with different layers of nickel nanostrands™ added to the control specimen: exterior, interlaminar, and mid-plane. These four were further tested for their EMI and resistivity properties before, during and after monotonic tension tests of increasing loads up to fracture. This study found that the UTS and Young's modulus (E) do not change after exposure to the space environment, EMI shielding of the exterior specimen is 25% better than the control specimen, sheet resistance measurements show that exterior specimens are 11% better at ESD protection than the control, and failure mechanisms are the same regardless of composite configuration: The 90 plies failed first, causing delamination in the 0/90 plies leading to transverse matrix cracking and delamination in the 45 plies resulting in ultimate failure, and in all configurations the nanostrand layers were not damaged.

DTIC

Artificial Satellites; Composite Materials; Composite Structures; Electric Discharges; Nanocomposites

13
ASTRODYNAMICS

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

20080040116 Air Force Research Lab., Edwards AFB, CA USA

Self-Passivation of POSS-Kapton-Polyimides in the Presence of Atomic Oxygen (Preprint)

Tomczak, Sandra J; Wright, Michael E; Vij, Vandana; Minton, Timothy K; Brunsvold, Amy L; Petteys, Brian J; Guenther, Andrew J; Yandek, Gregory; Mabry, Joseph M; Oct 29, 2007; 5 pp.; In English

Contract(s)/Grant(s): Proj-DARPA443

Report No.(s): AD-A483018; AFRL-RZ-ED-TP-2007-462; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Evidence for the formation of a protective silica layer on the surface of POSS-Kapton(Registered)-PIs upon exposure to AO was found in X-Ray Photoelectron Spectroscopy (XPS) studies of POSS-Kapton(R)-PIs flown on the Materials International Space Station Experiment (MISSE1), and in separate studies of POSS-Kapton(R)-PIs exposed to AO in a ground-based facility. To directly compare the effect of AO on Kapton H(R), SiO₂ coated Kapton HN(R), and 8.75 weight % SiO₂ cage 'main-chain' POSS-Kapton(R)-polyimide (8.75 wt % SiO₂ MC-POSS-PI), these materials were exposed to AO, scratched, and exposed to a second equivalent AO fluence. The erosion of the three materials, inside and outside of the scratched area, was monitored by stylus surface profilometry. The results of this study indicate that the POSS Kapton(R) PI reproducibly eroded about 200 nm before forming a silica layer. A thin film of 7 wt % SiO₂ survived a 3.9 year flight on the MISSE1, on the International Space Station which resides at 500 km in LEO. The effects of temperature, physical property characterizations, and the MISSE1 flight will be discussed.

DTIC

Aerospace Environments; Kapton (Trademark); Oxygen Atoms; Passivity; Polyimides; Polymers

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)*.

20080039237 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The NASA Ground Network Vision for the Future

Clson, Roger N.; Matalavage, Jill E.; Taylor, David A.; May 12, 2008; 9 pp.; In English; SpaceOps 2008, 12-16 May 2008, Heidelberg, Germany; Original contains black and white illustrations

Contract(s)/Grant(s): NNG04DA00C; Copyright; Avail.: CASI: [A02](#), Hardcopy

This paper will highlight the GN's mission, motivation, and future plans, specifically in relation to the increase of commercialization for routine services and partnership opportunities for routine and unique services with the goal that other agencies can benefit from our approach as they pursue their science and exploration goals.

Author

Communication Networks; Commercialization; Aerospace Vehicles; Mission Planning; Large Space Structures; Space Flight; Superhigh Frequencies; Ultrahigh Frequencies

20080039238 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Linking and Combining Distributed Operations Facilities using NASA's 'GMSEC' Systems Architectures

Smith, Danford; Grubb, Thomas; Esper, Jaime; May 12, 2008; 12 pp.; In English; SpaceOps 2008, 12-16 May 2008, Heidelberg, Germany; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039238>

NASA's Goddard Mission Services Evolution Center (GMSEC) ground system architecture has been in development since late 2001, has successfully supported eight orbiting satellites and is being applied to many of NASA's future missions. GMSEC can be considered an event-driven service-oriented architecture built around a publish/subscribe message bus middleware. This paper briefly discusses the GMSEC technical approaches which have led to significant cost savings and risk

reduction for NASA missions operated at the Goddard Space Flight Center (GSFC). The paper then focuses on the development and operational impacts of extending the architecture across multiple mission operations facilities.

Author

NASA Programs; Service Oriented Architecture; Applications Programs (Computers); Architecture (Computers)

20080039241 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Evolution and Reengineering of NASA's Flight Dynamics Facility (FDF)

Stengle, Thomas; Hoge, Susan; May 12, 2008; 17 pp.; In English; Space Operations 2008 Conference, 12-16 May 2008, Heidelberg, Germany; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy
ONLINE: <http://hdl.handle.net/2060/20080039241>

The NASA Goddard Space Flight Center's Flight Dynamics Facility (FDF) is a multimission support facility that performs ground navigation and spacecraft trajectory design services for a wide range of scientific satellites. The FDF also supports the NASA Space Network by providing orbit determination and tracking data evaluation services for the Tracking Data Relay Satellite System (TDRSS). The FDF traces its history to early NASA missions in the 1960's, including navigation support to the Apollo lunar missions. Over its 40 year history, the FDF has undergone many changes in its architecture, services offered, missions supported, management approach, and business operation. As a fully reimbursable facility (users now pay 100% of all costs for FDF operations and sustaining engineering activities), the FDF has faced significant challenges in recent years in providing mission critical products and services at minimal cost while defining and implementing upgrades necessary to meet future mission demands. This paper traces the history of the FDF and discusses significant events in the past that impacted the FDF infrastructure and/or business model, and the events today that are shaping the plans for the FDF in the next decade. Today's drivers for change include new mission requirements, the availability of new technology for spacecraft navigation, and continued pressures for cost reduction from FDF users. Recently, the FDF completed an architecture study based on these drivers that defines significant changes planned for the facility. This paper discusses the results of this study and a proposed implementation plan. As a case study in how flight dynamics operations have evolved and will continue to evolve, this paper focuses on two periods of time (1992 and the present) in order to contrast the dramatic changes that have taken place in the FDF. This paper offers observations and plans for the evolution of the FDF over the next ten years. Finally, this paper defines the mission model of the future for the FDF based on NASA's current mission list and planning for the Constellation Program. As part of this discussion the following are addressed: the relevance and benefits of a multi-mission facility for NASA's navigation operations in the future; anticipated technologies affecting ground orbit determination; continued incorporation of Commercial Off-the-shelf (COTS) software into the FDF; challenges of a business model that relies entirely on user fees to fund facility upgrades; anticipated changes in flight dynamics services required; and considerations for defining architecture upgrades given a set of cost drivers.

Author

Spacecraft Trajectories; Scientific Satellites; Orbit Determination; Navigation; Mission Planning; Space Navigation

20080040185 NASA Langley Research Center, Hampton, VA, USA

Design and Field Test of a Mass Efficient Crane for Lunar Payload Handling and Inspection: The Lunar Surface Manipulation System

Doggett, William R.; King, Bruce D.; Jones, Thomas Carno; Dorsey, John T.; Mikulas, Martin M.; September 09, 2008; 12 pp.; In English; AIAA Space 2008 Conference and Exposition, 9-11 Sep. 2008, San Diego, CA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 431731.04.02.04

Report No.(s): LAR-17528-1; Copyright; Avail.: CASI: [A03](#), Hardcopy

Devices for lifting, translating and precisely placing payloads are critical for efficient Earthbased construction operations. Both recent and past studies have demonstrated that devices with similar functionality will be needed to support lunar outpost operations. Lunar payloads include: a) prepackaged hardware and supplies which must be unloaded from landers and then accurately located at their operational site, b) sensor packages used for periodic inspection of landers, habitat surfaces, etc., and c) local materials such as regolith which require grading, excavation and placement. Although several designs have been developed for Earth based applications, these devices lack unique design characteristics necessary for transport to and use on the harsh lunar surface. These design characteristics include: a) composite components, b) compact packaging for launch, c) simple in-field reconfiguration and repair, and d) support for tele-operated or automated operations. Also, in contrast to Earth-based construction, where special purpose devices dominate a construction site, a lunar outpost will require versatile devices which provide operational benefit from initial construction through sustained operations. This paper will detail the design of a unique, high performance, versatile lifting device designed for operations on the lunar surface. The device is called

the Lunar Surface Manipulation System to highlight the versatile nature of the device which supports conventional cable suspended crane operations as well as operations usually associated with a manipulator such as precise positioning where the payload is rigidly grappled by a tool attached to the tip of the device. A first generation test-bed to verify design methods and operational procedures is under development at the NASA Langley Research Center and recently completed field tests at Moses Lake Washington. The design relied on non-linear finite element analysis which is shown to correlate favorably with laboratory experiments. A key design objective, reviewed in this paper, is the device's simplicity, resulting from a focus on the minimum set of functions necessary to perform payload offload. Further development of the device has the potential for significant mass savings, with a high performance device incorporating composite elements estimated to have a mass less than 3% of the mass of the maximum lunar payload lifted at the tip. The paper will conclude with future plans for expanding the operational versatility of the device.

Author

Cranes; Design Analysis; Field Tests; Lunar Bases; Lunar Surface; Lunar Construction Equipment; Payloads; Materials Handling

20080040717 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Lunar Reconnaissance Orbiter FlatSat

Wright, Michael; May 25, 2008; 14 pp.; In English; IEEE 13th European Test Symposium IEEE Computer Society and Test Technology Technical Council, 25-29 May 2008, Verbania, Italy; Original contains poor quality, truncated or crooked pages; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040717>

This viewgraph presentation reviews the use of FlatSat as a platform for use during flight integration and testing (I&T) of the Lunar Reconnaissance Orbiter (LRO). Included in the presentations are requirements for the facility, a diagram of the LRO FlatSat lab, and discussion of the operational documentation, facility scheduling, and issues and lessons learned.

CASI

Flight Tests; Test Facilities; Spacecraft Electronic Equipment

15

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*.

20080039584 Army War Coll., Carlisle Barracks, PA USA

Space Power Theory: Controlling the Medium Without Weapons in Space

Wilkerson, Don L; Mar 2008; 37 pp.; In English

Report No.(s): AD-A482300; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482300>

Since space operations are inherently joint, the Services have strived to normalize and operationalize space operations for military utility. Services rely heavily on space-based force enhancement capabilities as combat multipliers for on-demand communications, navigation, missile early warning, reconnaissance and surveillance. The protection of U.S. strategic space assets and the ability to negate enemy space systems is essential to U.S. space strategy in controlling the geographical environment of space, predominately in the Lower Earth Orbit (LEO). Modern theorists suggest today's military is poised to develop a space power theory, similar to Gorbett's sea power theory, that is relevant in the exploitation of the space medium. The challenges associated with space power as a theory begins with the emerging threat to on-orbit assets by nation states as well as non-state actors. This paper examines whether the U.S. military should deploy weapons into space, or are emerging offensive ground-based weapon systems and conventional weapons sufficient for a space power theory today. It answers the question: does the U.S. need weapons in orbit to control the space medium in order to have a recognizable DoD space power theory?

DTIC

Warfare; Aerospace Systems; Weapon Systems

20080039662 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Determining the Capability Requirements for a Space-Based Optical Sensor to Determine the Trajectory of an Incoming Antisatellite Weapon

Guelmuesh, Mesut; Mar 2008; 131 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DACA99-99-C-9999

Report No.(s): AD-A482716; AFIT/GSS/ENY/08-M03; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482716>

The goal of this research is to build up a logic to catch and track the incoming ASAT weapons by using space-based onboard optical sensors. The satellite orbit and ASAT trajectory of the Chinese test were generated to relate the research to the real world application. These position and velocity values are used to generate simulated observation data for the imaginary sensor on the targeted satellite. These observation values are assumed to be true, and some representative amounts of error is added to these data. Only two body dynamics are considered, drag effect and other perturbations are neglected. The modern orbit determination process, least squares method, and Monte Carlo techniques are used to calculate the estimated orbit of the ASAT. Standard deviations of the relative position of the ASAT with respect to the targeted satellite at the time of impact are calculated for different sensors with different accuracy and data collection intervals.

DTIC

Optical Measuring Instruments; Orbit Determination; Trajectories

20080039742 Massachusetts Inst. of Tech., Cambridge, MA USA

Terminal Control of a Variable-Stability Slender Reentry Vehicle

Karmondy, Matthew T; Jun 2, 2008; 137 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482876; CI08-0014; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482876>

Various terminal control schemes are applied to a proposed slender reentry vehicle, controlled by two separately-articulating flaps. The flap deflections are summarized as symmetric and asymmetric flap deflections; the former manipulates the drag, lift-curve slope, and static margin; the latter controls the vehicle trim characteristics. The control problem is interesting because the static margin can be actively controlled from statically stable in pitch to statically unstable in pitch. Deflection limits on the flaps present a control saturation that must be considered in control system design. A baseline, angle of attack tracking linear-quadratic servo (LQ-servo) controller is detailed, including an analysis of actuator dynamics and a lead compensator. Desired time response characteristics and robustness to center of pressure uncertainty, reduced control effectiveness, and external pitch accelerations drive the selection of a symmetric deflection at specified points on the reentry trajectory. A hybrid switching- linear controller (SLC) is developed to reduce the peak overshoot and settling time. A saturated control drives the phase plane trajectory toward a region of satisfactory linear control, where the LQ-servo controller is properly initialized and controls the phase plane trajectory to the reference command. SLC does not provide appreciable robustness gains compared to the LQ-servo controller. A model-reference adaptive controller is described. Saturation effects prevent the adaptive controller from providing additional robustness. A method to adaptively control both the symmetric and asymmetric flap deflections is proposed.

DTIC

Adaptive Control; Control Stability; Deflection; Reentry Vehicles; Terminal Guidance

20080039852 Army Command and General Staff Coll., Fort Leavenworth, KS USA

China's Anti-Satellite Test: A Precursor to Challenge U.S. Freedom to Maneuver in Space?

Mahler, Fredrick W; Jun 13, 2008; 131 pp.; In English

Report No.(s): AD-A483025; No Copyright; Avail.: Defense Technical Information Center (DTIC)

On January 11, 2007, the People's Republic of China (PRC) launched a direct-ascent anti-satellite (ASAT) weapon and destroyed one of their satellites. Uncovering Chinese motivations for this action has been problematic because the Chinese government has given virtually no explanation for this act. China seems to be actively attempting to challenge other nations' freedom to maneuver in space. Thus, the central research question of this thesis is as follows: Is the motivation behind current Chinese efforts in its ASAT program to challenge U.S. freedom of maneuver in space? China is not without precedent. From the 1960s to the late 1980s both the USA and the Soviet Union conducted extensive ASAT testing in the development and deployment of ASAT weapons as part of their military space programs. In the case of the USSR, ASAT weapons were extensively tested and deployed, but their relatively low success rate and marginal military value led the Soviet government to abandon the program in favor of arms control negotiations. In the case of the USA, ASAT was another component to ensure

national security of all space assets. The USSR study illustrates the inherent political instability of pursuing space weapons, while the U.S. study illustrates the political desire to remain weapon-free in space, but retain the right to defend space assets with force if necessary. China, with its notion of active defense and deterrence doctrine, would seem to align closely with the USA in ASAT employment, and not challenge U.S. freedom of maneuver in space per se, but ensure its own freedom of maneuver in space as it continues to grow a dependence on space assets in the future.

DTIC

Ascent; China; Missiles; Space Weapons; U.S.S.R.; United States

20080040059 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Process Time Refinement for Reusable Launch Vehicle Regeneration Modeling

Servidio, Joseph A; Mar 2008; 188 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482814; AFIT/GLM/ENS/08-11; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482814>

To sustain operational effectiveness, the Air Force has invested in the research and development of space-based technologies. Certain ongoing spacelift research efforts are focused on developing operationally responsive Reusable Military Launch Vehicles (RMLV) capable of launching payloads into orbit within hours of a tasking notification. Previous Air Force Research Laboratory-sponsored AFIT studies have resulted in the development of the MILEPOST discrete-event simulation model. This model has enabled the ability to analyze the impacts to responsiveness and manpower requirements given different RMLV design alternatives. The focus of this thesis is to improve the fidelity of the MILEPOST model by developing parametric models of simulation process times in terms of certain influential factors which affect maintenance task times. Based on MILEPOST process modules, the research developed a Work Unit Code (WUC) structure, providing the means to document key maintenance tasks which are required during the regeneration of the vehicle. Additionally, the research determined that significant parametric relationships exist between task times and certain influential vehicle design and human factors. Incorporated into the MILEPOST model, the identified prediction expressions provide a more precise evaluation of RMLV design alternatives.

DTIC

Launch Vehicles; Refining; Reusable Launch Vehicles; System Effectiveness

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*.

20080039227 NASA Goddard Space Flight Center, Greenbelt, MD, USA

CCMC Support of Active Missions: STEREO, THEMIS

Szabeo, A.; November 05, 2007; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

The Coordinated Community Modeling Center has been providing custom support for current active missions, such as STEREO and THEMIS. Global heliospheric and magnetospheric MHD model results and their presentation along the actual spacecraft trajectories are invaluable for the rapid contextualization of the observations. User feedback will be provided from the point of view of a mission scientist with suggestions for future improvements.

Author

STEREO (Observatory); THEMIS Project; Heliosphere; Magnetohydrodynamics; Spacecraft Trajectories

20080039235 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Adaptive Power Control for Space Communications

Thompson, Willie L., II; Israel, David J.; March 2008; 5 pp.; In English; IEEE Aerospace Conference, 1-8 Mar. 2008, Big Sky, TM, USA; Original contains black and white illustrations

Report No.(s): IEEEAC Paper 1188, Version 5; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039235>

This paper investigates the implementation of power control techniques for crosslinks communications during a rendezvous scenario of the Crew Exploration Vehicle (CEV) and the Lunar Surface Access Module (LSAM). During the rendezvous, NASA requires that the CEV supports two communication links: space-to-ground and crosslink simultaneously. The crosslink will generate excess interference to the space-to-ground link as the distances between the two vehicles

decreases, if the output power is fixed and optimized for the worst-case link analysis at the maximum distance range. As a result, power control is required to maintain the optimal power level for the crosslink without interfering with the space-to-ground link. A proof-of-concept will be described and implemented with Goddard Space Flight Center (GSFC) Communications, Standard, and Technology Lab (CSTL).

Author

Space Communication; Crosslinking; Adaptive Control; Control Systems Design; Proving

20080039286 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Evolution of the Lunar Network

Gal-Edd, Jonathan; Fatig, Curtis C.; Miller, Ron; March 2008; 11 pp.; In English; IEEE Aerospace Conference, 1 - 8 Mar. 2008, Big Sky, Montana, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

The National Aeronautics and Space Administration (NASA) is planning to upgrade its network Infrastructure to support missions for the 21st century. The first step is to increase the data rate provided to science missions to at least the 100 megabits per second (Mbps) range. This is under way, using Ka-band 26 Gigahertz (GHz), erecting an 18-meter antenna for the Lunar Reconnaissance Orbiter (LRO), and the planned upgrade of the Deep Space Network (DSN) 34-meter network to support the James Webb Space Telescope (JWST). The next step is the support of manned missions to the Moon and beyond. Establishing an outpost with several activities such as rovers, colonization, and observatories, is better achieved by using a network configuration rather than the current method of point-to-point communication. Another challenge associated with the Moon is communication coverage with the Earth. The Moon's South Pole, targeted for human habitat and exploration, is obscured from Earth view for half of the 28-day lunar cycle and requires the use of lunar relay satellites to provide coverage when there is no direct view of the Earth. The future NASA and Constellation network architecture is described in the Space Communications Architecture Working Group (SCAWG) Report. The Space Communications and Navigation (SCAN) Constellation Integration Project (SCIP) is responsible for coordinating Constellation requirements and has assigned the responsibility for implementing these requirements to the existing NASA communication providers: DSN, Space Network (SN), Ground Network (GN) and the NASA Integrated Services Network (NISN). The SCAWG Report provides a future architecture but does not provide implementation details. The architecture calls for a Netcentric system, using hundreds of 12-meter antennas, a ground antenna array, and a relay network around the Moon. The report did not use cost as a variable in determining the feasibility of this approach. As part of the SCIP Mission Concept Review and the second iteration of the Lunar Architecture Team (LAT), the focus is on cost, as well as communication coverage using operational scenarios. This approach maximizes use of existing assets and adds capability in small increments. This paper addresses architecture decisions such as the Radio Frequency (RF) signal and network (Netcentric) decisions that need to be made and the difficulty of implementing them into the existing Space Network and DSN. It discusses the evolution of the lunar system and describes its components: Tracking and Data Relay Satellite System (TDRSS), Earth-based ground stations, Lunar Relay, and surface systems.

Author

Lunar Communication; Ground-Air-Ground Communication; Communication Networks; Tracking Networks; Astrionics

20080039288 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Maneuver Planning for Conjunction Risk Mitigation with Ground-track Control Requirements

McKinley, David; January 21, 2008; 12 pp.; In English; AAS/AIAA Spacecraft Mechanics Conference, 21-31 Jan. 2008, Galveston, TX, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NNG04DA01C; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039288>

The planning of conjunction Risk Mitigation Maneuvers (RMM) in the presence of ground-track control requirements is analyzed. Past RMM planning efforts on the Aqua, Aura, and Terra spacecraft have demonstrated that only small maneuvers are available when ground-track control requirements are maintained. Assuming small maneuvers, analytical expressions for the effect of a given maneuver on conjunction geometry are derived. The analytical expressions are used to generate a large trade space for initial RMM design. This trade space represents a significant improvement in initial maneuver planning over existing methods that employ high fidelity maneuver models and propagation.

Author

Risk Management; Spacecraft Maneuvers; Ground Tracks; Satellite Control; Satellite Tracking

20080039310 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Building a GPS Receiver for Space Lessons Learned

Sirotzky, Steve; Heckler, G. W.; Boegner, G.; Roman, J.; Wennersten, M.; Butler, R.; Davis, M.; Lanham, A.; Winternitz, L.; Thompson, W.; Bamford, B.; Banes, V.; January 28, 2008; 10 pp.; In English; ION (Institute of Navigation), National Technical Meeting, 28 Jan. 2008, San Diego, CA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

Over the past 4 years the Component Systems and Hardware branch at NASA GSFC has pursued an inhouse effort to build a unique space-flight GPS receiver. This effort has resulted in the Navigator GPS receiver. Navigator's first flight opportunity will come with the STS-125 HST-SM4 mission in August 2008. This paper covers the overall hardware design for the receiver and the difficulties encountered during the transition from the breadboard design to the final flight hardware design. Among the different lessons learned, the paper stresses the importance of selecting and verifying parts that are appropriate for space applications, as well as what happens when these parts are not accurately characterized by their datasheets. Additionally, the paper discusses what analysis needs to be performed when deciding system frequencies and filters. The presentation also covers how to prepare for thermal vacuum testing, and problems that may arise during vibration testing. It also contains what criteria should be considered when determining which portions of a design to create in-house, and which portions to license from a third party. Finally, the paper shows techniques which have proven to be extraordinarily helpful in debugging and analysis.

Author

Global Positioning System; Receivers; Design Analysis; Technology Assessment; Lessons Learned; Spacecraft Equipment; Astrionics

20080039317 NASA Goddard Space Flight Center, Greenbelt, MD, USA

NASA SpaceWire Activities/Comments/Recommendations

Rakow, Glenn; May 18, 2006; 16 pp.; In English; Sixth SpaceWire Working Group Meeting, 18 - 19 May 2006, Noordwijk, Netherlands; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039317>

This viewgraph presentation reviews NASA's activities, and proposes recommendations for the further use of the SpaceWire (SpW). The areas covered in this presentation are: (1) Protocol ID assignment, (2) Protocol development, (3) Plug & Play (PnP), (4) Recommended additions to SpW protocol and (5) SpaceFibre trade.

CASI

Satellite Communication; Radio Communication; Communication Networks; Data Links; Data Transmission; International Cooperation

20080039324 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Successful Component Architecture for Interoperable and Evolvable Ground Data Systems

Smith, Danford S.; Bristow, John O.; Wilmot, Jonathan; June 19, 2006; 30 pp.; In English; SpaceOps 2006, 19-23 Jun. 2006, Rome, Italy; Original contains black and white illustrations

Report No.(s): 58308; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039324>

The National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC) has adopted an open architecture approach for satellite control centers and is now realizing benefits beyond those originally envisioned. The Goddard Mission Services Evolution Center (GMSEC) architecture utilizes standardized interfaces and a middleware software bus to allow functional components to be easily integrated. This paper presents the GMSEC architectural goals and concepts, the capabilities enabled and the benefits realized by adopting this framework approach. NASA experiences with applying the GMSEC architecture on multiple missions are discussed. The paper concludes with a summary of lessons learned, future directions for GMSEC and the possible applications beyond NASA GSFC.

Author

Satellite Control; Data Acquisition; Ground Tests; Applications Programs (Computers); Approach Control

20080040127 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Constellation Design of Geosynchronous Navigation Satellites Which Maximizes Availability and Accuracy Over a Specified Region of the Earth

Oezdemir, Halil I; Mar 2008; 149 pp.; In English; Original contains color illustrations

Report No.(s): AD-A483046; AFIT/GSS/ENG/08-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Currently, there are four Global Navigation Satellite Systems (GNSS) either being developed or in existence-GPS,

GLONASS, Compass, and Galileo. Additionally, there are several Regional Navigation Satellite Systems (RNSS) planned or in existence, as well as numerous augmentation systems (which require a GNSS for operation). It can be anticipated that there will be interest in developing additional independent regional navigation satellite systems to cover areas of interest to particular countries or regions, who want to have their own system. In this paper, a genetic algorithm is used in an effort to determine near-optimal RNSS constellations. First, a cost function is setup, which involves a weighted combination of dilution of precision (DOP) values and percentage availability for any number of receiver locations on the ground (which themselves can be weighted). Effectively, using this approach it is easy to quantify the quality of coverage, in terms of measurement geometry, over a specific region of the earth. Next, a genetic algorithm is used in order to attempt to converge to the lowest-cost constellation possible.

DTIC

Constellations; Global Positioning System; Navigation Satellites; Synchronous Satellites

20080040715 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Kalman Filter for Spinning Spacecraft Attitude Estimation

Markley, F. Landis; Sedlak, Joseph E.; [2008]; 17 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper presents a Kalman filter using a seven-component attitude state vector comprising the angular momentum components in an inertial reference frame, the angular momentum components in the body frame, and a rotation angle. The relatively slow variation of these parameters makes this parameterization advantageous for spinning spacecraft attitude estimation. The filter accounts for the constraint that the magnitude of the angular momentum vector is the same in the inertial and body frames by employing a reduced six-component error state. Four variants of the filter, defined by different choices for the reduced error state, are tested against a quaternion-based filter using simulated data for the THEMIS mission. Three of these variants choose three of the components of the error state to be the infinitesimal attitude error angles, facilitating the computation of measurement sensitivity matrices and causing the usual 3x3 attitude covariance matrix to be a submatrix of the 6x6 covariance of the error state. These variants differ in their choice for the other three components of the error state. The variant employing the infinitesimal attitude error angles and the angular momentum components in an inertial reference frame as the error state shows the best combination of robustness and efficiency in the simulations. Attitude estimation results using THEMIS flight data are also presented.

Author

Angular Momentum; Attitude (Inclination); Kalman Filters; Spacecraft Stability; Satellite Attitude Control

20080040772 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The GSFC Communications, Standards, and Technology Laboratory (CSTL)

Israel, David J.; Marquart, Jane K.; Thompson, Willie L., II; March 2008; 5 pp.; In English; 2008 IEEE Aerospace Conference, 1-8 Mar. 2008, Big Sky, MT, USA; Original contains black and white illustrations; No Copyright; Avail.:

Other Sources

The NASA Goddard Space Flight Center (GSFC) has created the Communications, Standards, and Technology Lab (CSTL) for the investigation, development, and demonstration of new communications standards and technologies. The testbed combines elements from the Microwave & Communications Systems Branch labs with the Flight Software Branch labs to form an end-to-end communications scenario. The testbed is currently configured to demonstrate IP communications for the Crew Exploration Vehicle (CEV) and Lunar Surface Access Module (LSAM). The RF systems in the CSTL are implemented using software defined radio (SDR) technology and NASA engineering model transponders. Various link layer, modulation and coding schemes have been developed and tested, including the Traclung and Data Relay Satellite System (TDRSS) spread spectrum waveforms. Flight components include mission flight software and hardware, onboard LANs, space-qualified routers, voice and video simulators. New and proposed applications and transport protocols are being tested for flight worthiness. The ground support system includes both GOTS and COTS command/telemetry equipment. This paper highlights the current capabilities of the CSTL and will present an overview of previous CSTL activities and results, as well as planned future work and opportunities.

Author

Telecommunication; Spread Spectrum Transmission; Ground Support Systems; Flight Control; Microwave Equipment; Radio Frequencies

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*.

20080039260 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Systems Engineering Technical Authority: A Path to Mission Success

Andary, James F.; So, Maria M.; Breindel, Barry; June 15, 2008; 15 pp.; In English; International Council on Systems Engineering (INCOSE) 18th Annual International Symposium 2008, 15-19 Jun. 2008, Utrecht, Netherlands; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The systems engineering of space missions to study planet Earth has been an important focus of the National Aeronautics and Space Administration (NASA) since its inception. But all space missions are becoming increasingly complex and this fact, reinforced by some major mishaps, has caused NASA to reevaluate their approach to achieving safety and mission success. A new approach ensures that there are adequate checks and balances in place to maximize the probability of safety and mission success. To this end the agency created the concept of Technical Authority which identifies a key individual accountable and responsible for the technical integrity of a flight mission as well as a project-independent reporting path. At the Goddard Space Flight Center (GSFC) this responsibility ultimately begins with the Mission Systems Engineer (MSE) for each satellite mission. This paper discusses the Technical Authority process and then describes some unique steps that are being taken at the GSFC to support these MSEs in meeting their responsibilities.

Author

Systems Engineering; Space Missions; NASA Programs; Probability Theory

20080039263 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Characterization of a Prototype Radio Frequency Space Environment Path Emulator for Evaluating Spacecraft Ranging Hardware

Mitchell, Jason W.; Baldwin, Philip J.; Kurichh, Rishi; Naasz, Bo J.; Luquette, Richard J.; August 20, 2007; 13 pp.; In English; AIAA Guidance, Navigation and Control Conference and Exhibit, 20-23 Aug. 2007, Hilton Head, SC, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039263>

The Formation Flying Testbed (FFTB) at the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC) provides a hardware-in-the-loop test environment for formation navigation and control. The facility is evolving as a modular, hybrid, dynamic simulation facility for end-to-end guidance, navigation and control (GN&C) design and analysis of formation flying spacecraft. The core capabilities of the FFTB, as a platform for testing critical hardware and software algorithms in-the-loop, have expanded to include S-band Radio Frequency (RF) modems for interspacecraft communication and ranging. To enable realistic simulations that require RF ranging sensors for relative navigation, a mechanism is needed to buffer the RF signals exchanged between spacecraft that accurately emulates the dynamic environment through which the RF signals travel, including the effects of the medium, moving platforms, and radiated power. The Path Emulator for Radio Frequency Signals (PERFS), currently under development at NASA GSFC, provides this capability. The function and performance of a prototype device are presented.

Author

Formation Flying; Guidance (Motion); Radio Frequencies; Rangefinding; Computerized Simulation; Design Analysis; Superhigh Frequencies; Ultrahigh Frequencies; Aerospace Environments

20080039269 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Spacecraft Formation Control: Managing Line-of-Sight Drift Based on the Dynamics of Relative Motion

Luquette, Richard J.; Sammer, Robert M.; April 23, 2008; 6 pp.; In English; 3rd International Symposium on Formation Flying Missions and Technologies, 23-25 Apr. 2008, Noordwijk, Netherlands; Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

In a quest to improve space-based observational capability, an increasing number of investigators are proposing missions with precision formation flying architectures. Typical missions include the Micro- Arcsecond X-ray Imaging Mission (MAXIM), Stellar Imager (SI), and the New Worlds Observer (NWO). Missions designed to explore targets in deep-space generally require holding a formation configuration fixed in inertial space during science observation. Analysis in this paper

is specifically aimed at the NWO architecture, characterizing the natural drift of the line-of-sight and the separation range for two spacecraft operating in the vicinity of the Earth/Moon-Sun L(sub 2) libration point. Analysis employs a linear form of the relative dynamics associated with an n-body gravity field. The study is designed to identify favorable observation directions, characterized by minimal line-of-sight drift, along the mission timeline.

Author

Formation Flying; Deep Space; Line of Sight; X Ray Imagery; Many Body Problem; Gravitational Fields

20080039441 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Estimation of Spacecraft Inertia Parameters

Thienel, Julie K.; Luquette, Richard J.; Sanner, Robert M.; [2007]; 7 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

The rigid body dynamics of a spacecraft are dependent on the spacecraft inertia. The inertia matrix is determined prior to flight during the spacecraft development. However, the inertia properties can change after launch due to the shifting of hardware caused by launch or environmental effects, fuel usage, or failure of a component to deploy into the expected configuration. This paper presents a method for adaptively estimating all the spacecraft inertia components, with no a priori information, as part of an angular velocity tracking control algorithm. A persistency of excitation condition guarantees exponential convergence of the inertia estimates to the true values.

Author

Inertia; Rigid Structures; Angular Velocity; Algorithms; Tracking (Position); Spacecraft Components; Spacecraft Design; Estimating; Launching

20080039634 NASA Goddard Space Flight Center, Greenbelt, MD, USA

SAMPEX Spin Stabilized Mode

Tsai, Dean C.; Markley, F. Landis; Watson, Todd P.; May 12, 2008; 10 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

The Solar, Anomalous, and Magnetospheric Particle Explorer (SAMPEX), the first of the Small Explorer series of spacecraft, was launched on July 3, 1992 into an 82° inclination orbit with an apogee of 670 km and a perigee of 520 km and a mission lifetime goal of 3 years. After more than 15 years of continuous operation, the reaction wheel began to fail on August 18, 2007. With a set of three magnetic torquer bars being the only remaining attitude actuator, the SAMPEX recovery team decided to deviate from its original attitude control system design and put the spacecraft into a spin stabilized mode. The necessary operations had not been used for many years, which posed a challenge. However, on September 25, 2007, the spacecraft was successfully spun up to 1.0 rpm about its pitch axis, which points at the sun. This paper describes the diagnosis of the anomaly, the analysis of flight data, the simulation of the spacecraft dynamics, and the procedures used to recover the spacecraft to spin stabilized mode.

Author

Explorer Satellites; Flight Tests; Attitude (Inclination); Attitude Control; Torquers; Control Systems Design; Apogees

20080040163 NASA Langley Research Center, Hampton, VA, USA

Ares-I-X Stability and Control Flight Test: Analysis and Plans

Brandon, Jay M.; Derry, Stephen D.; Heim, Eugene H.; Hueschen, Richard M.; Bacon, Barton J.; September 09, 2008; 17 pp.; In English; AIAA Space 2008 Conference and Exposition, 9-11 Sep. 2008, San Diego, CA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 136905.10.10.20.20

Report No.(s): AIAA-2008-7807; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040163>

The flight test of the Ares I-X vehicle provides a unique opportunity to reduce risk of the design of the Ares I vehicle and test out design, math modeling, and analysis methods. One of the key features of the Ares I design is the significant static aerodynamic instability coupled with the relatively flexible vehicle - potentially resulting in a challenging controls problem to provide adequate flight path performance while also providing adequate structural mode damping and preventing adverse control coupling to the flexible structural modes. Another challenge is to obtain enough data from the single flight to be able to conduct analysis showing the effectiveness of the controls solutions and have data to inform design decisions for Ares I. This paper will outline the modeling approaches and control system design to conduct this flight test, and also the system

identification techniques developed to extract key information such as control system performance (gain/phase margins, for example), structural dynamics responses, and aerodynamic model estimations.

Author

Ares I Launch Vehicle; Stability Tests; Design Analysis; Aerodynamic Characteristics; Dynamic Structural Analysis; Dynamic Response; Vibration Damping; Flight Paths; Control Systems Design

20080040688 Arizona State Univ., Tempe, AZ, USA; Lunar and Planetary Inst., Houston, TX, USA

Go for Lunar Landing: From Terminal Descent to Touchdown Conference Report

Gregory, William, Editor; Ottinger, Wayne, Editor; Robinson, Mark, Editor; Schmitt, Harrison, Editor; Lawrence, Samuel J., Editor; March 05, 2008; 45 pp.; In English; Go for Lunar Landing: From Terminal Descent to Touchdown Conference Report, 4-5 Mar. 2008, Tempe, AZ, USA; Copyright; Avail.: CASI: [A03](#), Hardcopy

This report summarizes the proceedings and conclusions of the ‘Go for Lunar Landing: From Terminal Descent to Touchdown’ conference held March 4th and 5th, 2008, at the Fiesta Inn Resort in Tempe, Arizona, under the auspices of Arizona State University, the Lunar and Planetary Institute, and the University of Arizona. The conference brought together Project Constellation personnel, management, and potential industry partners to discuss and leverage the experiences and lessons learned from the six Apollo lunar landings as new lander designs and operations are considered. The conference was conceived to specifically consider the last few hundred feet of the landing trajectory to touchdown, and all aspects of design, training, and operations that relate directly or indirectly to the success of touchdown. ‘Go for Lunar Landing’ provided a forum for direct communication between the Apollo and Constellation generations as well as interactive comparisons between past, present, and future technologies. The planned Lunar Surface Access Module (LSAM), or Altair, will undoubtedly have some degree of automated landing capability. Due to advances in technology since the last manned planetary landing four decades ago, it is now possible to place even more reliance upon automated descent modes. The known difficulties of landing on Mars, however, require that we develop full understanding of the integration of human and automated capabilities. In this light, some key questions concerning astronaut training for manual descent to the Moon and ultimately to Mars need to be addressed as the 21st-century architecture for a human lunar return matures. To address these questions, the ‘Go For Lunar Landing’ conference was structured to facilitate discussion amongst all of the stakeholders and offer valuable input to the initial definition phase for the new Altair spacecraft. The conference panelist expertise included cartography and lunar surface imaging, avionics, simulation, and guidance, navigation, and control (GNC). Panelists gave short summary presentations on relevant topics followed by extensive question-and-answer sessions from the attendees. This report includes contributions summarizing the panel sessions and selected transcripts from the discussion period in order to capture a flavor of the proceedings and record the key points made by the participants.

Derived from text

Lunar Landing; Descent Trajectories; Astronaut Training; Landing Simulation; Space Navigation; Spacecraft Guidance; Apollo Project; Spacecraft Landing; Lunar Module

20080040787 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Radiation Hardness Assurance (RHA) for Space Systems

Poivey, Christian; Buchner, Stephen; December 10, 2007; 26 pp.; In English; SERESSA - 3rd International School on the Effects of Radiation on Embedded Systems for Space Applications, 10 - 12 Dec. 2007, Buenos Aires, Argentina; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

This presentation discusses radiation hardness assurance (RHA) for space systems, providing both the programmatic aspects of RHA and the RHA procedure. RHA consists of all activities undertaken to ensure that the electronics and materials of a space system perform to their design specifications after exposure to the space radiation environment. RHA also pertains to environment definition, part selection, part testing, spacecraft layout, radiation tolerant design, and mission/system/subsystems requirements. RHA procedure consists of establishing mission requirements, defining and evaluating the radiation hazard, selecting and categorizing the appropriate parts, and evaluating circuit response to hazard. The RHA approach is based on risk management and is confined only to parts, it includes spacecraft layout, system/subsystem/circuit design, and system requirements and system operations. RHA should be taken into account in the early phases of a program including the proposal and feasibility analysis phases.

CASI

Aerospace Environments; Extraterrestrial Radiation; Aerospace Systems; Radiation Effects; Spacecraft Electronic Equipment; Risk Management; Systems Engineering; Spacecraft Design

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*.

20080039255 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Sustainable and Autonomic Space Exploration Missions

Hinchey, Michael G.; Sterritt, Roy; Rouff, Christopher; Rash, James L.; Truskowski, Walter; July 17, 2006; 8 pp.; In English; IEEE Space Mission Challenges for IT (SMC-IT), 17-20 Jul. 2006, Pasadena, CA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

Visions for future space exploration have long term science missions in sight, resulting in the need for sustainable missions. Survivability is a critical property of sustainable systems and may be addressed through autonomicity, an emerging paradigm for self-management of future computer-based systems based on inspiration from the human autonomic nervous system. This paper examines some of the ongoing research efforts to realize these survivable systems visions, with specific emphasis on developments in Autonomic Policies.

Author

Long Duration Space Flight; Spacecraft Survivability; Systems Engineering; Airborne/Spaceborne Computers

20080039318 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Performance of the GLAS Laser Transmitter in Space

Yu, Anthony W.; Afzal, Robert S.; Dallas, Joseph L.; Melak, Anthony; Mamakos, William; July 24, 2006; 4 pp.; In English; The 23rd International Laser Radar Conference, 24 - 28 Jul. 2006, Nara City, Japan; Original contains black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

The Geoscience Laser Altimeter System (GLAS), launched in January 2003, is a laser altimeter and lidar for the Earth Observing System's (EOS) ICESat mission. The laser transmitter requirements, design and qualification test results and in-flight performance for this space-based remote sensing instrument is summarized and presented.

Author

Laser Altimeters; Remote Sensing; Satellite-Borne Instruments; Spaceborne Lasers; Transmitters; Satellite Altimetry; Characterization; Performance

20080039550 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Qualification of Technologies and Lessons Learned from Satellite LIDAR and Altimeter Missions

Coyle, Donald B.; June 21, 2006; 1 pp.; In English; The Second ESA-NASA Working Meeting on Optoelectronics: Qualifications of Technologies and Lessons Learned from Satellite LIDAR and Altimeter Missions, 21-23 Jun. 2006, Noordwijk, Netherlands; No Copyright; Avail.: Other Sources; Abstract Only

Flight qualified laser transmitters for remote sensing applications from space have progressed significantly over the past decade. More laser-based missions are underway and several are recently launched and on route, under flight build, or being proposed. However, most of the progress made in the solid state laser field has not been solely in the technology front, but more in the design and implementation of existing technologies. Recent events in flight laser performance and delivery have resulted in a more conservative process in the selection of laser-based instruments for space. The result of these efforts will hopefully be an improved rate of success and more flight laser mission awards. An overview of these efforts and some results will be presented as well as current and future work at NASA.

Author

Lasers; Lessons Learned; Optical Radar; Remote Sensing; Laser Altimeters; Laser Applications

20080039650 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The 24 Million Kilometer Optical Link with the Mercury Laser Altimeter

Coyle, Donald B.; June 21, 2006; 1 pp.; In English; The Second ESA-NASA Working Meeting on Optoelectronics: Qualifications of Technologies and Lessons Learned from Satellite LIDAR and Altimeter Missions, 21-23 Jun. 2006, Noordwijk, Netherlands; No Copyright; Avail.: Other Sources; Abstract Only

A recent experiment has been completed at NASA Goddard Geophysical and Astronomical Observatory (GGAO) where an optical link has been achieved with the Mercury laser altimeter (MLA) instrument about the Messenger spacecraft on its

way to Mercury. A pulsed laser source at 1 micron based on Earth has been recorded on MLA. Simultaneously, the spacecrafts altimeter has been properly aimed and laser pulses transmitted to earth where they were detected and recorded at the same facility. This optical link was used to calibrate and verify operation of the MLA instrument and onboard laser, as well as to gain valuable information with the methods and means of very long range optical communication pointing and receiving techniques. An overview of this experiment, the hardware, and data products will be presented.

Author

Laser Altimeters; Astronomical Observatories; Pulsed Lasers; Optical Communication; Geophysical Observatories; Multispectral Linear Arrays

20080040689 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Automated Absorber Attachment for X-ray Microcalorimeter Arrays

Moseley, S.; Allen, Christine; Kilbourne, Caroline; Miller, Timothy M.; Costen, Nick; Schulte, Eric; Moseley, Samuel J.; July 22, 2007; 5 pp.; In English; 12th International Workshop on Low Temperature Detectors, 22-27 Jul. 2007, Paris, France; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040689>

Our goal is to develop a method for the automated attachment of large numbers of absorber tiles to large format detector arrays. This development includes the fabrication of high quality, closely spaced HgTe absorber tiles that are properly positioned for pick-and-place by our FC150 flip chip bonder. The FC150 also transfers the appropriate minute amount of epoxy to the detectors for permanent attachment of the absorbers. The success of this development will replace an arduous, risky and highly manual task with a reliable, high-precision automated process.

Author

Calorimeters; Mercury Tellurides; Epoxy Resins; Tasks; Tiles; Fabrication

20080040694 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Phillips SA8016BW 2.5 GHz Synthesizer SEE Testing

Carts, Marty; Ladbury, Ray; Marshall, Paul W.; Mackey, Susan; April 15, 2008; 6 pp.; In English; 2008 Single Event Effects Symposium, 15 Apr. 2008, Long Beach, CA, USA; Original contains black and white illustrations; Copyright; Avail.:

CASI: [A02](#), Hardcopy

This viewgraph presentation reviews the Single Event Effects (SEE) testing of the Phillips SA8016BW 2.5 GHz Synthesizer that was chose by the GLAST Program for Frequency Generation. Included in this are diagrams of the phased-locked loop (PLL), the synthesizer, and heater.

CASI

Frequencies; Synthesizers; Radiation Dosage; Spacecraft Electronic Equipment; Irradiation; Radiation Effects

20

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*.

20080040686 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Binding Procurement

Rao, Gopalakrishna M.; Vaidyanathan, Hari; November 27, 2007; 8 pp.; In English; 2007 NASA Aerospace Battery Workshop, 27-29 Nov. 2007, Huntsville, AL, USA; Copyright; Avail.: CASI: [A02](#), Hardcopy

This viewgraph presentation reviews the use of the binding procurement process in purchasing Aerospace Flight Battery Systems. NASA Engineering and Safety Center (NESC) requested NASA Aerospace Flight Battery Systems Working Group to develop a set of guideline requirements document for Binding Procurement Contracts.

CASI

Electric Batteries; Government Procurement; Equipment Specifications; Spacecraft Power Supplies

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*.

20080039190 Inovatia Labs., LLC, Fayette, MO USA

Self-Decontaminating Chemical Agent Resistant Coating (CARC) Technology (BRIEFING SLIDES)

Waggoner, J B; Thomas, Rhys N; Jun 2, 2008; 11 pp.; In English; Original contains color illustrations

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

Report No.(s): AD-A482446; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482446>

Inovatia Labs is developing a family of coatings that incorporate a pigment that promotes oxidation of contaminants by several mechanisms, including absorption of visible light and catalytic activation of atmospheric oxygen. Topical application of ethyl 2-chloroethyl sulfide (CEES) and of triethyl phosphite (TEP) as a challenge resulted in 50% conversion of CEES and TEP into the respective oxides CEESO and TEPO in an hour and a minute, respectively. This suggests capacity to protect against HD and organophosphates. Testing with challenges of *E. coli* and of *B. subtilis* spores shows the ability of the coating to suppress colonization of plastic tubing and of water in the tubing, even when 67% of the tubing is wrapped to exclude light, as in a dental irrigation system. Gradual attenuation of moderately large populations in water is also seen. Applications are proposed to maintaining sterility in clean areas, polishing and preservation of potable water, enhancement of chem-bio decontamination procedures on coated surfaces, and as a sensor for biological contamination.

DTIC

Biological Effects; Chemical Attack; Chutes; Coating; Coatings; Contamination; Decontamination; Oxidation

20080039296 Berenato, White and Stavish, LLC, Bethesda, MD, USA

Spatially Selective Deposition of Polysaccharide Layer onto Patterned Template

Bentley, W. E., Inventor; Ghodssi, R., Inventor; Payne, G. F., Inventor; Rubloff, G. W., Inventor; Wu, L. Q., Inventor; 17 Jun 05; 18 pp.; In English

Contract(s)/Grant(s): BES-01 114790

Patent Info.: Filed Filed 17 Jun 05; US-Patent-Appl-SN-11-155 116

Report No.(s): PB2008-103582; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method is provided for electrochemically depositing a polymer with spatial selectivity. A substrate having a substrate surface is contacted with an aqueous solution containing a selectively insolubilizable polysaccharide, such as chitosan, which is subjected to electrochemically treatment to deposit, with spatial selectivity, the selectively insolubilizable polysaccharide on a patterned electrically conductive portion of the substrate surface.

NTIS

Deposition; Patent Applications; Polysaccharides; Templates

20080039304 Taylor, Porter, Brooks and Phillips, L.L.P, Baton Rouge, LA, USA

Mechanical Seal Having a Single-Piece, Perforated Mating Ring

Khonsari, M. M., Inventor; Somanchi, A. K., Inventor; 12 Nov 04; 12 pp.; In English

Contract(s)/Grant(s): DE-FG48-02R810707

Patent Info.: Filed Filed 12 Nov 04; US-Patent-Appl-SN-10-987 352

Report No.(s): PB2008-103590; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A mechanical seal (e.g., single mechanical seals, double mechanical seals, tandem mechanical seals, bellows, pusher mechanical seals, and all types of rotating and reciprocating machines) with reduced contact surface temperature, reduced contact surface wear, or increased life span. The mechanical seal comprises a rotating ring and a single-piece, perforated mating ring, which improves heat transfer by controllably channeling coolant flow through the single-piece mating ring such that the coolant is in substantially uniform thermal contact with a substantial portion of the interior surface area of the seal face, while maintaining the structural integrity of the mechanical seal and minimizing the potential for coolant flow interruptions to the seal face caused by debris or contaminants (e.g., small solids and trash) in the coolant.

NTIS

Bonding; Patent Applications; Seals (Stoppers)

20080039375 DeWitt Ross and Stevens, Madison, WI, USA

Bifunctional-Modified Hydrogels (PAT-APPL-11-273 393)

Kao, W. J., Inventor; Li, J., Inventor; Lok, D., Inventor; Gundloori, R., Inventor; 14 Nov 05; 34 pp.; In English

Contract(s)/Grant(s): NIH HL63686

Patent Info.: Filed 14 Nov 05; US-Patent-Appl-SN-11-273 393

Report No.(s): PB2008-103505; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Disclosed are hydrogels wherein a polymer matrix is modified to contain a bifunctional poly(alkylene glycol) molecule covalently bonded to the polymer matrix. The hydrogels can be cross-linked using, for example, glutaraldehyde. The hydrogels may also be crosslinked via an interpenetrating network of a photopolymerizable acrylates. The hydrogels may also be modified to have pharmacologically-active agents covalently bonded to the poly(alkylene glycol) molecules or entrained within the hydrogel. Living cells may also be entrained within the hydrogels.

NTIS

Gels; Patent Applications

20080039377 Department of Energy, Washington, DC, USA

Evaluation of a Surface Treatment on the Performance of Stainless Steels for SOFC Interconnect Applications

Alman, D. E.; Holcomb, G. R.; Adler, T. A.; Wilson, R. W.; Jablonski, P. D.; Apr. 01, 2007; 33 pp.; In English

Report No.(s): DE2007-916949; DOE/NETL-IR-2007-126; No Copyright; Avail.: National Technical Information Service (NTIS)

Pack cementation-like Cerium based surface treatments have been found to be effective in enhancing the oxidation resistance of ferritic steels (Crofer 22APU) for solid oxide fuel cell (SOFC) applications. The application of either a CeN- or CeO₂ based surface treatment results in a decrease in weight gain by a factor of three after 4000 hours exposure to air+3% H₂O at 800 degrees C. Similar oxide scales formed on treated and untreated surfaces, with a continuous Cr-Mn outer oxide layer and a continuous inner Cr₂O₃ layer formed on the surface. However, the thickness of the scales, and the amount of internal oxidation were significantly reduced with the treatment, leading to the decrease in oxidation rate. This presentation will detail the influence of the treatment on the electrical properties of the interconnect. Half-cell experiments (LSM cathode sandwiched between two steel interconnects) and full SOFC button cell experiments were run with treated and untreated interconnects. Preliminary results indicate the Ce treatment can improve SOFC performance.

NTIS

Solid Oxide Fuel Cells; Stainless Steels; Surface Finishing; Surface Treatment

20080039379 National Energy Technology Lab., Morgantown, WV, USA

Influence of a Cerium Surface Treatment on the Oxidation Behavior of Cr₂O₃-Forming Alloys (title on slides varies: Oxidation Behavior of Cerium Surface Treated Chromia Forming Alloys)

Alman, D. E.; Jablonski, P. D.; Holcomb, G. R.; Adler, T. A.; Apr. 01, 2007; 42 pp.; In English

Report No.(s): DE2007-916963; DOE/NETL-IR-2007-236; No Copyright; Avail.: National Technical Information Service (NTIS)

Current goals of the U.S. Department of Energy's Advanced Power Systems Initiatives include coal generation at 60% efficiency, which would require steam temperatures of up to 760 degrees C. This temperature will require the construction of boiler and turbine components from austenitic stainless steels and nickel alloys. Many of the alloys being considered for use are primarily Cr₂O₃ forming alloys. It is well known that the addition of a small amount of reactive elements, such as the rare earths elements Ce, La, and Y, can significantly improve the high temperature oxidation resistance of both iron- and nickel-base alloys. A list of the benefits of the reactive element effect include: (1) slowing scale growth, (2) enhancing scale adhesion; and (3) stabilizing Cr₂O₃ formation at lower Cr levels. The incorporation of the reactive element can be made in the melt or through a surface infusion or surface coating. Surface modifications allow for the concentration of the reactive element at the surface where it can provide the most benefit. This paper will detail a Ce surface treatment developed at NETL that improves the high temperature oxidation resistance of Cr₂O₃ forming alloys. The treatment consists of painting, dip coating, or spraying the alloy surface with a slurry containing CeO₂ and a halide activator followed by a thermal treatment in a mild (x10⁻³ Torr) vacuum. During treatment the CeO₂ reacts with the alloy to form a thin CrCeO₃-type scale on the alloy surface. Upon subsequent oxidation, scale growth occurs at a reduced rate on alloys in the surface treated condition compared to those in the untreated condition.

NTIS

Cerium; Chromium Oxides; Chutes; Oxidation; Surface Treatment

20080039380 OLI Systems, Inc., Morris Plains, NJ, USA; Southwest Research Inst., Houston, TX, USA

Prediction of Corrosion of Advanced Materials and Fabricated Components

Anderko, A.; Jakab, M. A.; Sep. 29, 2007; 194 pp.; In English

Contract(s)/Grant(s): DE-FC36-04GO14043

Report No.(s): DE2007-916966; OLI-2007-09-29; No Copyright; Avail.: National Technical Information Service (NTIS)

The goal of this project is to provide materials engineers, chemical engineers and plant operators with a software tool that will enable them to predict localized corrosion of process equipment including fabricated components as well as base alloys. For design and revamp purposes, the software predicts the occurrence of localized corrosion as a function of environment chemistry and assists the user in selecting the optimum alloy for a given environment. For the operation of existing plants, the software enables the users to predict the remaining life of equipment and help in scheduling maintenance activities. This project combined fundamental understanding of mechanisms of corrosion with focused experimental results to predict the corrosion of advanced, base or fabricated, alloys in real-world environments encountered in the chemical industry. At the heart of this approach is the development of models that predict the fundamental parameters that control the occurrence of localized corrosion as a function of environmental conditions and alloy composition. The fundamental parameters that dictate the occurrence of localized corrosion are the corrosion and repassivation potentials. The program team, OLI Systems and Southwest Research Institute, has developed theoretical models for these parameters. These theoretical models have been applied to predict the occurrence of localized corrosion of base materials and heat-treated components in a variety of environments containing aggressive and non-aggressive species. As a result of this project, a comprehensive model has been established and extensively verified for predicting the occurrence of localized corrosion as a function of environment chemistry and temperature by calculating the corrosion and repassivation potentials.

NTIS

Corrosion; Fabrication; Nickel Alloys; Stainless Steels

20080039495 Wolf, Greenfield and Sacks, P.C., Boston, MA, USA

Graft Copolymers

Mayes, A. M., Inventor; Park, J. Y., Inventor; Acar, M. H., Inventor; Akthakul, A., Inventor; 5 Jan 05; 35 pp.; In English

Contract(s)/Grant(s): N00014-99-1-0310

Patent Info.: Filed Filed 5 Jan 05; US-Patent-Appl-SN-11-030 576

Report No.(s): PB2008-103126; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This invention relates to methods of making graft copolymers, and articles having such graft copolymers. The methods may provide better control than in radicalization or photoinitiated polymerization techniques. For example, a graft copolymer can be prepared by reacting an alkoxide ion with a polymer. The alkoxide, in turn, can be provided by any suitable technique, for example, by reacting an alcohol with a base. In some embodiments of the invention, the graft copolymers may be a normally hydrophobic polymer, such as a polysulfone, that has been made more hydrophilic due to the attachment of hydrophilic side groups such as polyethylene glycol or polypropylene glycol. The copolymers of the invention have many uses, for example, in films or porous membranes.

NTIS

Copolymers; Grafting; Patent Applications; Polymerization

20080039496 Bacon and Thomas, PLLC, Alexandria, VA, USA

Polycarbonates Made Using Highly Selective Catalysts

Coates, G. W., Inventor; Qin, Z., Inventor; Cohen, C. T., Inventor; 6 Dec 05; 16 pp.; In English

Contract(s)/Grant(s): DMR-0079992

Patent Info.: Filed Filed 6 Dec 05; US-Patent-Appl-SN-11-244 231

Report No.(s): PB2008-103136; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The invention is directed at high selectivity cobalt containing catalysts for producing poly(alkylene carbonates) from alkylene oxide and carbon dioxide, to a process for producing polycarbonates using the catalysts and to polycarbonates produced thereby.

NTIS

Carbon Dioxide; Carbonates; Catalysts; Oxides; Patent Applications; Polycarbonates

20080039505 Sterne Kessler Goldstein and Fox, PLLC, Washington, DC, USA; Pennsylvania Univ., Philadelphia, PA, USA

Diphenyl Ether Derivatives and Their Use for Imaging Serotonin Transporters

Kung, H. F., Inventor; 9 Sep 05; 38 pp.; In English

Contract(s)/Grant(s): EB-00369; NH-68782

Patent Info.: Filed 9 Sep 05; US-Patent-Appl-SN-11-222 249

Report No.(s): PB2008-103148; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This invention relates to diphenyl ether derivatives and their use in imaging of Serotonin Transporters (SERTS). The present invention also provides diagnostic compositions comprising the compounds of the present invention, and a pharmaceutically acceptable carrier or diluent. The invention further provides a method of imaging SERTS, comprising introducing into a patient a detectable quantity of a labeled compound of the present invention, or a pharmaceutically acceptable salt, ester, amide or prodrug thereof, allowing sufficient time for the labeled compound to associate with one or more SERTs, and detecting the labeled compound. The present invention can also be used to follow the progression of a disease associated with SERTs or a therapy that targets SERTs.

NTIS

Derivation; Diphenyl Compounds; Ethers; Imaging Techniques; Patent Applications; Serotonin; Transporter

20080039512 Whitham, Curtis and Christofferson, P.C., Reston, VA, USA

Method for Polymeric Surface Modification

Wynne, K. J., Inventor; 30 Nov 05; 23 pp.; In English

Contract(s)/Grant(s): NSF-523279; DARPA-528979

Patent Info.: Filed 30 Nov 05; US-Patent-Appl-SN-11-289 422

Report No.(s): PB2008-102479; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Polymers, and particularly conventional commodity bulk polymers, are modified to have a surface activity of interest using a surface modifying polymer that includes a moiety that favors migration to the surface of the bulk polymer together with a moiety provides the activity of interest (e.g., biocidal, wettability modifying (hydrophobic or hydrophilic), resistance to radiant energy, providing a functional group for functionalizing the surface, etc.). The surface modifying polymer is combined with the bulk polymer, and, due to the presence of the moiety that favors migration, concentrates primarily on the surface of the bulk polymer such that the moiety that provides the activity of interest is located primarily on the surface of the bulk polymeric article which is produced.

NTIS

Patent Applications; Polymers; Surface Properties

20080039514 General Electric Co., Niskayuna, NY, USA

Carbide Nanostructures and Methods for Making Same

Tsakalagos, L., Inventor; Han, S. S., Inventor; Osaheni, J. A., Inventor; Mani, V., Inventor; 10 Nov 04; 8 pp.; In English

Contract(s)/Grant(s): NIST-70NANB2H3030

Patent Info.: Filed 10 Nov 04; US-Patent-Appl-SN-10-986 599

Report No.(s): PB2008-103054; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A structure includes a substrate and a metallized carbon nano-structure extending from a portion of the substrate. In a method of making a metallized carbon nanostructure, at least one carbon structure formed on a substrate is placed in a furnace. A metallic vapor is applied to the carbon nanostructure at a preselected temperature for a preselected period of time so that a metallized nanostructure.

NTIS

Carbides; Carbon Compounds; Nanostructures (Devices); Patent Applications; Silicon Carbides

20080039524 Russell (Donna J.), Mount Juliet, TN, USA

Method for Synthesis of BETA Glucans

Ensley, H. E., Inventor; Williams, D. L., Inventor; Yu, H., Inventor; 6 Oct 05; 39 pp.; In English

Contract(s)/Grant(s): NIH-GM53522

Patent Info.: Filed 6 Oct 05; US-Patent-Appl-SN-11-244 639

Report No.(s): PB2008-101647; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The invention provides a method for forming P-glucoside linkages in carbohydrate polymers, particularly synthetic glucan molecules, by attaching a protecting group to the C2 position of a glucoside donor. The protecting group of the invention stabilizes the dioxolenium ion and prevents orthoester formation to promote the beta linkage and inhibit the undesirable alpha linkage. One such protecting group is 4-acetoxy-2,2-dimethylbutanoyl chloride.

NTIS

Carbohydrates; Linkages; Patent Applications

20080039527 Quarles and Brady, LLP., Milwaukee, WI, USA

pH-Sensitive Methacrylic Copolymers and the Production Thereof

Mallapragada, S. K., Inventor; Anderson, B. C., Inventor; Ashby, V. V. S., Inventor; Bloom, P. D., Inventor; 22 Nov 05; 17 pp.; In English

Contract(s)/Grant(s): DE-W-7405-ENG-82

Patent Info.: Filed 22 Nov 05; US-Patent-Appl-SN-11-284 502

Report No.(s): PB2008-101650; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention provides novel multi-functional methacrylic copolymers that exhibit cationic pH-sensitive behavior as well as good water solubility under acidic conditions. The copolymers are constructed from tertiary amine methacrylates and poly(ethylene glycol) containing methacrylates. The copolymers are useful as gene vectors, pharmaceutical carriers, and in protein separation applications.

NTIS

Copolymers; Patent Applications; pH; Sensitivity

20080039867 Texas Univ., Austin, TX USA

Experimental Investigation of the Interaction of Electrothermal Plasmas with Solid Propellants

Varghese, Philip L; Clemens, Noel T; Ryan, Michael D; Sep 14, 2007; 35 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W911NF-06-1-0373

Report No.(s): AD-A483061; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We report measurements of the interaction between plasma radiation and solid propellant. We made heat flux measurements of the electrothermal plasma jet impinging on a sensor mimicking a disk of propellant. We made planar laser-induced fluorescence images of NO, a JA2 decomposition product at the propellant surface. High speed video imaging of the propellant surface and scattering of ejected particles was used to study how the propellant surface evolves during exposure to plasma radiation. During the radiation interaction scattering particles and NO appeared between 100 and 150 microseconds after the beginning of the discharge and propagated away from the propellant surface. The ejected material occurred in identifiable structures that are irregular in shape and distribution suggesting that ejection occurred at semi-discrete locations on the surface rather than uniformly. During the plasma firing the propellant surface changed markedly by forming irregularly shaped decomposition structures that grew in size over the course of the discharge. No correlation was observed between the structure of the ejected material and the decomposition structures formed on the propellant surface during the discharge. After the plasma discharge, the propellant continued to react, with bubbles forming on the surface up to 9 ms after the discharge finished.

DTIC

Laser Induced Fluorescence; Plasma Jets; Plasmas (Physics); Solid Propellants

24

COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

20080039295 3M Innovative Properties Co., Saint Paul, MN, USA

Cable and Method of Making the Same (PAT-APPL-11-317 608)

Johnson, D. E., Inventor; McCullough, C., Inventor; 23 Dec 05; 21 pp.; In English

Contract(s)/Grant(s): DE-FC02-02CH11111

Patent Info.: Filed 23 Dec 05; US-Patent-Appl-SN-11-317 608

Report No.(s): PB2008-103520; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Cable and method for cable. Embodiments of the cable are useful, for example, as an overhead power transmission line.

NTIS

Cables (Ropes); Patent Applications

20080039303 Docket Clerk, Dallas, TX, USA

Pultruded Composite Guardrail

Troutman, D. L., Inventor; Weyant, S. E., Inventor; Foedinger, R., Inventor; Bronstad, M. E., Inventor; Molengraft, E. C., Inventor; 29 Sep 05; 13 pp.; In English

Contract(s)/Grant(s): DTRS57-01-C-10054

Patent Info.: Filed Filed 29 Sep 05; US-Patent-Appl-SN-11-238 846

Report No.(s): PB2008-103589; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A pultruded composite guardrail is comprised of one or more layered reinforcement materials and a resin permeating the one or more layered reinforcement materials, the one or more layered reinforcement materials and resin forming a solid shaped guardrail or guardrail beam when the resin is cured. The shaped member may be thrie beam shaped and the resin used may be a poly-urethane thermoset resin. The guardrail may be used in a guardrail system comprised of one or more guardrails and one or more posts. The guardrail system may also include a spacer block attached to each post, an anchor attached to the posts, a splice plate coupling a plurality of the guardrails together, and a plurality of fasteners for joining the components of the guardrail system.

NTIS

Composite Materials; Highways; Patent Applications; Pultrusion; Resins

20080039413 Applied Research Associates, Inc., Tyndall AFB, FL USA

Fiber Reinforced Polymer (FRP) Panels for Blast and Fragmentation Mitigation

Hoemann, John; Salim, Hani; Dinan, Robert J; Nov 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F08637-03-C-6006; Proj-4915

Report No.(s): AD-A482678; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Panels comprised of honeycomb fiber reinforced polymer (FRP) laminations were evaluated to examine their utility as prefabricated fighting positions. The panels were tested for both their blast, and fragmentation mitigation ability. Static resistance functions were developed using a combination of analytical and laboratory procedures in order to obtain the panels response, the response was implemented into a single-degree of freedom (SDOF) dynamic analysis. Engineered analytical prediction models showed that the panels' response in live explosive blast testing could be predicted. Sand-filled wall panels were subjected to blast and fragmentation loadings in full-scale experiments, but experimental and analytical evaluation indicated that further refinement of the panels design would be recommended.

DTIC

Composite Materials; Fiber Composites; Fragmentation; Panels; Reinforcing Fibers

20080039487 Banner and Witcoff Ltd., Chicago, IL, USA; Advanced Ceramics Research, Inc., Tucson, AZ, USA

Aligned Composite Structures for Mitigation of Impact Damage and Resistance to Wear in Dynamic Environments

Mulligan, A. C., Inventor; Rigali, M. J., Inventor; Sutaria, M. P., Inventor; Popovich, D., Inventor; Halloran, J. P., Inventor; 9 Dec 05; 16 pp.; In English

Contract(s)/Grant(s): DE-FC02-96CH10861; DE-FC26-01NT41051

Patent Info.: Filed Filed 9 Dec 05; US-Patent-Appl-SN-11-298 194

Report No.(s): PB2008-103113; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Fibrous monolith composites having architectures that provide increased flaw insensitivity, improved hardness, wear resistance and damage tolerance and methods of manufacture thereof are provided for use in dynamic environments to mitigate impact damage and increase wear resistance.

NTIS

Composite Materials; Composite Structures; Fiber Composites; Impact Damage; Patent Applications; Wear

20080039518 Kushman (Brooks), P.C., Southfield, MI, USA; Federal Aviation Administration, Washington, DC USA

Well-Defined Nanosized Building Blocks for Organic/Inorganic Nanocomposites

Laine, R. M., Inventor; Tamaki, R., Inventor; Choi, J., Inventor; Roll, M., Inventor; Brick, C. M., Inventor; 2 Mar 05; 26 pp.; In English

Contract(s)/Grant(s): 95-G-026

Patent Info.: Filed Filed 2 Mar 05; US-Patent-Appl-SN-11-070 617

Report No.(s): PB2008-103155; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Functionalized silsesquioxanes containing from 6 to 24 silicon atoms and minimally about 67 mol percent RSiO(sub 3/2) moieties where R is a phenyl group bearing a chemically reactive functional group are highly suitable for use as nanoparticles in producing highly ordered nanocomposites of many types, containing a high proportion of interphase. The nanocomposites have unusual physicochemical properties due to the use of uniform, highly functionalized nanoparticles.

NTIS

Nanocomposites; Patent Applications; Chemical Reactions; Molecular Structure; Nanoparticles

20080039608 Colorado School of Mines, Golden, CO USA

The Potential for a Novel Transformation-Toughened Composite

Reimanis, Ivar E; Jul 24, 2007; 9 pp.; In English

Contract(s)/Grant(s): W911NF-06-1-0338

Report No.(s): AD-A482589; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Research was conducted to examine the possibility to design a novel transformation-toughened composite utilizing a phase transformation in beta-eucryptite. Specimens comprising zirconium oxide as the matrix and beta-eucryptite as the particulate phase were made with varying amounts of eucryptite particle size. Indentation fracture experiments were conducted and four-point bend notch bars were fabricated. The indentation experiments showed significant crack deflection, suggesting that toughening may occur. However, quantitative results (from the four-point bend bars) have not yet been achieved.

DTIC

Composite Materials; Toughness; Phase Transformations

20080039647 NASA Langley Research Center, Hampton, VA, USA

Variable Stiffness Composite Panels: Effects of Stiffness Variation on the In-Plane and Buckling Response

Gurdal, Z.; Tatting, B. F.; Wu, C.; [2008]; 22 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 23-064-30-34; Copyright; Avail.: Other Sources

Descriptions of fiber orientation variation for flat rectangular composite laminates that possess variable stiffness properties are introduced. The simplest definition employs a unidirectional variation based on a linear function for the fiber orientation angle of the individual layers. Analyses of variable stiffness panels for in-plane and buckling responses are developed and demonstrated for two distinct cases of stiffness variations. The first case assumes a stiffness variation in the direction of the loading, and numerical results indicate small improvements in buckling load for some panel configurations due to favorable distribution of the transverse stresses over the panel planform. The second case varies the stiffness perpendicular to the loading, and provides a much higher degree of improvement due to the re-distribution of the applied loads. It is also demonstrated that the variable stiffness concept provides a flexibility to the designer for trade-offs between overall panel stiffness and buckling load, in that there exist many configurations with equal buckling loads yet different global stiffness values, or vice versa.

Author

Laminates; Panels; Fiber Orientation; Stiffness; Stress Distribution; Loads (Forces); Buckling

20080040103 Air Force Research Lab., Wright-Patterson AFB, OH USA

Z-Pin Stubble Technology Advanced Research (ZSTAR)

Clay, Stephen B; Pommer, Amanda K; Apr 2008; 60 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-A03M

Report No.(s): AD-A483021; AFRL-RB-WP-TR-2008-3107; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Z-pins are small-diameter carbon rods that are ultrasonically inserted through composite laminates in the z-direction to provide extra resistance to crack growth and delamination. They are normally inserted through co-cured composites, but this report presents an experimental study on a new z-pin stubble manufacturing technique that is compatible with the co-bonding process. Early researchers were limited to an exposed stubble height of 0.030 inch, which would not provide all of the benefits of a full-depth co-cured z-pin reinforced joint. This report describes a study in which the stubble lengths were increased to 0.250 inch. Double cantilever beam specimens were used to characterize the effect of stubble diameter and height on the Mode I crack resistance. It was found that increasing the stubble height from 0.040 inch to 0.125 inch resulted in a significant improvement in Mode I properties. Z-pins are small diameter carbon rods that are ultrasonically inserted through composite laminates in the z-direction to provide extra resistance to crack growth and delamination. They are normally inserted through co-cured composites, but this paper presents an experimental study on a new z-pin stubble manufacturing technique that is compatible with the co-bonding process. Z-pin stubble is created by inserting pins through the thickness of an uncured laminate and trimming the pins to a certain height above the surface. After initial cure, another uncured composite part is cured on the exposed stubble. Early researchers were limited to an exposed stubble height of 0.030 inch, which would not provide all of the benefits of a full-depth co-cured z-pin reinforced joint. This paper describes a study in which the stubble lengths were increased to 0.250 inch. Double cantilever beam (DCB) specimens were used to characterize the effect of stubble diameter and height

DTIC

Adhesive Bonding; Fabrication; Laminates; Pins

20080040160 NASA Langley Research Center, Hampton, VA, USA

Strain and Temperature Sensing Properties of Multiwalled Carbon Nanotube Yarn Composites

Kahng, Seun K.; Gates, Thomas S.; Jefferson, Gail D.; September 08, 2008; 10 pp.; In English; SAMPE '08 Fall Technical Conference, 8-11 Sep. 2008, Memphis, TN, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 561581.02.08.15.02; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040160>

Strain and temperature response of Multiwalled Carbon Nanotube (MWCNT/CNT) yarns on a stainless steel test beam has been studied. The carbon nanotube yarns are spun from a multiwalled carbon nanotube forest grown on a silicon substrate to a 4-ply yarn with a diameter of about 15-20 microns. Four of the 4-ply CNT yarns are arranged in a Wheatstone bridge configuration on the stainless steel test beam using a thin layer of polyurethane resin that insulates and protects the yarns from the test beam. Strain sensitivities of the CNT yarn sensors range from 1.39 to 1.75 mV/V/1000 microstrain at room temperature, and temperature sensitivity of the CNT yarn bridge is 91 microA/degC. Resistance of the yarns range from 215 to 270 ohms for CNT yarn length of approximately 5 mm. Processes used in attaching the CNT yarns on the test beam and experimental procedures used for the measurements are described. Conventional metallic foil strain gages are attached to the test beam to compare with the CNT sensors. The study demonstrates multifunctional capability of the sensor for strain and temperature measurements and shows its applicability where engineering strain is less than 3%.

Author

Carbon Nanotubes; Strain Measurement; Temperature Measurement; Stainless Steels; Silicon; Substrates; Nanocomposites; Nanotechnology

20080040161 NASA Langley Research Center, Hampton, VA, USA

The Effects of Single-Wall Carbon Nanotubes on the Shear Piezoelectricity of Biopolymers

Lovell, Conrad; Fitz-Gerald, James M.; Harrison, Joycelyn S.; Park, Cheol; September 08, 2008; 9 pp.; In English; SAMPE '08 Fall Technical Conference, 8-11 Sep. 2008, Memphis, TN, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 698671.01.07.04; Copyright; Avail.: CASI: A02, Hardcopy

Shear piezoelectricity was investigated in a series of composites consisting of increased loadings of single-wall carbon nanotubes (SWCNTs) in poly (gamma-benzyl-L-glutamate), or PBLG. The effects of the SWCNTs on this material property in PBLG will be discussed. Their influence on the morphology of the polymer (degree of orientation and crystallinity), and electrical and dielectric properties of the composite will be reported

Author

Piezoelectricity; Nanocomposites; Dielectric Properties; Carbon Nanotubes; Biopolymers; Electrical Properties

20080040162 Army Research Lab., Hampton, VA, USA

Assessment of Composite Delamination Self-Healing Via Micro-Encapsulation

O'Brien, T. Kevin; White, Scott R.; September 09, 2008; 18 pp.; In English; American Society for Composites 23rd Annual Technical Conference, 9-11 Sep. 2008, Memphis, TN, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 561581.02.07; Copyright; Avail.: CASI: A03, Hardcopy

Composite skin/stringer flange debond specimens manufactured from composite prepreg containing interleaf layers with a polymer based healing agent encapsulated in thin walled spheres were tested. As a crack develops and grows in the base polymer, the spheres fracture releasing the healing agent. The agent reacts with catalyst and polymerizes healing the crack. In addition, through-thickness reinforcement, in the form of pultruded carbon z-pins were included near the flange tips to improve the resistance to debonding. Specimens were manufactured with 14 plies in the skin and 10 plies in the stiffener flange. Three-point bend tests were performed to measure the skin/stiffener debonding strength and the recovered strength after healing. The first three tests performed indicated no healing following unloading and reloading. Micrographs showed that delaminations could migrate to the top of the interleaf layer due to the asymmetric loading, and hence, bypass most of the embedded capsules. For two subsequent tests, specimens were clamped in reverse bending before reloading. In one case, healing was observed as evidenced by healing agent that leaked to the specimen edge forming a visible 'scar'. The residual strength measured upon reloading was 96% of the original strength indicating healing had occurred. Hence, self-healing is possible in fiber reinforced composite material under controlled conditions, i.e., given enough time and contact with pressure on the crack surfaces. The micro-encapsulation technique may prove more robust when capsule sizes can be produced that are small enough to be embedded in the matrix resin without the need for using an interleaf layer. However, in either configuration,

the amount of healing that can occur may be limited to the volume of healing agent available relative to the crack volume that must be filled.

Author

Encapsulating; Composite Materials; Prepregs; Cyclic Loads; Debonding (Materials); Fiber Composites; Surface Cracks; Residual Strength; Asymmetry; Stringers; Delaminating

20080040703 NASA Langley Research Center, Hampton, VA, USA

Design and Analysis of Tow-Steered Composite Shells Using Fiber Placement

Wu, K. Chauncey; September 09, 2008; 18 pp.; In English; American Society for Composites 23rd Annual Technical Conference, 9-11 Sep. 2008, Memphis, TN, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.07.15.03; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040703>

In this study, a sub-scale advanced composite shell design is evaluated to determine its potential for use on a future aircraft fuselage. Two composite shells with the same nominal 8-ply $[\pm 45/\pm \Theta]_s$ layup are evaluated, where Θ indicates a tow-steered ply. To build this shell, a fiber placement machine would be used to steer unidirectional prepreg tows as they are placed around the circumference of a 17-inch diameter right circular cylinder. The fiber orientation angle varies continuously from 10 degrees (with respect to the shell axis of revolution) at the crown, to 45 degrees on the side, and back to 10 degrees on the keel. All 24 tows are placed at each point on every fiber path in one structure designated as the shell with overlaps. The resulting pattern of tow overlaps causes the laminate thickness to vary between 8 and 16 plies. The second shell without tow overlaps uses the capability of the fiber placement machine to cut and add tows at any point along the fiber paths to fabricate a shell with a nearly uniform 8-ply laminate thickness. Issues encountered during the design and analysis of these shells are presented and discussed. Static stiffness and buckling loads of shells with tow-steered layups are compared with the performance of a baseline quasi-isotropic shell using both finite element analyses and classical strength of materials theory.

Author

Composite Structures; Design Analysis; Fiber Orientation; Mechanical Properties; Shells (Structural Forms); Reinforcing Fibers; Composite Materials

25

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*.

20080039188 TDA Research, Inc., Wheat Ridge, CO USA

Evaluation of Catalyst Activity - Detoxification of Chemical Warfare Agents Under Oxidation and Hydrolysis Conditions

Bell, William; Smith, Brian; Scholten, Trudy; Stapleton, Meg; Fitzpatrick, Richard; Gerovac, James P; Aug 15, 2006; 41 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-05-C-0041

Report No.(s): AD-A482413; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482413>

This project screened potential catalysts for the detoxification of chemical warfare (CW) agents by catalytic oxidation and hydrolysis under ambient conditions. TDA contacted interested researchers, who submitted their candidate catalysts directly to CUBRC (Ashford Test Site, Springville, NY). CUBRC evaluated the activity of catalysts and their ability to detoxify the chemical warfare agents GD, VX and HD. The specific focus of this test program was to screen a wide range of candidate catalyst under the same conditions using live agents. Hydrolysis catalysts were evaluated using GD and VX in buffered aqueous solution (pH 7.2). Oxidation catalysts were evaluated using VX and HD in methyl-tert-butyl ether (MTBE) solution with a headspace of air. All samples were shaken continuously on a mechanical shaker. Aliquots were removed at time intervals of $t = 0, 1, 2, 6,$ and 22 hours and analyzed by Electron Impact - Gas Chromatography Mass Spectrometry (EI-GCMS) with high-resolution capillary chromatography. None of the catalysts evaluated displayed significant activity under the test conditions. However, some of these materials may display useful activity under other conditions.

DTIC

Catalysts; Chemical Warfare; Decontamination; Hydrolysis; Oxidation

20080039215 Army Research Lab., Adelphi, MD USA

Emission Measurements of Ultracell XX25 Reformed Methanol Fuel Cell System

Rong, Charles; Tran, Dat; Ferry, Elizabeth; Chu, Deryn; Jun 2008; 24 pp.; In English; Original contains color illustrations
Report No.(s): AD-A482391; ARL-TR-4477; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: <http://hdl.handle.net/100.2/ADA482391>

Four Ultracell XX25 Rev B. Reforming Methanol Fuel Cell systems have been tested for exhaust emissions at the U.S. Army Research Laboratory (ARL) under different operating conditions. These tests were conducted at a government facility to verify data previously reported and measured at Ultracell facilities. Two identical Agilent micro-GC systems were used to carry out the test. Personnel from Ultracell Corporation and Agilent Technologies, and Government Personnel from CERDEC and ARL participated in the test. This report documents the test procedure, analytical instrument calibration, operating parameters, and the obtained results. Hazardous exhaust emission components, such as carbon monoxide, methane, and methanol, were found during the start up time, and more found during the cold start up time (the fuel cell system was presoaked at 0 C for 1.5 h). However, all emissions that were detected and reported in this document are expected to be below the OSHA standards for exposure limits if the system is subjected to the OSHA conditions for measurements. The cause of the emission was the formation of some incompletely burned methanol molecule that was used to heat up the reformer and fuel cell stack in the system. The efficiency and reliability of the burner over the life time of the fuel cell system is at the center of the issue, a common understanding accepted by all the parties involved in the testing.

DTIC

Carbon Monoxide; Emission; Fuel Cells; Methyl Alcohol

20080039290 Fleming and Faulkner, State College, PA, USA

Process for the Conversion of Methane

Sen, A., Inventor; Lin, M., Inventor; 13 Apr 05; 7 pp.; In English

Contract(s)/Grant(s): DE-FG02-03ER86160

Patent Info.: Filed Filed 13 Apr 05; US-Patent-Appl-SN-11-105 245

Report No.(s): PB2008-103506; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A process for the facile two-step synthesis of methanol from methane is disclosed. In accordance with the invention, an appropriate combination of initiator and reaction medium is employed to achieve methane conversion in very high selectivity and yield under near-ambient temperature.

NTIS

Methane; Methyl Alcohol; Patents; Synthesis (Chemistry)

20080039291 Eisenber (Howard), Esq., Perkasi, PA, USA

Method for Halogenating or Radiohalogenating a Chemical Compound

Kabalka, G. W., Inventor; 5 Jul 05; 5 pp.; In English

Patent Info.: Filed Filed 5 Jul 05; US-Patent-Appl-SN-11-174 797

Report No.(s): PB2008-103507; No Copyright; Avail.: CASI: [A01](#), Hardcopy

A method for obtaining a halogenated organic compound, whereby an organotrifluoroborate compound is reacted with a halide ion in the presence of an oxidizing agent to produce the corresponding halogenated organic compound. The method may be used for producing radiohalogenated organic compounds.

NTIS

Chemical Composition; Halogenation; Organic Compounds; Patent Applications

20080039307 Kieaxh (Alan D.), Idaho Falls, ID, USA

Chemical Reactor and Method for Chemically Converting a First Material into a Second Material

Kong, P. C., Inventor; 17 Nov 04; 11 pp.; In English

Contract(s)/Grant(s): DE-AC07-991D13727

Patent Info.: Filed Filed 17 Nov 04; US-Patent-Appl-SN-10-992 498

Report No.(s): PB2008-103591; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A chemical reactor and method for converting a first material into a second material is disclosed and wherein the chemical reactor is provided with a feed stream of a first material which is to be converted into a second material; and wherein the first material is combusted in the chemical reactor to produce a combustion flame, and a resulting gas; and an electrical arc is

provided which is passed through or superimposed upon the combustion flame and the resulting gas to facilitate the production of the second material.

NTIS

Chemical Reactors; Patent Applications

20080039366 Massachusetts Univ., Lowell, MA USA

Wafer-Fused Orientation-Patterned GaAs

Li, Jin; Fenner, David B; Termkoa, Krongtip; Allen, Mark G; Moulton, Peter F; Lynch, Candace; Bliss, David F; Goodhue, William D; Feb 13, 2008; 9 pp.; In English

Contract(s)/Grant(s): Proj-2305

Report No.(s): AD-A482555; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The fabrication of thick orientation-patterned GaAs (OP-GaAs) films is reported using a two-step process where an OP-GaAs template with the desired crystal domain pattern was prepared by wafer fusion bonding and then a thick film was grown over the template by low pressure hydride vapor phase epitaxy (HVPE). The OP template was fabricated using molecular beam epitaxy (MBE) followed by thermocompression wafer fusion, substrate removal, and lithographic patterning. On-axis (100) GaAs substrates were utilized for fabricating the template. An approximately 350 micrometers thick OP-GaAs film was grown on the template at an average rate of ~70 micrometers/hr by HVPE. The antiphase domain boundaries were observed to propagate vertically and with no defects visible by Nomarski microscopy in stain-etched cross sections. The optical loss at ~2 micrometers wavelength over an 8 mm long OP-GaAs grating was measured to be no more than that of the semi-insulating GaAs substrate. This template fabrication process can provide more flexibility in arranging the orientation of the crystal domains compared to the Ge growth process and is scalable to quasi-phase-matching (QPM) devices operating from the IR to terahertz frequencies utilizing existing industrial foundries.

DTIC

Gallium Arsenides; Optical Properties; Semiconductors (Materials); Wafers

20080039378 National Energy Technology Lab., Morgantown, WV, USA

Surface Modifications for Oxidation Resistance

Jablonski, P. E.; Aug. 01, 2007; 33 pp.; In English

Report No.(s): DE2007-916962; DOE/NETL-IR-2007-235; No Copyright; Avail.: National Technical Information Service (NTIS)

No abstract available

Oxidation Resistance; Surface Treatment

20080039448 McKinley Law Office, Richland, WA, USA

Method and Apparatus for Packed Column Separations and Purifications

Holman, D. A., Inventor; Bruckner-Lea, C. J., Inventor; Brockman, F. J., Inventor; Chandler, D. P., Inventor; 5 Dec 05; 16 pp.; In English

Contract(s)/Grant(s): DE-AC06-76RLO 1830

Patent Info.: Filed Filed 5 Dec 05; US-Patent-Appl-SN-11-294 713

Report No.(s): PB2008-103521; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In one aspect, the invention encompasses a method of packing and unpacking a column chamber. A mixture of a fluid and a matrix material are introduced through a column chamber inlet so that the matrix material is packed within a column chamber to form a packed column. After the packing, the matrix material is unpacked from the column chamber without moving the column chamber. More specifically, the column chamber having the column chamber inlet or first port for receiving the mixture further has an outlet port and an actuator port. The outlet port is partially closed for capturing the matrix material and permitting the fluid to flow therepast by rotating relative one to the other of a rod placed in the actuator port. Further rotation relative one to the other of the rod and the column chamber opens the outlet and permits the matrix material and the fluid to flow therethrough thereby unpacking the matrix material from the column chamber. In another aspect, the invention encompasses a method of purifying a component of a sample. A column chamber having an inlet end, an outlet end and an actuator end is provided. Flow of matrix material is obstructed by a rod with a binary end inserted in the actuator end. A suspension of the first fluid and the matrix material is flowed into the column chamber to form a packed column of the matrix

material within the column chamber. The matrix material is configured to selectively retain a component of the sample. The sample is flowed through the packed column and past the rod to separate the component from the rest of the sample.

NTIS

Matrix Materials; Patent Applications; Fluid Flow

20080039449 Myers Bigel Sibley and Sajovec, Raleigh, NC, USA

Fixed-Dried Red Blood Cells

Fischer, T. H., Inventor; Read, M. S., Inventor; Bode, A. P., Inventor; Nichols, T. C., Inventor; 24 Jan 05; 14 pp.; In English
Contract(s)/Grant(s): N00014-97-1-0867

Patent Info.: Filed Filed 24 Jan 05; US-Patent-Appl-SN-11-041 560

Report No.(s): PB2008-103150; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Fixed-dried red blood cells (RBCs), and processes for preparing the same are disclosed. The red blood cells, upon reconstitution with distilled water or appropriate buffer: bind oxygen with native affinities, have partial deformability, present minimal thrombogenicity to platelets, and have obliterated blood group antigens. The RBCs are preferably fixed by means of cross-linkers with aldehyde functions such as paraformaldehyde or glutaraldehyde either alone or in combination. Native oxygen kinetics are achieved by preparing the red blood cells with 1,6-diphosphofructose. Blood group antigens and chemical functions that render the lyophilized RBCs thrombogenic are occluded by chemically attaching polyoxyethylene glycol polymers to the surface membrane of the red blood cells. The cross-linked red blood cells are preferably dried by lyophilization.

NTIS

Drying; Erythrocytes; Patent Applications

20080039482 Microfabrica Inc., Van Nuys, CA, USA; University of Southern California, Los Angeles, CA USA

Method for Electrochemically Fabricating Three-Dimensional Structures Including Pseudo-Rasterization of Data

Cohen, A. L., Inventor; Thompson, J. A., Inventor; 3 Jan 05; 22 pp.; In English

Contract(s)/Grant(s): DABT63-97-C-0051; DABT63-99-C-0042

Patent Info.: Filed Filed 3 Jan 05; US-Patent-Appl-SN-11-029 173

Report No.(s): PB2008-103182; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Some embodiments of the invention are directed to techniques for electrochemically fabricating multi-layer three-dimensional structures where selective patterning of at least one or more layers occurs via a mask which is formed using data representing cross-sections of the three-dimensional structure which has been modified to place it in a polygonal form which defines only regions of positive area. The regions of positive area are regions where structural material is to be located or regions where structural material is not to be located depending on whether the mask will be used, for example, in selectively depositing a structural material or a sacrificial material. The modified data may take the form of adjacent or slightly overlapped relative narrow rectangular structures where the width of the structures is related to a desired formation resolution. The spacing between centers of adjacent rectangles may be uniform or may be a variable. The data modification may also include the formation of duplicate copies of an original structure, scaled copies, mirrored copies, rotated copies, complementary copies, and the like.

NTIS

Fabrication; Patent Applications; Laminates

20080039484 Pearl Cohen Zedek, LLP, New York, NY, USA

Synthetic HLA Binding WT-1 Peptide Analogues and Uses Thereof

Scheinberg, D. A., Inventor; Ibarz, J. P., Inventor; 12 Sep 05; 35 pp.; In English

Contract(s)/Grant(s): 08748; PO1 33049

Patent Info.: Filed Filed 12 Sep 05; US-Patent-Appl-SN-11-223 139

Report No.(s): PB2008-103187; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention is directed to a synthetic peptide comprising a sequence of amino acids containing at least a segment that is an analogue of a native peptide that specifically binds to HLA A0201 or HLA A0301 molecules on a cell characteristic of a pathophysiological state in a mammal. The synthetic peptide may be derived from native peptides comprising a breakpoint region of the WTI protein.

NTIS

Amino Acids; Analogs; Patent Applications; Peptides

20080039490 Wood, Herron and Evans, LLP, Cincinnati, OH, USA; Cincinnati Univ., OH, USA

Slow-Release Inhibitor for Corrosion Control of Metals

van Ooij, W. J., Inventor; Manian, H., Inventor; Yang, L., Inventor; Yang, H., Inventor; 4 Nov 04; 11 pp.; In English

Contract(s)/Grant(s): AFOSR F 49620-01-1-0352

Patent Info.: Filed Filed 4 Nov 04; US-Patent-Appl-SN-10-981 017

Report No.(s): PB2008-103116; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention provides for a slow-release inhibitor that is applied to a metal surface, such as by way of a paint or primer coating, for corrosion control of the metal. An exemplary embodiment of the slow-release corrosion inhibitor includes a water-soluble particle, or pigment, and an organic polymeric film that encapsulates the particle. This water-soluble particle may be either organic or inorganic and, preferably, is non-carcinogenic and non-toxic. An additional water-soluble particle having an encapsulating, organic polymeric film further may be provided along with a water-soluble, organic compound to form the corrosion inhibitor. The polymeric film(s) are of a desired hydrophobicity and permeability to permit, upon interaction of the particle(s) with water, controlled diffusion of particle ions therethrough.

NTIS

Corrosion; Corrosion Prevention; Inhibitors; Metals; Patent Applications; Protective Coatings

20080039491 Berger, Peter, Levisohn Lerner Berger and Langsam, New York, NY, USA

Method and Apparatus for Multiplexing Plural Ion Beams to a Mass Spectrometer

Boyle, J. G., Inventor; Valley, R. A., Inventor; 2 Nov 04; 28 pp.; In English

Patent Info.: Filed Filed 2 Nov 04; US-Patent-Appl-SN-10-979 623

Report No.(s): PB2008-103117; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method/apparatus for multiplexing plural ion beams to a mass spectrometer. At least two ion sources are provided with means of transporting the ions from the ion sources to separate two-dimensional ion traps. Each ion trap is used for storage and transmission of the ions and operates between the ion sources and the mass analyzer. Each ion trap has a set of equally spaced, parallel multipole rods, as well as entrance and exit sections into which and from which ions enter and exit the trap, respectively. For each ion trap, the entrance section is placed in a region where background gas pressure is at viscous flow. The pressure at the exit section drops to molecular flow pressure regimes without a break in the structure of the ion trap. Each trap alternately stores and transmits ions by way of a fast voltage switch applied to the ion trap exit lens.

NTIS

Ion Beams; Ion Sources; Mass Spectrometers; Multiplexing; Patent Applications

20080039503 Lane (Philip D), Charlotte, NC, USA

High Density Carbon From Coal (PAT-APPL-11-039 775)

Morgan, D. R., Inventor; Lucas, R. D., Inventor; 20 Jan 05; 5 pp.; In English

Contract(s)/Grant(s): F33615-03-M-5022

Patent Info.: Filed Filed 20 Jan 05; US-Patent-Appl-SN-11-039 775

Report No.(s): PB2008-103145; No Copyright; Avail.: CASI: [A01](#), Hardcopy

A high density carbon material produced from coal is described. The carbon material may have a density ranging from about 1.0 g/cc to about 1.6 g/cc and may have a crush strength of up to about 20,000 psi. The high density carbon material is produced by slowly heating comminuted swelling bituminous coal particles under pressures of 400 psi to about 500 psi to a first temperature at about the initial plastic temperature of the coal. The material is held at this temperature for a period of time sufficient to provide for a uniform temperature throughout the coal. The material is then heated to a second temperature for a period of time sufficient to provide for the coal achieving an essentially uniform temperature. The resulting product is a three-dimensional, self-supporting carbon that has a substantially continuous carbon matrix defining grain boundaries within the carbon matrix. The characteristics of the carbon material may be altered by further heating to carbonize or graphitize the high density carbon material.

NTIS

Carbon; Coal; Patent Applications

20080039504 Stites and Harbison, PLLC, Nashville, TN, USA

Agents with Selective K-Opioid Receptor Affinity

Zjawiony, J., Inventor; Fahmy, H., Inventor; Stewart, D. J., Inventor; Roth, B., Inventor; 29 Jul 05; 12 pp.; In English

Contract(s)/Grant(s): 5 RO1 FA-017229-04-02

Patent Info.: Filed Filed 29 Jul 05; US-Patent-Appl-SN-11-192 925

Report No.(s): PB2008-103147; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Compounds and compositions that are salvinorin A and salvinorin B derivatives that demonstrate selectivity and/or potency for the k-opioid receptor (KOR), allowing for their use as medicines, as well as chemical probes (both radiolabeled and cold) for fields utilizing the techniques of radiolabeled binding assays.

NTIS

Patent Applications; Assaying

20080039506 Wolf Greenfield and Sacks, P.C., Boston, MA, USA; Massachusetts Inst. of Tech., Cambridge, MA, USA
Methods and Products Related to the Intracellular Delivery of Polysaccharides

Berry, D. A., Inventor; Anderson, D. G., Inventor; Lynn, D. M., Inventor; Sasisekharan, R., Inventor; Langer, R. S., Inventor; 15 Apr 05; 81 pp.; In English

Contract(s)/Grant(s): GM26698; CA52857

Patent Info.: Filed Filed 15 Apr 05; US-Patent-Appl-SN-11-107 360

Report No.(s): PB2008-103149; No Copyright; Avail.: CASI: [A05](#), Hardcopy

The invention relates, in part, to methods and compositions for the intracellular delivery of polysaccharides. In particular, the methods and compositions relate to the intracellular delivery of glycosaminoglycans, such as heparin. The invention in other aspects relates to the use of glycosaminoglycans for the treatment of proliferative disorders, such as cancer. The invention, in still other aspects, relates to improving cell viability. The invention also relates to the delivery of polysaccharides while avoiding unwanted effects of the polysaccharides. For example, heparin can be delivered while avoiding its anticoagulant effects.

NTIS

Patent Applications; Polysaccharides

20080039511 Peters Verny Jones and Schmitt, Palo Alto, CA, USA

Nanoscale Mass Conveyors

Regan, B. C., Inventor; Aloni, S., Inventor; Zettl, A. K., Inventor; 21 Mar 05; 13 pp.; In English

Contract(s)/Grant(s): DE-AC03-76SF00098

Patent Info.: Filed Filed 21 Mar 05; US-Patent-Appl-SN-11-085 397

Report No.(s): PB2008-102160; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A mass transport method and device for individually delivering chargeable atoms or molecules from source particles is disclosed. It comprises a channel; at least one source particle of chargeable material fixed to the surface of the channel at a position along its length; a means of heating the channel; and a means for applying an controllable electric field along the channel, whereby the device transports the atoms or molecules along the channel in response to applied electric field. In a preferred embodiment, the mass transport device will comprise a multiwalled carbon nanotube (MWNT), although other one dimensional structures may also be used. The MWNT or other structure acts as a channel for individual or small collections of atoms due to the atomic smoothness of the material. Also preferred is a source particle of a metal such as indium. The particles move by dissociation into small units, in some cases, individual atoms. The particles are preferably less than 100 nm in size.

NTIS

Conveyors; Mass Transfer; Patent Applications; Transport Properties

20080039519 Westerman, Hattori, Daniels and Adrian, Washington, DC, USA; Department of the Navy, Washington, DC, USA

New Luminescent Compositions and Their Uses

Morishita, Y., Inventor; Nomura, S., Inventor; Tsuda, Y., Inventor; Marrocco, M. L., Inventor; Motamedi, F. J., Inventor; 15 Oct 04; 66 pp.; In English

Contract(s)/Grant(s): N00014-02-C-046 1

Patent Info.: Filed Filed 15 Oct 04; US-Patent-Appl-SN-10-966 370

Report No.(s): PB2008-103156; No Copyright; Avail.: CASI: [A04](#), Hardcopy

High quantum yield luminescent monomers, oligomers, and polymers, comprising benzotriazole repeating units and derivatives thereof have been discovered and utilized in optical devices and components therefor, including electroluminescent

devices, light emitting devices, photoluminescent devices, organic light emitting diodes (OLEDs), OLED displays, sensors, and the like.

NTIS

Luminescence; Monomers; Oligomers; Patent Applications

20080039528 Sughrue Mion, PLLC, Washington, DC, USA

Method and a Composite for Mercury Capture From Fluid Streams

Mazyck, D. W., Inventor; Wu, C. Y., Inventor; Pitoniak, E. R., Inventor; Powers, K. W., Inventor; Londeree, D. J., Inventor; 5 Mar 04; 14 pp.; In English

Contract(s)/Grant(s): NCC-9-110; EPA-R-82960201

Patent Info.: Filed Filed 5 Mar 04; US-Patent-Appl-SN-10-522 589

Report No.(s): PB2008-101653; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method for removing mercury from a fluid stream includes the steps of providing a porous composite material comprising a substrate and a plurality of catalyst and/or photocatalyst particles, and contacting substrate with a fluid stream. The porous composite material adsorbs and/or then oxidizes or reduces metallic species including elemental mercury. A fossil fuel fired power plant can include an emission control device comprising the porous composite material to filter flue gas emissions into the environment.

NTIS

Composite Materials; Gas Streams; Patent Applications; Streams

20080039537 VanDeuren (Reinhart Boerner), Milwaukee, WI, USA

Layer by Layer Self-Assembly of Large Response Molecular Electro-Optic Materials by a Desilylation Strategy

Marks, T. J., Inventor; van der Boom, M. E., Inventor; 10 Feb 05; 23 pp.; In English

Contract(s)/Grant(s): DMR 9632472; ONR N00014-95-1-1219

Patent Info.: Filed Filed 10 Feb 05; US-Patent-Appl-SN-11-054 962

Report No.(s): PB2008-102475; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The preparation of robust, thin film materials with large second-order optical nonlinearities through the covalent self-assembly of chromophoric compositions and innovative use of silyl chemistry.

NTIS

Electro-Optics; Patent Applications; Self Assembly

20080039539 Lahive and Cockfield, LLP, Boston, MA, USA

T-BET Compositions and Methods of Use Thereof

Glimcher, L. H., Inventor; Szabo, S. J., Inventor; 30 Nov 05; 73 pp.; In English

Contract(s)/Grant(s): AI/AG 37833; AI 39646

Patent Info.: Filed Filed 30 Nov 05; US-Patent-Appl-SN-11-291 426

Report No.(s): PB2008-103173; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Isolated nucleic acid molecules encoding T-bet, and isolated T-bet proteins, are provided. The invention further provides antisense nucleic acid molecules, recombinant expression vectors containing a nucleic acid molecule of the invention, host cells into which the expression vectors have been introduced and non-human transgenic animals carrying a T-bet transgene. The invention further provides T-bet fusion proteins and anti-T-bet antibodies. Methods of using the T-bet compositions of the invention are also disclosed, including methods for detecting T-bet activity in a biological sample, methods of modulating T-bet activity in a cell, and methods for identifying agents that modulate the activity of T-bet.

NTIS

Patent Applications; Nucleic Acids; Detection; Coding; Proteins

20080039541 Dorman (Ira S.), Hartford,, CT, USA

Method and Apparatus for Rapid Extraction and Analysis, By SERS, of Drugs in Saliva (PAT-APPL-10-967 486)

Farquharson, S., Inventor; Gift, A. D., Inventor; Inscore, F. E., Inventor; Shende, C. S., Inventor; 18 Oct 04; 11 pp.; In English

Contract(s)/Grant(s): 1R43CA94457-01; DMI-0214280

Patent Info.: Filed Filed 18 Oct 04; US-Patent-Appl-SN-10-967 486

Report No.(s): PB2008-103179; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The method and apparatus rapidly separate drugs and their metabolites from saliva and, in a continuous sequence of steps, rapidly detect, identify and quantify them through surface-enhanced Raman spectroscopy.

NTIS

Drugs; Extraction; Patent Applications; Raman Spectroscopy; Saliva

20080039542 Dorman (Ira S.), Hartford,, CT, USA

Method and Apparatus for Rapid Extraction and Analysis By SERS, of Drugs in Saliva (PAT-APPL-11-098 844)

Farquharson, S., Inventor; Inscore, F. E., Inventor; Gift, A. D., Inventor; Shende, C. S., Inventor; 5 Apr 05; 14 pp.; In English
Contract(s)/Grant(s): 1R43CA94457-01; DMI-0214280

Patent Info.: Filed Filed 5 Apr 05; US-Patent-Appl-SN-11-098 844

Report No.(s): PB2008-103180; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The method and apparatus rapidly separate drugs and their metabolites from saliva and, in a continuous sequence of steps, rapidly detect, identify and quantify them through surface-enhanced Raman spectroscopy.

NTIS

Drugs; Extraction; Patent Applications; Raman Spectroscopy; Saliva

20080039663 Stanford Univ., Stanford, CA USA

Development of an Aerosol Loading Technique for Ignition Time Measurements in Shock Tubes

Hanson, R K; Davidson, D F; Aug 2007; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-1-0148

Report No.(s): AD-A482717; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482717>

We have developed a new aerosol loading technique to be used in shock tube measurements of combustion kinetics, in particular ignition times, of low-vapor pressure fuels. This technique provides a uniform spatial distribution of aerosol in the shock tube, which ensures well-behaved shock-induced flows and a narrow micron-sized aerosol size distribution that rapidly evaporates, thereby providing the capability to produce high-concentration vapor mixtures derived from a wide variety of fluids including low-vapor-pressure practical fuels and fuel surrogates. At present we utilize the incident shock wave to vaporize the fuel droplets, and the reflected shock wave to induce chemical reaction. We report here the first aerosol shock tube ignition delay time measurements of n-dodecane/O₂/argon mixtures. These measurements are found to be consistent with those made in our heated shock tube facility.

DTIC

Aerosols; Fuels; Ignition; Shock Tubes; Time Measurement

20080039664 Alabama Univ., Huntsville, AL USA

Multi-scale Modeling of Proton Transport, Water Distribution, and Methanol Permeability in Proton Exchange Membranes (PEMs)

Paddison, Stephen J; Tuckerman, Mark E; May 26, 2008; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-07-1-0085

Report No.(s): AD-A482718; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482718>

We have undertaken our multiscale modeling of proton exchange membranes through three simultaneous but distinct studies of perfluorosulfonic acid (PFSA) systems at different time and length scales: (1) hydrated morphology of PFSA membranes with dissipative particle dynamics (DPD) simulations; (2) classical MD simulations of the hydration and hydronium ion diffusion of the short-side chain (SSC) PFSA membrane; and (3) ab initio density functional theory Car-Parrinello MD simulations of model PFSA systems. A course-grained study of the hydrated morphology of Nafion and the SSC ionomer as a function of water content and equivalent weight (EW) was undertaken using DPD simulations. The results were analyzed through water contour plots, radial distribution functions of the water, and scattering plots. This work provides the first insight into how EW and side chain chemistry of the ionomer effects morphology. In the second study a unique force field was derived for the fully atomistic MD simulations of the SSC ionomer. The EW was fixed but the water content (from minimal to intermediate) was varied. Structural data and proton diffusion coefficients were computed on a small system of the SSC ionomer and provide a base line for simulations that treat the atoms as classical particles only. Finally, we performed density functional theory Car-Parrinello MD simulations of the mono-, di- and tetra- hydrates of trifluoromethanesulfonic acid as model systems for minimally hydrated PFSA polymers. We developed a consistent set of

dispersion corrected atom-centered potentials to account for van der Waals interactions in these solids in order to match structural and lattice parameters.

DTIC

Hydrates; Membranes; Methyl Alcohol; Permeability; Protons; Rotons; Water

20080039670 California Univ., San Diego, La Jolla, CA USA

Combustion of JP8 in Laminar Premixed Flames

Seshadri, Kalyanasundaram; Mar 12, 2008; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-1-0158

Report No.(s): AD-A482726; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482726>

Experimental and numerical studies are carried out to develop a surrogate that can reproduce selected aspects of combustion of JP-8. Surrogate fuels are defined as mixtures of few hydrocarbon compounds with combustion characteristics similar to those of commercial fuels. A mixture of n-decane and trimethylbenzene, called the Aachen surrogate, and a mixture of n-dodecane, methylcyclohexane, and o-xylene called Surrogate C are selected for consideration as possible surrogates of JP-8. Experiments under nonpremixed conditions are carried out employing the counterflow configuration. The fuels tested are JP-8 and the Aachen surrogate. Critical conditions of extinction, autoignition, and volume fraction of soot measured in laminar nonpremixed flows burning the Aachen surrogate are found to be similar to those in flames burning JP-8. Numerical calculations are performed using the chemical kinetic mechanism for the Aachen surrogate. The calculated values of the critical conditions of autoignition and soot volume fraction agree well with experimental data. Experimental studies are carried out to characterize premixed combustion of jet fuels and its surrogates in laminar nonuniform flows. The counterflow configuration is employed. Studies are performed with a premixed reactant stream made up of prevaporized fuel, oxygen and nitrogen from one duct, and an inert stream of nitrogen from the other duct. Critical conditions of extinction are measured for JP-8, Aachen surrogate and Surrogate C. The measured critical conditions of extinction of these surrogates agree well with those for JP-8. This study confirms that the Aachen Surrogate and Surrogate C are possible surrogates of JP-8.

DTIC

Combustion; Flames; Fuels; Jet Engine Fuels; Laminar Flow; Premixed Flames

20080039686 Naval Research Lab., Washington, DC USA

Surface Morphology of Homoepitaxial GaSb Films Grown on Flat and Vicinal Substrates

Nosho, B Z; Bennett, B R; Aifer, E H; Goldenberg, M; Aug 2001; 11 pp.; In English

Report No.(s): AD-A482755; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482755>

We have compared the surface morphology of GaSb homoepitaxial films grown on both flat and 1 deg vicinal [miscut towards (1 1 1)A] (0 0 1) substrates using atomic force microscopy and scanning tunneling microscopy. Mound formation is observed for GaSb homoepitaxy on the flat substrates over a range of growth temperatures when either Sb₂ or Sb₄ is used to supply the group V flux. At sufficiently high growth temperatures, which are different depending on whether Sb₂ or Sb₄ is used, the mounds transform into fairly well-defined pyramids comprised of distinctly stacked layers that are clearly separated by monolayer-height steps.

DTIC

Gallium Antimonides; Gallium Arsenides; Morphology; Substrates

20080039689 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

In Vitro Toxicity of Aluminum Nanoparticles in Human Keratinocytes

McCormack-Brown, Stephanie; Mar 2008; 90 pp.; In English

Report No.(s): AD-A482760; AFIT/GIH/ENV/08-M01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482760>

Nanotechnology promises to be the defining technology of the 21st century. At an annual investment of \$1B, it provides significant contributions to manufacturing, medicine, energy conservation, and the environment. Nanoparticles are structures with at least one dimension in the 1 to 100 nanometer (nm) range. DoD and US Air Force interest in aluminum nanoparticles (AL NPs) stems from its ability to enhance combustion jet fuel, thus increasing fuel efficiency. The addition of AL NPs to JP-8 may pose a unique dermal hazard to aircraft maintenance workers. There is no published data on AL NP toxicity effects on

human skin. This research used in vitro techniques to determine the cytotoxicity of AL NPs, sized 50, 80, and 120 nm, on human keratinocytes. AL NPs at concentrations 10 - 10,000 micrograms/mL and 24-hour exposure did not have a negative effect on cell viability, as assessed by membrane leakage, metabolic function, and reactive oxygen species generation. Keratinocyte expression of proinflammatory interleukins-1 α and -8 was quantified to determine if AL NPs induced precursor cytokines for irritant contact or sensitizer response dermatitis. After 24-hour exposure to AL NPs, keratinocytes expressed significant concentrations of IL-8, 24 - 100 times greater than IL-1 α , indicating that AL NPs may induce sensitizer response dermatitis.

DTIC

Aluminum; Cells (Biology); Epidermis; In Vitro Methods and Tests; Nanoparticles; Toxicity

20080039736 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Fuel Composition Analysis of Endothermically Heated JP-8 Fuel for Use in a Pulse Detonation Engine

Nagley, Eric A; Jun 2008; 124 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482863; AFIT/GAE/ENY/08-J08; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482863>

Waste heat from a pulse detonation engine (PDE) was extracted via zeolite catalyst coated concentric tube-counter flow heat exchangers to produce supercritical pyrolytic conditions for JP-8 fuel. A sampling system and method were developed that enabled samples of reacted fuel to be extracted during steady state operation. Samples were taken over a range of heat exchanger exit temperatures from 820 K (1016 F) to 940 K (1232 F). Offline analysis of liquid and vapor fuel samples indicated fuel decomposition via typical pyrolytic reaction pathways. The liquid analysis showed conversion of parent fuel components with formation of unsaturates (aromatics and alkenes) and smaller alkanes. The gaseous products consisted of predominantly C1-C3 alkanes and alkenes (> 75% of total vapor yield) with moderate amounts of hydrogen and C4-C6 alkanes and alkenes. The components that were present in the stressed fuel samples were more detonable and could be linked to improved PDE performance. The ignition time decreased by over 20% as temperature increased from 820 K (1016 F) to 935 K (1224 F) and by more than 30% when compared to unreacted (flash vaporized) JP-8.

DTIC

Cracking (Chemical Engineering); Detonation; Fuel Systems; Fuels; Heat Exchangers; Jet Engine Fuels; JP-8 Jet Fuel; Pulse Detonation Engines

20080039744 Naval Research Lab., Washington, DC USA

Structure of Ge(113): Origin and Stability of Surface Self-Interstitials

Laracuente, A; Erwin, S C; Whitman, L J; Aug 1998; 5 pp.; In English

Report No.(s): AD-A482881; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482881>

Using atomic-resolution scanning tunneling microscopy and first-principles calculations we show that Ge and Si(113) are structurally similar, contrary to previous reports. Both surfaces have (3 x 2) and (3 x 1) reconstructions stabilized by surface self-interstitials, with the (3 x 2) lower in energy on Si but degenerate with the (3 x 1) on Ge. Statistical analysis of fluctuations observed between the two structures on Ge, combined with calculations for bulk interstitials, indicate that the surface (not the bulk) is the likely source and sink of the surface self-interstitials for both materials.

DTIC

Germanium; Interstitials; Stability

20080039745 Naval Research Lab., Washington, DC USA

Ga-Induced Restructuring of Si(112) and Si(337)

Baski, A A; Whitman, L J; Apr 1996; 4 pp.; In English

Report No.(s): AD-A482883; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482883>

The adsorption of gallium on Si(112) and Si(337) has been studied with scanning tunneling microscopy. When clean, these two high-index surfaces are unstable and facet to other orientations: (112) to (111)- and (337)-like nanofacets, and (337)

to the stable (5 5 12) plane. When Ga is adsorbed onto each of these surfaces and annealed, the top surface layers undergo substantial rearrangements, exposing Ga-reconstructed (112) planes in both cases.

DTIC

Gallium; Silicon

20080039800 Naval Research Lab., Washington, DC USA

A Scanning Tunneling Microscopy Study of Hydrogen Adsorption on Si(112)

Baski, A A; Whitman, L J; Jun 1995; 5 pp.; In English

Report No.(s): AD-A482924; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The adsorption of atomic hydrogen on Si(112) has been investigated using scanning tunneling microscopy. The clean (112) surface is reconstructed into quasiperiodic nanofacts [each composed of a (111) and (337) terrace], and we find that atomic hydrogen does not remove this nanofacet structure at room temperature or 430 deg. C. This result demonstrates the surprising stability of the facet reconstruction.

DTIC

Adsorption; Electron Microscopy; Hydrogen; Scanning Tunneling Microscopy; Silicon

20080039803 Naval Research Lab., Washington, DC USA

Barrier Roughness Effects in Resonant Interband Tunnel Diodes

Magno, R; Bracker, A S; Bennett, B R; Nosh, B Z; Whitman, L J; Dec 15, 2001; 6 pp.; In English

Report No.(s): AD-A482928; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Peak current densities of InAs/AlSb/GaSb/AlSb/InAs resonant interband tunneling diodes (RITD) grown by molecular beam epitaxy have been measured as a function of the growth temperature. The growth procedures were designed to produce nominally identical AlSb tunneling barriers. The variations observed in the peak current for positive bias are consistent with the barrier on the substrate side of the RITD becoming effectively thicker for diodes grown at high temperatures. Plan-view in situ scanning tunneling microscopy (STM) measurements indicate that smoother AlSb barriers are grown at high temperature. The growth temperature dependence of the peak current density and STM results are consistent, because tunneling is highly dependent on barrier thickness. While the high and low temperature growths were designed to have the same barrier thickness, the large current flowing through the thin areas of a rough barrier result in an effectively thinner barrier compared to the smooth one.

DTIC

Diodes; Indium Arsenides; Molecular Beam Epitaxy; Resonant Tunneling Diodes; Surface Roughness; Tunnel Diodes

20080039805 Naval Research Lab., Washington, DC USA

Nucleation and Growth of Fe on GaAs(001)-(2x4) Studied by Scanning Tunneling Microscopy

Thibado, P M; Kneeder, E; Jonker, B T; Bennett, B R; Shanabrook, B V; Whitman, L J; Apr 15, 1996; 5 pp.; In English

Report No.(s): AD-A482930; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The nucleation and growth of Fe on GaAs(001)-(2x4) has been studied in situ with scanning tunneling microscopy. The growth is dominated by the structure of the substrate reconstruction. Fe initially forms stable six- to eight-atom two-dimensional islands confined to the first-layer As-dimer rows. The islands preferentially coalesce along the rows, leading to an anisotropic film morphology that persists for at least the first 50 angstrom of growth. These results provide insight into the growth mode of Fe on GaAs surfaces and have implications for the magnetic properties of ultrathin Fe films.

DTIC

Gallium Arsenides; Iron; Magnetic Properties; Nucleation; Scanning Tunneling Microscopy

20080039809 Army Construction Engineering Research Lab., Champaign, IL USA

Direct Carbon Fuel Cells: Converting Waste to Electricity

Wolk, Ronald H; Lux, Scott; Gelber, Stacy; Holcomb, Franklin H; Sep 2007; 54 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482934; ERDC/CERL-TR-07-32; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The U.S. Army has policies to minimize production of waste materials, maximize recycle of waste materials, and minimize energy consumption on its installations. A beneficial way to implement these policies is to convert paper, wood, vegetation, and Municipal Solid Waste (MSW) fractions into a carbon-rich feed stock by pyrolysis to fuel Direct Carbon Fuel Cells (DCFCs). DCFCs potentially offer a unique approach for the direct conversion of biomass-derived, carbon-rich solid fuel

to electricity at very high conversion, with the production of a CO₂-rich flue gas. This work gathered information on the quantities of waste material available at U.S. Army installations from installation reports and from the U.S. Army Solid Waste Annual Reporting System (SWARS) database, then estimated the amount of electricity that DCFC technologies could generate from those wastes, and finally compared those amounts with the current average annual electrical loads at the 10 largest Army installations.

DTIC

Carbon; Electricity; Fuel Cells; Pyrolysis; Solid Wastes; Vegetation

20080039812 Naval Research Lab., Washington, DC USA

Structure of III-Sb(001) Growth Surfaces: The Role of Heterodimers

Barvosa-Carter, W; Bracker, A S; Culbertson, J C; Nosh, B Z; Shanabrook, B V; Whitman, L J; Kim, Hanchul; Modine, N A; Kaxiras, E; May 15, 2000; 5 pp.; In English

Report No.(s): AD-A482938; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have determined the structure of AlSb and GaSb (001) surfaces prepared by molecular beam epitaxy under typical Sb-rich device growth conditions. Within the range of flux and temperature where the diffraction pattern is nominally (1 x 3), we find that there are actually three distinct, stable (4 x 3) surface reconstructions. The three structures differ from any previously proposed for these growth conditions, with two of the reconstructions incorporating mixed III-V dimers within the Sb surface layer. These heterodimers appear to play an important role in island nucleation and growth.

DTIC

Aluminum; Antimony; Dimers; Gallium Antimonides; Molecular Beam Epitaxy

20080039816 Sensor Tech, Inc., Savannah, GA USA

Detection of Specific Gases by Metal Oxide Catalysis

Horovitz, Michael; Gregory, Otto; Anderson, Karl; Jun 28, 2008; 14 pp.; In English

Contract(s)/Grant(s): HR0011-06-C-0135; ARPA ORDER-W200/00

Report No.(s): AD-A482946; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Unambiguous detection of specific gases has been demonstrated to occur at specific temperatures by metal oxide catalysis. Potentially useful metal oxides and their combinations were deposited for evaluation by means of combinatorial material synthesis. The resulting material libraries were then tested for desired catalytic activity using thermal spectroscopy with a differential calorimetry detector. Experimental results suggest that some gases may be optimally detected with oxides of a single metal while other gases may be optimally detected with specific combinations of at least two metal oxides.

DTIC

Catalysis; Detection; Gas Detectors; Metal Oxides; Oxides

20080039839 Materials Research Society, Warrendale, PA USA

Symposium DD: Low-Dimensional Materials-Synthesis, Assembly, Property Scaling and Modeling. Held in San Francisco, CA on April 9-13, 2007

Shim, Moosub; Jun 2008; 81 pp.; In English

Contract(s)/Grant(s): N00014-07-1-0660

Report No.(s): AD-A482988; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Low-dimensional materials such as nanocrystals, nanowires, and nanotubes are at the forefront of materials research. Novel physical and chemical phenomena observed in these systems allow us to envision a variety of next-generation technologies such as high-performance transistors for nano- and microelectronics, low-cost, high-efficiency photovoltaics, high-density magnetic storage media, nano-electromechanical systems and miniaturized biosensors. Fundamental challenges include synthesis of chemically and structurally well-defined nanoscale materials, developing methods of assembly, and establishing an understanding of how properties of isolated nano-objects change and scale as they are incorporated into functional architectures at multiple-length scales. Robust and verified theoretical methods and computational tools ranging from solid-state theory, surface science and computational quantum chemistry to theories that address multiple-length- and time-scale integration need to be developed in parallel with synthetic and experimental efforts. This symposium will focus on advanced syntheses of nanoscale materials (e.g. heterostructures of nanoparticles and nanowires); directed and self assembly of functional architectures (e.g. bio-inspired assemblies and combined top-down/bottom-up patterning); properties of isolated nanoscale objects; how these properties change and scale (in relation to areas such as nanoelectronics, magnetism, photonics,

photovoltaics, and bio-imaging); and computational applications and theoretical developments (related to the design, synthesis, properties and understanding of low-dimensional nanomaterial structures, assemblies and phenomena).

DTIC

Conferences; San Francisco (CA)

20080039864 Texas Tech Univ. Health Sciences Center, Lubbock, TX USA

Counter Terrorism Measures to Combat Yersinia pestis With Selenium Pharmaceuticals

Reid, Ted W; Tran, Phat; Spallholz, Julian; Fralick, Joe A; Jul 1, 2003; 8 pp.; In English; Original contains color illustrations
Report No.(s): AD-A483053; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this study is to produce selenium labeled peptides and phage (bacterial viruses) that can selectively bind to the surface of the pathogenic bacteria Yersinia pestis (the plague) and inactivate it through the generation of superoxide radicals on its surface, similar to the way that it is inactivated by superoxide in macrophage. The results show that phage specific for a given bacteria can be obtained from phage expression libraries. These same phage can be covalently labeled with selenium and still retain their binding ability. Selenium labeled phage can kill targeted bacteria that are resistant to the phage without selenium.

DTIC

Combat; Drugs; Selenium; Terrorism

20080039869 EAI Corp., Abingdon, MD USA

Detection and Decontamination Kinetics of Vx and Related Compounds by LC/MS

Creasy, William; McGarvey, David J; O'Connor, Richard J; Durst, H D; Jul 1, 2003; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAM01-97-0005

Report No.(s): AD-A483068; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Liquid Chromatography/Mass Spectrometry (LC/MS) and Nuclear Magnetic Resonance Spectrometry (NMR) analytical methods were tested for the detection of EA-2192 in caustic monoethanolamine (MEA) decontamination solution. Precision and accuracy testing was done for the LC/MS method which gave a minimum detection limit (MDL) of 7.6 ng/mL after dilution, or 760 ng/mL in the original solution, which was adequate for the study and gave better sensitivity than NMR. The spike recovery was 70%. The method was used to measure the kinetics of VX and EA-2192 reaction at temperatures of 25 and 50 C. Half life of VX in the solution at 50 C was 5 min. or less, but the half life of EA-2192 was 56 min. For runs at room temperature, the decrease in the EA-2192 concentration was much slower. Results from NMR analyses were in good agreement.

DTIC

Decontamination; Detection; Kinetics; Liquid Chromatography

20080039881 Yale Univ., New Haven, CT USA

New Synthesis for Lanthanum Hexaboride Nanocrystals

Pfefferle, Lisa; Mar 26, 2008; 4 pp.; In English

Contract(s)/Grant(s): W911NF-06-1-0176

Report No.(s): AD-A483089; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Although lanthanum hexaboride has been used for many years as a cathode material, new applications exploiting its unusual electron emission properties are now being investigated. Nanocrystalline LaB₆ materials have been predicted to provide important advantages for IR absorbers as well as for nanoelectronics in general because of their low work function. Lanthanum hexaboride is usually made by mixing La and B with Al in a furnace at 1500K. The molten flux method precipitates large crystals. This method, however, is not suitable for nanocrystal production. The authors have synthesized LaB₆ nanocrystals for the first time using a low temperature sonochemical synthesis. Several different types of crystals were synthesized. First, 20-200 nm diameter crystals were synthesized using lithium borohydride and lanthanum carbonate sonicated in a tetrahydrofuran solvent. These showed a good XRD pattern, confirming the lanthanum hexaboride structure. They also showed that they can control the thickness of the crystals by adding HCl during the synthesis. A small amount of HCl acid in the synthesis leads to thinner/smaller crystalline domains and reduces the amorphous material; adding more HCl results in further thinning as observed by further significant broadening of the peaks in XRD. A different synthesis strategy using Lanthanum chloride as the La precursor resulted in smaller (several nm diameter) boron/lanthanum/oxygen particles which could likely be annealed at high T to give LaB₆. Another strategy using the same precursor with water as the solvent

resulted in a purple powder containing amorphous boron/lanthanum particles 3-5 nm in diameter. Thus several different routes to varied structure LaB6 nanocrystals have been demonstrated.

DTIC

Borides; Crystals; Lanthanum; Low Temperature; Nanocrystals; Nanostructures (Devices)

20080039884 Southwest Research Inst., San Antonio, TX USA

Investigation of AFB Ground Vapor Extraction & Combustion Using a Diesel Engine

Schulman, Matthew E; Apr 2006; 17 pp.; In English

Contract(s)/Grant(s): DAAE07-99-C-L053

Report No.(s): AD-A483093; TFLRF-383; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project aims to remediate fuel spills by extracting hydrocarbon vapors from contaminated earth, and burning them in a diesel engine. The diesel engine destroys hydrocarbons more effectively than spark-ignited units currently in use, uses less fuel, uses fuel commonly available on Air Force installations, and produces usable electrical power as a by-product. A surplus diesel-powered electrical generator was fitted with measurement and control mechanisms for the project. Limitations were identified in terms of the concentration of gaseous fuel, hydrocarbon destruction efficiency and the fuel required. The unit's operation was tested during six days of operation connected to extraction wells at Kirtland AFB, in Albuquerque, New Mexico.

DTIC

Combustion; Diesel Engines; Extraction; Fuels; Spilling; Vapors

20080039887 Naval Research Lab., Washington, DC USA

Optically Detected Magnetic Resonance of (Effective-Mass) Shallow Acceptors in Si-Doped GaN Homoepitaxial Layers

Glaser, E R; Freitas, Jr, J A; Shanabrook, B V; Koleske, D D; Lee, S K; Park, S S; Han, J Y; Jan 2003; 7 pp.; In English

Report No.(s): AD-A483100; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Optically detected magnetic resonance (ODMR) has been performed on Si-doped GaN homoepitaxial layers grown by organometallic chemical vapor deposition on free-standing GaN templates. In addition to intense excitonic bandedge emission with narrow linewidths (<0.4 meV), these films exhibit strong shallow donor shallow acceptor recombination at 3.27 eV. Most notably, ODMR on this photoluminescence band reveals a highly anisotropic resonance with $g \sim -2.193 \pm 0.001$ and $g \sim 0$ as expected for effective-mass shallow acceptors in wurtzitic GaN from k.p theory. This previously elusive result is attributed to the much reduced dislocation density and impurity levels compared to those typically found in the widely investigated Mg-doped GaN heteroepitaxial layers. The possible chemical origin of the shallow acceptors in these homoepitaxial films will be discussed.

DTIC

Acceptor Materials; Depth; Doped Crystals; Epitaxy; Gallium Nitrides; Magnetic Resonance; Silicon

20080039888 Naval Research Lab., Washington, DC USA

Photoionization Spectroscopy in AlGaIn/GaN High Electron Mobility Transistors

Klein, P B; Nov 1, 2002; 6 pp.; In English

Report No.(s): AD-A483101; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A model is developed to describe the light-induced restoration of the drain current from current collapse in AlGaIn/GaN high electron mobility transistors. The model assumes that the collapse results from a transfer at large drain bias of hot carriers from the gate drain region of the two-dimensional electron gas to deep traps in the high-resistivity GaN layer. Application of the model provides a means of determining the photoionization cross sections and the areal densities of the responsible traps. Where multiple trapping species are involved, it is shown that photoinduced transitions between trapping sites can significantly alter the response of the drain current to light illumination, and must therefore be taken into account.

DTIC

Aluminum Gallium Arsenides; Electron Gas; Gallium Nitrides; High Electron Mobility Transistors; Photoionization; Spectroscopy

20080039889 Naval Research Lab., Washington, DC USA

Surface Reconstruction Phase Diagrams for InAs, AlSb, and GaSb

Bracker, A S; Yang, M J; Bennett, B R; Culbertson, J C; Moore, W J; Jan 2000; 10 pp.; In English

Report No.(s): AD-A483102; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present experimental flux-temperature phase diagrams for surface reconstruction transitions on the 6.1As compound

semiconductors. The phase transitions occur within or near typical substrate temperature ranges for growth of these materials by molecular beam epitaxy and therefore provide a convenient temperature standard for optimizing growth conditions. Phase boundaries for InAs (0 0 1) [(2*4)->(4*2)], AlSb (0 0 1) [c(4*4)->(1*3)], and GaSb (0 0 1) [(2*5)>(1*3)] are presented as a function of substrate temperature and Group V-limited growth rate (proportional to flux), for both cracked and uncracked Group V species. We discuss differences between materials in the slopes and offsets of the phase boundaries for both types of Group V species.

DTIC

Aluminum Antimonides; Gallium Antimonides; Indium Antimonides; Molecular Beam Epitaxy; Phase Diagrams

20080039890 Naval Research Lab., Washington, DC USA

Magnetic Resonance Studies of Defects in GaN With Reduced Dislocation Densities

Glaser, E R; Freitas, Jr , J A; Braga, G C; Carlos, W E; Twigg, M E; Wickenden, A E; Koleskea, D D; Henry, R L; Leszczynski, M; Grzegory, I; Jan 2001; 8 pp.; In English

Report No.(s): AD-A483104; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Magnetic resonance experiments, including optically detected magnetic resonance (ODMR) and electron paramagnetic resonance (EPR), have been performed on Si-doped homoepitaxial GaN layers grown by MOCVD and on high quality, free-standing (~200 micrometers-thick) GaN grown by HVPE. This allowed us to obtain information on the properties of native defects and dopants in GaN with a significantly reduced density of dislocations (<-10(exp 7)/sq cm) compared to that typically observed (~mid 10(exp 8) -10(exp 10)/sq cm) in conventional heteroepitaxial GaN layers. The high structural and optical quality of the layers was revealed by cross-sectional TEM and detailed low-temperature photoluminescence (PL) studies, respectively. ODMR at 24GHz on strong shallow donor shallow acceptor recombination from the Si-doped homoepitaxial layer reveals evidence for Si or C shallow acceptors on the N sites. EPR of the new free-standing HVPE GaN confirms the low concentration of residual donors (~10(exp 16)/cu cm) as determined by Hall effect measurements. In addition, new deep centers are found from ODMR on the 2.4eV 'green' PL band and on the broad emission less than 1.8eV from the HVPE GaN template. However, contrary to expectations, the reduction of random strain fields (associated with dislocations) has not led to significant changes in the character of the magnetic resonance (such as resolved electron-nuclear hyperfine structures) compared to that typically found for heteroepitaxial GaN layers.

DTIC

Defects; Electron Paramagnetic Resonance; Gallium Nitrides; Magnetic Resonance

20080040132 Naval Research Lab., Washington, DC USA

A Stable High-Index Surface of Silicon: Si(5 5 12)

Baski, A A; Erwin, S C; Whitman, L J; Sep 15, 1995; 6 pp.; In English

Report No.(s): AD-A482925; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A stable high-index surface of silicon, Si(5 5 12), is described. This surface forms a 2 x 1 reconstruction with one of the largest unit cells ever observed, 7.7 angstroms by 53.5 angstroms. Scanning tunneling microscopy (STM) reveals that the 68 surface atoms per 2 x 1 unit cell are reconstructed only on a local scale. A complete structural model for the surface is proposed, incorporating a variety of features known to exist on other stable silicon surfaces. Simulated STM images based on this model have been computed by first-principles electronic-structure methods and show excellent agreement with experiment.

DTIC

Silicon; Scanning Electron Microscopy; Structural Properties (Geology)

20080040133 Naval Research Lab., Washington, DC USA

A Monohydride High-Index Silicon Surface: Si(114):H-(2x1)

Laracuate, A; Erwin, S C; Whitman, L J; Mar 8, 1999; 4 pp.; In English

Report No.(s): AD-A482937; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We describe the adsorption of H on Si(114)-(2x1) as characterized by scanning tunneling microscopy and first-principles calculations. Like Si(001)-and despite the relative complexity of the (114) structure-a well-ordered, low-defect-density monohydride surface forms at approx. 400 deg. C. Surprisingly, the clean surface reconstruction is essentially maintained on the (2 x 1) monohydride surface, composed of dimers, rebonded double-layer steps, and nonrebonded double-layer steps, with

each surface atom terminated by a single H. This H-passivated surface can also be easily and uniformly patterned by selectively desorbing the H with low-voltage electrons.

DTIC

Silicon; Adsorption; Scanning Tunneling Microscopy; Hydrides

20080040206 Air Force Research Lab., Edwards AFB, CA USA

Synthesis, NMR and Vibrational Spectroscopic Characterization, and Computational Study of the cis-IO2F32- Anion (Preprint)

Mack, Jonathan P; Gerken, Michael; Boatz, Jerry; Nov 19, 2007; 19 pp.; In English

Contract(s)/Grant(s): Proj-5026

Report No.(s): AD-A482983; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The N(CH₃)₄⁺ salt of the cis-IO₂F₃(exp 2-) anion was synthesized from [N(CH₃)₄][IO₂F₂] and excess [N(CH₃)₄][F] in CH₃CN solvent. The [N(CH₃)₄]₂[IO₂F₃] salt was characterized by Raman, infrared, and ¹⁹F solid-state MAS NMR spectroscopy. Geometry optimization and calculation of the vibrational frequencies at the DFT level of theory corroborated the experimental finding that the IO₂F₃²⁻ anion exists as a single isomer with a cis-dioxo and mer-trifluoro arrangement. The fluorine atom in IO₂F₃(exp 2-) that is trans to one of the oxygen atoms is very weakly bound with a calculated bond length of 228.1 pm. The IO₂F₃²⁻ anion is only the second example of an AEO₂F₃ species after XeO₂F₃⁻.

DTIC

Anions; Characterization; Nuclear Magnetic Resonance; Spectroscopy; Vibration

26

METALS AND METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.

20080039208 Parker (Anthony P.), East Sussex, UK

Demonstration Project Relating to Stress Analysis of SWAGE-Autofrettagged and Re-Autofrettagged Gun Tubes

Parker, Anthony P; May 23, 2008; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-07-1-0565

Report No.(s): AD-A482333; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482333>

The principal investigator (APP), worked for a total of two weeks at Benet Research Laboratory, Watervliet, NY, using results from a dummy swage autofrettage FEA stress analysis in a non-linear stress analysis of the post heat treatment hydraulic re-autofrettage of a swaged tube. APP collaborated with Benet staff in: (a) Predicting permanent OD strains for a re-autofrettagged gun tube manufactured from HB7 steel. and (b) Devising material modeling procedures for use with ABAQUS/FEA aimed at incorporating Bauschinger effect. APP attended the 2007 ASME Pressure Vessels and Piping Conference in San Antonio, Texas, presenting two papers relating to autofrettage design. Subsequently the principal investigator (c) Developed the analyses relating to the demonstration project; (d) Collaborated with Mr. E. Troiano of Benet Labs and others in the preparation of a paper on material modeling for autofrettage analysis; (e) Provided a draft paper analyzing stresses due to swage autofrettage and hydraulic re-autofrettage of a gun tube; (f) Supplied a draft patent outline relating to hydraulic re-autofrettage of a swage-autofrettagged pressure vessel. The final patent application has now been submitted. This report contains descriptions and references relating to all significant project outcomes.

DTIC

Stress Analysis; Swaging

20080039501 Pratt and Whitney Aircraft, East Hartford, CT, USA

Low Porosity Powder Metallurgy Produced Components

Das, G., Inventor; 20 Oct 04; 14 pp.; In English

Contract(s)/Grant(s): F33615-01-C-2181

Patent Info.: Filed Filed 20 Oct 04; US-Patent-Appl-SN-10-969 160

Report No.(s): PB2008-103143; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Components produced by powder metallurgy techniques are described herein. Embodiments of these components have little or no porosity therein after processing. Embodiments of these components are created by creating a preform from a powder; creating a component from the preform; heat treating the component to create a predetermined microstructure therein;

and then hot isostatic pressing the heat treated component to reduce any porosity therein. The components can then be machined to their final dimensions, if necessary.

NTIS

Patent Applications; Porosity; Powder Metallurgy

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*.

20080039204 Air Force Research Lab., Hanscom AFB, MA USA

Ultra-Compact Polymer and Silicon Modulator Design Based on Photonic Crystal Ring Resonators

Soref, Richard A; Qiang, Zexuan; Zhou, Weidong; Ma, Zhenqiang; Feb 12, 2008; 9 pp.; In English

Contract(s)/Grant(s): Proj-2305

Report No.(s): AD-A482304; AFRL-RY-HS-TP-2008-0004; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482304>

Ultra-small silicon-based photonic-crystal ring resonators (PCRRs), both passive and active, will be key contributors to the emerging low-power nanophotonic technology. We have modeled and simulated the diameter-dependent loss, Q, and FSR of such PCRRs and find a 0.02 dB 'intrinsic' loss that is independent of diameter, unlike the $\sim 1/D$ loss of micro-strip resonators. Close to 100% drop efficiency at the drop channel of 1557.5nm was obtained by design with a high spectral selectivity of Q greater than 1319 in the single-ring PCRR-based add-drop filters with ring radius of 1.2 m. Ultra-compact polymer modulators were proposed and simulated, based on the hybrid integration of functional polymer materials with Si based PCRRs, which can lead to high speed modulators, suitable for photonic integration and RF photonics.

DTIC

Crystals; Modulators; Polymers; Resonators; Silicon

20080039294 Aerospace Corp., El Segundo, CA, USA

Ceramic Ball Bearing Acoustic Test Method

O'Brien, M. J., Inventor; Nelson, B. A., Inventor; Hilton, M. R., Inventor; 15 Nov 04; 11 pp.; In English

Contract(s)/Grant(s): F04701-00-C-0009

Patent Info.: Filed Filed 15 Nov 04; US-Patent-Appl-SN-10-989 180

Report No.(s): PB2008-103519; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An acoustical mechanical test method prescribes compressing brittle balls in spherical conforming opposing platens producing equatorial bulging, tensile stresses, and resulting in crack or flaw growth with emissions of acoustical sounds for direct identification of brittle balls having a flaw exceeding a maximum allowable size, such as flaws in silicon-nitride balls used in hybrid bearings as well as conventional steel ball bearings.

NTIS

Ball Bearings; Brittleness; Ceramics; Patent Applications; Sound Detecting and Ranging; Ultrasonic Tests

20080039452 Fish and Richardson, P.C., Minneapolis, MN, USA

Nanoporous Coatings (PAT-APPL-11-246 334)

Hiller, J. A., Inventor; Mendelsohn, J. D., Inventor; Rubner, M. F., Inventor; 6 Oct 05; 8 pp.; In English

Contract(s)/Grant(s): NSF-CTS-9729569; NSF-DMR-9808941

Patent Info.: Filed Filed 6 Oct 05; US-Patent-Appl-SN-11-246 334

Report No.(s): PB2008-103545; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Nanoporous coatings can be prepared on a substrate from a polyelectrolyte multilayer by aqueous processing.

NTIS

Patent Applications; Coatings

20080039489 Foley and Lardner, LLP, Madison, WI, USA

Strain-Engineered Ferroelectric Thin Films

Eom, C. B., Inventor; Choi, K. J., Inventor; Schlom, D. G., Inventor; Chen, L. Q., Inventor; 29 Oct 04; 15 pp.; In English
Contract(s)/Grant(s): NSF 0296021

Patent Info.: Filed Filed 29 Oct 04; US-Patent-Appl-SN-10-977 335

Report No.(s): PB2008-103115; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A strained thin film structure includes a substrate layer formed of a crystalline scandate material having a top surface, and a strained layer of crystalline ferroelectric epitaxially grown with respect to the crystalline substrate layer so as to be in a strained state and at a thickness below which dislocations begin to occur in the crystalline ferroelectric layer. An intermediate layer may be grown between the top surface of the substrate layer and the ferroelectric layer wherein the intermediate layer carries the lattice structure of the underlying substrate layer. The properties of the ferroelectric film are greatly enhanced as compared to the bulk ferroelectric material, and such films are suitable for use in applications including ferroelectric memories.

NTIS

Ferroelectric Materials; Ferroelectricity; Patent Applications; Thin Films

20080039492 Shannan (Paul J.), North Huntingdon, PA, USA

Cold Spray Formation of Thin Metal Coatings

Liu, J., Inventor; 3 Nov 04; 13 pp.; In English

Contract(s)/Grant(s): N00421-04-P-0625

Patent Info.: Filed Filed 3 Nov 04; US-Patent-Appl-SN-10-980 708

Report No.(s): PB2008-103119; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The invention relates to an adaptation of the cold spray process to provide a method of coating fine metal particles, including aluminum and copper, onto a work piece. In one embodiment, the invention is a metal agglomerated hard sphere composition capable of providing about a 1 micron or thicker coating of a metal on a work piece in a cold spray process. In another embodiment the invention is a method of coating metal particles, including metal particles having a particle size of about 0.01 to about 10 micron, onto a work piece. The method of the invention circumvents many of the problems associated with cold spray processing of very fine particles.

NTIS

Metal Coatings; Metal Particles; Metal Spraying; Patent Applications; Sprayers

20080039497 Groves (James F.), Charlottesville, VA, USA

Method and System for Focused Ion Beam Directed Self-Assembly of Metal Oxide Island Structures

Groves, J. F., Inventor; Du, Y., Inventor; Wortman, R., Inventor; 21 Jan 05; 7 pp.; In English

Contract(s)/Grant(s): DMR-0080016; EEC-0244436

Patent Info.: Filed Filed 21 Jan 05; US-Patent-Appl-SN-11-039 305

Report No.(s): PB2008-103138; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A process for guiding the growth of metal oxide islands of material which involves: presenting a metal oxide surface to a charged particle beam; impinging the metal oxide surface with ions from the charged particle beam; presenting said metal oxide surface to a deposition chamber; coating said surface with vapor to generate metal oxide islands.

NTIS

Ion Beams; Islands; Metal Oxides; Patent Applications; Self Assembly

20080039502

Multi-Well Plates (PAT-APPL-11-155 294)

Bahr, J. A., Inventor; 17 Jun 05; 8 pp.; In English

Contract(s)/Grant(s): N00014-03-1-0702; N00014-04-1-0597

Patent Info.: Filed Filed 17 Jun 05; US-Patent-Appl-SN-11-155 294

Report No.(s): PB2008-103144; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A test panel for use in preparing a coating array, includes a plate having a non-corrosive surface and a plurality of raised edges integrally formed as part of the non-corrosive surface. The raised edges define a plurality of wells. Also disclosed is a method of testing coatings placed on a panel.

NTIS

Coating; Patent Applications

20080039530 Guthier and Connors, LLP, Boston , MA, USA

Thermochromic Indicator Materials with Controlled Reversibility

Lucht, B., Inventor; Euler, W. B., Inventor; Wang, Y., Inventor; 28 Dec 04; 15 pp.; In English

Patent Info.: Filed 28 Dec 04; US-Patent-Appl-SN-11-024 326

Report No.(s): PB2008-101656; No Copyright; Avail.: CASI: A03, Hardcopy

A thermal indicator material which comprises a plurality of polythiophenes having a second low temperature color and a high temperature color. The polythiophenes are structured and arranged to exhibit a color change from the second low temperature color to the high temperature color when the thermal indicator material is exposed to a temperature that meets or exceeds a pre-determined temperature and to exhibit a color change from the high temperature color to a first low temperature color when the thermal indicator material is exposed to a decline in temperature from a temperature that meets or exceeds the predetermined temperature to a temperature of within the range of between about 5 to 20 degrees C. below the pre-determined temperature that occurs in a time period of greater than 2.0 seconds.

NTIS

Color; Patent Applications; Thermochromic Coatings

20080039834 Illinois Univ., Urbana-Champaign, IL USA

A Novel MEMS Platform for Mechanical Testing of Polymeric Nanofibers

Chasiotis, Ioannis; Sottos, Nancy; Jul 24, 2007; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-1-0356

Report No.(s): AD-A482977; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this project is the design and fabrication of a platform to study the mechanical behavior of electrospun polymer nanofibers. Among different methods of mechanical characterization of nanofibers such as nanoindentation, bending tests, and tensile testing, the latter is considered here as the primary approach to study the mechanical behavior of polymer nanofibers because of its advantages over other methods in investigating different mechanical behaviors including strain rate dependent mechanical responses and large deformations, both of which are expected in polymer nanofibers. Due to high ductility of electrospun nanofibers, the test platform should be capable of generating deformations of 100 microns on 25 microns long sample, while the net axial force applied on the fibers can be as high as 100 microN. The tensile testing apparatus described here for the above purposes is a MEMS device actuated using an on-chip MEMS capacitive based actuator, called nanotractor, with grips to mount the sample, in which the axial force in the sample is measured by a leaf spring MEMS loadcell. Using on-chip actuator eliminates sample misalignment and off-axis loading that could occur in case of external actuation.

DTIC

Deformation; Microelectromechanical Systems; Polymers

20080040058 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Creep-Rupture and Fatigue Behavior of a Notched Oxide/Oxide Ceramic Matrix Composite at Elevated Temperature

Boyer, Barth H; Jun 2008; 116 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482828; AFIT/GAE/ENY/08-J01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482828>

The inherent resistance to oxidation of oxide/oxide ceramic matrix composites makes them ideal for aerospace applications that require high temperature and long life under corrosive environments. The ceramic matrix composite (CMC) of interest in the study is the Nextel (tm) 720/Alumina (N720/A) which is comprised of an 8-harness satin weave of Nextel (tm) fibers embedded in an alumina matrix. One of the top applications for N720/A is in the combustion section of a turbine engine. This will require mounting and shaping the material with rivets and possibly sharp edges thereby introducing geometry based stress concentration factors. Sullivan's research concentrated on the effects of central circular notches with a notch to width ratio ($2a/w$) of 0.33. This study expands upon his research to include the creep and fatigue response to double edge notch geometry with the same notch to width ratio of 0.33. In short, 12.0 mm wide rectangular specimens with two edge notches of 2 mm depth and 0.15 mm width were subjected to creep and fatigue loading conditions in 1200 deg. C of air. All fracture surfaces were examined by an optical microscope and a scanning electron microscope. Sullivan's research concluded that specimens with a central circular notch were insensitive to creep but slightly more sensitive to fatigue than unnotched specimens. In contrast, this study showed significant creep and fatigue life reductions for double edge notch specimens.

DTIC

Ceramic Matrix Composites; Creep Rupture Strength; Creep Strength; High Temperature; Oxides

20080040188 NASA Langley Research Center, Hampton, VA, USA

Molecular Dynamics Simulations of Adhesion at Epoxy Interfaces

Frankland, Sarah-Jane V.; Clancy, Thomas C.; Hinkley, J. A.; Gates, T. S.; September 09, 2008; 12 pp.; In English; American Society for Composites 23rd Annual Technical Conference, 9-11 Sep. 2008, Memphis, TN, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 698259.02.07.07.04.04; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040188>

The effect of moisture on adhesives used in aerospace applications can be modeled with chemically specific techniques such as molecular dynamics simulation. In the present study, the surface energy and work of adhesion are calculated for epoxy surfaces and interfaces, respectively, by using molecular dynamics simulation. Modifications are made to current theory to calculate the work of adhesion at the epoxy-epoxy interface with and without water. Quantitative agreement with experimental values is obtained for the surface energy and work of adhesion at the interface without water. The work of adhesion agrees qualitatively with the experimental values for the interface with water: the magnitude is reduced 15% with respect to the value for the interface without water. A variation of 26% in the magnitude is observed depending on the water configuration at a concentration of 1.6 wt%. The methods and modifications to the method that are employed to obtain these values are expected to be applicable for other epoxy adhesives to determine the effects of moisture uptake on their work of adhesion.

Author

Adhesion; Adhesives; Epoxy Resins; Molecular Dynamics; Simulation; Water

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*.

20080039727 Naval Research Lab., Washington, DC USA

Biodiesel Fuels: The Use of Soy Oil as a Blending Stock for Middle Distillate Petroleum Fuels

Mushrush, George W; Beal, Erna J; Hughes, Janet M; Wynne, James H; Sakran, Joseph V; Hardy, Dennis R; Jul 2000; 18 pp.; In English

Report No.(s): AD-A482850; XB-NRL/MR/6120; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482850>

The U.S. Navy is a very large consumer of middle distillate fuels. Fuels for military applications have more severe restrictions than for the usual commercial consumer. One of the most stringent and difficult requirements to meet is that of fuel storage stability. Storage instability is defined in terms of solids formation which can plug nozzles and filters. Middle distillate fuels for the military can remain unused in storage typically for a year and often much longer. Many fuels show significant deterioration in storage. Storage stability complicates the addition of any other type of natural occurring blending stock. Materials added as fuel blending stocks must be chemically stable and not induce instability in the fuel to which it is added. Furthermore, the blending stock must not react with MILSpec required fuel additives. In the present research, a soybean derived fuel was added in concentrations up to 20% in both stable and unstable petroleum middle distillate fuels. The storage stability of the mixture was tested by ASTM 5304. The soy-fuel mixtures proved stable in the stable fuel and reduced the instability in the unstable fuel significantly.

DTIC

Crude Oil; Diesel Fuels; Distillation; Fuels; Mixtures; Oils; Soybeans

20080040053 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Feasibility of JP-8 to Jet a Fuel Conversion at U.S. Military Facilities

Vann, Lance A; Mar 2008; 111 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482832; AFIT/GLM/ENS/08-13; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482832>

In FY06, Department of Defense (DoD) military grade jet fuel expenditures eclipsed \$6.6 billion dollars. In a search for more cost effective options, the Office of the Secretary of Defense Comptroller recently expressed interest in the quantity of commercial Jet A fuel that the USA Transportation Command uses in lieu of military grade JP-8. In accordance with AFSO 21 and LEAN concepts, this research examines the technical feasibility and opportunity for cost avoidance of a conversion

from JP-8 to Jet A at six Northwestern USA military installations. The technical feasibility analysis examines the chemical likeness of JP-8 and Jet A and identifies any aircraft or equipment that may impede a complete conversion. Accordingly, the opportunity for cost avoidance is considered through an analysis of military and commercial grade jet fuel influenced by West Coast refinery prices. The results show no technical barriers to a complete conversion, but there is no opportunity for cost avoidance.

DTIC

Cost Effectiveness; Jet Engine Fuels; JP-8 Jet Fuel

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*.

20080039790 Defence Science and Technology Organisation, Salisbury, Australia

Manual for the Maintenance of the MRL Smoke Chamber Instrumentation and Recording System

Ingram, J D; Aug 1986; 116 pp.; In English

Report No.(s): AD-A482903; ERL-0386-MA; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This manual describes the history, circuitry, setting-up and operating instructions for the MRL Smoke Chamber IR Scanning Radiometer (2 to 15 micrometers waveband) for the Australian Smoke Programme. It describes in detail the progress over a number of years of the modifications required and the reasons for these modifications from the original design in 1979.

DTIC

Maintenance; Manuals; Smoke; Transmissometers

20080039850 Naval Research Lab., Bay Saint Louis, MS USA

HYCOM Consortium for Data-Assimilative Ocean Modeling

Hurlburt, Harley E; Jan 2004; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A483019; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Long term goals: Make HYCOM (HYbrid Coordinate Ocean Model) a state of the art community ocean model with data assimilation capability that can (1) be used in a wide range of ocean-related research, (2) be used in a next generation eddy-resolving global ocean prediction system and (3) be coupled to a variety of other models including littoral, atmospheric ice and bio-chemical.

DTIC

Ocean Models; Oceans; Organizations

20080039999 Department of the Navy, Washington, DC USA

Remote Blood Pressure Waveform Sensing Method and Apparatus

Antonelli, Lynn T, Inventor; Jun 2, 2008; 26 pp.; In English

Report No.(s): AD-D020369; No Copyright; Avail.: Other Sources

The invention as disclosed is a non-contact method and apparatus for continuously monitoring a physiological event in a human or animal, such as blood pressure, which involves utilizing a laser-based interferometer system in combination with a laser tracking system and a signal processor to produce a waveform that is representative of a continuous physiological event such as blood pressure or respiration in a subject.

DTIC

Blood Pressure; Detection; Patent Applications; Remote Sensing; Waveforms

20080040081 Army Tank-Automotive Research and Development Command, Warren, MI USA

An Army Discussion on Ground Vehicles and the ARC

Schihl, Pete; May 20, 2008; 24 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482771; TARDEC-18880; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482771>

Agenda: Introduction to Army Ground Vehicles; TARDEC Strategic Thrust Areas; Mobility and Propulsion Synergy with TARDEC; Conclusions

DTIC

Engines; Military Vehicles

20080040204 Army Defense Ammunition Center, McAlester, OK USA

Engineering Evaluation Tests of 16 Gauge vs 14 Gauge Staples IAW MIL-STD-1660, 40MM Cartridge on Wooden Pallet

Dugan, Jeffery L; May 2008; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482960; DAC/VED-08-14; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SJMAG-DEV) conducted Engineering Evaluation Tests IAW MIL-STD-1660, 'Design Criteria for Ammunition Unit Loads' on the use of 16 gauge staples vs 14 gauge staples. The unit load tested simulated 40MM cartridges, packed 32 per PA120 metal container, and unitized 48 containers per 40' x 48' pallet. Three test units were tested with a load of 2,290 lbs, 2,295 lbs, and 2,295 lbs. The testing accomplished on the test units was the Stacking, Repetitive Shock, Drop, Incline-Impact, Forklifting, and Disassembly Tests. Test Units #1 and #3 were unitized using 16 gauge staples holding the wooden gates in place, while Test Unit #2 was unitized using the existing requirement of 14 gauge staples holding the gates in place. Test Unit #1 was tested using the proposed 16 gauge staple in accordance with MIL-STD-1660 at ambient temperature. No damage was noted during the Stacking, Repetitive Shock, Drop, Forklifting, and Disassembly Testing. During all of the Incline-Impact tests, the optional timber was employed which extended approximately 9 inches above the carriage. It was noted that two (2) staples on one side and one (1) staple on the opposite side of the test unit were disengaged. The test unit remained intact and all testing was completed with no further damage noted. Test Unit #2 utilized the existing requirement of 14 gauge staples for the gates. MIL-STD-1660 testing was completed with one (1) staple each on opposite sides being disengaged. Test Unit #3 was tested using the proposed 16 gauge staples as used for Test Unit #1 and had similar results during Incline-Impact tests as seen in the previous test units. The result of the staples being disengaged did not differ significantly between the use of the 14 gauge or 16 gauge staples.

DTIC

Assembling; Cartridges; Drop Tests; Measuring Instruments; Shock Tests; Wood

32

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*.

20080039210 Harvard Univ., Cambridge, MA USA

Research in Wireless Networks and Communications

Kung, H T; May 2008; 50 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-05-1-0035; Proj-CITE

Report No.(s): AD-A482344; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482344>

Since fiscal year 2000, DOD significantly increased the number of major defense acquisition programs and its overall investment in them. During this same time period, acquisition outcomes have not improved. Based on our analysis, total acquisition costs for the fiscal year 2007 portfolio of major defense acquisition programs increased 26 percent and development costs increased by 40 percent from first estimates both of which are higher than the corresponding increases in DOD's fiscal year 2000 portfolio. In most cases, the programs we assessed failed to deliver capabilities when promised often forcing warfighters to spend additional funds on maintaining legacy systems. Our analysis shows that current programs are experiencing, on average, a 21-month delay in delivering initial capabilities to the warfighter, a 5-month increase over fiscal year 2000 programs. Several underlying systemic problems at the strategic level and at the program level continue to contribute to poor weapon system program outcomes. At the strategic level, DOD does not prioritize weapon system investments and the department's processes for matching warfighter needs with resources are fragmented and broken. Furthermore, the requirements and acquisition processes are not agile enough to support programs that can meet current operational requirements. At the program level, programs are started without knowing what resources will truly be needed and are managed with lower levels of product knowledge at critical junctures than expected under best practices standards. In the absence of such knowledge, managers rely heavily on assumptions about system requirements, technology, and design

maturity, which are consistently too optimistic. This exposes programs to significant and unnecessary technology, design, and production risks, and ultimately damaging cost growth and schedule delays.

DTIC

Communication Networks; Wireless Communication

20080039298 Sacco and Associates, PA, Palm Beach Gardens, FL, USA

Flexure Elastomer Antenna Isolation System

Harless, R. I., Inventor; Hoffman, M., Inventor; Calhoun, D., Inventor; Fandrich, R. T., Inventor; Vajanyi, A. J., Inventor; 12 Nov 04; 8 pp.; In English

Contract(s)/Grant(s): HQ0006-01-C-0001

Patent Info.: Filed Filed 12 Nov 04; US-Patent-Appl-SN-10-987 061

Report No.(s): PB2008-103586; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A vibration isolation system for a payload. The vibration isolation system provides a level of vibration isolation for all vibration translational and rotational components, while minimizing the moment of the payload mass relative to the isolation system. The system includes a base and a plurality of vibration isolators. Each vibration isolator includes a semi-rigid first support member having first portion positioned below the base and an opposing second portion positioned above the base, and a second support member having a first portion fixed to the base and an opposing second portion extending above the base. An elastomeric coupling couples the first support member to the second support member at a height that is approximately equal to a height of a center of gravity of a combined mass of the base and the payload above the base.

NTIS

Antenna Design; Elastomers; Flexing; Isolation; Patent Applications; Payloads; Radio Antennas; Vibration Isolators

20080039371 Klauber and Jackson, Hackensack, NJ, USA

OFDM Peak-to-Average Power Ratio Reduction by Combined Symbol Rotation and Inversion with Limited Complexity

Bar-Ness, Y., Inventor; Tan, M., Inventor; 16 Nov 04; 15 pp.; In English

Patent Info.: Filed Filed 16 Nov 04; US-Patent-Appl-SN-10-989 895

Report No.(s): PB2008-103599; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A signal scrambling method based on combined symbol rotation and inversion (CSRI) for the peak-to-average power ratio (PAPR) reduction of OFDM signals. By dividing OFDM sequences into subblocks and performing symbol rotation and inversion in each subblock, high degrees of freedom are available to offset the possibility of encountering poor sequences with large PAPR. In order to reduce the complexity of this scheme, two suboptimal CSRI schemes are disclosed, one based on a successive approach combined with symbol grouping, and the other based on a random approach combined with threshold control.

NTIS

Frequency Division Multiplexing; Inversions; Patents

20080039411 CAE Professional Services, Kanata, Ontario Canada

Joint Command Decision Support for the 21st Century (JCDS 21) Technology Demonstration (TD) Project: Concept of Operations (CONOPs)

Hales, Doug; Scipione, Andrea; Apr 8, 2008; 97 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482655; DRDC-CR-2008-002; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This document proposes a Concept of Operations for the Joint Command Decision Support for the 21st Century Technology Demonstration Project. It summarizes key underlying concepts, describes the DND/CF Command & Control model and outlines emergent Situational Awareness & Decision Support requirements. A set of principles derive from this initial analysis and a domestic humanitarian scenario is used as an illustrative vignette depicting application. This CONOPs is intended both to situate the JCDS 21 work program and to stimulate dialogue.

DTIC

Command and Control; Decision Support Systems

20080039488 Myers, Bigel, Sibley and Sajovec, Raleigh, NY, USA

Asymmetric Layout Structures for Transistors and Methods of Fabricating the Same

Sriram, S., Inventor; Henning, J., Inventor; 29 Oct 04; 16 pp.; In English

Contract(s)/Grant(s): N00014-02-C-0250

Patent Info.: Filed Filed 29 Oct 04; US-Patent-Appl-SN-10-977 227

Report No.(s): PB2008-103114; No Copyright; Avail.: CASI: [A03](#), Hardcopy

High power transistors are provided. The transistors include a source region, a drain region and a gate contact. The gate contact is positioned between the source region and the drain region. First and second ohmic contacts are provided on the source and drain regions, respectively. The first and second ohmic contacts respectively define a source contact and a drain contact. The source contact and the drain contact have respective first and second widths. The first and second widths are different. Related methods of fabricating transistors are also provided.

NTIS

Fabrication; Layouts; Patent Applications; Transistors

20080039510 Sterne, Kessler, Goldstein and Fox, PLLC, Washington, DC, USA

Method and System for a Single-Fed Patch Antenna Having Improved Axial Ratio Performance

Mahmoud, M. S., Inventor; 9 Nov 04; 17 pp.; In English

Patent Info.: Filed Filed 9 Nov 04; US-Patent-Appl-SN-10-983 603

Report No.(s): PB2008-101659; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A micro-strip antenna includes a conducting ground plane and a dielectric substrate mounted above the conducting ground plane. A patch element is mounted above the dielectric substrate and configured to produce an antenna pattern. The antenna pattern is formed by a number of linear polarization components. The patch element includes a single feed point extending through the conducting ground plane and the dielectric substrate. Two or more notches within the patch element are configured to perturb each of the linear polarization components.

NTIS

Antenna Radiation Patterns; Microwaves; Patch Antennas; Patent Applications

20080039529 Lawrence Livermore National Lab., Livermore, CA USA

Multi-Channel Time-Reversal Receivers for Multi and 1-Bit Implementations

Candy, J. V., Inventor; Chambers, D. H., Inventor; Guidry, B. L., Inventor; Poggio, A. J., Inventor; Robbins, C. L., Inventor; 10 Nov 05; 20 pp.; In English

Contract(s)/Grant(s): DE-W-7405-ENG-48

Patent Info.: Filed Filed 10 Nov 05; US-Patent-Appl-SN-11-271 334

Report No.(s): PB2008-101655; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A communication system for transmitting a signal through a channel medium comprising digitizing the signal, time-reversing the digitized signal, and transmitting the signal through the channel medium. In one embodiment a transmitter is adapted to transmit the signal, a multiplicity of receivers are adapted to receive the signal, a digitizer digitizes the signal, and a time-reversal signal processor is adapted to time-reverse the digitized signal. An embodiment of the present invention includes multi bit implementations. Another embodiment of the present invention includes 1-bit implementations. Another embodiment of the present invention includes a multiplicity of receivers used in the step of transmitting the signal through the channel medium.

NTIS

Patent Applications; Receivers; Telecommunication

20080039583 Army War Coll., Carlisle Barracks, PA USA

Mass Media Theory, Leveraging Relationships, and Reliable Strategic Communication Effects

Robinson, John R; Mar 19, 2008; 31 pp.; In English

Report No.(s): AD-A482269; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482269>

A review of known mass media and social theories shows that the U.S. military may be off track with regard to how it plans and conducts strategic communication. Even though the U.S. military emphasizes achieving strategic communication effects through carefully prepared written and verbal messages, research shows that effects from these messages are unreliable. On the other hand, strategic communication effects that stem from relationships are shown to be much more reliable. Embracing a relationship-centric rather than message-centric perspective of strategic communication can severely change how communicators view their information battlespace. This research shows that by moving to a relationship-centric vice message-centric strategic communication strategy more reliable effects in the information environment will be achieved within an information battlespace that is less fluid and more manageable. While such a shift will dramatically change how

commanders view their information battlespace it will ensure that more appropriate strategic communication approaches are employed to achieve positive and decisive results.

DTIC

News Media; Verbal Communication

20080039682 Navajo Technical Coll., Crownpoint, NM USA

Wireless Grid Education Project: Ending the Digital Divide

Romero, Leslie T; Feb 29, 2008; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-1-0026

Report No.(s): AD-A482748; DOD-EWG-007; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482748>

Set up wireless grid for educational and community networking and Internet access in Eastern Navajo Nation to enhance the educational capabilities of Navajo Technical College.

DTIC

American Indians; Education

20080039825 Army Command and General Staff Coll., Fort Leavenworth, KS USA

Command, Control, Communications, Computers, and Intelligence (C4I) Interoperability: Are We There Yet

Worth, Brian J; Jun 2008; 90 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482964; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study examines command, control, communications, computer, and intelligence (C4I) systems interoperability progress within the USA (U.S.) military services and amongst coalition partners since the year 2000. This study uses national military strategy, joint military strategy, service unique strategy and doctrine, Joint Tactical Radio System (JTRS) and Defense Integrated Military Human Resource System (DIMHRS) case studies, Defense Information Systems Agency (DISA) technological standards, C4I technical reports to establish trends, patterns, and gaps in coalition interoperability. C4I interoperability successes are abundant since 2000 but it is clear from current day operations and research that the U.S., its allies and coalition partners need further improvements in order to master the many moving parts required for true coalition C4I systems interoperability. Clearly, acquisition, development, testing, and fielding must be fully integrated into either a joint or coalition solution. In order to achieve C4I interoperability, this study recommends changes in law, namely to the Goldwater-Nichols Act of 1986 to further define the strategic intent of system interoperability among services of the DoD and foreign nations. Changes to national military strategy, joint military strategy, and service-unique military strategy are required to overhaul and emphasize the unequivocal need for fully interoperable C4I systems across the DoD and amongst coalition members. Acquisition, although not fully explored within this study, requires a greater emphasis in order to speed delivery of these interoperable systems to the field. Development and testing mechanisms exist throughout industry and within the military services to ensure interoperability but again, speed requires greater emphasis to ensure the technological advancements meet the soldier, sailor, airman,

DTIC

Command and Control; Computers; Intelligence; Interoperability; Telecommunication

20080039830 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Creating an Agent Based Framework to Maximize Information Utility

Pecarina, John M; Mar 2008; 122 pp.; In English; Original contains color illustrations

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

Report No.(s): AD-A482972; AFIT/GCS/ENG/08-19; No Copyright; Avail.: Defense Technical Information Center (DTIC)

With increased reliance on communications to conduct military operations, information centric network management becomes vital. A Defense department study of information management for net-centric operations lists the need for tools for information triage (based on relevance, priority, and quality) to counter information overload, semi-automated mechanisms for assessment of quality and relevance of information, and advances to enhance cognition and information understanding in the context of missions. Maximizing information utility to match mission objectives is a complex problem that requires a comprehensive solution in information classification, in scheduling, in resource allocation, and in QoS support. Of these research areas, the resource allocation mechanism provides a framework to build the entire solution. Through an agent based mindset, the lessons of robot control architecture are applied to the network domain. The task of managing information flows is achieved with a hybrid reactive architecture. By demonstration, the reactive agent responds to the observed state of the

network through the Unified Behavior Framework (UBF). As information flows relay through the network, agents in the network nodes limit resource contention to improve average utility and create a network with smarter bandwidth utilization. While this is an important result for information maximization, the agent based framework may have broader applications for managing communication networks.

DTIC

Communication Networks; Control; Data Management; Military Operations; Robotics

20080039840 Tennessee Technological Univ., Cookeville, TN USA

Time Reversal for Ultra-wideband (UWB) Sensor Networking

Calderon, Martha A; Qiu, Robert C; Jul 31, 2007; 172 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-1-0349

Report No.(s): AD-A482991; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report organized into six chapters. It addresses coupling effects, an analysis of the virtual array, single-user and multi-user time reversal UWB-MIMO system performance, and a comparison with time reversal UWB-MISO. The central topic of this report is to experimentally study the multiusers MIMO with time reversal transmission. When transmitting to 10 users simultaneously in the system, it is found that the interference is high and BER performance is poor, thus, MIMO multiple access schemes such as zero-forcing at the transmitter must be considered.

DTIC

Antennas; Broadband; Transmittance

20080039873 Michigan Univ., Ann Arbor, MI USA

Cross-Layer Design and Analysis of Wireless Networks

Stark, Wayne; Anastasopoulos, Achilleas; Chang, Shihyu; Wang, Hua; Jun 2, 2004; 52 pp.; In English; Original contains color illustrations

Report No.(s): AD-A483077; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Communication Networks; Design Analysis; Wireless Communication

20080039874 Naval Research Lab., Washington, DC USA

Energy-Aware Broadcasting and Multicasting in Wireless Ad Hoc Networks: A Cross-Layering Approach

Wieselthier, Jeffrey E; Nguyen, Gam D; Ephremides, Anthony; Jun 2, 2004; 21 pp.; In English; Original contains color illustrations

Report No.(s): AD-A483078; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Broadcasting; Communication Networks; Energy Consumption; Telecommunication; Wireless Communication

20080039892 RAND Corp., Santa Monica, CA USA

Multifunctional Information Distribution System (MIDS) Program Case Study

Gonzales, Daniel; Norton, Daniel; Hura, Myron; Jan 2000; 73 pp.; In English

Contract(s)/Grant(s): F49642-96-C-0001

Report No.(s): AD-A483106; RAND-DB-292-AF; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This documented briefing examines the Multifunctional Information Distribution System (MIDS) program and the challenges that the Air Force and the MIDS International Program Office (IPO) will likely face as the program moves into the production phase. A number of options are presented that could help the Air Force, the other U.S. military services, and the MIDS international partners meet future challenges. This case study should be of interest to Air Force planners and program managers involved in the development and upgrade of U.S. Air Force aircraft and those involved in the development and acquisition of future tactical data communication systems for ships, aircraft, air defense sites, and command and control centers. This study, part of the Interoperability of Allied and U.S. Air Forces in Future Operations project, was conducted in the Aerospace Force Development Program of Project AIR FORCE.

DTIC

Communication Networks; Data Links; Data Transmission; Information Systems; Interoperability; Telecommunication

20080040064 Army Research Inst. for the Behavioral and Social Sciences, Orlando, FL USA

Tailoring an Information Flow Model to Trainee Level of Proficiency

Meliza, Larry L; Barnett, John S; Oct 2006; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482740; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482740>

U.S. Army units equipped with emerging networked command and control systems, like all organizations, must channel, manage, assess, and exploit information and requests. The building block relationships among these skills (e.g., channeling facilitates management) relates directly to the crawl-walk-run approach to training. At lower levels of proficiency in applying networked systems, more effort should be spent on information channeling and management, while assessment and exploitation become the foci at higher levels of proficiency. The after action review (AAR) process whereby organizations decide what happened, why it happened, and how to improve or sustain future performance is likely to be a key feedback mechanism for training units using networked systems. AARs can be facilitated by the use of aids that increase awareness and understanding of military exercise events. This paper describes the types of AAR aids relevant to diagnosing problems in information channeling, management, assessment, and exploitation. The paper also describes how levels of network proficiency affect the need for AAR aids.

DTIC

Abilities; Combat; Communication Networks; Education; Feedback; Information Flow; Simulation; Students

20080040130 Department of the Navy, Washington, DC USA

Noise-Riding Video Signal Threshold Generation Scheme for a Plurality of Video Signal Channels

Catabia, Derek J, Inventor; Feb 12, 2007; 16 pp.; In English

Report No.(s): AD-D020370; No Copyright; Avail.: Other Sources

An apparatus for adaptively generating video signal thresholds for a comparator circuit having a plurality of signal channels. The apparatus has input circuitry in electrical signal communication with the plurality of signal channels. The input circuitry uses a selector circuit to select one signal channel of the plurality of signal channels for processing. The apparatus also has a processing resource having an input joined to process the electrical signals on the selected one signal channel to determine if a video signal is present and, if no video signal is present to process noise signals on the selected one signal channel to generate a new video signal threshold. The processing resource has an output to provide the new video signal threshold to the comparator circuit corresponding to the selected signal channel.

DTIC

Video Signals; Comparator Circuits

20080040184 NASA Langley Research Center, Hampton, VA, USA

RFID Transponders' RF Emissions in Aircraft Communication and Navigation Radio Bands

Nguyen, Truong X.; Ely, Jay J.; Koppen Sandra V.; Fersch, Mariatheresa S.; September 08, 2008; 6 pp.; In English; EMC

Europe 2008 Hamburg, 8-12 Sep. 2008, Hamburg, Germany; Original contains color illustrations

Contract(s)/Grant(s): WBS 645846.02.07.07

Report No.(s): Paper Number 278; Copyright; Avail.: CASI: A02, Hardcopy

Radiated emission data in aircraft communication and navigation bands are presented for several active radio frequency identification (RFID) tags. The individual tags are different in design, operation and transmitting frequencies. The process for measuring the tags emissions in a reverberation chamber is discussed. Measurement issues dealing with tag interrogation, low level measurement in the presence of strong transmissions, and tags low duty factors are discussed. The results show strong emissions, far exceeding aircraft emission limits and can be of potential interference risks.

Author

Radio Frequencies; Transponders; Aircraft Communication; Radio Frequency Interference; Radio Transmitters; Air Navigation

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*.

20080039213 Army Research Lab., Adelphi, MD USA

Development of Gate and Base Drive Using SiC Junction Field Effect Transistors

Griffin, Timothy E; May 2008; 22 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482384; ARL-TR-4475; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482384>

A base drive and a gate drive were designed with 4H-SiC junction field effect transistors (JFET) and worked. Developmental JFET had uneven distribution of performance parameters. For example, the gate current (I_g) and voltage (V_{gs}) of each JFET required precise, customized control. This initial investigation designed and tested two JFETs into a base drive circuit board for an npn SiC bipolar junction transistor (BJT). The circuit rapidly drove a SiC BJT on and off with 4H-SiC semiconductor devices to perform to 150 C. For the gate of an n-MOS or insulated gate bipolar transistor (IGBT) two other JFETs were designed into a drive circuit which worked. For these JFETs $I_d - V_{ds}$ curves and reliability degraded moderately with use.

DTIC

Bipolar Transistors; Field Effect Transistors; JFET; Junction Transistors

20080039268 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Developing a NASA Lead-Free Policy for Electronics - Lessons Learned

Sampson, Michael J.; April 14, 2008; 10 pp.; In English; TRISMAC 08 Joint NASA/ESA/JAXA Conference, 14-16 Apr.

2008, Noordwijk, Netherlands; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039268>

The National Aeronautics and Space Administration (NASA) is not required by USA or international law to use lead-free (Pb-free) electronic systems but international pressure in the world market is making it increasingly important that NASA have a Pb-free policy. In fact, given the international nature of the electronics market, all organizations need a Pb-free policy. This paper describes the factors which must be taken into account in formulating the policy, the tools to aid in structuring the policy and the unanticipated and difficult challenges encountered. NASA is participating in a number of forums and teams trying to develop effective approaches to controlling Pb-free adoption in high reliability systems. The activities and status of the work being done by these teams will be described. NASA also continues to gather information on metal whiskers, particularly tin based, and some recent examples will be shared. The current lack of a policy is resulting in 'surprises' and the need to disposition undesirable conditions on a case-by-case basis. This is inefficient, costly and can result in sub-optimum outcomes.

Author

International Law; Lessons Learned; Policies; Lead (Metal); Tin; Electronics

20080039272 NASA Goddard Space Flight Center, Greenbelt, MD, USA

On Certain New Methodology for Reducing Sensor and Readout Electronics Circuitry Noise in Digital Domain

Kizhner, Semion; Miko, Joseph; Bradley, Damon; Heinzen, Katherine; September 17, 2008; 11 pp.; In English; Military and Aerospace Programmable Logic Devices (MAPLD-2008) Conference, 15-18 Sep. 2008, Annapolis, MD, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

NASA Hubble Space Telescope (HST) and upcoming cosmology science missions carry instruments with multiple focal planes populated with many large sensor detector arrays. These sensors are passively cooled to low temperatures for low-level light (L3) and near-infrared (NIR) signal detection, and the sensor readout electronics circuitry must perform at extremely low noise levels to enable new required science measurements. Because we are at the technological edge of enhanced performance for sensors and readout electronics circuitry, as determined by thermal noise level at given temperature in analog domain, we must find new ways of further compensating for the noise in the signal digital domain. To facilitate this new approach, state-of-the-art sensors are augmented at their array hardware boundaries by non-illuminated reference pixels, which can be used to reduce noise attributed to sensors. There are a few proposed methodologies of processing in the digital domain the information carried by reference pixels, as employed by the Hubble Space Telescope and the James Webb Space Telescope Projects. These methods involve using spatial and temporal statistical parameters derived from boundary reference pixel information to enhance the active (non-reference) pixel signals. To make a step beyond this heritage methodology, we apply

the NASA-developed technology known as the Hilbert- Huang Transform Data Processing System (HHT-DPS) for reference pixel information processing and its utilization in reconfigurable hardware on-board a spaceflight instrument or post-processing on the ground. The methodology examines signal processing for a 2-D domain, in which high-variance components of the thermal noise are carried by both active and reference pixels, similar to that in processing of low-voltage differential signals and subtraction of a single analog reference pixel from all active pixels on the sensor. Heritage methods using the aforementioned statistical parameters in the digital domain (such as statistical averaging of the reference pixels themselves) zeroes out the high-variance components, and the counterpart components in the active pixels remain uncorrected. This paper describes how the new methodology was demonstrated through analysis of fast-varying noise components using the Hilbert-Huang Transform Data Processing System tool (HHT-DPS) developed at NASA and the high-level programming language MATLAB (Trademark of MathWorks Inc.), as well as alternative methods for correcting for the high-variance noise component, using an HgCdTe sensor data. The NASA Hubble Space Telescope data post-processing, as well as future deep-space cosmology projects on-board instrument data processing from all the sensor channels, would benefit from this effort.

Author

Signal Detection; Noise Reduction; Hubble Space Telescope; Cosmology; Hilbert Transformation; Onboard Data Processing; Circuits; Thermal Noise; Digital Data

20080039276 Luedeka Neely and Graham, P.C., Knoxville, TN, USA

Microwave Heat Treating of Manufactured Components

Ripley, E. B., Inventor; 8 Nov 05; 19 pp.; In English

Contract(s)/Grant(s): DE-AC05-000R22800

Patent Info.: Filed 8 Nov 05; US-Patent-Appl-SN-11-269 236

Report No.(s): PB2008-100979; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An apparatus for heat treating manufactured components using microwave energy and microwave susceptor material. Heat treating medium such as eutectic salts may be employed. A fluidized bed introduces process gases which may include carburizing or nitriding gases. The process may be operated in a batch mode or continuous process mode. A microwave heating probe may be used to restart a frozen eutectic salt bath.

NTIS

Heat Treatment; Microwave Equipment; Microwaves; Patent Applications

20080039306 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Effect of Surge Current Testing on Reliability of Solid Tantalum Capacitors

Teverovsky, Alexander; March 17, 2008; 14 pp.; In English; Passive Components Symposium, CARTS, 17-20 Mar. 2008, Newport Beach, CA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Tantalum capacitors manufactured per military specifications are established reliability components and have less than 0.001% of failures per 1000 hours for grades D or S, thus positioning these parts among electronic components with the highest reliability characteristics. Still, failures of tantalum capacitors do happen and when it occurs it might have catastrophic consequences for the system. To reduce this risk, further development of a screening and qualification system with special attention to the possible deficiencies in the existing procedures is necessary. The purpose of this work is evaluation of the effect of surge current stress testing on reliability of the parts at both steady-state and multiple surge current stress conditions. In order to reveal possible degradation and precipitate more failures, various part types were tested and stressed in the range of voltage and temperature conditions exceeding the specified limits. A model to estimate the probability of post-surge current testing-screening failures and measures to improve the effectiveness of the screening process has been suggested.

Derived from text

Capacitors; Tantalum; Electric Potential; Surges; Electronic Equipment Tests; Circuit Protection; Power Supply Circuits

20080039309 International Business Machines, Corp., Scottsdale, AZ, USA

Dynamic Logic Circuit Incorporating Reduced Leakage State-Retaining Devices

Ngo, H. C., Inventor; Kuang, J. B., Inventor; Deogun, H. S., Inventor; Kleinosowski, A. J., Inventor; 18 Nov 04; 9 pp.; In English

Contract(s)/Grant(s): NBCH30390004; BGR W0132280

Patent Info.: Filed Filed 18 Nov 04; US-Patent-Appl-SN-10-992 486

Report No.(s): PB2008-103592; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A dynamic logic circuit incorporating reduced leakage state-retaining devices reduces power consumption of processors and other systems incorporating dynamic circuits. A keeper circuit provides a low leakage retention of the state of the output stage of the dynamic circuit so that an output circuit foot device can be disabled except when required for a transition in the output of the dynamic circuit. The keeper circuit includes a transistor having a smaller area than a corresponding transistor in the output circuit, thus reducing leakage through the gate of the output circuit when the keeper circuit is holding the output and the output circuit foot device is disabled. A self-clocked control of the output circuit foot device can be provided via a delayed version of the dynamic logic gate output, or may be provided by an external control circuit that generates a delayed version of the precharge clock or a multi-cycle signal.

NTIS

Leakage; Logic Circuits; Patent Applications

20080039370 Squire, Sanders and Dempsey, L.L.P., Tysons Corner, VA, USA

Adaptive Communication Protocol for Wireless Networks

Beyer, D. A., Inventor; Joaquin, J., Inventor; Aceves, G. L., Inventor; Fullmer, C. L., Inventor; 10 Feb 99; 19 pp.; In English
Contract(s)/Grant(s): DAAH01-98-C-R005

Patent Info.: Filed Filed 10 Feb 99; US-Patent-Appl-SN-09-248 738

Report No.(s): PB2008-103598; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A communication protocol that provides link-level and media access control (MAC) level functions for wireless (e.g., ad-hoc) networks and is robust to mobility or other dynamics, and for scaling to dense networks. In a mobile or otherwise dynamic network, any control-packet collisions will be only temporary and fair. In a dense network, the network performance degrades gracefully, ensuring that only a certain percentage of the common channel is consumed with control packets. The integrated protocol allows packets (e.g., data scheduling control packets) to be scheduled in a collision-free and predictable manner (known to all neighbors), multicast packets can be reliably scheduled, as well as streams of delay- or delay-jitter-sensitive traffic. Further, using an optional network code, the scheduling of control packets can appear to observers to be randomized.

NTIS

Adaptation; Communication Networks; Patent Applications; Protocol (Computers); Wireless Communication

20080039372 Naval Surface Warfare Center, Dahlgren, VA, USA

Bag Assembly Providing Electrostatic Discharge Protection

Main, R. E., Inventor; 15 Nov 04; 9 pp.; In English

Patent Info.: Filed Filed 15 Nov 04; US-Patent-Appl-SN-10-989 863

Report No.(s): PB2008-103600; No Copyright; Avail.: CASI: [A02](#), Hardcopy

An electrostatic discharge (ESD) protective bag assembly includes a tote bag and an envelope made from ESD protective material positioned at least partially within the tote bag. The envelope may be defined by two sheets of ESD protective material joined along at least two opposing sides thereof to form join regions. At least one layer of a reinforcing material, such as a fibrous web, is coupled to a portion of each of the join regions. The tote bag and envelope may be coupled to one another by stitches that pass through the reinforcing material.

NTIS

Electric Discharges; Electrostatics; Patent Applications; Protection

20080039374 VanDeuren (Reinhart Boerner), Milwaukee, WI, USA

p-Type Transparent Conducting Oxides and Methods for Preparation

Shahriari, D. Y., Inventor; Barnabe, A., Inventor; Mason, T. O., Inventor; Poeppelmeier, K. R., Inventor; 22 Dec 05; 14 pp.; In English

Contract(s)/Grant(s): DE-AAD-9-18668-05; NSF-DMR-0076097

Patent Info.: Filed Filed 22 Dec 05; US-Patent-Appl-SN-11-316 550

Report No.(s): PB2008-103602; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A facile, low temperature and low pressure method for the preparation of a wide range of phase pure ABO(sub 2) compositions.

NTIS

Oxides; Patent Applications; Semiconductors (Materials); Transparency

20080039421 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Compendium of Current Single Event Effects Results for Candidate Spacecraft Electronics for NASA

O'Bryan, Martha V.; Poivey, Christian; LaBel, Kenneth A.; Buchner, Stephen P.; Ladbury, Ray L.; Oldham, Timothy R.; Howard, James W., Jr.; Sanders, Anthony; Berg, Melanie; Titus, Jeffrey L.; July 23, 2007; 10 pp.; In English; IEEE Nuclear and Space Radiation Effects Conference (NSREC), 23-27 Jul. 2007, Honolulu, HI, USA; Original contains black and white illustrations

Contract(s)/Grant(s): IACRO# 07-42071

Report No.(s): IEEE NSREC 2007 W-27; Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://radhome.gsfc.nasa.gov>

Sensitivity of a variety of candidate spacecraft electronics to proton and heavy ion induced single event effects is presented. Devices tested include digital, linear, and hybrid devices.

Author

Spacecraft Electronic Equipment; Astrionics; Sensitivity; Single Event Upsets; Protons; Heavy Ions; Radiation Dosage; Performance Prediction

20080039450 White (Paul J.), Golden, CO, USA

Hot Wire Production of Single-Wall and Multi-Wall Carbon Nanotubes

Dillon, A. C., Inventor; Mahan, A. H., Inventor; Alleman, J. L., Inventor; 13 Mar 03; 19 pp.; In English

Contract(s)/Grant(s): DE-AC36-99GO10337

Patent Info.: Filed Filed 13 Mar 03; US-Patent-Appl-SN-10-548 924

Report No.(s): PB2008-103541; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Apparatus for producing a multi-wall carbon nanotube may comprise a process chamber, a furnace operatively associated with the process chamber, and at least one filament positioned within the process chamber. At least one power supply operatively associated with the at least one filament heats the at least one filament to a process temperature. A gaseous carbon precursor material operatively associated with the process chamber provides carbon for forming the multi-wall carbon nanotube. A metal catalyst material operatively associated with the process catalyzes the formation of the multi-wall carbon nanotube.

NTIS

Carbon Nanotubes; Patent Applications; Walls; Wire

20080039460 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

Comments on Cathode Contaminants and the LBNL Test Stand

Bieniosek, F.; Baca, D.; Greenway, W.; Leitner, M.; Kwan, J. W.; Nov. 13, 2006; 5 pp.; In English

Report No.(s): DE2007-902806; LBNL-61978; No Copyright; Avail.: National Technical Information Service (NTIS)

This report collects information on cathode contaminants we have gathered in the process of operating the LBNL DARHT cathode test stand. Information on contaminants is compiled from several sources. The attachment, 'Practical Aspects of Modern Dispenser Cathodes', is from Heat Wave Corp. (TB-134) and was originally published in Microwave Journal, September 1979. Cathode contamination depends on both material choices and residual gases. Table 1 of TB-134 lists materials that can poison dispenser cathodes. These include reactive residual gases or vapors such as oxygen, water vapor, benzene, chlorine, fluorine, sulfur, silicon, and most metals other than molybdenum, rhenium, tungsten, and copper. The metals interact with the cathode surface through their vapor pressure. A paper by Nexsen and Turner, J. Appl. Phys. 68, 298-303 (1990) shows the threshold effects of some common residual gases or vapors on cathode performance. The book by Walter H. Kohl, Handbook of Materials and Techniques for Vacuum Devices, also contains useful information on cathodes and poisoning agents. A plot of the vapor pressures and poisoning effect of certain metals (from Kohl) is shown below. Note that the vapor pressure of zinc is $1.1 \times 10^{(sup -8)}$ Torr at 400 K = 127 C, and $2.7 \times 10^{(sup -5)}$ at 500 K = 227 C. By contrast iron reaches a vapor pressure $1 \times 10^{(sup -8)}$ between 800 and 900 C. Therefore it is important to eliminate any brass parts that could exceed a temperature of 100 C.

NTIS

Cathodes; Contaminants; Contamination; Metals; Test Stands

20080039478 Impact Technologies, LLC, Tulsa, OK, USA; Texas Univ., Arlington, TX, USA

Advanced Ultra-High Speed Motor for Drilling

Feb. 01, 2007; 316 pp.; In English

Contract(s)/Grant(s): DE-FC26-04NT15502

Report No.(s): DE2007-917759; No Copyright; Avail.: National Technical Information Service (NTIS)

Three (3) designs have been made for two sizes, 6.91 cm (2.72 inch) and 4.29 cm (1.69 inch) outer diameters, of a patented inverted configured Permanent Magnet Synchronous Machines (PMSM) electric motor specifically for drilling at ultra-high rotational speeds (10,000 rpm) and that can utilize advanced drilling methods. Benefits of these motors are stackable power sections, full control (speed and direction) of downhole motors, flow hydraulics independent of motor operation, application of advanced drilling methods (water jetting and abrasive slurry jetting), and the ability of signal/power electric wires through motor(s). Key features of the final designed motors are: fixed non-rotating shaft with stator coils attached; rotating housing with permanent magnet (PM) rotor attached; bit attached to rotating housing; internal channel(s) in a nonrotating shaft; electric components that are hydrostatically isolated from high internal pressure circulating fluids (muds) by static metal to metal seals; liquid filled motor with smoothed features for minimized turbulence in the motor during operation; and new inverted coated metal-metal hydrodynamic bearings and seals.

NTIS

Drilling; Electric Motors; Oils; Wells

20080039483 Aerospace Corp., El Segundo, CA, USA

Phased Array Antenna Intermodulation Suppression Beam Smearing Method

Ksienski, D. A., Inventor; Shaw, G. M., Inventor; 12 Oct 04; 13 pp.; In English

Contract(s)/Grant(s): F04701-00-C-0009

Patent Info.: Filed Filed 12 Oct 04; US-Patent-Appl-SN-10-963 877

Report No.(s): PB2008-103183; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An intermodulation suppression method using phased array antenna electronics insignificantly degrades the desired primary main beams while substantially suppressing undesired intermodulation product beams, and particularly undesired third-ordered intermodulation product beams. The beam smearing method has two aspects, including phase smearing and angle smearing for respective subarrays to reduce the intermodulation-product beams of the phased array antenna beam patterns. With a 1 dB degradation of the primary main beams, a 6 dB to 10 dB suppression of the intermodulation product beams is achieved.

NTIS

Antenna Arrays; Antenna Radiation Patterns; Intermodulation; Patent Applications; Phased Arrays

20080039493 Wolf, Greenfield and Sacks, P.C., Boston, MA, USA

Motion Sensor and Method for Detecting Motion

Greene, M. E., Inventor; Trent, V. S., Inventor; 29 Oct 04; 24 pp.; In English

Contract(s)/Grant(s): N00178-02-C-1043; N00178-03-C-1059

Patent Info.: Filed Filed 29 Oct 04; US-Patent-Appl-SN-10-976 459

Report No.(s): PB2008-103120; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A motion sensor may detect linear and/or angular acceleration and/or angular velocity of a body relative to one axis, two orthogonal axes or three orthogonal axes. Movement of the body or reference structure may be detected relative to one or more spinning rotors. The rotor(s) may be suspended for rotation and/or other movement relative to the reference structure without physical contacting the reference structure. In one embodiment, the rotor(s) may be electrostatically suspended in such a way that movement of the rotor(s) relative to the reference structure may be detected.

NTIS

Accelerometers; Detection; Patent Applications

20080039508 MacPherson Kwok Chen and Heid, LLP, San Jose, CA, USA

Scale Factor Calibration and Compensation for Angular Position Resolver

Liu, K., Inventor; Wu, Y. A., Inventor; Lee, J. L., Inventor; 13 Oct 04; 9 pp.; In English

Patent Info.: Filed Filed 13 Oct 04; US-Patent-Appl-SN-10-965 441

Report No.(s): PB2008-101651; No Copyright; Avail.: CASI: [A02](#), Hardcopy

In accordance with an embodiment of the present invention, a resolver system has at least one resolver and at least one

amplifier in electrical communication with each resolver. A reference circuit is in electrical communication with the amplifiers. The reference circuit provides reference signals to the amplifiers. A non-linearity calibration and compensation circuit in communication with each amplifier uses the amplified reference signals to provide scale factors, so as to enhance a precision of the resolver system.

NTIS

Calibrating; Patent Applications; Resolvers

20080039517 Peabody (Nixon), LLP, Rochester, NY, USA

Prenyl-Electrostatic Switch and Methods of Use

Phillips, M. R., Inventor; Bivona, T. G., Inventor; 19 Apr 05; 28 pp.; In English

Contract(s)/Grant(s): RO1 GM55279

Patent Info.: Filed Filed 19 Apr 05; US-Patent-Appl-SN-11-109 262

Report No.(s): PB2008-103151; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention relates to a method of identifying compounds as candidate drugs for treatment of cancer by providing a cell expressing a GTPase protein that is regulated by a prenyl-electrostatic switch, contacting the cell with compounds to be evaluated, and selecting compounds able to regulate charge at the prenyl-electrostatic switch in the GTPase protein as candidate drugs for treatment of cancer. Also disclosed are methods of treating cancer in a patient. An isolated antibody which binds to a phosphorylated prenyl-electrostatic switch on a K-Ras4B protein is also disclosed, as is a kit for detecting phosphorylation of a prenyl-electrostatic switch in a K-Ras4B protein which includes a labeled antibody and a device to detect the label. Also disclosed is a method of detecting phosphorylation of a prenyl-electrostatic switch on a K-Ras4B protein in a biological sample.

NTIS

Cancer; Drugs; Electrostatics; Patent Applications; Switches

20080039522 Gifford Krass Groil Sprinkle and Citkowski, PC, Troy, MI, USA

Portable Virtual Reality Medical Demonstration and Training Apparatus

Haluck, R. S., Inventor; 11 Jan 05; 10 pp.; In English

Contract(s)/Grant(s): N00014-03-1-0863

Patent Info.: Filed Filed 11 Jan 05; US-Patent-Appl-SN-11-033 073

Report No.(s): PB2008-103159; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A training apparatus presents a virtual environment to a user and allows the user to interact with the virtual environment. The training apparatus includes a base, an interface and a tool. The base has a storage device and a central processing unit. The interface may provide haptic feedback responsive to interaction between the user and the virtual environment. The tool is operatively coupled to the interface, by which the user interacts with the virtual environment, and through which haptic feedback may be provided to the user from the interface. The tool has storage for software code that forms an application defining the virtual environment.

NTIS

Education; Patent Applications; Virtual Reality

20080039523 Townsend and Townsend and Crew, LLP, San Francisco, CA, USA; Department of Health and Human Services, Rockville, MD, USA

Grid Etcher (PAT-APPL-10-967 703)

Ravin, R., Inventor; Sullivan, J. V., Inventor; Hoepfner, D., Inventor; Munno, D. W., Inventor; McKay, R., Inventor; 14 Oct 04; 14 pp.; In English

Patent Info.: Filed Filed 14 Oct 04; US-Patent-Appl-SN-10-967 703

Report No.(s): PB2008-103160; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An apparatus and process for monitoring migratory cell proliferation with restricted migration on a substrate includes providing a substrate, coating the substrate with extracellular matrix, plating cells suspended in cell culture media on extracellular matrix, and placing intersecting channels across the extracellular matrix components by removing the extracellular matrix components from the channels to isolate islands of the extracellular matrix components on the substrate. When the cells are immersed with a fluid, migration of the cells is confined to the isolated islands of the extracellular matrix components, permitting long-term observation of a migratory population.

NTIS

Cells (Biology); Patent Applications; Regeneration (Physiology)

20080039531 Williams, Morgan and Ameron, P.C., Houston, TX, USA

Supercapacitor Having Electrode Material Comprising Single-Wall Carbon Nanotubes and Process for Making the Same

Liu, T., Inventor; Kumar, S., Inventor; 30 Jun 03; 19 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0147; N00014-01-1-0657

Patent Info.: Filed Filed 30 Jun 03; US-Patent-Appl-SN-10-609 725

Report No.(s): PB2008-101657; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention relates to a supercapacitor, also known as an electrical double-layer capacitor or ultracapacitor, having electrode material comprising single-wall carbon nanotubes. The carbon nanotubes can be derivatized with functional groups. The electrode material is made by preparing a polymer-nanotube suspension comprising polymer and nanotubes, forming the polymer-nanotube suspension into a polymer-nanotube composite of the desired form, carbonizing the polymer-nanotube composite to form a carbonaceous polymer-nanotube material, and activating the material. The supercapacitor includes electrode material comprising activated carbonaceous polymer-nanotube material in contact with current collectors and permeated with an electrolyte, which may be either fluid or solid. In the case of a fluid or compressible electrolyte, an electrolyte-permeable separator or spacer is interposed between the electrodes to keep the electrodes from shorting. The supercapacitor made with electrodes comprising underderivatized single-wall carbon nanotubes and polymer that has been carbonized and activated appears to operate as a non-Faradaic supercapacitor.

NTIS

Capacitors; Carbon Nanotubes; Electrochemical Capacitors; Electrodes; Patent Applications; Walls

20080039536 Pratt (John S), Esq. and Stockion (Kilpatrick), LLP, Atlanta, GA, USA

Nanocomposite Negative Resists for Next Generation Lithographies

Gonsalves, K., Inventor; Ali, M. A., Inventor; 19 Dec 02; 25 pp.; In English

Contract(s)/Grant(s): N66001-00-1-8903; DMR 9902944

Patent Info.: Filed Filed 19 Dec 02; US-Patent-Appl-SN-10-324 642

Report No.(s): PB2008-102471; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention provides new high resolution nanocomposite resists applicable to next generation lithographies, methods of making these novel resists, and methods of using these new resists in lithographic processes to effect state-of-the-art lithographies. New nanocomposite negative resists comprising a photoacid generating component, a styrene component, and an optional polyhedral oligosilsequioxane component are provided. Negative resists of this invention may also contain an optional methacrylate component. This invention and the embodiments described herein constitute fundamentally new architectures for high resolution resists.

NTIS

High Resolution; Lithography; Nanocomposites; Patents

20080039538 International Business Machines Corp., San Jose, CA, USA

Magnetic Tunnel Junctions Using Amorphous Materials as Reference and Free Layers

Parkin, S. S., Inventor; 10 Nov 04; 38 pp.; In English

Contract(s)/Grant(s): MDA972-01-C-0051

Patent Info.: Filed Filed 10 Nov 04; US-Patent-Appl-SN-10-904 449

Report No.(s): PB2008-103052; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Magnetic tunnel junctions are constructed from a MgO or Mg--ZnO tunnel barrier and amorphous magnetic layers in proximity with, and on respective sides of, the tunnel barrier. The amorphous magnetic layer preferably includes Co and at least one additional element selected to make the layer amorphous, such as boron. Magnetic tunnel junctions formed from the amorphous magnetic layers and the tunnel barrier have tunneling magnetoresistance values of up to 200% or more.

NTIS

Amorphous Materials; Magnetic Materials; Patent Applications; Tunnel Junctions

20080039612 Naval Research Lab., Washington, DC USA

Quasiperiodic Nanoscale Faceting of High-Index Si Surfaces

Baski, A A; Whitman, L J; Feb 6, 1995; 5 pp.; In English

Report No.(s): AD-A482501; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Scanning tunneling microscopy reveals that Si(112) reconstructs into quasiperiodic, nanometer-scale facets. Each

sawtoothlike facet consists of a single unit cell wide reconstructed (111) terrace (7 X 7 or 5 X 5) opposed by a 60 to 110 Argon wide (337) terrace. Nanofacets with a similar structure are also observed on Si(335), indicating that they are a general phenomenon for some range of vicinality towards [112]. The dimensions of these nanofacets suggest that Si(112) and Si(335) would be interesting substrates for the growth of corrugated superlattices.

DTIC

Superlattices; Scanning Tunneling Microscopy; Terraces (Landforms); Flat Surfaces

20080039621 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Fault Tolerance Implementation within SRAM Based FPGA Designs based upon Single Event Upset Occurrence Rates
Berg, Melanie; July 10, 2006; 3 pp.; In English; 12th IEEE International On-Line Testing Symposium, 10-12 Jul. 2006, Lake of Como, Italy; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A01](#), Hardcopy
ONLINE: <http://hdl.handle.net/2060/20080039621>

Emerging technology is enabling the design community to consistently expand the amount of functionality that can be implemented within Integrated Circuits (ICs). As the number of gates placed within an FPGA increases, the complexity of the design can grow exponentially. Consequently, the ability to create reliable circuits has become an incredibly difficult task. In order to ease the complexity of design completion, the commercial design community has developed a very rigid (but effective) design methodology based on synchronous circuit techniques. In order to create faster, smaller and lower power circuits, transistor geometries and core voltages have decreased. In environments that contain ionizing energy, such a combination will increase the probability of Single Event Upsets (SEUs) and will consequently affect the state space of a circuit. In order to combat the effects of radiation, the aerospace community has developed several 'Hardened by Design' (fault tolerant) design schemes. This paper will address design mitigation schemes targeted for SRAM Based FPGA CMOS devices. Because some mitigation schemes may be over zealous (too much power, area, complexity, etc. . .), the designer should be conscious that system requirements can ease the amount of mitigation necessary for acceptable operation. Therefore, various degrees of Fault Tolerance will be demonstrated along with an analysis of its effectiveness.

Author

Field-Programmable Gate Arrays; Integrated Circuits; Electric Potential; Radiation Effects; Single Event Upsets; Fault Tolerance; CMOS

20080039649 NASA Langley Research Center, Hampton, VA, USA; Shaeffer (John), Marietta, GA, USA

Direct Solve of Electrically Large Integral Equations for Problem Sizes to 1M Unknowns
Shaeffer, John; September 2008; 51 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAS1-02117
Report No.(s): NASA/CR-2008-215353; No Copyright; Avail.: CASI: [A04](#), Hardcopy
ONLINE: <http://hdl.handle.net/2060/20080039649>

Matrix methods for solving integral equations via direct solve LU factorization are presently limited to weeks to months of very expensive supercomputer time for problems sizes of several hundred thousand unknowns. This report presents matrix LU factor solutions for electromagnetic scattering problems for problem sizes to one million unknowns with thousands of right hand sides that run in mere days on PC level hardware. This EM solution is accomplished by utilizing the numerical low rank nature of spatially blocked unknowns using the Adaptive Cross Approximation for compressing the rank deficient blocks of the system Z matrix, the L and U factors, the right hand side forcing function and the final current solution. This compressed matrix solution is applied to a frequency domain EM solution of Maxwell's equations using standard Method of Moments approach. Compressed matrix storage and operations count leads to orders of magnitude reduction in memory and run time.

Author

Electromagnetic Scattering; Matrix Methods; Compressing; Matrices (Mathematics); Frequency Domain Analysis; Maxwell Equation; Integral Equations

20080039657 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Solder Reflow Failures in Electronic Components During Manual Soldering
Teverovsky, Alexander; Greenwell, Chris; Felt, Frederick; February 11, 2008; 10 pp.; In English; Components for Military and Space Electronics, 11-14 Feb. 2008, San Diego, CA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

This viewgraph presentation reviews the solder reflow failures in electronic components that occur during manual soldering. It discusses the specifics of manual-soldering-induced failures in plastic devices with internal solder joints. The

failure analysis turned up that molten solder had squeezed up to the die surface along the die molding compound interface, and the dice were not protected with glassivation allowing solder to short gate and source to the drain contact. The failure analysis concluded that the parts failed due to overheating during manual soldering.

CASI

Soldering; Solders; Electronic Equipment; Field Effect Transistors; Delaminating

20080039667 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Advanced Cathodes for Next Generation Electric Propulsion Technology

Warner, Dustin J; Mar 2008; 174 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482721; AFIT/GA/ENY/08-M07; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482721>

The research presented here investigated the feasibility of a 6.4 mm Lanthanum Hexaboride (LaB6) and Cerium Hexaboride (CeB6) hollow cathode for low power electric propulsion applications (100-300W). Two orifice geometries, one anode configuration, several anode and keeper currents, and a range of flow rates were tested for the LaB6 cathode. The CeB6 cathode underwent the same tests, with the exception of the second orifice geometry due to time constraints. The required instruments include an oscilloscope to monitor the keeper and anode voltages, a Langmuir probe measured electron temperature, plasma densities, and plasma potential for the coupling plasma, infrared imaging studied the thermal characteristics of each cathode, electron microscopy for surface contaminant analysis, and high-speed imaging for coupling plasma observations. The oscilloscope, Langmuir probe, and high-speed camera determined the cathodes' mode of operation and gave information that indicated stable spot mode or unstable, destructive plume mode. The CeB6 cathode operated in spot mode as low as 1.5 A and 1.5 sccm with no heater or keeper power, and as high as 6 A, 1.5 sccm with 1 A keeper current. Increasing the flow rate and keeper current mitigated plume mode. The CeB6 cathode was more susceptible to poisoning than the LaB6 cathode, requiring more heater power and flow to start after running at low flow and current for long periods. The CeB6 cathode also operated at slightly higher temperatures than the LaB6 cathode, indicating a higher emissivity. The LaB6 cathode ran in spot mode as low as 2.5 A, at 1.5 sccm with no heater or keeper power. However, when the aspect ratio was reduced to 0.25, the cathode operated as low as 1.4 A, with 1.5 sccm until the cathode exceeded the voltage limit of the power supply. The same spot/plume mode characteristics were observed for LaB6 as CeB6.

DTIC

Cathodes; Cerium Compounds; Electric Propulsion; Hall Thrusters

20080039687 Naval Research Lab., Washington, DC USA

Photoionization Spectroscopy of Traps in GaN Metal-Semiconductor Field-Effect Transistors

Klein, P B; Binari, S C; Freitas, Jr., J A; Wickenden, A E; Sep 1, 2000; 11 pp.; In English

Report No.(s): AD-A482757; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482757>

Measurements of the spectral and intensity dependences of the optically-induced reversal of current collapse in a GaN metal-semiconductor field-effect transistor (MESFET) have been compared to calculated results. The model assumes a net transfer of charge from the conducting channel to trapping states in the high-resistivity region of the device. The reversal, a light-induced increase in the trap-limited drain current, results from the photoionization of trapped carriers and their return to the channel under the influence of the built-in electric field associated with the trapped charge distribution. For a MESFET in which two distinct trapping centers have been spectrally resolved, the experimentally measured dependence upon light intensity was fitted using this model.

DTIC

Field Effect Transistors; Photoionization; Spectroscopy; Traps

20080039714 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Sensitivity Analysis of AlGaN/GaN High Electron Mobility Transistors to Process Variation

Liddle, Adam J; Feb 2008; 130 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-JON08-153

Report No.(s): AD-A482821; AFIT/GE/ENG/08-17; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482821>

A sensitivity analysis of AlGaN/GaN HEMT performance on material and process variations was performed. Aluminum mole fraction, barrier thickness, and gate length were varied + or - 5% over nominal values to determine how sensitive

simulated device performance was to changes in these 3 parameters. Simulated data was generated with the Synopsys TCAD software suite using a physics-based HEMT model. To validate model performance, simulated data was correlated with experimental data, which consisted of wafer epilayer characterization data as well as DC and small-signal RF device performance data from 1-26 GHz. Trends were observed in the experimental data due to variations in the fabrication process. Epilayer data showed cross-wafer trends in sheet resistance, barrier thickness and Al mole fraction but didn't show any discernable trends in mobility or sheet carrier concentration. Maximum output current was the only measured performance metric that showed a strong trend across the wafers. Data from two different device geometries on the same wafers were compared to determine whether performance variations across a wafer could be attributed to epilayer variation or device geometry. Variation in power and current gain cutoff frequencies was attributed to differences in the device geometry whereas variations in maximum output current was correlated to sheet resistance and barrier thickness variation. Simulated device performance showed varying sensitivities when + or - changes in aluminum mole fraction, barrier thickness, and gate length were made. Al mole fraction and barrier thickness had a large effect on DC output up to 40%, while the gate length only moderately effected DC output by 2-3%. However, of all 3 parameters, changes in gate length had the greatest effect on the RF performance (1-3%) while RF performance was negligibly affected by changes in Al mole fraction and barrier thickness.

DTIC

High Electron Mobility Transistors; Sensitivity Analysis

20080039716 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Design and Optimization of Broadband High Impedance Ground Planes (HIGP) for Surface Mount Antennas

Dogrul, Murat; Mar 2008; 136 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482826; AFIT/GE/ENG/08-08; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482826>

Gain and bandwidth metrics of broad-band low-profile antennas severely deteriorate when they are placed conformally onto the conductive skins of air, sea, and ground platforms. This detrimental effect is primarily due to out-of-phase reflections from the conductive body interfering with the antenna's self radiation. Furthermore, lateral waves launched by the antenna couple into the thin substrate placed between the antenna and the platform, giving rise to surface waves resulting in significant diffraction from the edges of the substrate. To remedy these two major mechanisms degrading antenna performance, high impedance ground planes (HIGP) were designed. HIGPs made of a 2-dimensional periodic arrangement of a mushroom structure not only provide perfect-magnetic-conductor (PMC)-like reflection but also suppress the surface waves within the stop-band of the substrate modes. This study presents new geometrical shape HIGP-antenna designs and optimizations. Dipole antenna, log periodic antenna and finally bow-tie antennas are used in the study. Multi-scale HIGP and antenna designs are introduced in the final part of the thesis.

DTIC

Antennas; Broadband; Design Optimization; Impedance; Supports

20080039720 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

A Wide Area Bipolar Cascade Resonant Cavity Light Emitting Diode for a Hybrid Range-Intensity Sensor

Turner, Reginald J; Jun 19, 2008; 195 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482835; AFIT/DEE/ENG/08-12; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482835>

This dissertation focused on the development of an illuminator for the HRIS. This illuminator enables faster image rendering and reduces the potential of errors in return signal data, that could be generated from extremely rough terrain. Four major achievements resulted from this work, which advance the field of 3-D image acquisition. The first is that the TJ is an effective current spreading layer for LEDs with mesa width up to 140 μm and current densities of $\sim 1 \times 10^6 \text{ A/cm}^2$. The TJ allows fabrication of an efficient illuminator, with required geometry for the HRIS to operate as a real-time 3-D imaging system. Secondly, a design for a Bipolar Cascade-Resonant Cavity Light Emitting Diode (BC-RCLED) has been accomplished, that will illuminate the FOV of the hybrid-ranged intensity system with a single sweep of the beam. This device is capable of producing $\sim 330 \text{ mW}$ of output power. Additionally, from this work, key parameters for HRIS design were identified. Using a collection optic with a 15 cm diameter, an HRIS mounting height of 1.5 m, and a detector integration time of 330 msec, a SNR of 20 dB was achieved. Lastly, we demonstrated that the BC-RCLED designed for the HRIS can deliver sufficient energy to produce the required SNR. Also, through parametric analysis, we determined that a system trade-off, between the collection optic diameter, and the integration time, results in an increase in the SNR from 20 to nearly 50, or extending the operational range from 50 to nearly 130 m.

DTIC

Bipolarity; Cavity Resonators; Detectors; Light Emitting Diodes

20080039730 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Limitations of a True Random Number Generator in a Field Programmable Gate Array

Brady, Jennifer L; Dec 2007; 146 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482856; AFIT/GE/ENG/08-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482856>

Random number generators are used in many areas of engineering, computer science, most notably in simulations and cryptographic applications. Only a true random number generator is secure because the output bits are non-repeating and non-reproducible. A true random number generator on a field programmable gate array allows the generator on chip reducing the possibility of a breach in security. An oscillator sampling technique is an effective TRNG in a Xilinx FPGA. This research examines how the differences in period of the oscillators, the size of the jitter zone, and sampling on the rising and falling edge of the oscillator rather than just the rising edge affects the TRNG. The proportion of the size of the jitter zone compared to the period difference between the two oscillators limits the performance. As the jitter zone gets larger, the proportion of the jitter zone to the difference in periods of the oscillators must increase for the output to remain random. Sampling on the rising and falling edge instead of only the rising was not effective. The output was random for only a jitter zone of 24 ps with a period difference of 50 ps and 100 ps.

DTIC

Computer Programming; Field-Programmable Gate Arrays; Oscillators; Random Numbers; Sampling

20080039743 Massachusetts Inst. of Tech., Cambridge, MA USA

Impact of the Boundary Layer on Pointing and Tracking in Airborne Free-Space Laser Communication Links

Conrad, Ross A; Jun 2008; 120 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482877; CI08-0020; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482877>

Free-space laser communication is a developing technology with enormous potential to revolutionize the way people communicate across the globe. Of specific interest are air-to-space lasercom links. Such a link experiences atmospheric scintillation, platform jitter, and boundary layer turbulence. This research investigated the tracking challenge using a focal plane array sensor with centroid and peak tracking algorithms. Also investigated was the use of a deformable mirror to recreate optical phase distortions from boundary layer turbulence. Experiments were conducted with realistic channel effects for multiple look angles between a subsonic aircraft at 29 kft and geosynchronous satellite. Performance was determined by power delivered to an optical fiber. The results show that the two tracking algorithms can differ by up to one decibel of fiber power, with centroid tracking generally performing best. Conclusions are highly dependent on aircraft and spacecraft parameters but point towards centroid tracking for maximizing received power.

DTIC

Airborne Lasers; Boundary Layers; Communication Networks; Deformable Mirrors; Focal Plane Devices; Optical Communication; Spaceborne Lasers; Tracking (Position); Turbulent Boundary Layer

20080039747 Naval Research Lab., Washington, DC USA

Effects of Surface Reconstruction on III-V Semiconductor Interface Formation: The Role of III/V Composition

Nosho, B Z; Weinberg, W H; Barvosa-Carter, W; Bennett, B R; Shanabrook, B V; Whitman, L J; Mar 22, 1999; 4 pp.; In English

Report No.(s): AD-A482885; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482885>

Using molecular-beam epitaxy and in situ scanning tunneling microscopy, we demonstrate how different reconstructions associated with different III V growth surfaces can create interfacial roughness, and that an understanding of this phenomenon can be used to control the roughness on the atomic scale. Specifically, the different compositions of a clean InAs(001)-(2X4) surface (V/III50.5 ML/0.75 ML) and an Sb-terminated one (~1.7 ML/1 ML) cause the InSb-like interfacial surface to have a bilevel morphology. This surface roughness can be eliminated by depositing additional In to exactly compensate for the difference. It is likely that similar types of roughness occur in all heterostructures where the growth surface reconstruction changes at the interfaces, and that a similar procedure will be equally effective at reducing that roughness.

DTIC

Electron Microscopy; Semiconductors (Materials)

20080039792 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Limitations of Segmented Wavefront Control Devices in Emulating Optical Turbulence

Plourde, Michael D; Mar 2008; 111 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482906; AFIT/GEO/ENG/08-02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Using a device to act as a surrogate for atmospheric turbulence in a laboratory is necessary to build and test optical systems for imaging, lidar, laser weapons, and laser communications. Liquid-crystal spatial light modulators (LC SLMs) and segmented micro-electro-mechanical-system (MEMS) deformable mirrors (DMs) are commonly used devices for altering wavefronts in order to simulate a portion of atmospheric turbulence. The best location of these devices was theoretically analyzed to obtain the broadest possible range of atmospheric conditions. It was revealed that a layered model for atmospheric turbulence strength can be represented by the atmospheric coherence diameter that a single segmented wavefront control device can produce. The limitations of pixelation effects on a segmented wavefront control device were investigated theoretically. The results of this analysis were then confirmed in simulation. The performance capabilities of several available commercial devices are better understood as a result of this research.

DTIC

Adaptive Optics; Atmospheric Turbulence; Control Equipment; Deformable Mirrors; Microelectromechanical Systems; Segments; Turbulence; Wave Fronts

20080039801 Naval Research Lab., Washington, DC USA

Direct Observation of Mass Oscillations Due to Ablative Richtmyer-Meshkov Instability in Plastic Targets

Aglitskiy, Y; Velikovich, A L; Karasik, M; Serlin, V; Pawley, C J; Schmitt, A J; Obenschain, S P; Mostovych, A N; Gardner, J H; Metzler, N; May 2002; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482926; XB-NRL/MR/6700; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We report the first direct experimental observation of the ablative Richtmyer-Meshkov instability. It manifests itself in oscillations of areal mass that occur during the shock transit time, which are caused by the rocket effect or dynamic overpressure characteristic of interaction between the laser absorption zone and the ablation front. With the 4 ns long Nike KrF laser pulse and our novel diagnostic technique (monochromatic x-ray imaging coupled to a streak camera) we were able to register a peak and a valley of the areal mass variation before the observed onset of the Rayleigh-Taylor growth.

DTIC

Ablation; Mass; Monochromatic Radiation; Observation; Oscillations; Plastics; Targets

20080039837 Defence Science and Technology Organisation, Edinburgh, Australia

Phased Array Radar Data Processing Using Adaptive Displaced Phase Centre Antenna Principle

Dong, Yunhan; Dec 2007; 55 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482982; DSTO-RR-0334; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Employing the autoregressive (AR) technique and the principle of displaced phase centre antenna (DPCA) we construct an optimum adaptive DPCA processor for moving target detection from airborne phased array radar data collected under non-DPCA conditions. It is fundamentally different from the existing adaptive DPCA which is not optimum. The number of range samples it needs to estimate its parameters is only approximately twice the number of antenna elements, significantly smaller than the number required by the conventional space-time adaptive processing (STAP) and other algorithms. Computationally it only requires 5-10% cost of STAP. The processor is tested using both the simulated and genuine airborne phased array radar data. With ample samples, its performance approaches optimum. In the case of reduced samples, it considerably outperforms STAP and others examined.

DTIC

Antenna Components; Data Processing; Phased Arrays; Radar Data; Targets

20080039853 Denselight Semiconductors Pte Ltd., Singapore

Speckle Free, Low Coherency, High Brightness, and High Pulse Speed Infrared Collimated Light Sources for Mid-IR Target Designator and Hyperspectral Imaging

Lam, Yee-Loy; Oct 31, 2007; 89 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-C-0072

Report No.(s): AD-A483027; 418-0041-005-07-006; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The indium phosphide-based SLED is an ideal light source for eye-safe target designation and imaging at 1550 nm spectral region. Its wide spectral width ensures low coherency, which is critical for speckle free imaging. A high brightness

and well-collimated output beam allow for projection of the illumination across long distances. In this project, a high brightness SLED chip that exceeds 200 mW in peak optical power output and >20 nm of spectral bandwidth at 1550 nm wavelength has been designed, developed and demonstrated. This optical power level is the highest value ever achieved, exhibiting more than 2 times improvement over baseline SLED chips operating in the same wavelength range. The SLED chip is packaged into a compact 7-pin TO-8 platform with built-in collimating aspherical lens, and the resultant transmitter optical sub-assembly (TOSA) achieved a very low beam divergence of 1 mrad. Additionally, an optical pulse stream of IONS pulse width, 0.1% duty ratio and rise and fall times of 1 ns has been demonstrated, allowing for high speed pulsed illumination applications.

DTIC

Brightness; Eye (Anatomy); High Speed; Imaging Techniques; Infrared Radiation; Laser Guidance; Light Sources; Luminaires; Safety; Targets

20080039880 Army Research Office, Research Triangle Park, NC USA

Nanosopic ZnO: Growth, Doping and Characterization

Olowolafe, Olufemi; Opila, Robert L; Sep 17, 2007; 8 pp.; In English

Contract(s)/Grant(s): W911NF-06-1-0511

Report No.(s): AD-A483088; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The authors have demonstrated the aqueous growth of ZnO nanorods on a wide variety of substrates, including Au, Al, Si, Pt, Ag, ITO, and silica. The rate of nucleation and the form of the crystals depends slightly upon the substrate. Additives can dramatically change growth behavior. The nanorods grow in the (1000) direction and are 0.1-10 μ m long. Short, squat rods are appropriate as MEMS actuators, and the authors are acquiring a nanoindenter to characterize their piezo-electric properties. Long, thin rods may be used as photovoltaic antennae, sensors, or field-effect transistors. They are in the process of testing the conductivity of these crystals by placing the crystal across a metallization pattern and contacting it. The metallization pattern provides the capability of making four-point contact. Integrity is ensured by the deposition of Pt using a focused ion beam. The surface of the ZnO will be passivated with Si₃N₄ and SiO₂.

DTIC

Additives; Aqueous Solutions; Characterization; Crystal Growth; Deposition; Electrical Properties; Nanorods; Nanostructures (Devices); Rods; Substrates; Zinc Oxides

20080040128 HRL Labs., LLC, Malibu, CA USA

Impact of Magneto-Electric Materials and Devices on Tactical Radio (and Radar)

Zinck, Jennifer; Henry, Christopher; Kirby, Deborah; Apr 2007; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-C-0051

Report No.(s): AD-A483074; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The interest in incorporating ME materials in electronic devices has been reinvigorated by the promising electric-field based control of magnetization or magnetization-based control of polarization in monolithic materials. Primary screening of ME monolithic materials based on their ferroelectric and magnetic ordering temperatures indicate they are not ready for application in devices and require further investment. Thus attention turned toward composite-based materials that magnetoelectrically couple through a strain field, which have known and beneficial properties, operate at room temperature or higher and can be modeled in a quasi-static fashion. While these composite materials may exhibit acceptable tunability and loss at low frequencies, strain nonuniformities, fabrication sensitivity, and proper evaluation of high frequency performance are still limitations. HFSS modeling to evaluate high frequency performance proved difficult because it cannot account for non-uniform magnetic fields nor magnetostrictive strain effects. Because of these current limitations, we recommend continued funding for ME materials research and for development of modeling and engineering expertise to realize the potential of these novel materials.

DTIC

Ferroelectric Materials; Nonuniform Magnetic Fields; Ferroelectricity

20080040685 MEI Technologies, Inc., Seabrook, MD, USA

Determining the Best-Fit FPGA for a Space Mission: An Analysis of Cost, SEU Sensitivity, and Reliability

Berg, Melanie; LaBel, Ken; December 04, 2007; 17 pp.; In English; Microelectronics Reliability and Qualification Workshop

(MRQW), 4-5 Dec. 2007, Manhattan Beach, CA, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy
ONLINE: <http://hdl.handle.net/2060/20080040685>

This viewgraph presentation reviews the selection of the optimum Field Programmable Gate Arrays (FPGA) for space missions. Included in this review is a discussion on differentiating amongst various FPGAs, cost analysis of the various options, the investigation of radiation effects, an expansion of the evaluation criteria, and the application of the evaluation criteria to the selection process.

CASI

Cost Analysis; Field-Programmable Gate Arrays; Reliability; Space Missions; Radiation Effects

20080040687 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Failures in Hybrid Microcircuits During Environmental Testing. History Cases

Teverovsky, Alexander; February 11, 2008; 11 pp.; In English; Components for Military and Space Electronics, 11 - 14 Feb. 2008, San Diego, California, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

This purpose of this viewgraph presentation is to discuss failures in hermetic hybrids observed at the GSFC PA Lab during environmental stress testing. The cases discussed are: Case I. Substrate metallization failures during Thermal cycling (TC). Case II. Flex lid-induced failure. Case III. Hermeticity failures during TC. Case IV. Die metallization cracking during TC. and how many test cycles and parts is necessary? Case V. Wire Bond failures after life test. Case VI. Failures caused by Au/In IMC growth.

Derived from text

Hermetic Seals; Microelectronics; Thermal Cycling Tests; Failure; Failure Analysis

20080040742 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Cosmic Microwave Background Polarization Detector with High Efficiency, Broad Bandwidth, and Highly Symmetric Coupling to Transition Edge Sensor Bolometers

Wollack, E.; Cao, N.; Chuss, D.; Denis, K.; Hsieh, W.-T.; Moseley, S. Harvey; Schneider, G.; Stevenson, T.; Travers, D.; U-yen, K.; [2008]; 1 pp.; In English; Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

Four probe antennas transfer signals from waveguide to microstrip lines. The probes not only provide broadband impedance matching, but also thermally isolate waveguide and detector. In addition, we developed a new photonic waveguide choke joint design, with four-fold symmetry, to suppress power leakage at the interface. We have developed facilities to test superconducting circuit elements using a cryogenic microwave probe station, and more complete systems in waveguide. We used the ring resonator shown below to measure a dielectric loss tangent $< 7 \times 10^{-4}$ over 10 - 45 GHz. We have combined component simulations to predict the overall coupling from waveguide modes to bolometers. The result below shows the planar circuit and waveguide interface can utilize the high beam symmetry of HE11 circular feedhorns with $> 99\%$ coupling efficiency over 30% fractional bandwidth.

Derived from text

Cosmic Microwave Background Radiation; Microstrip Transmission Lines; Dielectric Loss; Microwave Probes; Superconductivity; Broadband

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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*.

20080039267 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Optimized Heat Interception for Cryogen Tank Support

Canavan, Edgar R.; Miller, F. K.; July 16, 2007; 8 pp.; In English; Cryogenic Engineering Conference, 16-20 Jul. 2007, Chatanooga, TN, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039267>

We consider means for using the cooling available in boil-off gas to intercept heat conducted through the support structure of a cryogen tank. A one-dimensional model of the structure coupled to a gas stream gives an analytical expression for heat leak in terms of flow rate for temperature independent-properties and laminar flow. A numerical model has been developed

for heat transfer on a thin cylindrical tube with an attached vent line. The model is used to determine the vent path layout that will minimize heat flow into the cryogen tank. The results are useful for a number of applications, but the one of interest in this study is the minimization of the boil-off in large cryopropellant tanks in low Earth and low lunar orbit.

Author

Cryogenics; Heat Transfer; Interception; Propellant Tanks; Gas Streams; Heat Transmission; Evaporation

20080039498 Quarles and Brady, LLP., Milwaukee, WI, USA

Micro Fluidic System for Single Molecule Imaging

Schwartz, D. C., Inventor; Dimalanta, E. T., Inventor; Dimalanta, J. J., Inventor; 18 Oct 02; 9 pp.; In English

Contract(s)/Grant(s): DOE DE-FGO2-99ER62830; NIH HG00225

Patent Info.: Filed Filed 18 Oct 02; US-Patent-Appl-SN-10-713 898

Report No.(s): PB2008-103139; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Laminar flow of a carrier liquid and polymeric molecules through micro-channels is used to straighten the polymeric molecules and attach the straightened molecules to a wall of the micro-channel for subsequent treatment and analysis. Micro-channels can be manufactured using an elastic molding material. One micro-channel embodiment provides fluid flow using a standard laboratory centrifuge.

NTIS

Fluidics; Imaging Techniques; Laminar Flow; Molecules; Patent Applications

20080039500 IP and Internet Law North, LLC, Zelenople, PA, PA, USA

Blended Powder Solid-Supersolidus Liquid Phase Sintering

Liu, J., Inventor; Ryneson, M. L., Inventor; 16 Mar 04; 16 pp.; In English

Contract(s)/Grant(s): N00014-00-C-0378

Patent Info.: Filed Filed 16 Mar 04; US-Patent-Appl-SN-10-801 970

Report No.(s): PB2008-103142; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A green article comprising an A-B powder mixture and methods of manufacturing such green articles and corresponding sintered articles are disclosed. The A-B powder mixture consists of a minor volume fraction of a relatively fine powder A and a complementary major volume fraction of a relatively coarse prealloyed powder B wherein the A-B powder mean particle size ratio is at least about 1:5. Metal powder A consists of one or more elemental metals or alloys which has a melting or solidus temperature above the highest sintering temperature at which the A-B powder mixture may be sintered without slumping. Prealloyed metal powder B consists of one or more alloys which are amenable to supersolidus liquid phase sintering. Green articles made from the A-B powder have a wider sintering temperature window than do articles made from prealloyed metal powder B alone.

NTIS

Liquid Phase Sintering; Patent Applications; Powder (Particles); Solid Phases

20080039520 Wilson (Jenkins) and Taylor, PA, Durham, NC, USA; North Carolina Univ., Chapel Hill, NC, USA

Liquid Materials for Use in Electrochemical Cells

DeSimone, J. M., Inventor; Kelly, J. Y., Inventor; Rolland, J. P., Inventor; Zhou, Z., Inventor; Denison, G. M., Inventor; 21 Jan 05; 49 pp.; In English

Contract(s)/Grant(s): N00014210185; CHE-9876674

Patent Info.: Filed Filed 21 Jan 05; US-Patent-Appl-SN-11-040 317

Report No.(s): PB2008-103157; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Disclosed is the use of liquid precursor materials to prepare a processible polymeric electrolyte, which can be used to form a proton exchange membrane for use in an electrochemical cell. Also disclosed is the use of liquid precursor materials to prepare a processible catalyst ink composition, which can be conformally applied to a proton exchange membrane and an electrode material for use in an electrochemical cell. Also disclosed is the use of a photocurable perfluoropolyether (PFPE) material to form a microfluidic electrochemical cell.

NTIS

Electrochemical Cells; Patent Applications

20080039540 Burns (Greer) and Crain, Chicago, IL, USA

Supported Molecular Biofluid Viscosity Sensors for In Vitro and In Vivo Use

Haidekker, M. A., Inventor; Grant, S., Inventor; Theodorakis, E., Inventor; Intaglietta, M., Inventor; Frangos, J. A., Inventor; 20 Jan 05; 30 pp.; In English

Contract(s)/Grant(s): NIH 1R21 RRO18399

Patent Info.: Filed 20 Jan 05; US-Patent-Appl-SN-11-039 076

Report No.(s): PB2008-103178; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A device and a method for measuring viscosity that includes attaching molecular rotors to a solid surface, exposing the solid surface to a fluid having a viscosity to be measured, and taking optical measurements to determine viscosity. The solid surface is preferably quartz, polystyrene or silicate glass, such as a fiber optic probe or a glass cuvette. The molecular rotors are of the type that includes an electron-donor group and electron-acceptor group that are linked by a single bond so that the groups may rotate with respect to one another, and that exhibit a fluorescence emission when rotation is hindered.

NTIS

In Vitro Methods and Tests; In Vivo Methods and Tests; Patent Applications; Viscosity

20080039610 Alabama Univ., Birmingham, AL USA

Performance Benchmark for a Prismatic Flow Solver

Soni, Bharat K; Ito, Yasushi; Mar 26, 2007; 5 pp.; In English

Contract(s)/Grant(s): W911NF-06-1-0063

Report No.(s): AD-A482623; No Copyright; Avail.: Defense Technical Information Center (DTIC)

HPC Institute for Advanced Rotorcraft Modeling and Simulation (HI-ARMS) seeks the performance evaluation on various near-body/off-body spatial partitioning paradigm for the development of a computation engine for DoD's mission-critical design and analysis tasks. The purpose of this project is to benchmark the prismatic flow solver derived from the Tohoku University Aerodynamic Simulation (TAS) flow solver with a common test problem. The TAS code is an unstructured, implicit, compressible flow solver developed by Nakahashi et al. The full Reynolds-averaged Navier-Stokes (RANS) equations that retain the unsteady form are solved by a finite volume cell-vertex scheme. The control volumes are non-overlapping dual cells constructed around each node. The Harten-Lax-van Leer-Einfeldt-Wada (HLLEW) Riemann solver is used for the numerical flux computations. The Lower-Upper-Symmetric Gauss-Seidel (LU-SGS) implicit method is used for time integration to reduce the computational time. A one-equation turbulence model by Goldberg and Ramakrishnan and the Spalart-Allmaras model are implemented to treat turbulent boundary layers. A grid reordering method is implemented for the cell-vertex scheme implementation for three-dimensional hybrid grids for the LU-SGS method. The deliverables are used as the basis for measuring the attributes of the prismatic flow solver and its potential to meet long-term HI-ARMS objectives and program requirements.

DTIC

Computational Fluid Dynamics; Turbulent Boundary Layer; Reynolds Averaging

20080039677 Texas A&M Univ., College Station, TX USA

Reversible Control of Anisotropic Electrical Conductivity using Colloidal Microfluidic Networks

Beskok, Ali; Bevan, Michael; Lagoudas, Dimitris; Ounaies, Zoubeida; Bahukudumbi, Pradipkumar; Everett, William; Apr 17, 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-1-0050

Report No.(s): AD-A482733; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482733>

This research addresses the tunable assembly of reversible colloidal structures within microfluidic networks to engineer multifunctional materials that exhibit a wide range of electrical properties. Our work has focused on studying electric field-directed assembly of gold colloids and understanding how tuning colloidal configurations can be utilized to modulate electrical properties within a microfluidic electric circuit. More specifically, we have found that a single circuit element can act as a variable resistor, capacitor, and inductor by regulating the colloidal structures within the gap between electrodes. Navigating the applied AC voltage-frequency phase space allows us to probe a wide range of colloidal configurations that resemble 'capacitive' and 'resistive' networks in their limiting cases. All colloidal configurations formed were reversible and repeatable, and it was possible to switch from one configuration to other interchangeably. Based on a scaling analysis, different electrokinetic forces that drive assembly have been identified. The scaling analysis was able to consistently interpret

experimental observations of particle dynamics over the planar electrode system, and can be extended, within limits, to more complex electrode geometries for future studies.

DTIC

Anisotropy; Colloids; Electrical Properties; Electrical Resistivity; Fluidics; Microfluidic Devices

20080039737 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

The Impact of Heat Release in Turbine Film Cooling

Evans, Dave S; Jun 2008; 165 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482864; AFIT/GAE/ENY/08-J02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482864>

The Ultra Compact Combustor is a design that integrates a turbine vane into the combustor flow path. Because of the high fuel-to-air ratio and short combustor flow path, a significant potential exists for unburned fuel to enter the turbine. Using contemporary turbine cooling vane designs, the injection of oxygen-rich turbine cooling air into a combustor flow containing unburned fuel could result in heat release in the turbine and a large decrease in cooling effectiveness. The current study explores the interaction of cooling flow from typical cooling holes with the exhaust of a fuel-rich well-stirred-reactor operating at high temperatures over a flat plate. Surface temperatures, heat flux, and heat transfer coefficients are calculated for a variety of reactor fuel-to-air ratios, cooling hole geometries, and blowing ratios. Results demonstrate that reactions in the turbine cooling film can result in increased heat transfer to the surface. The amount of this increase depends on hole geometry and blowing ratio and fuel content of the combustor flow. Failure to design for this effect could result in augmented heat transfer caused by the cooling scheme, and turbine life could be degraded substantially.

DTIC

Combustion Chambers; Film Cooling; Fuel-Air Ratio; Heat Transfer; Heat Transfer Coefficients; Turbine Blades; Turbines

20080039753 Army Engineer Waterways Experiment Station, Vicksburg, MS USA

Wave Momentum Flux Parameter: A Descriptor for Nearshore Waves

Hughes, Steven A; Jul 16, 2004; 19 pp.; In English

Report No.(s): AD-A482898; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482898>

A new parameter representing the maximum depth-integrated wave momentum flux occurring over a wave length is proposed for characterizing the wave contribution to nearshore coastal processes on beaches and at coastal structures. This parameter has units of force per unit crest width, and it characterizes flow kinematics in nonbreaking waves at a given depth better than other wave parameters that do not distinguish increased wave nonlinearity. The wave momentum flux parameter can be defined and estimated for periodic and nonperiodic (transient) waves. Thus, it has potential application for correlating to processes responding to different types of waves. This paper derives the wave momentum flux parameter for linear, extended linear, and solitary waves; and it presents an empirical formula estimating the parameter for nonlinear steady waves of permanent form. Guidance is suggested for application to irregular waves. It is anticipated that the wave momentum flux parameter may prove useful for developing improved semiempirical formulas to describe nearshore processes and wave/structure interactions such as wave runup, overtopping, reflection, transmission, and armor stability. Surf zone processes where waves break as plunging or spilling breakers may not benefit from use of the wave momentum flux parameter because the breaking processes effectively negates the advantage of characterizing the wave nonlinearity.

DTIC

Beaches; Momentum

20080039786 Oak Ridge National Lab., TN USA

A Preliminary Experimental Study of Vortex Tubes for Gas-Phase Fission Heating

Kerrebrock, J L; Keyes, Jr, J J; Feb 20, 1959; 54 pp.; In English

Contract(s)/Grant(s): W-7405-ENG-26

Report No.(s): AD-C075813; ORNL-2660; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADC075813>

No abstract available

Fission; Fluid Dynamics; Heating; Hilsch Tubes; Vapor Phases; Vortices

20080039787 Oak Ridge National Lab., TN USA

Analytical Study of Some Aspects of Vortex Tubes for Gas-Phase Fission Heating

Kerrebrock, J L; Lafyatis, P G; Jul 21, 1958; 87 pp.; In English

Contract(s)/Grant(s): W-7405-ENG-26

Report No.(s): AD-C075814; ORNL-58-7-4; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADC075814>

No abstract available

Fission; Fluid Dynamics; Heating; Hilsch Tubes; Vapor Phases; Vortices

20080039799 Army Engineer Waterways Experiment Station, Vicksburg, MS USA

Modeling Vessel-Generated Currents and Bed Shear Stresses

Hammack, E A; Smith, David S; Stockstill, Richard L; Jun 2008; 56 pp.; In English; Original contains color illustrations
Report No.(s): AD-A482922; ERDC/CHL-TR-08-7; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Adaptive Hydraulics (ADH) is a computational fluid dynamics package that solves the Navier-Stokes equations and shallow-water (depth-averaged Navier-Stokes) equations on two- and three-dimensional computational meshes for overland flow, sediment transport, and groundwater problems. The capability to model the hydrodynamic effects of vessels moving through a two-dimensional flow field has been added to ADH. Using empirical relations developed by Maynard (2000), the bed shear stresses induced by a barge bow and towboat propeller may also be calculated, which, in turn, can be used to predict sediment transport. Guidelines have been developed for sufficient mesh refinement near the vessel and appropriate values for the mesh adaption parameters in ADH. To demonstrate the new modeling capability, this report describes in detail a study of the effects of a vessel sailing through a stretch of the Illinois Waterway near Kampsville, IL. The vessel-induced shear stresses are also reported for the Kampsville study.

DTIC

Computational Fluid Dynamics; Sediment Transport; Shear Stress

20080040052 DE Technologies, Inc., King of Prussia, PA USA

Supersonic Penetration by Wedges and Cones into Dry Sand (Preprint)

Flis, William J; Jann, David; Shan, Lucia; Jun 2008; 10 pp.; In English

Contract(s)/Grant(s): FA8651-05-C-0114; Proj-3005

Report No.(s): AD-A482749; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482749>

An analytical model of penetration by non-deforming pointy projectiles into dry sand is proposed. The model postulates that an oblique compaction wave in the sand is attached to the penetrator's tip. Sand is modeled by the P-alpha porosity model up to full compaction, then is taken as incompressible. The sand's compaction is considered the most important effect; strength and friction are neglected. The model handles wedges, for which a closed-form solution is derived, and cones, which require numerical integration. For a given penetration velocity, the model predicts the shock angle and the pressure on the penetrator surface. Hydrocode computations agree closely with the model.

DTIC

Drying; Penetration; Sands; Wedges

20080040105 Army Missile Command, Redstone Arsenal, AL USA

A Film Cooling Model for a RP-1/GOX Staged Combustion Liquid Rocket Engine (Preprint)

Haberlen, Philip A; Greisen, Daniel A; Anderson, William E; Nov 7, 2007; 31 pp.; In English

Contract(s)/Grant(s): F04611-00-C-0009; Proj-3005

Report No.(s): AD-A483024; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An experimental study of supercritical RP-1 film cooling was conducted in a RP-1/GOX rocket combustor. A heat sink test section, heavily instrumented with dual Type E coaxial thermocouples, was used for measurement of wall temperature and derived gas-side wall heat flux. Varying amounts of fuel, ranging from about 40% to 70% of the total fuel flowrate, were injected as a film coolant downstream of a coaxial injector element. An existing film cooling model was modified and applied to these experimental results. The resultant model predicted combustion chamber adiabatic wall temperature profiles for input propellant flow conditions and chamber geometry. The predicted wall temperatures were compared with the experimental

measurements to assess the model's performance. The film cooling model wall temperature predictions had errors ranging from near 0 to approx. 33% compared to the experimental results for four out of five analyzed tests.

DTIC

Combustion; Combustion Chambers; Film Cooling; Liquid Propellant Rocket Engines

20080040106 Engineering Research and Consulting, Inc., Edwards AFB, CA USA
An Analytical Model of the Knudsen Layer with Thermal Conduction (Preprint)

Pekker, L; Keidar, M; Cambier, J L; Dec 11, 2007; 13 pp.; In English

Contract(s)/Grant(s): Proj-5026

Report No.(s): AD-A483029; AFRL-RZ-ED-TP-2007-531; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This work motivation is formulation of the boundary condition for numerical simulation of fluid dynamic with ablative boundaries. In this paper we develop an analytical model of the Knudsen layer by considering a kinetic formulation that takes into account the gas temperature gradient at a flat gas-wall interface. The main focus of this research is to study the effect of the thermal conductivity on the Knudsen layer formed near an ablating surface. This analysis is based on the premise that the thermal conductivity (the temperature gradient) in the bulk gas can be taken into account in the velocity distribution function at the outer boundary of the Knudsen layer. We use such a function obtained by Chapman-Enskog expansion method, based on the assumption that the molecular mean-free path is much smaller than the characteristic length scale of the temperature gradient. The model uses a bimodal velocity distribution function in the Knudsen layer which preserves the laws of conservation of mass, momentum and energy and converges to the Chapman-Enskog velocity distribution function at the outer boundary of the layer. The model allows obtaining the boundary conditions at the interface between the ablative surface and the bulk gas avoiding 'micro' modeling of the evaporation process at the mean free path scale. Thus, our Knudsen layer model can be used as a 'constructor' for boundary conditions between the bulk gas and ablative surface that is important for numerical simulation of evaporation processes and for fluid dynamics in general.

DTIC

Conductive Heat Transfer; Mathematical Models; Thermal Conductivity; Vaporizing

20080040194 NASA Glenn Research Center, Cleveland, OH, USA

A Step Towards CO₂-Neutral Aviation

Brankovic, Andreja; Ryder, Robert C.; Hendricks, Robert C.; Huber, Marcia L.; August 2008; 23 pp.; In English; 2007 Aerotech Congress and Exhibition. Session: Propulsion - Airbreathing Engine Systems (Paper 07ATC-214), 17-20 Sep. 2007, Los Angeles, CA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.16.03

Report No.(s): NASA/TM-2008-214998; 07ATC-214; E-16128-1; Copyright; Avail.: CASI: [A03](#), Hardcopy

An approximation method for evaluation of the caloric equations used in combustion chemistry simulations is described. The method is applied to generate the equations of specific heat, static enthalpy, and Gibb's free energy for fuel mixtures of interest to gas turbine engine manufacturers. Liquid-phase fuel properties are also derived. The fuels investigated include JP-8, synthetic fuel, and two blends of JP-8 and synthetic fuel. The complete set of fuel property equations for both phases are implemented into a computational fluid dynamics (CFD) flow solver database, and multiphase, reacting flow simulations of a well-tested liquid-fueled combustor are performed. The simulations are a first step in understanding combustion system performance and operational issues when using alternate fuels, at practical engine operating conditions.

Author

Computational Fluid Dynamics; Carbon Dioxide; Gibbs Free Energy; Combustion Chemistry; Synthetic Fuels; Specific Heat; Multiphase Flow

20080040793 NASA Langley Research Center, Hampton, VA, USA

Simultaneous Excitation of Multiple-Input Multiple-Output CFD-Based Unsteady Aerodynamic Systems

Silva, Walter A.; [2008]; 48 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040793>

A significant improvement to the development of CFD-based unsteady aerodynamic reduced-order models (ROMs) is presented. This improvement involves the simultaneous excitation of the structural modes of the CFD-based unsteady aerodynamic system that enables the computation of the unsteady aerodynamic state-space model using a single CFD

execution, independent of the number of structural modes. Four different types of inputs are presented that can be used for the simultaneous excitation of the structural modes. Results are presented for a flexible, supersonic semi-span configuration using the CFL3Dv6.4 code.

Author

Computational Fluid Dynamics; Unsteady Aerodynamics; Excitation; Nonlinear Systems; Aeronautical Engineering

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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*.

20080039206 Air Force Research Lab., Hanscom AFB, MA USA

Dynamic Range Compression Deconvolution for Enhancement of Automatic Target Recognition System Performance

Khoury, Jed; Haji-Saeed, Bahareh; Woods, Charles L; Kierstead, John; Goodhue, William; Jun 3, 2008; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-2305

Report No.(s): AD-A482319; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482319>

A generic nonlinear dynamic range compression deconvolver (DRCD) is proposed. We have performed the dynamic range compression deconvolution using three forms of nonlinearities: (1) digital implementation- A-law/ -law, (2) hybrid digital-optical implementation- two-beam coupling photorefractive holography, and (3) all optical implementation- MEMS deformable mirrors. The performance of image restoration improves as the saturation nonlinearity increases. The DRCD could be used as a preprocessor for enhancing Automatic Target Recognition (ATR) system performance. In imaging through atmosphere, factors such as rain, snow, haze, pollution, etc. affect the received information from a target; therefore the need for correcting these captured images before an ATR system is required. The DRCD outperforms well-established image restoration filters such as the inverse and the Wiener filters.

DTIC

Augmentation; Dynamic Range; Pattern Recognition; Signal Processing; Target Recognition

20080039410 Solid State Scientific Corp., Hollis, NH, USA; Air Force Research Lab., Hanscom AFB, MA USA

Smart Optical Receiver for Beamforming and Enhancement of Field of View in LADAR Systems

Khoury, Jed; Haji-saeed, Bahareh; Woods, Charles L; Kierstead, John; Jan 2008; 8 pp.; In English

Contract(s)/Grant(s): Proj-2305

Report No.(s): AD-A482650; AFRL-RY-HS-TP-2008-0007; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We propose using the smart antenna principle as the basis of a new design for smart optical receivers in LADAR systems. This paper demonstrates the feasibility of designing a LADAR system with a receiver consisting of an array of photodetectors, which leads to field-of-view enhancement and beamforming by fusing streams of video information received from the detectors. As a proof of concept, we demonstrate this design by fusing several video information streams from different fields of view using our Mathworks Simulink model. The fusion algorithm uses the fuzzy logic maximum operation on the data output from the cameras.

DTIC

Augmentation; Beamforming; Detection; Field of View; Laser Range Finders; Lasers; Optical Radar; Rangefinding; Receivers

20080039564 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The In-flight Spectroscopic Performance of the Swift XRT CCD Camera During 2006-2007

Godet, O.; Beardmore, A.P.; Abbey, A.F.; Osborne, J.P.; Page, K.L.; Evans, P.; Starling, R.; Wells, A.A.; Angelini, L.; Burrows, D.N.; Kennea, J.; Campana, S.; Chincarini, G.; Citterio, O.; Cusumano, G.; LaParola, V.; Mangano, V.; Mineo, T.; Giommi, P.; Perri, M.; Capalbi, M.; Tamburelli, F.; Submitted to SPIE Proceedings/SPIE.; [2007]; 8 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAS50136; NNG06EO90A; I/R/039/04; Copyright; Avail.: CASI: [A02](#), Hardcopy

The Swift X-ray Telescope focal plane camera is a front-illuminated MOS CCD, providing a spectral response kernel of

135 eV FWHM at 5.9 keV as measured before launch. We describe the CCD calibration program based on celestial and on-board calibration sources, relevant in-flight experiences, and developments in the CCD response model. We illustrate how the revised response model describes the calibration sources well. Comparison of observed spectra with models folded through the instrument response produces negative residuals around and below the Oxygen edge. We discuss several possible causes for such residuals. Traps created by proton damage on the CCD increase the charge transfer inefficiency (CTI) over time. We describe the evolution of the CTI since the launch and its effect on the CCD spectral resolution and the gain.

Author

CCD Cameras; Charge Transfer; Spectral Resolution; X Ray Telescopes; Spectroscopy; Calibrating; Kernel Functions

20080039635 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Analysis of Photogrammetry Data from ISIM Mockup, June 1, 2007

Nowak, Maria; Hill, Mike; August 26, 2007; 13 pp.; In English; SPIE Optics and Photonics, 25-30 Aug. 2007, San Diego, CA, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039635>

During ground testing of the Integrated Science Instrument Module (ISIM) for the James Webb Space Telescope (JWST), the ISIM Optics group plans to use a Photogrammetry Measurement System for cryogenic calibration of specific target points on the ISIM composite structure and Science Instrument optical benches and other GSE equipment. This testing will occur in the Space Environmental Systems (SES) chamber at Goddard Space Flight Center. Close range photogrammetry is a 3 dimensional metrology system using triangulation to locate custom targets in 3 coordinates via a collection of digital photographs taken from various locations and orientations. These photos are connected using coded targets, special targets that are recognized by the software and can thus correlate the images to provide a 3 dimensional map of the targets, and scaled via well calibrated scale bars. Photogrammetry solves for the camera location and coordinates of the targets simultaneously through the bundling procedure contained in the V-STARS software.

Derived from text

Calibrating; James Webb Space Telescope; Metrology; Photogrammetry; Cameras

20080039636 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Focal Plane Array Shutter Mechanism of the JWST NIRSpec Detector System

Hale, Kathleen; Sharma, Rajeev; May 17, 2006; 10 pp.; In English; Aerospace Mechanisms Symposium, 17-19 May 2006, Williamsburg, VA, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039636>

This viewgraph presentation reviews the requirements, chamber location, shutter system design, stepper motor specifications, dry lubrication, control system, the environmental cryogenic function testing and the test results of the Focal Plane Array Shutter mechanism for the James Webb Space Telescope Near Infrared Spectrum Detector system. Included are design views of the location for the Shutter Mechanism, lubricant (lubricated with Molybdenum Di Sulfide) thickness, and information gained from the cryogenic testing.

CASI

Design Analysis; Focal Plane Devices; James Webb Space Telescope; Lubricants; Specifications; Camera Shutters; Infrared Detectors

20080039655 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Auxiliary Components for Kilopixel Transition Edge Sensor Arrays

Brown, Ari-David; Chervenak, James A.; Chuss, David; Hilton Gene C.; Mikula, Vilem; Henry, ROss; Wollack, Edward; Zhao, Yue; December 12, 2007; 29 pp.; In English; 2007 International Semiconductor Device Research Symposium, 12-14 Dec. 2007, College Park, MD, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#),

Hardcopy

We have fabricated transition edge sensor bolometer focal plane arrays sensitive to mm-submillimeter (0.1-3 THz) radiation for the Atacama Cosmology Telescope (ACT), which will probe the cosmic microwave background at 0.147, 0.215, and 0.279 GHz. Central to the performance of these bolometers is a set of auxiliary resistive components. Here we discuss shunt resistors, which allow for tight optimization of bolometer time constant and sensitivity. Our shunt resistors consist of AuPd strips grown atop of interdigitated superconducting MoN, wires. We can tailor the shunt resistance by altering the dimensions of the AuPd strips and the pitch and width of the MoN, wires and can fabricate over 1000 shunts on a single 4" wafer. By modeling the resistance dependence of these parameters, a variety of different 0.77 +I-0.13 mOhm shunt resistors

have been fabricated. This variety includes different shunts possessing MoN, wires with wire width equal to 1.5 and 10 microns and pitch equal to 4.5 and 26 microns, respectively. Our ability to set the resistance of the shunts hints at the scalability of our design. We have also integrated a SiO₂ capping layer into our shunt resistor fabrication scheme, which inhibits metal corrosion and eventual degradation of the shunt. Consequently, their robustness coupled with their high packing density makes these resistive components attractive for future kilopixel detector arrays.

Author

Bolometers; Bypasses; Circuits; Fabrication; Focal Plane Devices; Resistors

20080039656 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Indium Hybridization of Large Format TES Bolometer Arrays to Readout Multiplexers for Far-Infrared Astronomy

Miller, Timothy M.; Costen, Nick; Allen, Christine; December 06, 2007; 1 pp.; In English; SOFIA 2020 Vision Scientific and Technological Opportunities Workshop, 6-8 Dec. 2007, Pasadena, CA, USA; Original contains poor quality, truncated or crooked pages; Copyright; Avail.: CASI: [A01](#), Hardcopy

This conference poster reviews the Indium hybridization of the large format TES bolometer arrays. We are developing a key technology to enable the next generation of detectors. That is the Hybridization of Large Format Arrays using Indium bonded detector arrays containing 32x40 elements which conforms to the NIST multiplexer readout architecture of 1135 micron pitch. We have fabricated and hybridized mechanical models with the detector chips bonded after being fully back-etched. The mechanical support consists of 30 micron walls between elements Demonstrated electrical continuity for each element. The goal is to hybridize fully functional array of TES detectors to NIST readout.

Derived from text

Bolometers; Fabrication; Indium; Readout; Infrared Detectors; Airborne Equipment

20080039660

Radar-Based Detection, Tracking and Speciation of Marine Mammals from Ships

DeProspero, Douglas F; Mobley, Joseph; Hom, Wai; Carron, Mike; Jan 2005; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-04-1-0729

Report No.(s): AD-A482441; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482441>

In addition to ship strikes, another cause of marine mammal injury and death is from exposure to high acoustic source levels (e.g., those encountered during Navy-sponsored Low Frequency Active (LFA) sonar tests). Irrespective of the method of mammal injury or death, the act of injuring or killing whales can and does result in litigation proceedings. This is a consequence of the legal protection that Cetaceans (whales and dolphins) are granted in U.S. waters by the Marine Mammal Protection Act of 1972 (as amended in 1994), with some species additionally protected by the Endangered Species Act of 1973. Previously developed mitigation technologies, such as passive acoustic and visual observation, still fall significantly short of achieving the detection performance necessary to achieve full marine mammal mitigation. Radar surveillance technology, being developed under the current supported program, represents a fundamental paradigm shift and new approach toward the goal of achieving robust marine mammal mitigation. The eventual long-term goal of this work, if successful under the baseline and option programs, is to develop and transition this new radar surveillance technology to both the military and commercial fleets. The primary benefit would be the mitigation of harmful effects on marine mammals due to acoustic testing and ship strikes. The overall objective of the baseline effort is to establish the ability of current or planned ship-based radars, augmented by specialized signal processing, to detect, discriminate, and track (geo-locate) a number of different marine mammal species (e.g., great whales, schooling dolphins, etc.) under a variety of representative sea environments (e.g., Atlantic, Pacific, Mediterranean, etc.). During FY05, the authors successfully demonstrated this technology for the first time from a ship-based platform during an experiment called CEDAR (CETacean Detection radAR) in the Mediterranean Sea.

DTIC

Animals; Biological Effects; Detection; Marine Biology; Marine Mammals; Radar Detection; Radar Signatures; Radar Tracking; Ships; Target Recognition; Tracking (Position)

20080039690 Walter Reed Army Inst. of Research, Washington, DC USA

Badges of Immobilized Enzymes: Detection of Chemical Warfare Agents

Gunduz, Alper T; Doctor, Bhupendra P; Gordon, Richard K; Jul 1, 2003; 10 pp.; In English

Report No.(s): AD-A482763; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482763>

Rapid detection of chemical warfare agents (CWAs) in all of its forms including gas and liquid is of paramount

importance to protect the warfighter or first responders in homeland defense. CWAs such as OPs and vesicants pose serious threats because these agents can be ingested with contaminated food or rapidly penetrate skin. We reported that polyurethane immobilized cholinesterases (acetyl and butyryl) yielded a product with similar enzyme activity as soluble enzyme. While enzyme sensors have the advantage of selectivity, sensitivity and, most important, specificity, ChEs are particularly ideal enzymes for rapid detection of OPs because they possess some of the fastest turnover rates known for any enzyme, and are the most sensitive targets for CWAs including GA (tabun), GB (sarin, the agent used by the terrorist group in Japan in 1995), GD (soman), and vX. We also reported that immobilized cholinesterase biosensors exhibited remarkable stability suitable for detection of OPs in both air and water, and stability to harsh environmental conditions because the immobilized enzymes do not leach from the polyurethane support. We now describe two improvements over current OP detecting kits. (1) Immobilized enzyme badges are being designed as a field system capable of identifying the type of OP present. This will aid in treatment. (2) A coupled enzyme reaction also provides rapid colorimetric or electrochemical indication of vesicants (HD). Therefore, one badge detects two classes of CWAs. With the constant threat of chemical warfare or terrorist acts, the development of alternative means to rapidly identify CWAs is critical.

DTIC

Chemical Warfare; Detectors

20080039691 Naval Research Lab., Washington, DC USA

Biological Agent Detection in Food With an Array Biosensor

Shriver-Lake, Lisa C; Taitt, Chris R; Golden, Joel P; Ligler, Frances S; Sapsford, Kim E; Shubin, Yura; Jul 1, 2003; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482764; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482764>

Intentional contamination of food with biological agents is a global concern. Most identification methods for these agents in food require extensive pre-treatment or concentration prior to analysis in a laboratory and take up to 4 days for bacterial agents. The Array Biosensor was developed for simultaneous analysis of multiple samples for multiple agents in a portable format. The simultaneous analysis of more than 6 agents takes less than 20 minutes. Analysis results of various foods spiked with SEB, F. coil O157:H7, Salmonella, and other bacterial agents will be presented.

DTIC

Bioinstrumentation; Biological Effects; Detection; Food

20080039715 Library of Congress, Washington, DC USA

Sea-Based Ballistic Missile Defense - Background and Issues for Congress

O'Rourke, Ronald; May 23, 2008; 49 pp.; In English

Report No.(s): AD-A482822; CRS-RL33745; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482822>

As part of its effort to develop a global ballistic missile defense (BMD) system, the Department of Defense (DOD) is modifying 18 Navy cruisers and destroyers for BMD operations, and has deployed a large BMD radar - the Sea-Based X-Band Radar (SBX) - on a modified floating oil platform. The eventual role for sea-based systems in the world-wide U.S. BMD architecture has not been determined. The overall issue for Congress discussed in this report is: What should be the role of sea-based systems in U.S. ballistic missile defense, and are DOD's programs for sea-based BMD capabilities appropriately structured and funded? Decisions that Congress reaches on this issue could affect U.S. BMD capabilities and funding requirements; the size, capabilities, and operational patterns of the Navy and the other services; and the shipbuilding industrial base.

DTIC

Antimissile Defense; Ballistic Missiles; Military Operations; Missile Defense; Radar; Seas

20080039721 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Combat Identification Modeling Using Robust Optimization Techniques

Kim, TaeHo; Mar 2008; 126 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482836; AFIT/GOR/ENS/08-11; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482836>

The purposes of this research were: (1) the modeling of a CID situation and (2) the search for robust and controllable input variable settings. The inputs were defined as controllable and noise variables and the confusion matrices in ROC theory were

adapted to act as controllable factors. In this research a simple virtual battlespace representation is employed. The experimental results of the CID system are summarized by a posterior confusion matrix and throughout the confusion matrix analysis we can obtain all various types of data such as accuracy, error cost, error rates, and so forth. To find the optimal parameters three evaluation techniques were applied: (1) Linearly constrained discrete optimization, (2) Taguchi's S/N ratio method and (3) Robust parameter design with a combined array. The results are compared and contrasted across different objective functions.

DTIC

Combat

20080039879 Army Soldier and Biological Chemical Command, Aberdeen Proving Ground, MD USA

AIRIS Wide Area Detection System

Marinelli, William J; Gittins, Christopher M; Ustun, Teoman E; Jensen, James O; Jul 1, 2003; 9 pp.; In English
Report No.(s): AD-A483085; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The AIRIS Wide Area Detection System was employed, in both airborne and ground-based configurations, to detect chemical and biological agent stimulant releases during the Technology Readiness Evaluations conducted at Dugway Proving Grounds from 22-26 July 2002. Airborne observations were conducted from a gyro-stabilized pointing system mounted on a UH-1 helicopter and conducted at ranges up to ~ 7 km and altitudes to 1600 ft in conjunction with the Redstone Technical Test Center. Ground-based observations were made at ranges between 1 and 5 km. The sensors comprised 64 x 64 element HgCdTe detector arrays coupled to AIRIS tunable filters resulting in a system with nominal 10 cm⁻¹ spectral resolution and a 0.8 milliradian IFOV.

DTIC

Detection; Detectors

20080039891 Naval Research Lab., Washington, DC USA

Characterization of Nitrides by Electron Paramagnetic Resonance (EPR) and Optically Detected Magnetic Resonance (ODMR)

Glaser, E R; Carlos, W E; Braga, G C; Freitas, Jr, J A; Moore, W J; Shanabrook, B V; Wickenden, A E; Koleske, D D; Henry, R L; Bayerl, M W; Jan 2002; 11 pp.; In English
Contract(s)/Grant(s): N00014-96-1-1-1008

Report No.(s): AD-A483105; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We will highlight our recent work on the properties of residual defects and dopants in GaN heteroepitaxial layers and on the nature of recombination from InGaN single quantum well (SQW) light emitting diodes (LEDs) through magnetic resonance techniques. Electron paramagnetic resonance (EPR) and optically detected magnetic resonance (ODMR) were performed on undoped (highly resistive and n-type) and intentionally doped (Si, Mg, or Be) GaN films grown by a variety of techniques (MOCVD, MBE, and HVPE) in order to obtain general trends and behavior. Through the spin-Hamiltonian parameters, these methods can reveal symmetry information, the character of the wave function and (ideally) the chemical identity of the defect. In addition, low temperature EPR intensities can be used to determine the neutral acceptor or donor concentrations without the need for contacts or the high temperatures required for Hall effect measurements. The ODMR was performed on both bandedge (mainly shallow donor /shallow acceptor recombination) and deep (visible and near-IR) PL bands. In spite of the radically different (nonequilibrium) growth techniques, many of the same defects were found in the various samples. Finally, earlier ODMR studies of recombination from Nichia InGaN green and blue LEDs were extended to include shorter (violet) and longer (amber) wavelength LEDs and an undoped 30 Å In_{0.3}Ga_{0.7}N/GaN heterostructure. The results provide evidence for spatially separated electrons and holes in the optically-active 30 Å InGaN layers under low photoexcitation conditions, likely due to localization at different potential minima in the x /y planes and/or the large strain-induced piezoelectric fields parallel to the growth direction.

DTIC

Detection; Electron Paramagnetic Resonance; Magnetic Resonance; Nitrides; Optical Measurement

20080040139 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Close-packed Arrays of Transition-edge X-ray Microcalorimeters with High Spectral Resolution at 5.9 keV

Iyomoto, N.; Bandler, S. R.; Brekosky, R. P.; Brown, A.-D.; Chervenak, J. A.; Finkbeiner, F. M.; Kelley, R. L.; Kilbourne, C. A.; Porter, F. S.; Sadleir, J. E.; Smith, S. J.; Figueroa-Feliciano, E.; [2007]; 4 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

We present measurements of high fill-factor arrays of superconducting transition-edge x-ray microcalorimeters designed

to provide rapid thermalization of the x-ray energy. We designed an x-ray absorber that is cantilevered over the sensitive part of the thermometer itself, making contact only at normal metal-features. With absorbers made of electroplated gold, we have demonstrated an energy resolution between 2.4 and 3.1 eV at 5.9 keV on 13 separate pixels. We have determined the thermal and electrical parameters of the devices throughout the superconducting transition, and, using these parameters, have modeled all aspects of the detector performance.

Author

Calorimeters; Spectral Resolution; Superconductivity; Temperature Measuring Instruments; Arrays

20080040164 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Multiyear On-orbit Calibration and Performance of Terra MODIS Thermal Emissive Bands

Xiong, Xiaoxiong; Chiang, Kwo-Fu; Wu, Aisheng; Barnes, William; Guenther, Bruce; Salomonson, Vincent; [2007]; 32 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Since launch in December 1999, Terra MODIS has been making continuous Earth observations for more than seven years. It has produced a broad range of land, ocean, and atmospheric science data products for improvements in studies of global climate and environmental change. Among its 36 spectral bands, there are 20 reflective solar bands (RSB) and 16 thermal emissive bands (TEB). MODIS thermal emissive bands cover the mid-wave infrared (MWIR) and long-wave infrared (LWIR) spectral regions with wavelengths from 3.7 to 14.4 μ m. They are calibrated on-orbit using an on-board blackbody (BB) with its temperature measured by a set of thermistors on a scan-by-scan basis. This paper will provide a brief overview of MODIS TEB calibration and characterization methodologies and illustrate on-board BB functions and TEB performance over more than seven years of on-orbit operation and calibration. Discussions will be focused on TEB detector short-term stability and noise characterization, and changes in long-term response (or system gain). Results show that Terra MODIS BB operation has been extremely stable since launch. When operated at its nominal controlled temperature of 290K, the BB temperature variation is typically less than +0.30mK on a scan-by-scan basis and there has been no time-dependent temperature drift. In addition to excellent short-term stability, most TEB detectors continue to meet or exceed their specified noise characterization requirements, thus enabling calibration accuracy and science data product quality to be maintained. Excluding the noisy detectors identified pre-launch and those that occurred post-launch, the changes in TEB responses have been less than 0.7% on an annual basis. The optical leak corrections applied to bands 32-36 have been effective and stable over the entire mission

Author

Calibrating; MODIS (Radiometry); Thermal Emission; Black Body Radiation

20080040168 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Theoretical Noise Analysis on a Position-sensitive Metallic Magnetic Calorimeter

Smith, Stephen J.; [2007]; 22 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNH06CC03B; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040168>

We report on the theoretical noise analysis for a position-sensitive Metallic Magnetic Calorimeter (MMC), consisting of MMC read-out at both ends of a large X-ray absorber. Such devices are under consideration as alternatives to other cryogenic technologies for future X-ray astronomy missions. We use a finite-element model (FEM) to numerically calculate the signal and noise response at the detector outputs and investigate the correlations between the noise measured at each MMC coupled by the absorber. We then calculate, using the optimal filter concept, the theoretical energy and position resolution across the detector and discuss the trade-offs involved in optimizing the detector design for energy resolution, position resolution and count rate. The results show, theoretically, the position-sensitive MMC concept offers impressive spectral and spatial resolving capabilities compared to pixel arrays and similar position-sensitive cryogenic technologies using Transition Edge Sensor (TES) read-out.

Author

Calorimeters; Cryogenics; Sensitivity; Electromagnetic Noise; X Ray Detectors

20080040201 Naval Postgraduate School, Monterey, CA USA

Bomb Strike Experiment for Mine Countermeasure

Chu, Peter C; Ray, Greg; Fleischer, Peter; Gefken, Paul; Jan 2006; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N6230604PO00123; N6230605PO00223; N0001405WR20209; N0001406WR20076

Report No.(s): AD-A482911; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Navy's bomb maneuvering model (STRIKE35) predicts the bomb location and trajectory in air and water columns.

The Bomb Strike Experiment for Mine Countermeasure Operations, currently sponsored through the Office of Naval Research mine and obstacle breaching technology program, is part of a multi-year, comprehensive effort aimed at enhancing the Navy's fleet naval mine clearance capability and success. The investigation discussed in this thesis examines the experimental and theoretical characteristics of a rigid body falling through the air, water, and sediment column at high speed. Several experiments were conducted to launch bomb-like rigid bodies with the density ratio similar to operational munitions, namely the MK-84 general purpose bomb, into a hydrodynamic test tank. Careful observations of the bomb-like rigid body's position and orientation were collected and analyzed to produce a series of three-dimensional coordinate time-space data tables and plots. The resulting data set reveals a strong correlation between shape type and trajectory and dispersion patterns for rigid bodies moving through the water column at high velocity. This data will be used for development and verification of the three-dimensional model bomb strike model (STRIKE35) aimed at predicting the overall trajectory, maneuvering, burial depth and orientation of a falling high-velocity rigid body in the air-water-sediment column. The long-term goal of this project is to improve warhead lethality for use in quick, precise and accurate strikes on known enemy naval minefields in the littoral combat environment.

DTIC

Countermeasures; Explosives; Bombs (Ordnance)

20080040682 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Neutron Imaging Camera

Hunter, Stanley; deNolfo, G. A.; Barbier, L. M.; Link, J. T.; Son, S.; Floyd, S. R.; Guardala, N.; Skopec, M.; Stark, B.; March 16, 2008; 7 pp.; In English; SPIE Defense and Security, 15-20 Mar. 2008, Orlando, FL, USA; Original contains poor quality, truncated or crooked pages; Copyright; Avail.: CASI: [A02](#), Hardcopy

The Neutron Imaging Camera (NIC) is based on the Three-dimensional Track Imager (3DTI) technology developed at GSFC for gamma-ray astrophysics applications. The 3-DTI, a large volume time-projection chamber, provides accurate, approximately 0.4 mm resolution, 3-D tracking of charged particles. The incident direction of fast neutrons, $E_n > 0.5$ MeV, are reconstructed from the momenta and energies of the proton and triton fragments resulting from $(^3\text{He}(n,p))$ (^3H) interactions in the 3-DTI volume. The performance of the NIC from laboratory and accelerator tests is presented.

Author

Cameras; Imaging Techniques; Fast Neutrons; Neutron Sources; Neutrons; Particle Energy

20080040684 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Burst Chasing X-ray Polarimeter

Hill, Joanne; June 14, 2007; 43 pp.; In English; Joint Physics/Space Physics Seminar, 6 Mar. 2007, IA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NNG06EO90A; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040684>

This viewgraph presentation reviews the rationale, design, and importance of an X-Ray Polarimeter. There is a brief discussion of Gamma Ray Bursts, followed by a review of the theories of Gamma-Ray Bursts Polarization. This leads to the question of 'How do we measure the polarization?' and a discussion of the GRB x-ray emission, the photoelectric effect and photoelectric polarimetry. The requirements for the work, can only be approached using a gas detector. This leads to a discussion of a Micropattern Gas Polarimeter, and the Time-Projection Chamber (TPC) X-ray Polarimeter.

CASI

Gas Detectors; Polarimeters; Astronomical Polarimetry; X Ray Astronomy

20080040716 International Society for Optical Engineering, USA; NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Burst Chasing X-ray Polarimeter

Hill, Joanne; Hill, Joe; Barthelmy, S.; Black, K.; Deines-Jones, P.; Jahoda, K.; Sakamoto, T.; Kaaret, P.; McConnell, M.; Bloser, P.; Macri, J.; Legere, J.; Ryan, J.; Smith, B., Jr.; Zhang, B.; August 26, 2007; 38 pp.; In English; SPIE Conference, 26-30 Aug. 2007, San Diego, CA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NNG06EO90A; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040716>

This is a viewgraph presentation of a discussion of the X-ray Polarimeter. Gamma-ray bursts are one of the most powerful explosions in the universe and have been detected out to distances of almost 13 billion light years. The exact origin of these

energetic explosions is still unknown but the resulting huge release of energy is thought to create a highly relativistic jet of material and a power-law distribution of electrons. There are several theories describing the origin of the prompt GRB emission that currently cannot be distinguished. Measurements of the linear polarization would provide unique and important constraints on the mechanisms thought to drive these powerful explosions. We present the design of a sensitive, and extremely versatile gamma-ray burst polarimeter. The instrument is a photoelectric polarimeter based on a time-projection chamber. The photoelectric time-projection technique combines high sensitivity with broad band-pass and is potentially the most powerful method between 2 and 100 keV where the photoelectric effect is the dominant interaction process. We present measurements of polarized and unpolarized X-rays obtained with a prototype detector and describe the two mission concepts, the Gamma-Ray Burst Polarimeter (GRBP) for the U S Naval Academy satellite MidSTAR-2, and the Low Energy Polarimeter (LEP) onboard POET, a broadband polarimetry concept for a small explorer mission.

CASI

Gamma Ray Bursts; Linear Polarization; Polarimeters; Polarimetry

20080040775 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Lessons Learned from the Wide Field Camera 3 TV1 and TV2 Thermal Vacuum Test Campaigns

Peabody, Hume; Stavelly, Richard; Bast, William; June 28, 2008; 10 pp.; In English; International Conference on Environmental Systems, 29 Jun. - 2 Jul. 2008, San Francisco, CA, USA; Original contains black and white illustrations Report No.(s): 08ICES-0152; Copyright; Avail.: Other Sources

The Wide Field Camera 3 (WFC3) instrument has undergone two complete thermal vacuum tests (TV1 and TV2), during which valuable lessons were learned regarding test configuration, test execution, model capabilities, and modeling practices. The very complex thermal design of WFC3 produced a number of challenging aspects to ground testing with numerous ThermoElectric Coolers and heat pipes, not all of which were functional. Lessons learned during TV1 resulted in significant upgrades to the model capabilities and a change in the test environment approach for TV2. These upgrades proved invaluable during TV2 when pretest modeling assumptions proved to be false. Each of the lessons learned relate to one of two following broad statements: 1. Ensure the design can be tested and that the effect of non-flight like conditions is well understood, particularly with respect to non passive devices (TECs, Heat Pipes, etc) 2. Ensure that the model is sufficiently detailed and is capable of predicting off-nominal behavior and the power dissipation of any thermal devices, especially TECs This paper outlines a number of the lessons learned over these two test campaigns with respect to the thermal design, model, and test configuration and presents recommendations for future tests.

Author

Cameras; Lessons Learned; Thermal Vacuum Tests; Ground Tests; Thermoelectricity; Coolers

20080040792 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Indium Hybridization of Large Format TES Bolometer Arrays to Readout Multiplexers for Far-Infrared Astronomy

Miller, Timothy M.; Costen, Nick; Allen, Christine; July 22, 2007; 16 pp.; In English; 12th International Workshop on Low Temperature Detectors, 22 - 27 Jul. 2007, Paris, France; Original contains poor quality, truncated or crooked pages; Copyright; Avail.: CASI: [A03](#), Hardcopy

The advance of new detector technologies combined with enhanced fabrication methods has resulted in an increase in development of large format arrays. The next generation of scientific instruments will utilize detectors containing hundreds to thousands of elements providing a more efficient means to conduct large area sky surveys. Some notable detectors include a 32x32 x-ray microcalorimeter for Constellation-X, an infrared bolometer called SAFIRE to fly on the airborne observatory SOFIA, and the sub-millimeter bolometer SCUBA-2 to be deployed at the JCMT which will use more than 10,000 elements for two colors, each color using four 32x40 arrays. Of these detectors, SCUBA-2 is farthest along in development and uses indium hybridization to multiplexers for readout of the large number of elements, a technology that will be required to enable the next generation of large format arrays. Our current efforts in working toward large format arrays have produced GISMO, the Goddard IRAM Superconducting 2-Millimeter observer. GISMO is a far infrared instrument to be field tested later this year at the IRAM 30 meter telescope in Spain. GISMO utilizes transition edge sensor (TES) technology in an 8x16 filled array format that allows for typical fan-out wiring and wire-bonding to four 1x32 NIST multiplexers. GISMO'S electrical wiring is routed along the tops of 30 micron walls which also serve as the mechanical framework for the array. This architecture works well for the 128 element array, but is approaching the limit for routing the necessary wires along the surface while maintaining a high fill factor. Larger format arrays will benefit greatly from making electrical connections through the wafer to the backside, where they can be hybridized to a read-out substrate tailored to handling the wiring scheme. The next generation array we are developing is a 32x40 element array on a pitch of 1135 microns that conforms to the NIST multiplexer, already developed for the SCUBA-2 instrument This architecture will utilize electrical connections that route from the TES

to the support frame and through the wafer. The detector chip will then be hybridized to the NIST multiplexer via indium bump bonding. In our development scheme we are using substrates that allow for diagnostic testing of electrical continuity across the entire array and we are testing our process to minimize or eliminate any contact resistance at metal interfaces. Our goal is hybridizing a fully functional 32x40 array of TES bolometers to a NIST multiplexer. The following work presents our current progress toward enabling this technology.

Derived from text

Bolometers; Transition; Edge Detection; Indium; Fabrication; Infrared Detectors

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*.

20080039671 Naval Research Lab., Washington, DC USA

Portable Neutron Source

Davis, J; Petrov, G M; May 30, 2008; 50 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482727; NRL/MR/6720-08-9123; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482727>

The angular distribution of neutrons formed in nuclear fusion reactions of a high-energy deuteron beam with a deuterated polyethylene (CD₂) was investigated with a Monte Carlo ion beam-target deposition model. The initial conditions were obtained from a two-dimensional particle-in-cell laser-target deposition model. The neutron yield and its angular distribution were studied as a function of peak laser intensity, laser pulse duration and primary target thickness. The proposed scheme for neutron production delivers a typical neutron yield of 10E+5-10E+7 neutrons/ion and 10E+5-10E+7 neutrons/Joule laser energy.

DTIC

Deuterons; Neutron Sources; Neutrons; Pulsed Lasers; Target Acquisition

20080039725 Naval Research Lab., Washington, DC USA

Soft X-ray Emission from Post-Pulse Expanding Laser-Produced Plasmas

Weaver, J L; Feldman, U; Mostovych, A N; Seely, J F; Colombant, D; Holland, G; Dec 2003; 30 pp.; In English

Report No.(s): AD-A482843; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482843>

A new diagnostic spectrometer has been developed at the Naval Research Laboratory (NRL) to measure the time resolved absolute intensity of radiation emitted by the Nike laser irradiated targets. The spectrometer consists of a dispersive transmission grating of 2500 lines/mm or 5000 lines/mm and a detection system consisting of an absolutely calibrated Si photodiode array and a CCD camera. In this paper, this spectrometer was used to study the spatial distribution of soft x-ray radiation from low Z elements (primarily carbon) that lasted tens of nanoseconds after the main laser illumination was over. Using the newly developed spectrometer, we recorded soft x-ray emission as a function of the target material and target orientation with respect to the incoming laser beam and the spectrometer line of sight. While a number of spectral features have been identified in the data, the instrument's combined temporal and spatial resolution led to the observation of the plasma expansion from CH targets for up to ~ 25 ns after the cessation of the main laser pulse. The inferred plasma expansion velocities are slightly higher than those previously reported.

DTIC

Emission; Laser Plasmas; Pulsed Lasers; X Rays

20080039738 Naval Research Lab., Washington, DC USA

Growth of Pellet Imperfections and Laser Imprint in Direct Drive Inertial Confinement Fusion Targets

Schmitt, Andrew J; Velikovich, A L; Gardner, J H; Pawley, C; Obenschain, S P; Aglitskij, Y; Chan, Y; Jan 2001; 32 pp.; In English

Report No.(s): AD-A482867; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482867>

Simple hydrodynamic models for describing the Richtmyer-Meshkov (RM) growth and the Rayleigh-Taylor (RT)

instability are tested by simulation. The RM sharp boundary model predictions are compared with numerical simulations of targets with surface perturbations or stationary intensity perturbations. Agreement is found in the overall trends, but the specific behavior can be significantly different. RM growth of imprint from optically smoothed lasers is also simulated and quantified. The results are used to calculate surface perturbations, growth factors, and laser imprint efficiencies. These in turn are used with standard RT growth formulas to predict perturbation growth in multimode simulations of compression and acceleration of planar and spherical targets. The largest differences between prediction and theory occur during ramp-up of the laser intensity, where RT formulas predict more growth than seen in the simulations.

DTIC

Defects; Inertial Confinement Fusion; Lasers; Pellets; Targets

20080039900 Naval Research Lab., Washington, DC USA

Rear Surface Light Emission Measurements from Laser-produced Shock Waves in Clear and Al-coated Polystyrene Targets

McLean, E A; Deniz, A V; Schmitt, A J; Stamper, J A; Obenschain, S P; Lehecka, T; Mostovych, A N; Seely, J; Aug 1999; 10 pp.; In English

Report No.(s): AD-A483119; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Nike KrF laser, with its very uniform focal distributions, has been used at intensities near $10(\text{exp.}14) \text{ W/cm}^2$ to launch shock waves in polystyrene targets. The rear surface visible light emission differed between clear CH targets and targets with a thin (125 nm) Al coating on the rear side. The uncoated CH targets showed a relatively slowly rising emission followed by a sudden fall when the shock emerges, while the Al-coated targets showed a rapid rise in emission when the shock emerges followed by a slower fall -- allowing an unambiguous determination of the time the shock arrived at the rear surface. A half-aluminized target allowed us to observe this difference in a single shot. The brightness temperature of both the aluminized targets and the non-aluminized targets were slightly below but close to rear surface temperature predictions of a hydrodynamic code. A discussion of preheat effects is given.

DTIC

Coatings; Light Emission; Polystyrene; Pulsed Lasers; Shock Waves; Targets

37

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*.

20080039638 NASA Glenn Research Center, Cleveland, OH, USA

Identifying Bearing Rotordynamic Coefficients using an Extended Kalman Filter

Miller, Bard A.; Howard, Samuel A.; August 2008; 23 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNC06GA10G; WBS 877868.02.07.03.01.01

Report No.(s): NASA/TM-2008-215298; E-16567; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039638>

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

Rotor Dynamics; Foil Bearings; Gas Bearings; Shafts (Machine Elements); Turbomachinery; Kalman Filters; Stiffness; Damping

20080040157 NASA Glenn Research Center, Cleveland, OH, USA

Fatigue Crack Growth Behavior Evaluation of Grainex Mar-M 247 for NASA's High Temperature, High Speed Turbine Seal Test Rig

Delgado, Irebert R.; Steinetz, Bruce M.; Rimnac, Clare M.; Lewandowski, John J.; August 2008; 33 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.15.02

Report No.(s): NASA/TM-2008-215287; E-16529-1; Copyright; Avail.: CASI: [A03](#), Hardcopy

The fatigue crack growth behavior of Grainex Mar-M 247 is evaluated for NASA's Turbine Seal Test Facility. The facility is used to test air-to-air seals primarily for use in advanced jet engine applications. Because of extreme seal test conditions of temperature, pressure, and surface speeds, surface cracks may develop over time in the disk bolt holes. An inspection interval is developed to preclude catastrophic disk failure by using experimental fatigue crack growth data. By combining current fatigue crack growth results with previous fatigue strain-life experimental work, an inspection interval is determined for the test disk. The fatigue crack growth life of the NASA disk bolt holes is found to be 367 cycles at a crack depth of 0.501 mm using a factor of 2 on life at maximum operating conditions. Combining this result with previous fatigue strain-life experimental work gives a total fatigue life of 1032 cycles at a crack depth of 0.501 mm. Eddy-current inspections are suggested starting at 665 cycles since eddy current detection thresholds are currently at 0.381 mm. Inspection intervals are recommended every 50 cycles when operated at maximum operating conditions.

Author

Fatigue (Materials); Crack Propagation; Test Facilities; Life (Durability); Turbines; High Temperature; Fatigue Life; Surface Cracks

38

QUALITY ASSURANCE AND RELIABILITY

Includes approaches to, and methods for reliability analysis and control, quality control, inspection, maintainability, and standardization.

20080040791 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Visual Inspection of Surfaces

Hughes, David; Perez, Xavier; July 17, 2007; 14 pp.; In English; Contamination and Coatings Workshop, 17 - 19 Jul. 2007, Columbia, MD, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040791>

This presentation evaluates the parameters that affect visual inspection of cleanliness. Factors tested include surface reflectance, surface roughness, size of the largest particle, exposure time, inspector and distance from sample surface. It is concluded that distance predictions were not great, particularly because the distance at which contamination is seen may depend on more variables than those tested. Most parameters estimates had confidence of 95% or better, except for exposure and reflectance. Additionally, the distance at which surface is visibly contaminated decreases with increasing reflectance, roughness, and exposure. The distance at which the surface is visually contaminated increased with the largest particle size. These variables were only slightly affected the observer.

Derived from text

Visual Observation; Cleanliness; Surface Properties; Contamination; Clean Rooms; Quality Control

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*.

20080039409 Army Research Lab., White Sands Missile Range, NM USA

Urban-Small Building Complex Environment: W07US Stability Analysis and Inter-Study Comparison, Volume AS-2

Vaucher, Gail; May 2008; 54 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482613; ARL-TR-4452; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Urban atmospheric stability patterns impact military and civilian health, tools, operations, and planning. By identifying repeatable urban stability patterns, improvements to each of these impacted areas can be achieved. In this report, the White

Sands Missile Range (WSMR) Urban Study research project is reviewed with a focus on stability characterization; specifically, the stable urban environment. Results from the WSMR 2007 Urban Study stability assessment are described and contrasted with the previous two urban studies. Eight stable environment characteristics were gleaned from the inter-Study analyses. The stable conditions observed showed an extremely consistent temporal pattern. The spatial distribution proved inconsistent however, the seasonally similar field studies showed patterns worthy of special note. Examples of the seasonally-similar stable patterns are given. A short summary of stable environment characteristics observed thus far are tallied in the Summary and several recommendations for subsequent research conclude the technical report. Preliminary results from the ongoing higher time resolution analysis are documented in appendix A.

DTIC

Buildings; Cities; Stability Tests

20080039641 NASA Langley Research Center, Hampton, VA, USA

Ares I-X Upper Stage Simulator Residual Stress Analysis

Raju, Ivatury S.; Brust, Frederick W.; Phillips, Dawn R.; Cheston, Derrick; August 2008; 58 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 510505.03.0701.11

Report No.(s): NASA/TM-2008-215339; NESC-RP-08-09/06-081-E; L-19513; Copyright; Avail.: CASI: [A04](#), Hardcopy

The structural analyses described in the present report were performed in support of the NASA Engineering and Safety Center (NESC) Critical Initial Flaw Size (CIFS) assessment for the Ares I-X Upper Stage Simulator (USS) common shell segment. An independent assessment was conducted to determine the critical initial flaw size (CIFS) for the flange-to-skin weld in the Ares I-X Upper Stage Simulator (USS). The Ares system of space launch vehicles is the US National Aeronautics and Space Administration's plan for replacement of the aging space shuttle. The new Ares space launch system is somewhat of a combination of the space shuttle system and the Saturn launch vehicles used prior to the shuttle. Here, a series of weld analyses are performed to determine the residual stresses in a critical region of the USS. Weld residual stresses both increase constraint and mean stress thereby having an important effect on fatigue and fracture life. The results of this effort served as one of the critical load inputs required to perform a CIFS assessment of the same segment.

Author

Critical Loading; Ares 1 Upper Stage; Stress Analysis; Spacecraft Launching; NASA Programs; Fatigue (Materials)

20080039646 NASA Langley Research Center, Hampton, VA, USA

An Investigation of High-Cycle Fatigue Models for Metallic Structures Exhibiting Snap-Through Response

Przekop, Adam; Rizzi, Stephen A.; Sweitzer, Karl A.; [2008]; 31 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 599489.02.07.07.02.66; Copyright; Avail.: Other Sources

A study is undertaken to develop a methodology for determining the suitability of various high-cycle fatigue models for metallic structures subjected to combined thermal-acoustic loadings. Two features of this problem differentiate it from the fatigue of structures subject to acoustic loading alone. Potentially large mean stresses associated with the thermally pre- and post-buckled states require models capable of handling those conditions. Snap-through motion between multiple post-buckled equilibrium positions introduces very high alternating stress. An aluminum beam structure is chosen as the computational test article, with its geometric and material nonlinear response determined via numerical simulation. A cumulative damage model is employed using a rainflow cycle counting scheme and fatigue estimates are made for 2024-T3 aluminum using various non-zero mean stress fatigue models, including Walker, Morrow, Morrow with true fracture strength, and MMPDS. A baseline zero-mean stress model is additionally considered. It is shown that for this material, the Walker model produces the most conservative fatigue estimates when the stress response has a tensile mean introduced by geometric nonlinearity, but remains in the linear elastic range. However, when the loading level is sufficiently high to produce plasticity, the response becomes more fully reversed and the baseline, Morrow, and Morrow with true fracture strength models produce the most conservative fatigue estimates.

Author

Stress Analysis; Mechanical Properties; Loads (Forces); Fracture Strength; Cumulative Damage; Acoustic Fatigue; Beams (Supports)

20080039708 Library of Congress, Washington, DC USA

Iraq: Reconstruction Assistance

Tarnoff, Curt; May 22, 2008; 46 pp.; In English

Report No.(s): AD-A482810; CRS-RL31833; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482810>

A large-scale assistance program has been undertaken by the USA in Iraq since mid-2003. To date, nearly \$45 billion has been appropriated for Iraq reconstruction. On December 26, 2007, H.R. 2764, the FY2008 Consolidated Appropriations Act, was signed into law (P.L. 110-161). Although it specifically rejects most regular or supplemental economic assistance to Iraq under the State/Foreign Operations appropriations, it provides about \$2.1 billion in reconstruction assistance, mostly for the training of Iraqi security forces. Congress is currently considering a \$6.2 billion FY2008 and FY2009 supplemental request for Iraq economic and security reconstruction aid. On June 28, 2004, the entity implementing assistance programs, the Coalition Provisional Authority (CPA), dissolved, and sovereignty was returned to Iraq. U.N. Security Council Resolution 1546 of June 8, 2004, returned control of assets held in the Development Fund for Iraq to the government of Iraq. U.S. economic assistance is now provided through the U.S. embassy, while security aid is chiefly managed by the Pentagon. Reconstruction priorities have changed over time. Allocations within the Iraq Relief and Reconstruction Fund (IRRF), the main U.S. assistance account in the first few years, mirrored shifting events on the ground. However, funds shifted to security and democratization in the period from 2004 to 2006 meant fewer funds available for electric power and water projects. At this time, most large-scale infrastructure programs are no longer funded; however, many small-scale, targeted community-level infrastructure efforts are funded under the Commander's Emergency Response Program (CERP) and the Economic Support Fund (ESF). The key emphases of the aid program are the training of Iraqi forces and programs assisting the development of Iraqi governing capacities and supporting the work of the Provincial Reconstruction Teams (PRTs).

DTIC

Education; Iraq; Security; Stability; United States

20080039882 Pittsburgh Univ., Pittsburgh, PA USA

Structures with Reconfigurable Circulatory Systems

Clark, William W; Beckman, Eric J; Cho, Sung K; Weiland, Lisa M; Bielawski, Christopher W; May 16, 2008; 27 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0552

Report No.(s): AD-A483091; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In order to provide structures with new and better characteristics, researchers often look to biological systems for inspiration. One trait that many biological system have that conventional structures do not is a circulatory system, which can be used for many purposes, one of which is the transport of structural material. This project explored the possibility of enabling structures with reconfigurable transport networks by creating materials that can change from solid (load bearing state) to liquid (transport state) upon stimulus from a controlled trigger. In addition, the benefits of transporting structural material were explored analytically, for the purpose of changing the structure's static, dynamic, and shape characteristics. Results from this study indicate that it is feasible to create such state-changing materials with photonic and electrical triggers. In addition, a great deal of structural control can be achieved with such materials and transport mechanisms.

DTIC

Circulatory System; Networks

20080040155 NASA Langley Research Center, Hampton, VA, USA

A Finite Element Analysis for Predicting the Residual Compression Strength of Impact-Damaged Sandwich Panels

Ratcliffe, James G.; Jackson, Wade C.; September 09, 2008; 20 pp.; In English; 23rd Annual Technical Conference of the American Society of Composites, 9-11 Sep. 2008, Memphis, TN, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 877868.02.07.07.05.02; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040155>

A simple analysis method has been developed for predicting the residual compression strength of impact-damaged sandwich panels. The method is tailored for honeycomb core-based sandwich specimens that exhibit an indentation growth failure mode under axial compression loading, which is driven largely by the crushing behavior of the core material. The analysis method is in the form of a finite element model, where the impact-damaged facesheet is represented using shell elements and the core material is represented using spring elements, aligned in the thickness direction of the core. The nonlinear crush response of the core material used in the analysis is based on data from flatwise compression tests. A

comparison with a previous analysis method and some experimental data shows good agreement with results from this new approach.

Author

Compression Tests; Residual Strength; Sandwich Structures; Data Compression; Finite Element Method; Honeycomb Cores; Mathematical Models

20080040784 NASA Langley Research Center, Hampton, VA, USA

POD/MAC-Based Modal Basis Selection for a Reduced Order Nonlinear Response Analysis

Rizzi, Stephen a.; Przekop, Adam; [2008]; 34 pp.; In English; To be published in the Journal of Sound and Vibration, volume 315, no. 3, pp. 467-485, August 2008; Original contains color illustrations

Contract(s)/Grant(s): WBS 599489.02.07.07.02.66; Copyright; Avail.: Other Sources

Reduced order nonlinear simulation is often times the only computationally efficient means of calculating the extended time response of large and complex structures under severe dynamic loading. This is because the structure may respond in a geometrically nonlinear manner, making the computational expense of direct numerical integration in physical degrees of freedom prohibitive. As for any type of modal reduction scheme, the quality of the reduced order solution is dictated by the modal basis selection. The techniques for modal basis selection currently employed for nonlinear simulation are ad hoc and are strongly influenced by the analyst's subjective judgment. This work develops a reliable and rigorous procedure through which an efficient modal basis can be chosen. The method employs proper orthogonal decomposition to identify nonlinear system dynamics, and the modal assurance criterion to relate proper orthogonal modes to the normal modes that are eventually used as the basis functions. The method is successfully applied to the analysis of a planar beam and a shallow arch over a wide range of nonlinear dynamic response regimes. The error associated with the reduced order simulation is quantified and related to the computational cost.

Author

Aerospace Engineering; Structural Engineering; Structural Analysis; Nonlinear Systems; Dynamic Response

20080040794 Southwest Research Inst., San Antonio, TX, USA

Elastic-Plastic Fracture Mechanics Analysis of Critical Flaw Size in ARES I-X Flange-to-Skin Welds

Chell, G. Graham; Hudak, Stephen J., Jr.; September 2008; 40 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NNL07AA00B; WBS 510505.03.07.01.11; SwRI Proj. 18.13011

Report No.(s): NASA/CR-2008-215340; NESC-RP-08-09/06-081-E; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040794>

NASA's Ares 1 Upper Stage Simulator (USS) is being fabricated from welded A516 steel. In order to insure the structural integrity of these welds it is of interest to calculate the critical initial flaw size (CIFS) to establish rational inspection requirements. The CIFS is in turn dependent on the critical final flaw size (CFS), as well as fatigue flaw growth resulting from transportation, handling and service-induced loading. These calculations were made using linear elastic fracture mechanics (LEFM), which are thought to be conservative because they are based on a lower bound, so called elastic, fracture toughness determined from tests that displayed significant plasticity. Nevertheless, there was still concern that the yield magnitude stresses generated in the flange-to-skin weld by the combination of axial stresses due to axial forces, fit-up stresses, and weld residual stresses, could give rise to significant flaw-tip plasticity, which might render the LEFM results to be non-conservative. The objective of the present study was to employ Elastic Plastic Fracture Mechanics (EPFM) to determine CFS values, and then compare these values to CFS values evaluated using LEFM. CFS values were calculated for twelve cases involving surface and embedded flaws, EPFM analyses with and without plastic shakedown of the stresses, LEFM analyses, and various welding residual stress distributions. For the cases examined, the computed CFS values based on elastic analyses were the smallest in all instances where the failures were predicted to be controlled by the fracture toughness. However, in certain cases, the CFS values predicted by the elastic-plastic analyses were smaller than those predicted by the elastic analyses; in these cases the failure criteria were determined by a breakdown in stress intensity factor validity limits for deep flaws (a greater than 0.90t), rather than by the fracture toughness. Plastic relaxation of stresses accompanying shakedown always increases the calculated CFS values compared to the CFS values determined without shakedown. Thus, it is conservative to ignore shakedown effects.

Author (revised)

Ares 1 Upper Stage; Flanges; Weld Strength; Fracture Mechanics; Elastic Properties; Plastic Properties; Cracks; Structural Engineering; Fatigue (Materials)

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*.

20080039189 Fisk Univ., Nashville, TN USA

Technical Operations Support (TOPS) III. Delivery Order 0007: Chalcopyrite Crystal Growth

Burger, Arnold; Dec 2007; 16 pp.; In English

Contract(s)/Grant(s): FA8650-05-D-5807-0007; Proj-4348

Report No.(s): AD-A482433; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482433>

1. Chalcopyrite crystal growth - AgGaSeTe was grown via Accelerated Crucible Rotation Technique (ACRT). ACRT did provide good homogeneity and elimination of bulk bubbles, however overall crystal quality was inferior to crystals grown by Horizontal Bridgman technique. The anisotropic expansion of AgGaSeTe results in better growth in horizontal configurations which leave a degree of freedom for expansion and contraction along the long, unrestricted (top) side of the crystal. AgGaSe₂ and AgGa_{0.6}In_{0.4}Se₂ was grown using horizontal Bridgman. Characterization via photoluminescence, optical transmission, and Raman indicate high crystal quality. 2. LiGaX₂ crystal growth - LiGaTe₂ and LiGaSe₂ were grown using horizontal electrodynamic gradient technique with a 24-zone furnace. Li could not be obtained with purity better than 99.99%. Synthesis and crystal growth were done in the same carbon-coated vessel, in order to accommodate the high reactivity of Li with the ampoule walls and with air. The LiGaTe₂ crystal was of good optical quality for a first attempt at this material, however only a small single crystal could be mined from the polycrystalline ingot that resulted from the growth attempt. A larger crystal was obtained from the LiGaSe₂ growth, but its optical quality was very poor. 3. GaTe crystal growth - GaTe, GaSe_{0.2}Te_{0.8}, GaSe_{0.8}Te_{0.2}, and GaSe were grown via vertical seeded Bridgman, resulting in large crystals of good quality. Optical band gaps were measured by optical transmission and photoluminescence. These results are encouraging that further work could result in a ternary crystal with improved terahertz nonlinear optical performance over GaSe.

DTIC

Crystal Growth; Pyrites

20080039283 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Spatial Aspects of Multi-Sensor Data Fusion: Aerosol Optical Thickness

Leptoukh, Gregory; Zubko, V.; Gopalan, A.; July 22, 2007; 4 pp.; In English; International Geosciences and Remote Sensing Symposium, 22-27 Jul. 2007, Barcelona, Spain; Original contains black and white illustrations; Copyright; Avail.: CASI:

[A01](#), Hardcopy

The Goddard Earth Sciences Data and Information Services Center (GES DISC) investigated the applicability and limitations of combining multi-sensor data through data fusion, to increase the usefulness of the multitude of NASA remote sensing data sets, and as part of a larger effort to integrate this capability in the GES-DISC Interactive Online Visualization and Analysis Infrastructure (Giovanni). This initial study focused on merging daily mean Aerosol Optical Thickness (AOT), as measured by the Moderate Resolution Imaging Spectroradiometer (MODIS) onboard the Terra and Aqua satellites, to increase spatial coverage and produce complete fields to facilitate comparison with models and station data. The fusion algorithm used the maximum likelihood technique to merge the pixel values where available. The algorithm was applied to two regional AOT subsets (with mostly regular and irregular gaps, respectively) and a set of AOT fields that differed only in the size and location of artificially created gaps. The Cumulative Semivariogram (CSV) was found to be sensitive to the spatial distribution of gap areas and, thus, useful for assessing the sensitivity of the fused data to spatial gaps.

Author

Remote Sensing; Satellite Imagery; Data Acquisition; Data Processing; Multisensor Fusion; Spatial Distribution; Optical Thickness; Aerosols

20080039285 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A-Train Data Depot: Integrating and Exploring Data Along the A-Train Tracks

Leptoukh, G.; Kempler, S.; Smith, P.; Savtchenko, A.; Kummerer, R.; Gopalan, A.; Farley, J.; Chen, A.; July 22, 2007; 4 pp.; In English; International Geosciences and Remote Sensing Symposium, 22 - 27 Jul. 2007, Barcelona, Spain; Original contains black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

The immense potential for new science findings as a result of inter-instrument data analysis has led to the development

of a new data portal at GSFC: the A-train Data Depot. The power and utility of this new service to the general public is amplified immensely when the archived data are used in conjunction with online data analysis services like Giovanni. This presentation details some of the challenges of data usage from multiple distinct missions and how the tool sets we have developed can help to overcome these challenges, considerably cut down on analysis overhead and promote science exploration in an otherwise very challenging arena.

Author

Satellite Orbits; Remote Sensing; Data Acquisition; Data Processing; Data Integration; Data Storage

20080039308 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Improving Access to Precipitation Data for GIS Users: Designing for Ease of Use

Stocker, Erich F.; Kelley, Owen A.; August 20, 2007; 7 pp.; In English; IASTED Environment Stimulation and Modeling Conference, 20-22 Aug. 2007, Honolulu, HI, USA; Original contains black and white illustrations; Copyright; Avail.:

CASI: [A02](#), Hardcopy

The Global Precipitation Measurement Mission (GPM) is a NASA/JAXA led international mission to configure a constellation of space-based radiometers to monitor precipitation over the globe. The GPM goal of making global 3-hour precipitation products available in near real-time will make such global products more useful to a broader community of modelers and Geographic Information Systems (GIS) users than is currently the case with remote sensed precipitation products. Based on the existing interest to make Tropical Rainfall Measuring Mission (TRMM) data available to a growing community of GIS users as well as what will certainly be an expanded community during the GPM era, it is clear that data systems must make a greater effort to provide data in formats easily used by GIS. We describe precipitation GIS products being developed for TRMM data. These products will serve as prototypes for production efforts during the GPM era. We describe efforts to convert TRMM precipitation data to GeoTIFF, Shapefile, and ASCII grid. Clearly, our goal is to format GPM data so that it can be easily used within GIS applications. We desire feedback on these efforts and any additions or direction changes that should be undertaken by the data system.

Author

Precipitation Measurement; Geographic Information Systems; TRMM Satellite; Data Products; Data Processing; Data Retrieval; Remote Sensing

20080039334 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The New Landsat Image Mosaic of Antarctica; A Part of Your World You've Never Seen Before

Bindschadler, Robert; Binnie, Douglas; Fox, Adrian; Vornberger, Patricia; Mullins, Jerry; April 25, 2008; 1 pp.; In English; Association of American Geographers 2008 Annual Meeting, 15 - 19 Apr. 2008; Copyright; Avail.: Other Sources; Abstract Only

The first-ever true-color, high-resolution digital mosaic of Antarctica has been produced from nearly 11 00 Landsat-7 ETM+ images. This project is an early 1999-2001 benchmark data set of the International Polar Year and represents a close and successful collaboration between NASA, USGS, the British Antarctic Survey and the National Science Foundation. The production of the mosaic required the development of new procedures for treating sensor saturation, adjusting for non-diffusive reflectance and for balancing color between images to remove distracting image edges. All adjustments were physically based to achieve the goal that each pixel's value is surface reflectance. This makes this mosaic more than just a pretty picture to guide users to individual scenes, but one where the mosaics can be used directly for quantitative research. The 15-m resolution, pan-sharpened mosaic, numerous derivative mosaics that enhance various ice sheet features, and the individual scenes are all served to the public via a web site hosted by the USGS. This site also enables on-line exploration of the various mosaics, including panning and zooming functions. Datasets can be customized by the user and downloaded. An associated web site, hosted by NASA, uses the mosaic as a means to demonstrate the value of satellite imagery of Antarctica. It is hoped this data set will enable the public and researcher alike a new and realistic view of the seventh continent.

Author

Landsat Satellites; Satellite Imagery; Antarctic Regions; Geological Surveys; Surface Properties; Mosaics; Diffusivity; High Resolution

20080039422 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Laser Sounder for Global Measurement of CO₂ Concentrations in the Troposphere from Space

Abshire, James B.; Riris, Haris; Kawa, S. Randy; Sun, Xiaoli; Chen, Jeffrey; Stephen, Mark A.; Collatz, G. James; Mao, Jianping; Allan, Graham; June 25, 2007; 1 pp.; In English; 4th International Workshop on Greenhouse Gas Measurements from Space, 25 - 27 Jun. 2007, Paris, France; Copyright; Avail.: Other Sources; Abstract Only

Measurements of tropospheric CO₂ abundance with global-coverage, a few hundred km spatial and monthly temporal

resolution are needed to quantify processes that regulate CO₂ storage by the land and oceans. The Orbiting Carbon Observatory (OCO) is the first space mission focused on atmospheric CO₂ for measuring total column CO₂ and O₂ by detecting the spectral absorption in reflected sunlight. The OCO mission is an essential step, and will yield important new information about atmospheric CO₂ distributions. However there are unavoidable limitations imposed by its measurement approach. These include best accuracy only during daytime at moderate to high sun angles, interference by cloud and aerosol scattering, and limited signal from CO₂ variability in the lower tropospheric CO₂ column. We have been developing a new laser-based technique for the remote measurement of the tropospheric CO₂ concentrations from orbit. Our initial goal is to demonstrate a lidar technique and instrument technology that will permit measurements of the CO₂ column abundance in the lower troposphere from aircraft. Our final goal is to develop a space instrument and mission approach for active measurements of the CO₂ mixing ratio at the 1-2 ppmv level. Our technique is much less sensitive to cloud and atmospheric scattering conditions and would allow continuous measurements of CO₂ mixing ratio in the lower troposphere from orbit over land and ocean surfaces during day and night. Our approach is to use the 1570nm CO₂ band and a 3-channel laser absorption spectrometer (i.e. lidar used an altimeter mode), which continuously measures at nadir from a near polar circular orbit. The approach directs the narrow co-aligned laser beams from the instrument's lasers toward nadir, and measures the energy of the laser echoes reflected from land and water surfaces. It uses several tunable fiber laser transmitters which allowing measurement of the extinction from a single selected CO₂ absorption line in the 1570 nm band. This band is free from interference from other gases and has temperature insensitive absorption lines. During the measurement the lasers are tuned on- and off- a selected CO₂ line near 1572 nm and a selected O₂ line near 768 nm in the Oxygen A band at kHz rates. The lasers use tunable diode seed lasers followed by fiber amplifiers, and have spectral widths much narrower than the gas absorption lines. The receiver uses a 1-m diameter telescope and photon counting detectors and measures the background light and energies of the laser echoes from the surface. The extinction and column densities for the CO₂ and O₂ gases are estimated from the ratio of the on and offline surface echo via the differential optical absorption technique. Our technique rapidly alternates between several on-line wavelengths set to the sides of the selected gas absorption lines. It exploits the atmospheric pressure broadening of the lines to weight the measurement sensitivity to the atmospheric column below 5 km. This maximizes sensitivity to CO₂ in the boundary layer, where variations caused by surface sources and sinks are largest. Simultaneous measurements of O₂ column will use an identical approach with an O₂ line. These laser frequencies are tunable and have narrow (MHz) line widths. In combination with sensitive photon counting detectors these enables much higher spectral resolution and precision than is possible with passive spectrometer. Laser backscatter profiles are also measured, which permits identifying measurements made to cloud tops and through aerosol layers. The measurement approach using lasers in common-nadir-zenith path allows retrieving CO₂ column mixing ratios in the lower troposphere irrespective of sun angle. Pulsed laser signals, time gated receiver and a narrow receiver field-of-view are used to isolate the surface laser echo signals and to exclude photons scattered from clouds and aerosols. Nonetheless, the optical absorption change due to a change of a few ppO₂ is small, <1 % which makes achieving the needed measurement sensitivities and stabilities quite challenging. Measurement SNRs and stabilities of >600:1 are needed to estimate CO₂ mixing ratio at the 1-2 ppm level. We have calculated characteristics of the technique and have demonstrated aspects of the laser, detector and receiver approaches in the laboratory. We have also measured O₂ in an absorption cell, and made CO₂ measurements over a 400 m long (one way) horizontal path using a sensor breadboard. We will describe these and more details of our approach in the paper.

Author

Atmospheric Composition; Carbon Dioxide; Carbon Dioxide Concentration; Laser Outputs; Laser Spectroscopy; Lasers; Oxygen; Remote Sensing; Troposphere; Satellite Observation

20080039423 NASA Goddard Space Flight Center, Greenbelt, MD, USA

An Experimental System for a Global Flood Prediction: From Satellite Precipitation Data to a Flood Inundation Map

Adler, Robert; June 23, 2007; 1 pp.; In English; 32nd International Symposium on Remote Sensing of Environment, 23-28 Jun. 2007, San Jose, Costa Rica; No Copyright; Avail.: Other Sources; Abstract Only

Floods impact more people globally than any other type of natural disaster. It has been established by experience that the most effective means to reduce the property damage and life loss caused by floods is the development of flood early warning systems. However, advances for such a system have been constrained by the difficulty in estimating rainfall continuously over space (catchment-, national-, continental-, or even global-scale areas) and time (hourly to daily). Particularly, insufficient in situ data, long delay in data transmission and absence of real-time data sharing agreements in many trans-boundary basins hamper the development of a real-time system at the regional to global scale. In many countries around the world, particularly in the tropics where rainfall and flooding co-exist in abundance, satellite-based precipitation estimation may be the best source of rainfall data for those data scarce (ungauged) areas and trans-boundary basins. Satellite remote sensing data acquired and processed in real time can now provide the space-time information on rainfall fluxes needed to monitor severe flood events

around the world. This can be achieved by integrating the satellite-derived forcing data with hydrological models, which can be parameterized by a tailored geospatial database. An example that is a key to this progress is NASA's contribution to the Tropical Rainfall Measuring Mission (TRMM), launched in November 1997. Hence, in an effort to evolve toward a more hydrologically-relevant flood alert system, this talk articulates a module-structured framework for quasi-global flood potential naming, that is 'up to date' with the state of the art on satellite rainfall estimation and the improved geospatial datasets. The system is modular in design with the flexibility that permits changes in the model structure and in the choice of components. Four major components included in the system are: 1) multi-satellite precipitation estimation; 2) characterization of land surface including digital elevation from NASA SRTM, topography-derived hydrologic parameters such as flood direction, flow accumulation, basin, and river network etc.; 3) spatially distributed hydrological models to infiltrate rainfall and route overland runoff; and 4) an implementation interface to relay the input data to the models and display the flood inundation results to the users and decision-makers. Early results appear reasonable in terms of location and frequency of events. Case studies of this experimental system are evaluated with surface runoff data and other river monitoring systems, such as Dartmouth Flood Observatory's 'Surface Water Watch' array of river reaches that are measured daily via other satellite remote sensing data. A major outcome of this progress will be the availability of a global overview of flood alerts that should consequently improve the performance of Decision Support System. We expect these developments in utilization of satellite remote sensing technology to offer a practical solution to the challenge of building a cost-effective early warning system for data scarce and under-developed areas.

Author

Floods; Hydrology Models; Rain; Satellite Imagery; Satellite Observation; Warning Systems; Flood Predictions; Storm Damage; Tropical Meteorology; Remote Sensing

20080039428 NASA Goddard Space Flight Center, Greenbelt, MD, USA

NASA's Earth Observations of the Global Environment: Our Changing Planet and the View from Space

King, Michael D.; February 05, 2008; 1 pp.; In English; SOURCE Science Meeting 2008, 5-7 Feb. 2008, Santa Fe, NM, USA; No Copyright; Avail.: Other Sources; Abstract Only

Observations of the Earth from space over the past 30 years has enabled an increasingly detailed view of our Earth's atmosphere, land, oceans, and cryosphere, and its many alterations over time. With the advent of improvements in technology, together with increased understanding of the physical principles of remote sensing, it is now possible to routinely observe the global distribution of atmospheric constituents, including both cloud and aerosol optical properties, land surface reflectance, sea ice and glaciers, and numerous properties of the world's oceans. This talk will review the current status of recent NASA Earth observing missions, and summarize key findings. These missions include EOS missions such as Landsat 7, QuikScat, Terra, Jason-1, Aqua, ICESat, SORCE, and Aura, as well as Earth probe missions such as TRMM and SeaWiFS. Recent findings from Cloud-Sat and CALIPSO from the Earth System Science Pathfinder program will also be summarized, if time permits. Due to its wide utilization by the Earth science community, both in the US and abroad, special emphasis will be placed on the Moderate Resolution Imaging Spectroradiometer (MODIS), developed by NASA and launched onboard the Terra spacecraft in 1999 and the Aqua spacecraft in 2002. As the quintessential instrument of the Earth Observing System, it is widely used for studies of the oceans, land, and atmosphere, and its lengthening time series of Earth observations is finding utilization in many communities for both climate, weather, and applications use.

Author

Earth Observations (From Space); Earth Surface; Cryospheres; TRMM Satellite; Sea-Viewing Wide Field-of-View Sensor; MODIS (Radiometry); Spectral Reflectance; Surface Properties; Atmospheric Composition; Cloud Physics; Remote Sensing

20080039436 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Surveillance and Control of Malaria Transmission in Thailand using Remotely Sensed Meteorological and Environmental Parameters

Kiang, Richard K.; Adimi, Farida; Soika, Valerii; Nigro, Joseph; December 03, 2007; 4 pp.; In English; Mekong Malaria Colloquium, 3-5 Dec. 2007, Hanoi, Viet Nam; Original contains black and white illustrations; No Copyright; Avail.:

CASI: A01, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039436>

These slides address the use of remote sensing in a public health application. Specifically, this discussion focuses on the use of remote sensing to detect larval habitats to predict current and future endemicity and identify key factors that sustain or promote transmission of malaria in a targeted geographic area (Thailand). In the Malaria Modeling and Surveillance Project, which is part of the NASA Applied Sciences Public Health Applications Program, we have been developing techniques to enhance public health's decision capability for malaria risk assessments and controls. The main objectives are: 1) identification

of the potential breeding sites for major vector species; 2) implementation of a risk algorithm to predict the occurrence of malaria and its transmission intensity; 3) implementation of a dynamic transmission model to identify the key factors that sustain or intensify malaria transmission. The potential benefits are: 1) increased warning time for public health organizations to respond to malaria outbreaks; 2) optimized utilization of pesticide and chemoprophylaxis; 3) reduced likelihood of pesticide and drug resistance; and 4) reduced damage to environment. Environmental parameters important to malaria transmission include temperature, relative humidity, precipitation, and vegetation conditions. The NASA Earth science data sets that have been used for malaria surveillance and risk assessment include AVHRR Pathfinder, TRMM, MODIS, NSIPP, and SIESIP. Textural-contextual classifications are used to identify small larval habitats. Neural network methods are used to model malaria cases as a function of the remotely sensed parameters. Hindcastings based on these environmental parameters have shown good agreement to epidemiological records. Discrete event simulations are used for modeling the detailed interactions among the vector life cycle, sporogonic cycle and human infection cycle, under the explicit influences of selected extrinsic and intrinsic factors. The output of the model includes the individual infection status and the quantities normally observed in field studies, such as mosquito biting rates, sporozoite infection rates, gametocyte prevalence and incidence. Results are in good agreement with mosquito vector and human malaria data acquired by Coleman et al. over 4.5 years in Kong Mong Tha, a remote village in western Thailand. Application of our models is not restricted to the Greater Mekong Subregion. Our models have been applied to malaria in Indonesia, Korea, and other regions in the world with similar success.

Author

Remote Sensing; Environmental Monitoring; Larvae; Habitats; Infectious Diseases; Parasitic Diseases; Epidemiology

20080039562 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Landsat-based Analysis of Mountain Forest-tundra Ecotone Response to Climate Trends in Sayan Mountains

Kharuk, Viatcheslav I.; Im, Sergey T.; Ranson, K. Jon; To be submitted to Remote Sensing of Environment; [2007]; 14 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): RFFI 06-05-64939; Copyright; Avail.: CASI: [A03](#), Hardcopy

observations of temperatures Siberia has shown a several degree warming over the past 30 years. It is expected that forest will respond to warming at high latitudes through increased tree growth and northward or upward slope migration. migration. Tree response to climate trends is most likely observable in the forest-tundra ecotone, where temperature mainly limits tree growth. Making repeated satellite observations over several decades provides an opportunity to track vegetation response to climate change. Based on Landsat data of the Sayan Mountains, Siberia, there was an increase in forest stand crown closure and an upward tree-line shift in the of the forest-tundra ecotone during the last quarter of the 20th century,. On-ground observations, supporting these results, also showed regeneration of Siberian pine in the alpine tundra, and the transformation of prostrate Siberian pine and fir into arboreal (upright) forms. During this time period sparse stands transformed into closed stands, with existing closed stands increasing in area at a rate of approx. 1 %/yr, and advancing their upper border at a vertical rate of approx. 1.0 m/yr. In addition, the vertical rate of regeneration propagation is approx. 5 m/yr. It was also found that these changes correlated positively with temperature trends

Author

Landsat Satellites; Climate Change; Forests; Satellite Imagery; Vegetation; Tundra; Trends; Satellite Observation

20080039568 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Cooling of the North Atlantic by Saharan Dust

Lau, K. M.; Kim, K. M.; [2007]; 17 pp.; In English; Original contains black and white illustrations; No Copyright;

Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039568>

Using aerosol optical depth, sea surface temperature, top-of-the-atmosphere solar radiation flux, and oceanic mixed-layer depth from diverse data sources that include NASA satellites, NCEP reanalysis, in situ observations, as well as long-term dust records from Barbados, we examine the possible relationships between Saharan dust and Atlantic sea surface temperature. Results show that the estimated anomalous cooling pattern of the Atlantic during June 2006 relative to June 2005 due to attenuation of surface solar radiation by Saharan dust remarkably resemble observations, accounting for approximately 30-40% of the observed change in sea surface temperature. Historical data analysis show that there is a robust negative correlation between atmospheric dust loading and Atlantic SST consistent with the notion that increased (decreased) Saharan dust is associated with cooling (warming) of the Atlantic during the early hurricane season (July- August-September).

Author

Aerosols; Dust; Cooling; Sea Surface Temperature; Atmospheric Temperature; Solar Radiation

20080039644 NASA Stennis Space Center, Stennis Space Center, MS, USA

NASA Remote Sensing Applications for Archaeology and Cultural Resources Management

Giardino, Marco J.; September 30, 2008; 2 pp.; In English; Advances in Remote Sensing for Archaeology and Cultural Heritage, 30 Sep. - 5 Oct. 2008, Rome, Italy; No Copyright; Avail.: Other Sources; Abstract Only

NASA's Earth Science Mission Directorate recently completed the deployment of the Earth Observation System (EOS) which is a coordinated series of polar-orbiting and low inclination satellites for long-term global observations of the land surface, biosphere, solid Earth, atmosphere, and oceans. One of the many applications derived from EOS is the advancement of archaeological research and applications. Using satellites, manned and unmanned airborne platform, NASA scientists and their partners have conducted archaeological research using both active and passive sensors. The NASA Stennis Space Center (SSC) located in south Mississippi, near New Orleans, has been a leader in space archaeology since the mid-1970s. Remote sensing is useful in a wide range of archaeological research applications from landscape classification and predictive modeling to site discovery and mapping. Remote sensing technology and image analysis are currently undergoing a profound shift in emphasis from broad classification to detection, identification and condition of specific materials, both organic and inorganic. In the last few years, remote sensing platforms have grown increasingly capable and sophisticated. Sensors currently in use, including commercial instruments, offer significantly improved spatial and spectral resolutions. Paired with new techniques of image analysis, this technology provides for the direct detection of archaeological sites. As in all archaeological research, the application of remote sensing to archaeology requires a priori development of specific research designs and objectives. Initially targeted at broad archaeological issues, NASA space archaeology has progressed toward developing practical applications for cultural resources management (CRM). These efforts culminated with the Biloxi Workshop held by NASA and the University of Mississippi in 2002. The workshop and resulting publication specifically address the requirements of cultural resource managers through the use of remote sensing. In 2007, NASA awarded six competitively chosen projects in Space Archaeology through an open solicitation whose purpose, among several, was to address the potential benefits to modern society that can be derived through a better understanding of how past cultures succeeded or failed to adapt to local, regional, and global change. A further objective of NASA's space archaeology is the protection and preservation of cultural heritage sites while planning for the sustainable development of cultural resources. NASA's archaeological approach through remote sensing builds on traditional methods of aerial archaeology (i.e. crop marks) and utilizes advanced technologies for collecting and analyzing archaeological data from digital imagery. NASA's archaeological research and application projects using remote sensing have been conducted throughout the world. In North America, NASA has imaged prehistoric mound sites in Mississippi; prehistoric shell middens in Louisiana, Puebloan sites in New Mexico and more recently the sites associated with the Lewis and Clark Corps of Discovery Expedition (1804-1806).

Author

Cultural Resources; Archaeology; Remote Sensing; Resources Management; Earth Observations (From Space); Image Analysis; Earth Sciences; Prediction Analysis Techniques

20080039746 Florida Inst. of Tech., Melbourne, FL USA

Morphologic Analysis of Sebastian Inlet, Florida: Enhancements to the Tidal Inlet Reservoir Model

Zarillo, Gary A; Kraus, Nicholas C; Hoeke, Ronald K; Jan 2003; 15 pp.; In English; Original contains color illustrations Report No.(s): AD-A482884; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482884>

Geomorphic analysis was conducted for Sebastian Inlet, FL to re-formulate an analytic model of shoal evolution and sediment bypassing. The Tidal Inlet Reservoir Model (Kraus 2002) was enhanced to include sediment pathways that allow seasonal reversals in littoral sand transport and episodic sand by-passing from an intra-inlet sand trap. The model was established with the aid of historical morphologic data from Sebastian Inlet, interpreted together with process data.

DTIC

Augmentation; Geomorphology; Reservoirs; Tides

20080039870 Onyx Optics, Inc., Dublin, CA USA

Production of Optical Quality Free Standing Diamond Wafer

Dubinskiy, Mark; May 19, 2008; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-07-2-0072; DAAD19-03-R-0017

Report No.(s): AD-A483071; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Valdosta Optics Laboratory, Incorporated (VOLI) is pursuing the capabilities of developing synthetic diamond and diamond-like materials, and integrating and implementing these materials in various applications, particularly as a high performance heat spreader for solid state laser (SSL) components, optical coatings, and active engineering materials for

micro-electro-mechanical systems (MEMS) and sensors. The current focus is on three key research and development directions, namely: 1) optical quality, highly oriented polycrystalline diamond (PCD) wafers as heat spreader for solid state laser crystals, 2) large area single crystal diamond synthesis, and Further adjustments and additions to the research and development projects/programs will be made as the company's capabilities continue to grow. In order to conduct the planned projects, experimental equipments and instruments, including microwave CVD reactor, DC/RF metal sputtering system, laser cutting system, sample pre- and postdeposition treatment facilities, and material characterization instruments, have been specified, designed, purchased, and installed.

DTIC

Cutting; Diamonds; Polycrystals; Wafers

20080039896 Florida State Univ., Tallahassee, FL USA

The Mineralogy and Geochemistry of Manganese Nodules From the Southern Ocean

Meylan, Maurice A; Feb 1968; 186 pp.; In English

Report No.(s): AD-A483112; CONTRIB-22; No Copyright; Avail.: Defense Technical Information Center (DTIC)

X-ray diffraction studies on 228 nodules from 91 bottom trawls and 58 piston cores from the Southern Ocean collected during USNS ELTANIN cruises show that todorokite is the principal manganese oxide phase present. A correlation exists between manganese content of the gross sample and the relative amount of todorokite as expressed by the ratio of peak areas 3.34 Angstrom A (quartz) plus 3.2 Angstrom A (plagioclase- phillipsite) vs. 9.7 Angstrom A (todorokite). The areal distribution of values for this ratio roughly corresponds to the rate of delivery of detrital quartz and feldspar to a particular area, the relative proportion of todorokite being lowest near the Antarctic continent, especially in the Drake Passage and Scotia Sea. Throughout the Southern Ocean, ferromanganese accumulations display a complex mineralogy. Birnessite and MnO₂ are manganese phases of secondary importance. Minor amounts of crystalline goethite and/or maghemite were detected in many of the samples, but much of the iron present is evidently contained in an amorphous hydroxide. Authigenic and detrital silicates are contained in the ferromanganese accumulations. Quartz, plagioclase, montmorillonite, and phillipsite are almost invariably present, while clinoptilolite and amphibole occur less frequently. Amphibole is more abundant in nodules from the Drake Passage and Scotia Sea. Examination of nodules contained within sediment cores shows that the mineralogy and chemical composition of the concretions have remained relatively constant at any one location throughout much of the Brunhes paleomagnetic epoch. The distribution of the concretions in general has also remained unchanged.

DTIC

Antarctic Ocean; Geochemistry; Manganese; Manganese Oxides; Mineralogy; Oceans

20080039898 Florida State Univ., Tallahassee, FL USA

Petrologic Variations Within Submarine Basalt Pillows of the South Pacific-Antarctic Ocean

Paster, Theodore P; Aug 1968; 120 pp.; In English

Report No.(s): AD-A483116; CONTRIB-27; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The chemistry of submarine basalts has been used in upper mantle petrogenesis models but criteria for selecting fresh, representative samples and an understanding of within-specimen variations are vague. In an effort to define alteration criteria, variations in the mineralogical, chemical and magnetic parameters of one alkalic and eight tholeiitic basalt pillows from abyssal hills in eight widely scattered localities of the Southern Ocean have been studied from glass rim to aphanitic interior. These variations are related to primary cooling (quenching and deuteric alteration) and secondary alteration (hydration and recrystallization). Four texturally gradational zones are defined from glass rim inward: hydrated glass, unhydrated glass, 'variolitic' zone, and aphanitic zone. This transition occurs through a minimum thickness of three centimeters. These zones are also characterized by low intensity of magnetization (J) and low susceptibility (c.g.s. units) in the glass (no opaques), high J and susceptibility in the variolitic zone (very minute opaques), and medium J and susceptibility in the aphanitic basalt (opaques larger than single domain size). Deuteric alteration affects the intensity and coercivity of the basalts. Vesicularity in the eight tholeiites does not exceed 3% at depths greater than 3200 meters which is consistent with physico-chemical data. Three types of alteration are common: (1) glass hydration (>2.0% total H₂O) resulting in loss of magnesium and calcium and increase of total iron ferric/ferrous ratio, and potassium; (2) serpentinization adjacent to joints and fractures; and (3) higher temperature deuteric alteration in the aphanitic zone causing depletion of magnesium and total iron as FeO (up to 2.0 wt. percent of rock). The iron migrates to joints where it is oxidized and made available in significant quantities for redeposition in iron-rich sediments and ferro-manganese concretions.

DTIC

Antarctic Ocean; Basalt; Pacific Ocean

20080040048 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

An Analysis of Groundwater Flow Patterns in a Constructed Treatment Wetland Cell

Corbin, Rebecca S; Mar 2008; 104 pp.; In English

Report No.(s): AD-A482747; AFIT/GEM/ENV/08-M04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482747>

This research effort analyzed groundwater flow paths within a treatment wetland constructed to degrade tetrachloroethylene (PCE) in groundwater. The treatment cell is a vertical flow wetland that allows the water to flow from the bottom to the surface breaking down PCE and daughter products. The method of conducting this research included collecting field data of hydraulic head contours nested piezometers and collecting data from sampling wells to determine hydraulic conductivities in the wetland. The field data was used to create a numerical computer model to determine groundwater flow patterns. The field data and the model demonstrate that there are areas in the wetland with flow velocities as low as 0.0019 m/day and as high as 2.779 m/day. The computer model also shows residence times of water particles traveling from the bottom of the wetland cell to the surface water varying from < 1 day, to over 1000 days. Groundwater flow patterns occurring in the wetland today were compared to a study five years ago. The hydraulic head contours and hydraulic parameters measured in the field were similar in both studies. The results of both studies show the residence times and the desired uniform flow across the wetland is being short circuited.

DTIC

Flow Distribution; Ground Water; Water Treatment; Wetlands

20080040138 NASA Goddard Space Flight Center, Greenbelt, MD, USA

An Improved Algorithm for Retrieving Surface Downwelling Longwave Radiation from Satellite Measurements

Zhou, Yaping; Kratz, David P.; Wilber, Anne C.; Gupta, Shashi K.; Cess, Robert D.; [2006]; 9 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

Retrieving surface longwave radiation from space has been a difficult task since the surface downwelling longwave radiation (SDLW) are integrations from radiation emitted by the entire atmosphere, while those emitted from the upper atmosphere are absorbed before reaching the surface. It is particularly problematic when thick clouds are present since thick clouds will virtually block all the longwave radiation from above, while satellites observe atmosphere emissions mostly from above the clouds. Zhou and Cess developed an algorithm for retrieving SDLW based upon detailed studies using radiative transfer model calculations and surface radiometric measurements. Their algorithm linked clear sky SDLW with surface upwelling longwave flux and column precipitable water vapor. For cloudy sky cases, they used cloud liquid water path as an additional parameter to account for the effects of clouds. Despite the simplicity of their algorithm, it performed very well for most geographical regions except for those regions where the atmospheric conditions near the surface tend to be extremely cold and dry. Systematic errors were also found for areas that were covered with ice clouds. An improved version of the algorithm was developed that prevents the large errors in the SDLW at low water vapor amounts. The new algorithm also utilizes cloud fraction and cloud liquid and ice water paths measured from the Cloud and the Earth's Radiant Energy System (CERES) satellites to separately compute the clear and cloudy portions of the fluxes. The new algorithm has been validated against surface measurements at 29 stations around the globe for the Terra and Aqua satellites. The results show significant improvement over the original version. The revised Zhou-Cess algorithm is also slightly better or comparable to more sophisticated algorithms currently implemented in the CERES processing. It will be incorporated in the CERES project as one of the empirical surface radiation algorithms.

Author

Algorithms; Long Wave Radiation; Meteorology; Satellite Observation; Terrestrial Radiation; Ice Environments; Clouds (Meteorology)

20080040144 NASA Goddard Space Flight Center, Greenbelt, MD, USA

SPOT-VEG Based Analysis of Siberian Silkmoth Outbreak

Kharuk, Viatcheslav I.; Ranson, K. Jon; Im, Sergey T.; January 2007; 15 pp.; In English

Contract(s)/Grant(s): RFFI-060564939; Copyright; Avail.: CASI: [A03](#), Hardcopy

The spatial and temporal dynamics of an outbreak of the Siberian silkmoth were correlated with topographic features of the affected area using SPOT-VEG data and a high resolution digital elevation model (DEM). In 2002-2003 an outbreak

affected approximately 20,000 ha in the South Siberian mountains of Russia. The outbreak began between the elevations of approximately 430- 480 m and on southwest slopes with steepness < 5 degrees. As the pest searched for food it moved up and down slope, resulting in an elevation distribution split within a range of approximately 390-540 m and slope steepness up to 15 degrees. In the final phase the azimuth distribution of damaged stands became even. The correlation between the initial phase and topographic features can be used to prioritize monitoring forest areas most vulnerable to destruction by pests.

Author

Forests; Defoliation; Moths; Digital Elevation Models

20080040744 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Impact of Urban Growth on Surface Climate: A Case Study in Oran, Algeria

Bounoua, Lahouari; Safia, Abdelmounaine; Masek, Jeffrey; Peters-Lidars, Christaq; Imhoff, Marc L.; May 02, 2008; 47 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

We develop a land use map discriminating urban surfaces from other cover types over a semiarid region in North Africa and use it in a land surface model to assess the impact of urbanized land on surface energy, water and carbon balances. Unlike in temperate climates where urbanization creates a marked heat island effect, this effect is not strongly marked in semiarid regions. During summer, the urban class results in an additional warming of 1.45 C during daytime and 0.81 C at night compared to that simulated for needleleaf trees under similar climate conditions. Seasonal temperatures show urban areas warmer than their surrounding during summer and slightly cooler in winter. The hydrological cycle is practically 'shut down' during summer and characterized by relatively large amount of runoff in winter. We estimate the annual amount of carbon uptake to 1.94 million metric tons with only 11.9% assimilated during the rainy season. However, if urbanization expands to reach 50% of the total area excluding forests, the annual total carbon uptake will decline by 35% and the July mean temperature would increase only 0.10 C, compared to current situation. In contrast, if urbanization expands to 50% of the total land excluding forests and croplands but all short vegetation is replaced by native broadleaf deciduous trees, the annual carbon uptake would increase 39% and the July mean temperature would decrease by 0.9 C, compared to current configuration. These results provide guidelines for urban planners and land use managers and indicate possibilities for mitigating the urban heat.

Author

Climate; Land Use; Arid Lands; Hydrological Cycle; Water Balance; Vegetation; Forests; Farmlands; Deciduous Trees; Surface Energy

20080040747 Texas A&M Univ., College Station, TX, USA

Impact of Uncertainty in the Drop Size Distribution on Oceanic Rainfall Retrievals From Passive Microwave Observations

Wilheit, Thomas T.; Chandrasekar, V.; Li, Wanyu; IEEE Transactions on Geoscience and Remote Sensing; October 2007; ISSN 0196-2892; Volume 45, Issue 10, pp. 316-3164; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAG5-13779; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1109/TGRS.2007.903824>

The variability of the drop size distribution (DSD) is one of the factors that must be considered in understanding the uncertainties in the retrieval of oceanic precipitation from passive microwave observations. Here, we have used observations from the Precipitation Radar on the Tropical Rainfall Measuring Mission spacecraft to infer the relationship between the DSD and the rain rate and the variability in this relationship. The impact on passive microwave rain rate retrievals varies with the frequency and rain rate. The total uncertainty for a given pixel can be slightly larger than 10% at the low end (ca. 10 GHz) of frequencies commonly used for this purpose and smaller at higher frequencies (up to 37 GHz). Since the error is not totally random, averaging many pixels, as in a monthly rainfall total, should roughly halve this uncertainty. The uncertainty may be lower at rain rates less than about 30 mm/h, but the lack of sensitivity of the surface reference technique to low rain rates makes it impossible to tell from the present data set.

Author

Rain; Drop Size; Size Distribution; Precipitation Measurement; Oceans; Meteorological Radar

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*.

20080039218 Texas Univ. at Dallas, Richardson, TX USA

Fuel-Powered Artificial Muscles for the Robotic Soldier

Baughman, Ray; Sep 1, 2007; 26 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-04-1-0174

Report No.(s): AD-A482408; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482408>

Two types of novel actuators that are powered by high-energy-density fuels (hydrogen, methanol, or formic acid fuel combined with air or oxygen) have been experimentally demonstrated in this program. The first type uses a carbon nanotube electrode that simultaneously functions as a muscle, a fuel cell electrode and a supercapacitor electrode. The result is a muscle that converts the chemical energy in the fuel to electrical energy and can use this electrical energy for actuation, store it, or potentially use it for other energy needs of a more complex system. The second type functions as a shorted fuel cell comprising a shape memory alloy, in which the chemical energy in a fuel converts to thermal energy that powers actuation. While the second type of fuel cell muscle provides the most powerful demonstration of the importance of this technology, the first type of fuel cell muscle provides a broader indication of technology scope. Our highest demonstrated actuator stroke and power densities for fuel cell muscles are comparable to natural skeletal muscle, and the generated stresses are over a hundred times higher than for natural muscle. Important information on temperature distribution in the muscles powered by methanol vapor/air mixture was obtained using thermal (infrared) imaging.

DTIC

Actuators; Carbon Nanotubes; Fuel Cells; Muscles; Robotics; Robots; Shape Memory Alloys

20080039289 Whitham, Curtis and Christofferson, P.C., Reston, VA, USA

Compression Moldable Composite Bipolar Plates with High Through-Plane Conductivity

Huang, J., Inventor; McGrath, J. E., Inventor; Baird, D. G., Inventor; 6 Oct 05; 15 pp.; In English

Contract(s)/Grant(s): DE-AC05-00OR22725

Patent Info.: Filed Filed 6 Oct 05; US-Patent-Appl-SN-11-244 401

Report No.(s): PB2008-101644; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A low cost method of fabricating bipolar plates for use in fuel cells utilizes a wet lay process for combining graphite particles, thermoplastic fibers, and reinforcing fibers to produce a plurality of formable sheets. The formable sheets are sandwiched between outer layers consisting of polymer and graphite particles, then molded into a bipolar plates with features impressed therein via the molding process. The bipolar plates formed by the process have sufficient mechanical strength and bulk conductivity to be used in fuel cells. The outer layers provide for enhanced conductivity and resistance to gas permeation.

NTIS

Bipolarity; Fuel Cells; Patent Applications; Plates (Structural Members)

20080039331 NASA Goddard Space Flight Center, Greenbelt, MD, USA; NASA Goddard Space Flight Center, Greenbelt, MD, USA

Wetlife Study of Nickel Hydrogen Cells

November 27, 2007; 15 pp.; In English; 2007 NASA Aerospace Battery Workshop, 27 - 29 Nov. 2007, Hunstville, Alabama, USA; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039331>

A study was undertaken to determine the residual Nickel Precharge, and to understand the Performance and Cycle Life of Aged Nickel Hydrogen cells that were in cold storage up to thirteen (13) years. Comsat Technical Services, Aerospace Corporation, and NSW/Crane test data to date indicate a nominal electrical performance with a small second plateau and the presence of Nickel Precharge in the cells: Cell Teardown, Plate (active Nickel Precharge determination), and Electrolyte Analyses are in progress. Preliminary Thermal Imaging data indicates that older the cell greater the heat generation, but cell

over charge (capacity) could dominate heat generation. U.S. Govt. cells has completed 1150 nominal 60% LEO cycles. The completion date for this study is January 31, 2008.

Derived from text

Nickel Hydrogen Batteries; COMSAT Program; Electrical Properties; Life (Durability); Performance Tests; Thermal Mapping; Electrolytes

20080039453 Harry M. Levy, Emrich and Dithmar, Chicago, IL, USA; Chicago Univ., Chicago, IL USA
Lithium Metal Oxide Electrodes for Lithium Cells and Batteries

Thackeray, M. M., Inventor; Johnson, C. S., Inventor; Amine, K., Inventor; 10 Nov 05; 26 pp.; In English

Contract(s)/Grant(s): DE-W-31-109-ENG-38

Patent Info.: Filed Filed 10 Nov 05; US-Patent-Appl-SN-11-271 462

Report No.(s): PB2008-103553; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A lithium metal oxide positive electrode for a non-aqueous lithium cell is disclosed. The cell is prepared in its initial discharged state and has a general formula $x\text{LiMO}(\text{sub } 2)(1-x)\text{Li}(\text{sub } 2)\text{M}'\text{O}(\text{sub } 3)$ in which $0 < x < 1$, and where M is one or more ion with an average trivalent oxidation state and with at least one ion being Mn or Ni, and where M' is one or more ion with an average tetravalent oxidation state. Complete cells or batteries are disclosed with anode, cathode and electrolyte as are batteries of several cells connected in parallel or series or both.

NTIS

Electric Batteries; Electrochemical Cells; Electrodes; Lithium Batteries; Lithium Oxides; Metal Oxides; Patent Applications

20080039846 Materials Research Society, Warrendale, PA USA

Symposium U: Thermoelectric Power Generation. Held in Boston, Massachusetts on November 26-29, 2007

Hogan, Timothy P; Yang, Jihui; Funahashi, Ryoji; Tritt, Terry M; Apr 2008; 29 pp.; In English

Contract(s)/Grant(s): N00014-07-1-1187

Report No.(s): AD-A483002; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Symposium U brought together scientists and engineers working on high efficiency thermal to electric energy conversion technologies to discuss the most recent progress in materials, current theoretical and experimental trends, characterization, and device fabrication. The symposium was designed to emphasize the multi-disciplinary nature (materials science, physics, chemistry and engineering) of the research needed to advance the state-of-the-art technology. Over 175 abstracts were received. This was more than any of the prior thermoelectrics MRS symposia and a strong testament to the continuing interest in this area of study.

DTIC

Conferences; Thermoelectric Power Generation

20080040202 Southwest Research Inst., San Antonio, TX USA

Evaluation of Synthetic Fuel in Military Tactical Generators

Alvarez, Ruben; Frame, Edwin A; Jun 2008; 40 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAE07-99-C-L053

Report No.(s): AD-A482914; TFLRF-392; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A program was developed to compare data on performance, fuel economy and exhaust emissions during side by-side evaluations of military tactical generator sets while using various fuels, including Fischer-Tropsch (FT) synthetic aviation kerosene fuel. The generators identified as Tactical Quiet Generators, 10kW 60 Hz, MEP-803A were provided by the Mobile Electric Power Group at Ft. Belvoir, VA. All three generators were operated on a 25-hour break-in run using Ultra-Low Sulfur Diesel (ULSD). Then, generators No. 1 and No. 3 operated on ULSD for a total of 100 hours and then were switched between JP-8 and a 50:50 volumetric blend of JP-8 and FT synthetic kerosene every 450 hours of operation. Generator No. 2 was operated on FT synthetic aviation kerosene fuel for the entire 1,000-hour test. The generators operated at 50% capacity throughout the evaluation and three 10kW electrical load banks provided continuous, controlled load to the generators. Monitored data included engine speed, electrical output, exhaust temperature, inlet fuel temperature, fuel consumption, and exhaust emissions. Variances of automated data, i.e., engine rpm, electrical output, fuel temperature and exhaust temperature

were insignificant during the test period. Measured emissions gasses were NO_x, ppm, CO, ppm, CO₂, %, and O₂ %. There were insignificant variances in CO₂ and O₂ emissions. However, data show reductions in NO_x and CO when using FT synthetic aviation kerosene or a blend of JP-8 and FT synthetic aviation kerosene fuel instead of ULSD or JP-8.

DTIC

Evaluation; Fischer-Tropsch Process; Synthetic Fuels; System Effectiveness

45

ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

20080039376 National Energy Technology Lab., Morgantown, WV, USA; Parsons, Inc., Morgantown, WV, USA

Solid Sorbents for CO₂ Capture from Post-Combustion and Pre-Combustion Gas Streams

Siriwardane, R.; Robinson, C.; Stevens, R.; Aug. 01, 2007; 7 pp.; In English

Report No.(s): DE2007-915812; DOE/NETL-IR-2007-192; No Copyright; Avail.: Department of Energy Information Bridge

A novel liquid impregnated solid sorbent was developed for CO₂ removal in the temperature range of ambient to 60 degrees C for both fixed bed and fluidized bed reactor applications. The sorbent is regenerable at 60-80 (deg) C. Multi-cycle tests conducted in an atmospheric bench scale reactor with simulated flue gas demonstrated that the sorbent retains its CO₂ sorption capacity with CO₂ removal efficiency of about 99%. A second, novel solid sorbent containing mixture of alkali earth and alkali compounds was developed for CO₂ removal at 200-315 (deg) C from high pressure gas streams (i.e., suitable for IGCC systems). The sorbent showed very high capacity for CO₂ removal from gas streams containing 28% CO₂ at 200 degrees C and 11.2 atm during lab-scale flow reactor tests as well as regenerability at 375 (deg) C.

NTIS

Air Pollution; Carbon Dioxide; Combustion; Gas Streams; Pollution Control; Solid Cryogenics; Solidified Gases; Sorbents

20080039480 Westinghouse Savannah River Co., Aiken, SC, USA

Comparisons for RAMS Models (v3a, v4.3, and v6.0)

Aug. 30, 2007; 39 pp.; In English

Contract(s)/Grant(s): DE-AC09-96SR18500

Report No.(s): DE2007-917784; WSRC-STI-2007-00467; No Copyright; Avail.: National Technical Information Service (NTIS)

The Regional Atmospheric Modeling System (RAMS) is an atmospheric numerical model developed by scientists at Colorado State University and the ASTER Division of Mission Research Corporation for simulating and forecasting meteorological phenomena. RAMS v3a and v4.3 are being used by the Savannah River National Laboratory (SRNL) as an operational tool for weather forecast and emergency response for the Savannah River Site (SRS). Atmospheric, Meteorological, and Environmental Technologies (ATMET) is now the proprietor of RAMS. The latest upgrade (v6.0) was officially released on January 11, 2006. ATG plans to eventually replace the RAMS v3a and v4.3 with the RAMS v6.0 for operational site forecasting if the newest version provides a significant improvement in the numerical forecast. A study to compare the three model (v3a, v4.3 and v6.0) results with respect to surface stations observations was conducted and is the subject of this report. Two cases were selected for simulation by these three RAMS models. One simulation started at 0 Z on April 3, 2007 and represents a warm weather case (high temperature of 26o C and low temperature of 16o C) at SRS, while the other simulation started at 0 Z on April 7, 2007 and represents a cold weather case (high temperature of 9o C and low temperature of -1o C) at SRS. The wind speeds, wind directions, temperatures and the dew point temperatures predicted by the three RAMS models were interpolated to 46 surface observation locations. The interpolated results were compared with the observation data. Statistically, the differences between the three model results were very small. For the present configurations, the predictions from RAMS v6.0 are no better than the older models with the exception of wind direction. The proposed path forward would be to fine tune the RAMS v6.0 model input parameters to improve the predictions. This should also provide insights into current weaknesses in all RAMS versions.

NTIS

Accidents; Atmospheric Models; Forecasting

20080039485 Westinghouse Savannah River Co., Aiken, SC, USA

Air Pathway Dose Modeling for the F-Area Tank Farm

Farfan, E. B.; Aug. 06, 2007; 20 pp.; In English

Contract(s)/Grant(s): DE-AC09-96SR18500

Report No.(s): DE2007-915499; WSRC-STI-2007-00343 REV 0; No Copyright; Avail.: Department of Energy Information Bridge

No abstract available

Air Pollution; Dosage; Pollution Monitoring; Radioactive Wastes

20080039515 Westinghouse Savannah River Co., Aiken, SC, USA

Transport of Waste Simulants in PJM Vent Lines

Qureshi, Z. H.; Feb. 01, 2007; 62 pp.; In English

Contract(s)/Grant(s): DE-AC09-96SR18500

Report No.(s): DE2007-915497; WSRC-STI-2006-00313 REV 0; SRNL-RPP-2006-00027 REV 0; No Copyright; Avail.: National Technical Information Service (NTIS)

The experimental work was conducted to determine whether there is a potential for waste simulant to transport or creep up the air link line and contaminate the pulse jet vent system, and possibly cause long term restriction of the air link line. Additionally, if simulant creep occurred, establish operating parameters for washing down the line. The amount of the addition of flush fluids and mixer downtime must be quantified.

NTIS

Radioactive Wastes; Transportation; Vents

20080039544 Michigan Dept. of Community Health, Lansing, MI, USA

Health Consultation: St. Louis Residential Mercury Spill, St. Louis, Gratiot County, Michigan

May 06, 2004; 10 pp.; In English

Report No.(s): PB2008-103265; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The purpose of this mercury investigation was to ensure proper cleanup of a residential home. A family from St. Louis, Michigan reported they broke a fever thermometer in their home. The tenants of the home followed Michigan Department of Community Health (MDCH) recommendations to clean up the spill. MDCH conducted a site visit after the initial cleanup activities and measured mercury vapor concentrations in the home.

NTIS

Hazards; Health; Indoor Air Pollution; Mercury (Metal); Michigan; Spilling

20080039545 Michigan Dept. of Commerce, Lansing, MI, USA

Health Consultation: Ontonagon High School Mercury Release, Ontonagon, Michigan. EPA Facility ID: MIN000510157

Apr. 03, 2007; 12 pp.; In English

Report No.(s): PB2008-103266; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The Michigan Department of Community Health (MDCH) received a call on September 28, 2006, from the Michigan Department of Environmental Quality (MDEQ) Upper Peninsula District office regarding a mercury spill in a high school woodshop. Over the next several days, MDCH advised the school principal and the school district superintendent regarding mercury containment, communication to interested parties, remediation, and biologic testing. The school engaged the services of an environmental contracting firm who remediated the spill area and performed clearance testing after ventilation and stabilization. Upon receipt of the data, MDCH noted that the air temperature at the time of the clearance testing was lower than necessary for accurate reading. The contractor was called back to the school, and with the assistance of contractors for the U.S. Environmental Protection Agency (EPA), found remaining hot spots of mercury and an additional area in the wood shop storage room that needed remediation. The contractor performed the additional cleanup and removal actions with EPA oversight, and the areas were cleared for reuse. MDCH considers this site a Past Health Hazard because of the mercury from historic spills discovered in the storage room.

NTIS

Hazards; Health; Indoor Air Pollution; Mercury (Metal); Schools; Spilling

20080039546 Agency for Toxic Substances and Disease Registry, Atlanta, GA USA

Health Consultation: Rubbertown Industrial Area, Jefferson County, Kentucky

Aug. 03, 2006; 80 pp.; In English

Report No.(s): PB2008-103273; No Copyright; Avail.: National Technical Information Service (NTIS)

Rubbertown is a highly industrialized area in West Louisville, Kentucky, where several large chemical and materials manufacturing facilities operate. Local residents are concerned about their exposure to ambient (outdoor) air in the West Louisville area. In this health consultation, the Agency for Toxic Substances and Disease Registry (ATSDR) addresses the question of whether exposure to the levels of ambient air chemicals detected in and around West Louisville could result in harmful health effects. During 2000 and 2001, ambient air samples were collected from 12 monitoring locations in West Louisville and analyzed for a variety of chemicals. Several of the chemicals detected in West Louisville air exhibited significant spatial variations, with their highest concentrations consistently measured at monitoring locations nearest to and in the Rubbertown industrial area. This pattern indicates that West Louisville residents are exposed to chemicals in the ambient air emitted from numerous Rubbertown industrial area sources.

NTIS

Air Pollution; Health; Industrial Areas; Kentucky

20080039547 Agency for Toxic Substances and Disease Registry, Atlanta, GA USA

Health Consultation: Pennzoil-Quaker State Refinery (a/k/a Atlas Processing Company), Shreveport, Caddo Parish, Louisiana. EPA Facility ID: LAD008052334

Jun. 01, 2004; 56 pp.; In English

Report No.(s): PB2008-103277; No Copyright; Avail.: National Technical Information Service (NTIS)

In October 2000, a community member petitioned the Agency for Toxic Substances and Disease Registry (ATSDR) to evaluate the potential public health impacts of the Pennzoil-Quaker State Refinery (PQS) in Shreveport, Louisiana. The petitioner requested ATSDR involvement at the site, mainly because of an explosion that occurred at the refinery in January 2000. However, verbal communication with the petitioner, other community members, and the community group named Residents for Air Neutralization (RAN) clarified that ongoing air releases are also a concern. In July 2001, ATSDR visited the site to collect the concerns of community residents and to gather available environmental data. ATSDR released this health consultation for public comment on August 19, 2003. This final version addresses all public comments received by ATSDR (see Appendix F) and updates the air monitoring data with current information.

NTIS

Air Pollution; Health

20080039548 Louisiana Dept. of Health and Hospitals, Baton Rouge, LA, USA

Health Consultation: South Scotlandville Air Contaminants 1999-2004, Baton Rouge, Louisiana

Jun. 20, 2005; 43 pp.; In English

Report No.(s): PB2008-103281; No Copyright; Avail.: National Technical Information Service (NTIS)

From 1999-2004, the South Scotlandville air monitor in East Baton Rouge Parish, Louisiana, detected 60 ambient air contaminants. In October 2004, the Louisiana Department of Environmental Quality (LDEQ) asked the Louisiana Department of Health and Hospitals/Office of Public Health/Section of Environmental Epidemiology and Toxicology (LDHH/OPH/SEET) to review 1,3-butadiene exceedences measured by the air monitor during this time period. SEET found no public health hazard involved with inhalation of these concentrations of 1,3-butadiene. LDEQ then requested that SEET review the 59 other air contaminants detected by the South Scotlandville air monitor during this time period. SEET, through a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), examined concentrations detected for these contaminants to determine whether they posed a threat to human health and to decide what further public health actions, if any, may be needed.

NTIS

Air Pollution; Health

20080039577 Louisiana Dept. of Health and Hospitals, Baton Rouge, LA, USA

Health Consultation: South Scotlandville 1,3-Butadiene Evaluation (a/k/a Rhodia, Inc. Unit 6), Baton Rouge, Louisiana

Mar. 21, 2005; 16 pp.; In English

Report No.(s): PB2008-103282; No Copyright; Avail.: National Technical Information Service (NTIS)

On October 18, 2004, the Louisiana Department of Environmental Quality (LDEQ) issued a press release stating that air

monitors at their South Scotlandville and Port Allen sites in Baton Rouge, LA, had recorded levels of 1,3-butadiene exceeding the Louisiana toxic air pollutant ambient air standard for this compound. Louisiana's ambient air standard for 1,3-butadiene is 0.42 parts per billion by volume (ppbv). The 2004 data for the South Scotlandville site yielded a mean annual average of 0.80 ppbv. The LDEQ is reviewing the permitted limits and any non-routine releases from area industries which may be responsible for these elevated levels.

NTIS

Air Pollution; Butadiene; Health

20080039581 Finnegan, Henderson, Farabow, Garrett, Dunner, LLP, Washington, DC, USA

Exhaust Purification with On-Board Ammonia Production

Robel, W. J., Inventor; Driscoll, J. J., Inventor; Coleman, G. N., Inventor; Knox, K. J., Inventor; 8 Nov 04; 11 pp.; In English
Contract(s)/Grant(s): DE-FC05-97OR22605

Patent Info.: Filed 8 Nov 04; US-Patent-Appl-SN-10-982 921

Report No.(s): PB2008-103496; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A power source is provided for use with selective catalytic reduction systems for exhaust-gas purification. The power source includes a first cylinder group with a first air-intake passage and a first exhaust passage, and a second cylinder group with a second air-intake passage and a second exhaust passage. The second air-intake passage is fluidly isolated from the first air-intake passage. A fuel-supply device may be configured to supply fuel into the first exhaust passage, and a catalyst may be disposed downstream of the fuel-supply device to convert at least a portion of the exhaust stream in the first exhaust passage into ammonia.

NTIS

Air Pollution; Ammonia; Exhaust Gases; Patent Applications; Purification

46

GEOFYSICS

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*.

20080039207 California Univ., San Diego, La Jolla, CA USA

Transition Zone Wave Propagation: Characterizing Travel-Time and Amplitude Information

Shearer, Peter; Lawrence, Jesse; Jan 18, 2008; 27 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8718-06-C-0005; Proj-1010

Report No.(s): AD-A482321; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482321>

We characterize transition-zone seismic wave propagation by mapping and calibrating the travel-time and amplitude behavior of P waves traveling through the transition zone at epicentral distances from 13 to 30 degrees and modeling the triplications resulting from the 410- and 660-km discontinuities. We have built an online database of waveforms from the IRIS FARM archive from 1990 to 2005 and process the data in order to compute source and station amplitude terms to correct for different magnitude sources and near-receiver site effects as well as errors in the instrument response functions. We use records from the full teleseismic P distance interval to estimate source-time-function envelopes and deconvolve them from the traces, discarding data from sources that last longer than 60 s and signals with low signal-to-noise ratios. The deconvolved traces are stacked into bins according to distance, providing an initial distance (or Earth-structure) wavefield term. Through several iterations we converge upon solutions for the event, station, and structure wavefield terms. This deconvolution technique is necessary to combine data from many different sources. We then compute both global and regional Earth-structure terms to obtain the average time-versus-distance amplitude of the wavefield, focusing on the 13 to 30 degree interval that is most sensitive to transition-zone structure. We model our data stacks using WKBJ synthetic seismograms and a niching genetic algorithm to explore the model space of different transition-zone velocity structures. We compare these results with long-wavelength models of 410- and 660-km discontinuity topography obtained from SS precursors and more detailed images beneath individual seismic stations derived from receiver functions.

DTIC

Amplitudes; Wave Propagation

20080039217 California Univ., San Diego, La Jolla, CA USA

Spectral Studies of Shallow Earthquakes and Explosions: Implications for P/S Energy Partitioning, Stress Drop, and Discrimination

Shearer, Peter; Allmann, Bettina; Jan 16, 2008; 35 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8718-06-C-0004; Proj-1010

Report No.(s): AD-A482401; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482401>

We compute and analyze P-wave spectra from 18,101 earthquakes and 1770 explosions recorded by 196 broadband seismic stations in southern California at epicentral distances up to 100 km. We use an online waveform database stored on a RAID system at Caltech, which provides complete access to the Southern California Seismic Network (SCSN) seismogram archive. We compute spectra using 1.28s noise and signal windows, positioned immediately before and after the P arrivals. After applying a signal-to-noise cutoff, we process the spectra using an iterative robust least-squares method to isolate source, receiver, and propagation path contributions. This corrects for first-order attenuation structure, as well as near-receiver site effects and any errors in the instrument response functions. Using the earthquake spectra and a simple source model, we compute an empirical Green's function to remove the tradeoff between the source terms and other terms in our model. Our observed earthquake spectra are fit reasonably well with a constant stress drop model over a wide range of moment. However, the explosion spectra show significant differences from the earthquake spectra and have generally steeper falloffs at high frequencies. We also compare P and S-wave amplitudes and find modestly smaller average S amplitudes for the explosions compared to the earthquakes. The best earthquake/explosion discriminant is the RMS misfit to an omega-2 source model, which works for ~90% of the events.

DTIC

Depth; Earthquakes; Explosions; Spectra

20080039365 Texas Univ. at Dallas, Richardson, TX USA

Ionospheric Monitoring and Specification Utilizing Data From the Defense Meteorological Satellite Program

Heelis, R A; Coley, W R; Power, R A; Oct 23, 2007; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8718-06-C-0070; Proj-1010

Report No.(s): AD-A482547; 632019; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Following the November 2006 launch of the DMSP F17 spacecraft, work was begun at the UTD on the development of ground software for the routine production of geophysical data records from the F17 SSIES-3 instrument package data that is provided to UTD by the scientists at the Air Force Research Laboratory (AFRL). The SSIES-3 sensors include the Retarding Potential Analyzer (RPA), the Drift Meter (DM), the Scintillation Meter (SM), the Electron Sensor (ES), and the Plasma Plate (PP). The first task performed during this contract period was the identification and remediation of single-event upsets occurring in the South Atlantic anomaly region. The primary accomplishment this year was the development of an integrated software package to routinely convert the raw data to time-tagged geophysical parameters. A basic production level software package has been created that processes the RPA, DM, SM, and ES sensor data. The PP algorithms are not yet reliably functioning. While the RPA algorithm is functioning well, it is expected, based on past experience, that as larger volumes of data are processed, further refinement will be required.

DTIC

Detectors; DMSP Satellites; Electrons; Ionospheres; Ions; Meteorological Satellites; Scintillation; Spectra

20080039369 Massachusetts Univ., Lowell, MA USA

Equator and High-Latitude Ionosphere-to-Magnetosphere Research

Reinisch, B W; Sales, G S; Paznukhov, V; Galkin, I A; Altadill, D F; Khmyrov, G; Oct 30, 2007; 72 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8718-06-C-0072; Proj-4827

Report No.(s): AD-A482580; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research contributes in critical areas toward the goals of (1) ionospheric effects on DoD systems research and (2) ionospheric research technology. Based on the proposal submitted to the Air Force, this year's efforts, as described in this report, involve support to the ionospheric specification objectives of the Air Force Research Laboratory (AFRL). The University of Massachusetts Lowell Center for Atmospheric Research (UMLCAR) has taken an approach that addresses the specification of ionospheric parameters on a global scale; a goal that is particularly facilitated using the digisonde system pioneered by UMLCAR. Global ionospheric modeling is a major part of space weather forecasting and global communications progress, and our support for these goals is presented here. Use of the ubiquitous digisonde offers the best tool for real time

ionospheric assimilative modeling as well as support to other systems that require verification and validation. A significant part of our research effort was providing the necessary validation of other methods of ionospheric specification by using the digisonde measurements as the 'truth' against which the performance of other systems was compared. These include cooperation with groups making ionospheric radio occultation and tomography, and UV measurements (Sections 2, 4, and 10). The Center is also evaluating the digisonde drift measurements against incoherent scatter radar plasma drift measurements (Section 6). The second major research concentration in this report involves the development of techniques that expand global ionospheric specification (Sections 3, 5, and 8). These cover the areas of digisonde profile uncertainty, improved ionogram virtual height measurements, and using digisondes to carry out routine measurements of the absorption of HF radio waves with the aim of predicting system outages with improved sensitivity.

DTIC

Equatorial Regions; Equators; Ionospheres; Ionospheric Drift; Magnetospheres; Polar Regions

20080039430 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Long-term Average Spectral and Spatial Distributions of Plasmaspheric Hiss Observed by the Akebono and IMAGE Satellites

Fung, Shing, et al.; [2007]; 2 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

The radiation belt slot region is known to result from losses of energetic electrons by enhanced pitch-angle scattering by whistler mode waves associated with plasmaspheric hiss emission. The distributions of whistler mode waves in the slot L range are therefore important for understanding the electron radiation belt. The sources and distributions of the waves are, however, still controversial. In the present study, using the Akebono/MCA data [1989-2005] and the IMAGE/RPI data [2000-2005], we have constructed the average plasmaspheric hiss spectral distributions over a broad frequency range. In addition, we have investigated the spatial distributions of plasmaspheric hiss with the wave map technique [Green et al.(2005)]. Our study shows that the broadband plasmaspheric hiss are distributed in the frequency range of 100Hz to several kHz, and exhibit a broad intensive peak. The frequency of the intensity peak tends to increase with magnetic latitude. The frequencies of the most intense waves in the nominal slot L range ($2 < L < 3$) during quiet times ($Dst > -50nT$) are found to be between 300Hz and 600Hz on average. During high storm activity ($Dst < -150nT$), however, the peak frequencies become slightly lower. The intensity of plasmaspheric hiss clearly depends on substorm activity as measured by the AE index, consistent with Meredith et al.(2004). The hiss wave intensity maps also show a strong local time asymmetry. The large amplitude waves are observed at 6:00-19:00 MLT. From our extensive analysis, we have also found an L dependence of hiss activity, with the larger amplitude waves being observed at lower L during substorm active conditions. The same tendency can be found for solar activity. The average intensities of the waves during 1989-1991 and 2000-2001 are a few dB larger than those during 1992-1997 and 2005. The most intense waves are observed at lower L during high solar activity. The statistical study on spectrum features of the plasmaspheric hiss together with the spatial distribution show clear dependences of storm, substorm and solar activities.

Author

Radiation Belts; Plasmasphere; Hiss; Spatial Distribution; Angular Distribution; Electron Radiation; Frequency Ranges

20080039434 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Magnetic Field Observations of Partial Ring Current during Storm Recovery Phase

Le, Guan; Russell, C. T.; Slavin, J. A.; Lucek, E. A.; July 30, 2007; 2 pp.; In English; ASIA Oceanic Geoscience Society (AOGS) 2007 4th Annual Meeting, 30 Jul - 5 Aug. 2007, Bangkok, Thailand; Copyright; Avail.: Other Sources; Abstract Only

We present results of an extensive survey of the magnetic field observations in the inner magnetosphere using 30 years of magnetospheric magnetic field data from Polar, Cluster, ISEE, and AMPTE/CCE missions. The purpose of this study is to understand the magnetic field evolution during the recovery phase of geomagnetic storms, and its implication to the ring current recovery and loss mechanisms of ring current particles. Our previous work on global ring current distribution [Le et al., 2004] has shown that a significant partial ring current is always present at all Dst levels (regardless of storm phases) even for quiet time ring current. The total current carried by the partial ring current is much stronger than (during stormtime) or at least comparable to (during quiet time) the symmetric ring current. It is now commonly believed that a strong partial ring current is formed during the storm main phase due to the enhanced earthward convection of energetic ions from nightside plasma sheet. But the presence of a strong partial ring current throughout the recovery phase remains controversial. The magnetic field generated by the ring current inflates the inner magnetosphere and causes magnetic field depressions in the equatorial magnetosphere. During the storm recovery phase, we find that the distribution of the equatorial magnetic field depression exhibits similar local time dependence as the ring current distribution obtained from the combined dataset in the

earlier study. It shows that a strong partial ring current is a permanent feature throughout the recovery phase. In the early recovery phase, the partial ring current peaks near the dusk terminator as indicated by the peak of the magnetic field depression. As the recovery phase progresses, the partial ring current decays most quickly near the dusk and results in a dusk-to-midnight moving of the peak of the partial ring current. Thus the loss mechanisms work most effectively near the dusk. The magnetic field depression increases the gyroradius of ring current protons to a scale greater or comparable to the thickness of the magnetopause, which increases the chance of ion drift loss near the dusk magnetopause at larger L-shell ($L > 5$). But the drift loss mechanism alone cannot explain the loss of ring current ions especially in the smaller L-shell ($L < 5$). The precipitation loss due to wave-particle interaction is most likely the dominant loss mechanism in the small L-shell as it works most effectively at the same local time.

Author

Magnetic Fields; Magnetic Storms; Current Distribution; Wave-Particle Interactions; Magnetopause; Ring Currents; Convection; Inner Radiation Belt

20080039628 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Stellar Ablation of Planetary Atmospheres

Moore, Thomas E.; Horwitz, J. L.; *Reviews of Geophysics*; August 09, 2007; ISSN 8755-1209; Volume 45; 34 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNG05GF67G; UPN 370-08-43; UPN 370-28-20; UPN 432-01-34; NSF ATM-0505918

Report No.(s): Paper number 2005RG000194; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1029/2005RG000194>

We review observations and theories of the solar ablation of planetary atmospheres, focusing on the terrestrial case where a large magnetosphere holds off the solar wind, so that there is little direct atmospheric impact, but also couples the solar wind electromagnetically to the auroral zones. We consider the photothermal escape flows known as the polar wind or refilling flows, the enhanced mass flux escape flows that result from localized solar wind energy dissipation in the auroral zones, and the resultant enhanced neutral atom escape flows. We term these latter two escape flows the 'auroral wind.' We review observations and theories of the heating and acceleration of auroral winds, including energy inputs from precipitating particles, electromagnetic energy flux at magnetohydrodynamic and plasma wave frequencies, and acceleration by parallel electric fields and by convection pickup processes also known as 'centrifugal acceleration.' We consider also the global circulation of ionospheric plasmas within the magnetosphere, their participation in magnetospheric disturbances as absorbers of momentum and energy, and their ultimate loss from the magnetosphere into the downstream solar wind, loading reconnection processes that occur at high altitudes near the magnetospheric boundaries. We consider the role of planetary magnetization and the accumulating evidence of stellar ablation of extrasolar planetary atmospheres. Finally, we suggest and discuss future needs for both the theory and observation of the planetary ionospheres and their role in solar wind interactions, to achieve the generality required for a predictive science of the coupling of stellar and planetary atmospheres over the full range of possible conditions.

Author

Planetary Atmospheres; Ablation; Solar Wind; Stellar Atmospheres; Magnetospheric Instability; Auroral Zones; Energy Dissipation; Magnetohydrodynamic Waves

20080039648 Brown Univ., Providence, RI, USA

Quantitative Morphologic Analysis of Boulder Shape and Surface Texture to Infer Environmental History: A Case Study of Rock Breakdown at the Ephrata Fan, Channeled Scabland, Washington

Ehlmann, Bethany L.; Viles, Heather A.; Bourke, Mary C.; *Journal of Geophysical Research*; May 6, 2008; ISSN 0148-0227; Volume 113; 20 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNG05GJ91G; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1029/2007JF000872>

Boulder morphology reflects both lithology and climate and is dictated by the combined effects of erosion, transport, and weathering. At present, morphologic information at the boulder scale is underutilized as a recorder of environmental processes, partly because of the lack of a systematic quantitative parameter set for reporting and comparing data sets. We develop such a parameter set, incorporating a range of measures of boulder form and surface texture. We use standard shape metrics measured in the field and fractal and morphometric classification methods borrowed from landscape analysis and applied to laser-scanned molds. The parameter set was pilot tested on three populations of basalt boulders with distinct breakdown histories in the Channeled Scabland, Washington: (1) basalt outcrop talus; (2) flood-transported boulders recently excavated from a quarry; and (3) flood-transported boulders, extensively weathered in situ on the Ephrata Fan surface. Size and shape data were found to distinguish between flood-transported and untransported boulders. Size and edge angles (approximately

120 degrees) of flood-transported boulders suggest removal by preferential fracturing along preexisting columnar joints, and curvature data indicate rounding relative to outcrop boulders. Surface textural data show that boulders which have been exposed at the surface are significantly rougher than those buried by fan sediments. Past signatures diagnostic of flood transport still persist on surface boulders, despite ongoing overprinting by processes in the present breakdown environment through roughening and fracturing in situ. Further use of this quantitative boulder parameter set at other terrestrial and planetary sites will aid in cataloging and understanding morphologic signatures of environmental processes.

Author

Fracturing; Geomorphology; Lithology; Quantitative Analysis; Rocks; Shapes; Petrology; Rock Mechanics

20080039654 Planetary Science Inst., Tucson, AZ, USA

Innovative Applications of Laser Scanning and Rapid Prototype Printing to Rock Breakdown Experiments

Bourke, Mary; Viles, Heather; Nicoll, Joe; Lyew-Ayee, Parris; Ghent, Rebecca; Holmlund, James; *Earth Surface Processes and Landforms*; September 2008; Volume 33, Issue 10, pp. 1614-1621; In English

Contract(s)/Grant(s): NNG05GJ91G

Report No.(s): PSI Contrib-419; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1002/esp.1631>

We present the novel application of two technologies for use in rock breakdown experiments, i.e. close-range, ground-based 3D triangulation scanning and rapid prototype printing. These techniques aid analyses of form-process interactions across the range of scales relevant to breakdown (micron-m). This is achieved through (a) the creation of DEMs (which permit quantitative description and analysis of rock surface morphology and morphological change) and (b) the production of more realistically-shaped experimental blocks. We illustrate the use of these techniques, alongside appropriate data analysis routines, in experiments designed to investigate the persistence of fluvially-derived features in the face of subsequent wind abrasion and weathering. These techniques have a range of potential applications in experimental field and lab-based geomorphic studies beyond those specifically outlined here.

Author

Geomorphology; Quantitative Analysis; Rocks; Weathering; Lithology; Petrology; Rock Mechanics; Erosion

20080039910 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Self-consistent Non-LTE Model of Infrared Molecular Emissions and Oxygen Dayglows in the Mesosphere and Lower Thermosphere

Feofilov, Artem G.; Yankovsky, Valentine A.; Pesnell, William D.; Kutepov, Alexander A.; Goldberg, Richard A.; Mauilova, Rada O.; December 09, 2007; 1 pp.; In English; 2007 Fall AGU meeting, 9-15 Dec. 2007, San Francisco, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

We present the new version of the ALI-ARMS (for Accelerated Lambda Iterations for Atmospheric Radiation and Molecular Spectra) model. The model allows simultaneous self-consistent calculating the non-LTE populations of the electronic-vibrational levels of the O3 and O2 photolysis products and vibrational level populations of CO2, N2, O2, O3, H2O, CO and other molecules with detailed accounting for the variety of the electronic-vibrational, vibrational-vibrational and vibrational-translational energy exchange processes. The model was used as the reference one for modeling the O2 dayglows and infrared molecular emissions for self-consistent diagnostics of the multi-channel space observations of MLT in the SABER experiment. It also allows reevaluating the thermalization efficiency of the absorbed solar ultraviolet energy and infrared radiative cooling/heating of MLT by detailed accounting of the electronic-vibrational relaxation of excited photolysis products via the complex chain of collisional energy conversion processes down to the vibrational energy of optically active trace gas molecules.

Author

Atmospheric Composition; Infrared Radiation; Models; Mesosphere; Oxygen; Ozone; Thermosphere; Vibration; Satellite Observation

20080040147 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Saharan Air and Atlantic Tropical Cyclone Suppression From a Global Modeling Perspective

Reale, O.; Lau, W. K. M.; daSilva, A.; Kim, K.-M.; [2007]; ISSN 0094-8276; 14 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

During summer 2006, the NASA African Monsoon Multidisciplinary Analysis (NAMMA) organized a field campaign in Africa called Special Observation Period (SOP-3), in which scientists in the field were involved in a number of surface

network and aircraft measurements. One of the scientific goals of the campaign was to understand the nature and causes for tropical cyclogenesis originating out of African Easterly Waves (AEWs, westward propagating atmospheric disturbances sometimes associated with precursors of hurricanes), and the role that the Saharan Air Layer (SAL, a hot and dry air layer advecting large amounts of dust) can play in the formation or suppression of tropical cyclones. During the NAMMA campaign a high-resolution global model, the NASA GEOS-5, was operationally run by the NASA Global Modeling and Assimilation Office (GMAO) in support to the mission. The daily GEOS-5 forecasts were found to be very useful by decision-making scientists in the field as an aid to discriminate between developing and non-developing AEWs and plan the flight tracks. In the post-event analyses which were performed mostly by the Goddard Laboratory for Atmospheres, two events were highlighted: a non-developing AEW which appeared to have been suppressed by Saharan air, compared to a developing AEW which was the precursor of hurricane Helene. Both events were successfully predicted by the GEOS-5 during the real-time forecasts provided in support to the mission. In this work it is found that very steep moisture gradients and a strong thermal dipole, with relatively warm air in the mid-troposphere and cool air below, are associated with SAL in both the GEOS-5 forecasts and the NCEP analyses, even at -great distance- from the Sahara. The presence of these unusual thermodynamic features over the Atlantic Ocean, at several thousands of kilometers from the African coastline, is suggestive that SAL mixing is very minimal and that the model's capability of retaining the different properties of air masses during transport are important to represent effectively the role of dry air intrusions in the tropical circulation.

Author

Cyclones; Monsoons; Air Masses; Ocean Surface; High Temperature Air; Tropical Storms; Moisture; Dust; Thermodynamics

20080040148 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Relationship of Loss, Mean Age of Air and the Distribution of CFCs to Stratospheric Circulation and Implications for Atmospheric Lifetimes

Douglass, A. R.; Stolarski, R. S.; Schoeberl, M. R.; Jackman, C. H.; Gupta, M. L.; Newman, P. A.; Nielsen, J. E.; Fleming, E. L.; [2007]; 45 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Man-made molecules called chlorofluorocarbons (CFCs) are broken apart in the stratosphere by high energy light, and the reactive chlorine gases that come from them cause the ozone hole. Since the ozone layer stops high energy light from reaching low altitudes, CFCs must be transported to high altitudes to be broken apart. The number of molecules per volume (the density) is much smaller at high altitudes than near the surface, and CFC molecules have a very small chance of reaching that altitude in any particular year. Many tons of CFCs were put into the atmosphere during the end of the last century, and it will take many years for all of them to be destroyed. Each CFC has an atmospheric lifetime that depends on the amount of energy required to break them apart. Two of the gases that were made the most are CFC13 and CF2C12. It takes more energy to break apart CF2C12 than CFC13, and its lifetime is about 100 years, nearly twice as long as the lifetime for CFC13. It is hard to figure out the lifetimes from surface measurements because we don't know exactly how much was released into the air each year. Atmospheric models are used to predict what will happen to ozone and other gases as the CFCs decrease and other gases like CO₂ continue to increase during the next century. CFC lifetimes are used to predict future concentrations and all assessment models use the predicted future concentrations. The models have different circulations and the amount of CFC lost according to the model may not match the loss that is expected according to the lifetime. In models the amount destroyed per year depends on how fast the model pushes air into the stratosphere and how much goes to high altitudes each year. This paper looks at the way the model circulation changes the lifetimes, and looks at measurements that tell us which model is more realistic. Some models do a good job reproducing the age-of-air, which tells us that these models are circulating the stratospheric air at the right speed. These same models also do a good job reproducing the amount of CFCs in the lower atmosphere where they were measured by instruments on NASA's ER-2, a research plane that flies in the lower stratosphere. The lifetime for CFC13 that is calculated using the models that do the best job matching the data is about 25% longer than most people thought. This paper shows that using these measurements to decide which models are more realistic helps us understand why their predictions are different from each other and also to decide which predictions are more likely.

Author

Atmospheric Chemistry; Chlorofluorocarbons; Ozone Depletion; Atmospheric Models; Chlorine; Lower Atmosphere; Stratosphere

20080040170 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Space Technology 5 Multi-point Measurements of Near-Earth Magnetic Fields: Initial Results

Slavin, James A.; Le, G.; Strangeway, R. L.; Wang, Y.; Boardsen, S.A.; Moldwin, M. B.; Spence, H. E.; [2007]; 18 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Space Technology 5 (ST-5) mission successfully placed three micro-satellites in a 300 x 4500 km dawn-dusk orbit

on 22 March 2006. Each spacecraft carried a boom-mounted vector fluxgate magnetometer that returned highly sensitive and accurate measurements of the geomagnetic field. These data allow, for the first time, the separation of temporal and spatial variations in field-aligned current (FAC) perturbations measured in low-Earth orbit on time scales of approximately 10 sec to 10 min. The constellation measurements are used to directly determine field-aligned current sheet motion, thickness and current density. In doing so, we demonstrate two multi-point methods for the inference of FAC current density that have not previously been possible in low-Earth orbit; 1) the 'standard method,' based upon s/c velocity, but corrected for FAC current sheet motion, and 2) the 'gradiometer method' which uses simultaneous magnetic field measurements at two points with known separation. Future studies will apply these methods to the entire ST-5 data set and expand to include geomagnetic field gradient analyses as well as field-aligned and ionospheric currents.

Author

Field Aligned Currents; Geomagnetism; Low Earth Orbits; Magnetic Effects; Earth Magnetosphere; Field Strength

20080040780 NASA Goddard Space Flight Center, Greenbelt, MD, USA

HIRDLS Observations and Simulation of a Lower Stratospheric Intrusion of Tropical Air to High Latitudes

Olsen, Mark A.; Douglass, Anne R.; Newman, Paul A.; Gille, John C.; Nardi, Bruno; Yudin, Valery A.; Kinnison, Douglas E.; Khosravi, Rashid; [2008]; 16 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI:

A03, Hardcopy

On 26 January 2006, the High Resolution Dynamic Limb Sounder (HIRDLS) observed low mixing ratios of ozone and nitric acid in an approximately 2 km vertical layer near 100 hPa extending from the subtropics to 55 degrees N over North America. The subsequent evolution of the layer is simulated with the Global Modeling Initiative (GMI) model and substantiated with HIRDLS observations. Air with low mixing ratios of ozone is transported poleward to 80 degrees N. Although there is evidence of mixing with extratropical air and diabatic descent, much of the tropical intrusion returns to the subtropics. This study demonstrates that HIRDLS and the GMI model are capable of resolving thin intrusion events. The observations combined with simulation are a first step towards development of a quantitative understanding of the lower stratospheric ozone budget.

Author

Atmospheric Composition; Mixing Ratios; Ozone; Polar Regions; Stratosphere; Tropical Regions

47

METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20080039212 National Center for Atmospheric Research, Boulder, CO USA

Impacts of Ocean Waves on the Atmospheric Surface Layer: Simulations and Observations

Sullivan, Peter P; McWilliams, James C; Melville, W K; Jun 6, 2008; 79 pp.; In English; Original contains color illustrations Contract(s)/Grant(s): N00014-06-M-0051; N00014-00-C-0180

Report No.(s): AD-A482362; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482362>

This award investigated surface boundary layers and air-sea interaction with theoretical and numerical research. Our long term scientific objective was to explore the nature of intermittence, coherent structures, and turbulent fluxes and their coupling in the surface layers of the marine atmospheric and oceanic planetary boundary layers (PBL). Efforts were focused on the effects of surface gravity waves on the near-surface dynamics, surface fluxes, and coupling between the atmospheric and oceanic PBLs. The final results of this work are provided in 2 journal articles and a reviewed meeting paper.

DTIC

Air Water Interactions; Ocean Surface; Simulation; Stability; Water Waves

20080039274 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Does Aerosol Weaken or Strengthen the South Asian Monsoon?

Lau, William K. M.; July 03, 2007; 1 pp.; In English; 2007 International Union of Geodesy and Geophysics, 3-14 Jul. 2007, Perugia, Italy; No Copyright; Avail.: Other Sources; Abstract Only

Aerosols are known to have the ability to block off solar radiation reaching the earth surface, causing it to cool - the so-called solar dimming (SDM) effect. In the Asian monsoon region, the SDM effect by aerosol can produce differential cooling at the surface reducing the meridional thermal contrast between land and ocean, leading to a weakening of the

monsoon (Ramanathan et al. 2005). On the other hand, absorbing aerosols such as black carbon and dust, when forced up against the steep slopes of the southern Tibetan Plateau can produce upper tropospheric heating, and induce convection-dynamic feedback leading to an advance of the rainy season over northern India and an enhancement of the South Asian monsoon through the 'Elevated Heat Pump' (EHP) effect (Lau et al. 2006). In this paper, we present modeling results showing that in a coupled ocean-atmosphere-land system in which concentrations of greenhouse gases are kept constant, the response of the South Asian monsoon to dust and black carbon forcing is the net result of the two opposing effects of SDM and EHP. For the South Asian monsoon, if the increasing upper tropospheric thermal contrast between the Tibetan Plateau and region to the south spurred by the EHP overwhelms the reduction in surface temperature contrast due to SDM, the monsoon strengthens. Otherwise, the monsoon weakens. Preliminary observations are consistent with the above findings. We find that the two effects are strongly scale dependent. On interannual and shorter time scales, the EHP effect appears to dominate in the early summer season (May-June). On decadal or longer time scales, the SDM dominates for the mature monsoon (July-August). Better understanding the physical mechanisms underlying the SDM and the EHP effects, the local emission and transport of aerosols from surrounding deserts and arid-regions, and their interaction with monsoon water cycle dynamics are important in providing better prediction and assessment of climate change impacts on precipitation of the Asian monsoon land regions.

Author

Aerosols; Air Water Interactions; Climate Change; Convection; Gas Composition; Periodic Variations; Solar Radiation; Temperature Effects; Greenhouse Effect

20080039275 NASA Goddard Space Flight Center, Greenbelt, MD, USA

SMART-COMMIT Observations and Deep-Blue Retrievals of Saharan Dust Properties during NAMMA

Tsay, Si-Chee; Hsu, N. Christina; Ji, Qiang; Jeong, Myeong-Jae; July 02, 2007; 1 pp.; In English; No Copyright; Avail.:

Other Sources; Abstract Only

Monsoon rainfalls sustain the livelihood of more than half of the world's population. The interaction between natural/anthropogenic aerosols, clouds, and precipitation is a critical mechanism that drives the water cycle and fresh water distribution. Analyses of the longterm trend of July-August precipitation anomaly for the last 50 years in the 20' century depict that the largest regional precipitation deficit occurs over the Sahel, where the monsoon water cycle plays an important role. Thus, it is of paramount importance to study how dust aerosols, as well as air pollution and smoke, influence monsoon variability. The NASA African Monsoon Multidisciplinary Activities (NAMMA) was conducted during the international AMMA Special Observation Period (SOP-3) of September 2006 to better comprehend the key attributes of the Saharan Air Layer (SAL) and how they evolve from the source regions to the Atlantic Ocean. The SAL occurs during the late spring through early fall and originates as a result of low-level convergence induced by heat lows over the Sahara that lifts hot, dry, dust laden air aloft into a well mixed layer that extends up to 500mb. This is crucial for understanding the impact of SAL on the key atmospheric processes that determine precipitation over West Africa and tropical cyclogenesis. Results obtained from the synergy of satellite (Deep- Blue) and surface (SMART-COMMIT) observations will be presented and discussed how the physical, optical and radiative properties of the dust in the SAL evolve from the continental to the marine environment.

Author

Aerosols; Dust; Monsoons; Wind (Meteorology); Fresh Water; Cyclogenesis

20080039321 NASA Goddard Space Flight Center, Greenbelt, MD, USA

3D Radiative Aspects of the Increased Aerosol Optical Depth Near Clouds

Marshak, Alexander; Wen, Guoyong; Remer, Lorraine; Cahalan, Robert; Coakley, Jim; June 07, 2007; 1 pp.; In English; 2007 International Union of Geodesy and Geophysics, 2-13 Jul. 2007, Perugia, Italy; Copyright; Avail.: Other Sources; Abstract

Only

To characterize aerosol-cloud interactions it is important to correctly retrieve aerosol optical depth in the vicinity of clouds. It is well reported in the literature that aerosol optical depth increases with cloud cover. Part of the increase comes from real physics as humidification; another part, however, comes from 3D cloud effects in the remote sensing retrievals. In many cases it is hard to say whether the retrieved increased values of aerosol optical depth are remote sensing artifacts or real. In the presentation, we will discuss how the 3D cloud affects can be mitigated. We will demonstrate a simple model that can assess the enhanced illumination of cloud-free columns in the vicinity of clouds. This model is based on the assumption that the enhancement in the cloud-free column radiance comes from the enhanced Rayleigh scattering due to presence of surrounding clouds. A stochastic cloud model of broken cloudiness is used to simulate the upward flux.

Author

Atmospheric Models; Aerosols; Cloud Cover; Optical Thickness; Radiance

20080039322 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Cloud Vertical and Horizontal Structure from ICESat/GLAS and MODIS

Marshak, Alexander; Chiu, Christine; Davis, Anthony; Wiscombe, Warren; July 02, 2007; 1 pp.; In English; 2007 International Union of Geodesy and Geophysics, 2-13 Jul. 2007, Perugia, Italy; Copyright; Avail.: Other Sources; Abstract Only

To accurately model radiative fluxes at the surface and within the atmosphere, we need to know both vertical and horizontal structures of cloudiness. While MODIS provides accurate information on cloud horizontal structure, it has limited ability to estimate cloud vertical structure. ICESat/GLAS on the other hand, provides the vertical distribution and internal structure of clouds as deep as the laser beam can penetrate and return a signal. Having different orbits, MODIS and GLAS provide few collocated measurements; hence a statistical approach is needed to learn about 3D cloud structures from the two instruments. In the presentation, we show the results of the statistical analysis of vertical and horizontal structure of cloudiness using GLAS and MODIS cloud top(s) data acquired in October-November 2003. We revisit the (H1, C1) plot, previously used for analyzing cloud liquid water data, and illustrate cloud structure for single and multiple-layer clouds.

Author

Cloud Cover; Cloud Physics; Ice, Cloud and Land Elevation Satellite; Vertical Distribution; Statistical Analysis

20080039327 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Application of Multi-Satellite Precipitation Analysis to Floods and Landslides

Adler, Robert; Hong, Yang; Huffman, George; December 1, 2007; 1 pp.; In English; PEHRPP Meeting, 1-9 Dec. 2007, Geneva, Switzerland; No Copyright; Avail.: Other Sources; Abstract Only

Satellite data acquired and processed in real time now have the potential to provide the spacetime information on rainfall needed to monitor flood and landslide events around the world. This can be achieved by integrating the satellite-derived forcing data with hydrological models and landslide algorithms. Progress in using the TRMM Multi-satellite Precipitation Analysis (TMPA) as input to flood and landslide forecasts is outlined, with a focus on understanding limitations of the rainfall data and impacts of those limitations on flood/landslide analyses. Case studies of both successes and failures will be shown, as well as comparison with ground comparison data sets both in terms of rainfall and in terms of flood/landslide events. In addition to potential uses in real-time, the nearly ten years of TMPA data allow retrospective running of the models to examine variations in extreme events. The flood determination algorithm consists of four major components: 1) multi-satellite precipitation estimation; 2) characterization of land surface including digital elevation from NASA SRTM (Shuttle Radar Terrain Mission), topography-derived hydrologic parameters such as flow direction, flow accumulation, basin, and river network etc.; 3) a hydrological model to infiltrate rainfall and route overland runoff; and 4) an implementation interface to relay the input data to the models and display the flood inundation results to potential users and decision-makers. In terms of landslides, the satellite rainfall information is combined with a global landslide susceptibility map, derived from a combination of global surface characteristics (digital elevation topography, slope, soil types, soil texture, and land cover classification etc.) using a weighted linear combination approach. In those areas identified as 'susceptible' (based on the surface characteristics), landslides are forecast where and when a rainfall intensity/duration threshold is exceeded. Results are described indicating general agreement with landslide occurrences. However, difficulties in comparing landslide event information (mostly from news reports) with the satellite-based forecasts are analyzed.

Author

Satellite Observation; Data Acquisition; Classifications; Rain; Landslides; Floods; Drainage; Hydrology Models; Forecasting

20080039328 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Multi-Scale Modeling System with Unified Physics

Tao, Wei-Kuo; December 03, 2008; 1 pp.; In English; 7th International GPM Meeting, 3-8 Dec. 2007, USA; No Copyright; Avail.: Other Sources; Abstract Only

Numerical cloud models, which are based the non-hydrostatic equations of motion, have been extensively applied to cloud-scale and mesoscale processes during the past four decades. Because cloud-scale dynamics are treated explicitly, uncertainties stemming from convection that have to be parameterized in (hydrostatic) large-scale models are obviated, or at least mitigated, in cloud models. Global models will use the non-hydrostatic framework when their horizontal resolution becomes about 10 km, the theoretical limit for the hydrostatic approximation. This juncture will be reached one to two decades from now. In recent years, exponentially increasing computer power has extended cloud-resolving-model integrations from hours to months, the number of computational grid points from less than a thousand to close to ten million. Three-dimensional models are now more prevalent. Much attention is devoted to precipitating cloud systems where the crucial 1-km scales are

resolved in horizontal domains as large as 10,000 km in two-dimensions, and 1,000 x 1,000 km² in three-dimensions. Cloud resolving models now provide statistical information useful for developing more realistic physically based parameterizations for climate models and numerical weather prediction models. It is also expected that NWP and mesoscale model can be run in grid size similar to cloud resolving model through nesting technique.

Author

Clouds (Meteorology); Atmospheric Models; Numerical Weather Forecasting; Three Dimensional Models; Computational Grids; Convection; Climate Models

20080039333 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Quantifying the Global Fresh Water Budget: Capabilities from Current and Future Satellite Sensors

Hildebrand, Peter; Zaitchik, Benjamin; December 10, 2007; 1 pp.; In English; AGU Fall Meeting, 10 - 14 Dec. 2007, California, USA; No Copyright; Avail.: Other Sources; Abstract Only

The global water cycle is complex and its components are difficult to measure, particularly at the global scales and with the precision needed for assessing climate impacts. Recent advances in satellite observational capabilities, however, are greatly improving our knowledge of the key terms in the fresh water flux budget. Many components of the of the global water budget, e.g. precipitation, atmospheric moisture profiles, soil moisture, snow cover, sea ice are now routinely measured globally using instruments on satellites such as TRMM, AQUA, TERRA, GRACE, and ICESat, as well as on operational satellites. New techniques, many using data assimilation approaches, are providing pathways toward measuring snow water equivalent, evapotranspiration, ground water, ice mass, as well as improving the measurement quality for other components of the global water budget. This paper evaluates these current and developing satellite capabilities to observe the global fresh water budget, then looks forward to evaluate the potential for improvements that may result from future space missions as detailed by the US Decadal Survey, and operational plans. Based on these analyses, and on the goal of improved knowledge of the global fresh water budget under the effects of climate change, we suggest some priorities for the future, based on new approaches that may provide the improved measurements and the analyses needed to understand and observe the potential speed-up of the global water cycle under the effects of climate change.

Author

Ice, Cloud and Land Elevation Satellite; Climate Change; Atmospheric Moisture; Soil Moisture; Water Currents; Satellite Observation; Sea Ice; Snow Cover; Ground Water

20080039431 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Atmospheric Parameter Climatologies from AIRS: Monitoring Short-, and Longer-Term Climate Variabilities and 'Trends'

Molnar, Gyula; Susskind, Joel; March 16, 2008; 11 pp.; In English; Proceedings SPIE, Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XIII, 16-20 Mar. 2008, Orlando, FL, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The AIRS instrument is currently the best space-based tool to simultaneously monitor the vertical distribution of key climatically important atmospheric parameters as well as surface properties, and has provided high quality data for more than 5 years. AIRS analysis results produced at the GODDARD/DAAC, based on Versions 4 & 5 of the AIRS retrieval algorithm, are currently available for public use. Here, first we present an assessment of interrelationships of anomalies (proxies of climate variability based on 5 full years, since Sept. 2002) of various climate parameters at different spatial scales. We also present AIRS-retrievals-based global, regional and 1x1 degree grid-scale 'trend'-analyses of important atmospheric parameters for this 5-year period. Note that here 'trend' simply means the linear fit to the anomaly (relative the mean seasonal cycle) time series of various parameters at the above-mentioned spatial scales, and we present these to illustrate the usefulness of continuing AIRS-based climate observations. Preliminary validation efforts, in terms of intercomparisons of interannual variabilities with other available satellite data analysis results, will also be addressed. For example, we show that the outgoing longwave radiation (OLR) interannual spatial variabilities from the available state-of-the-art CERES measurements and from the AIRS computations are in remarkably good agreement. Version 6 of the AIRS retrieval scheme (currently under development) promises to further improve bias agreements for the absolute values by implementing a more accurate radiative transfer model for the OLR computations and by improving surface emissivity retrievals.

Author

Meteorological Parameters; Time Series Analysis; Algorithms; Climate; Climatology; Long Wave Radiation; Emissivity

20080039438 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Remote Sensing of the Radiative and Microphysical Properties of Clouds during TC4: Results from MAS, MASTER, MODIS, and MISR

King, Michael D.; Platnick, Steven; Wind, Galina; Arnold, George T.; Ackerman, Steven A.; Frey, Richard; December 10, 2007; 2 pp.; In English; 2007 Fall American Geophysical Union (AGU) meeting, 10-14 Dec. 2007, San Francisco, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

The MODIS Airborne Simulator (MAS) and MODIS/ASTER Airborne Simulator (MASTER) were used to obtain measurements of the bidirectional reflectance and brightness temperature of clouds at 50 discrete wavelengths between 0.47 and 14.3 (12.9 m for MASTER). These observations were obtained from the NASA ER-2 aircraft as part of the Tropical Composition, Clouds and Climate Coupling Experiment (TC4) conducted over Central America and surrounding Pacific and Atlantic Oceans between July 17 and August 8, 2007. Multispectral images in eight distinct bands were used to derive a confidence in clear sky (or alternatively the probability of cloud) over land and ocean ecosystems. Based on the results of individual tests run as part of this cloud mask, an algorithm was developed to estimate the phase of the clouds (liquid water, ice, or undetermined phase). Finally, the cloud optical thickness and effective radius were derived for both liquid water and ice clouds that were detected during each flight, using a nearly identical algorithm as that implemented operationally to process MODIS cloud data from the Aqua and Terra satellites (Collection 5). This analysis shows that the cloud mask developed for operational use on MODIS, and tested using MAS and MASTER data in TC4, is quite capable of distinguishing both liquid water and ice clouds during daytime conditions over both land and ocean. The cloud optical thickness and effective radius retrievals used three distinct bands of the MAS (or MASTER), and these results were compared with nearly simultaneous retrievals of MODIS on the Terra spacecraft. Finally, this MODIS-based algorithm was adapted to MISR data to infer the cloud optical thickness of liquid water clouds from MISR. Results of this analysis will be presented and discussed.

Author

Remote Sensing; Ice Clouds; Bidirectional Reflectance; Brightness Temperature; Clouds (Meteorology); Optical Thickness; Ecosystems

20080039447 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Goddard Multi-Scale Modeling System with Unified Physics

Tao, W.K.; Anderson, D.; Atlas, R.; Chern, J.; Houser, P.; Hou, A.; Lang, S.; Lau, W.; Peters-Lidard, C.; Kakar, R.; Kumar, S.; Lapenta, W.; Li, X.; Matsui, T.; Rienecker, M.; Shen, B.W.; Shi, J.J.; Simpson, J.; Zeng, X.; Submitted to GEWEX Newsletter; [2008]; 7 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

Numerical cloud resolving models (CRMs), which are based the non-hydrostatic equations of motion, have been extensively applied to cloud-scale and mesoscale processes during the past four decades. Recent GEWEX Cloud System Study (GCSS) model comparison projects have indicated that CRMs agree with observations in simulating various types of clouds and cloud systems from different geographic locations. Cloud resolving models now provide statistical information useful for developing more realistic physically based parameterizations for climate models and numerical weather prediction models. It is also expected that Numerical Weather Prediction (NWP) and regional scale model can be run in grid size similar to cloud resolving model through nesting technique. Current and future NASA satellite programs can provide cloud, precipitation, aerosol and other data at very fine spatial and temporal scales. It requires a coupled global circulation model (GCM) and cloud-scale model (termed a szrper-parameterization or multi-scale modeling -framework, MMF) to use these satellite data to improve the understanding of the physical processes that are responsible for the variation in global and regional climate and hydrological systems. The use of a GCM will enable global coverage, and the use of a CRM will allow for better and more sophisticated physical parameterization. NASA satellite and field campaign can provide initial conditions as well as validation through utilizing the Earth Satellite simulators. At Goddard, we have developed a multi-scale modeling system with unified physics. The modeling system consists a coupled GCM-CRM (or MMF); a state-of-the-art weather research forecast model (WRF) and a cloud-resolving model (Goddard Cumulus Ensemble model). In these models, the same microphysical schemes (2ICE, several 3ICE), radiation (including explicitly calculated cloud optical properties), and surface models are applied. In addition, a comprehensive unified Earth Satellite simulator has been developed at GSFC, which is designed to fully utilize the multi-scale modeling system. A brief review of the multi-scale modeling system with unified physics/simulator and examples is presented in this article.

Author

Atmospheric Circulation; Atmospheric Models; Climate Models; Climatology; Cloud Physics; Clouds (Meteorology); Scale Models; Numerical Weather Forecasting

20080039554 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Interactions Between Vestige Atlantic Tropical Cyclones and Mid-Latitude Storms Over Mediterranean Basin

Smith, Eric A.; Mehta, Amita; Mugnai, Alberto; Tripoli, Gregory J.; April 15, 2007; 2 pp.; In English; EGU General Assembly 2007: Session NH1.01 - Satellite Remote Sensing Applications in Hydrometeorology, Water Cycle, and Flood Forecasting, 15-20 Apr. 2007, Vienna, Austria; Copyright; Avail.: Other Sources; Abstract Only

One of the more interesting tropical-mid-latitude interactions is one that has important effects on precipitation within the Mediterranean basin. This interaction consists of an Atlantic tropical cyclone vestige whose original disturbance travels eastward and northward across Atlantic basin, eventually intermingling with a mid-latitude cyclone entering southern Europe and/or the western Mediterranean Sea. The period for these interactions is from mid-September through November. If the tropical cyclone and its vestige is able to make the eastward Atlantic transit within the low to mid-levels, or if an upper level potential vorticity perturbation (Cjet streak) emitted by a Hurricane in its latter stages within the central Atlantic is able to propagate into and along the longwave pattern affecting the western Mediterranean Sea (MED), then there is the prospect for the tropical cyclone remnant to produce a major modification of the mid-latitude storm system preparing to affect the MED region. For such an occurrence to take place, it is necessary for an amplifying baroclinic perturbation to be already situated to the rear of a longwave trough, or to be excited by the emitted jet streak to the rear of a longwave trough -- in either case, preparing to affect the western MED. The Algiers City flood of 9-10 November 2001, which killed some 700 people, was produced by a Mediterranean cyclone that had been influenced by two vestige Atlantic tropical cyclones, Lorenzo and Noel. A published modeling study involving various of this study's authors has already described the dynamical development of the Algiers storm as it amplified from a developing baroclinic disturbance in the Rossby wave train, into a northern Africa hazardous flood system, then lingered in the western MED as a semi-intense warm core cyclone. In our new modeling experiments, we investigate the impact of what might have happened in the eventual precipitation field had the main features of the tropical cyclones NOT interacted with the developing baroclinic disturbance as it penetrated the western MED. To do so, we first remove the moisture and dynamical features of the two vestigial tropical cyclones from the large scale meteorological fields used to initialize the Mediterranean cyclone simulation. This is done through depletion of the moisture front associated with the two tropical cyclones, accomplished by relaxation to the suppressed east Atlantic conditions. The dynamical effects are removed through energetic destruction of the latter stages of the eastward traveling tropical cyclones, accomplished by lowering the underlying sea surface temperatures. A precipitation-distribution impact experiment is then run by initializing with the customized large-scale fields. The final precipitation-impact field is described by differencing the 'impact' run from the 'control' run -- the latter defined as the original simulation which intrinsically includes the effects of the two vestigial tropical cyclones.

Author

Cyclones; Mediterranean Sea; Tropical Storms; Planetary Waves; Hurricanes; Baroclinity; Perturbation

20080039555 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Performance of the Lidar Design and Data Algorithms for the GLAS Global Cloud and Aerosol Measurements

Spinhirne, James D.; Palm, Stephen P.; Hlavka, Dennis L.; Hart, William D.; July 22, 2007; 2 pp.; In English; IGARSS 2007 Symposium, 22-28 Jul. 2007, Barcelona, Spain; No Copyright; Avail.: Other Sources; Abstract Only

The Geoscience Laser Altimeter System (GLAS) launched in early 2003 is the first polar orbiting satellite lidar. The instrument design includes high performance observations of the distribution and optical scattering cross sections of atmospheric clouds and aerosol. The backscatter lidar operates at two wavelengths, 532 and 1064 nm. For the atmospheric cloud and aerosol measurements, the 532 nm channel was designed for ultra high efficiency with solid state photon counting detectors and etalon filtering. Data processing algorithms were developed to calibrate and normalize the signals and produce global scale data products of the height distribution of cloud and aerosol layers and their optical depths and particulate scattering cross sections up to the limit of optical attenuation. The paper will concentrate on the effectiveness and limitations of the lidar channel design and data product algorithms. Both atmospheric receiver channels meet and exceed their design goals. Geiger Mode Avalanche Photodiode modules are used for the 532 nm signal. The operational experience is that some signal artifacts and non-linearity require correction in data processing. As with all photon counting detectors, a pulse-pile-up calibration is an important aspect of the measurement. Additional signal corrections were found to be necessary relating to correction of a saturation signal-run-on effect and also for daytime data, a small range dependent variation in the responsivity. It was possible to correct for these signal errors in data processing and achieve the requirement to accurately profile aerosol and cloud cross section down to 10⁻⁷ IIm-sr. The analysis procedure employs a precise calibration against molecular scattering in the mid-stratosphere. The 1064 nm channel detection employs a high-speed analog APD for surface and atmospheric measurements where the detection sensitivity is limited by detector noise and is over an order of magnitude less than at 532

nm. A unique feature of the GLAS is a full acquisition of the surface return pulse, which has important application to the atmospheric transmission retrieval.

Author

Aerosols; Geophysics; Laser Altimeters; Optical Thickness; Optical Properties; Cloud Cover; Signal Processing

20080039560 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Bred Vectors and Forecast Errors in the NASA Coupled General Circulation Model

Yang, Shu-Chih; Kalnay, Eugenia; Cai, Ming; Rienecker, Michele M.; [2006]; 51 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAG5-5825; NAG5-12418; Copyright; Avail.: Other Sources

The breeding method has been implemented in the NASA Global Modeling and Assimilation Office (GMAO) coupled general circulation model (CGCM) in its operational configuration where ocean data assimilation is used to initialize the coupled forecasts. Bred vectors (BVs), designed to capture the dominant growing errors in the atmosphere-ocean coupled system, are applied as initial ensemble perturbations. We investigate the potential improvement for ensemble prediction by comparing BVs with the oceanic growing errors, estimated by the one-month forecast error from the non-perturbed forecast. Our results show that one-month forecast errors and BVs from the NASA CGCM share very similar features: BVs are clearly related to forecast errors in both SST and equatorial subsurface temperature, particularly when the BV growth rate is large. Both the forecast errors and the BVs in the subsurface are dominated by large-scale structures near the thermocline. Our results suggest that the forecast errors are dominated by dynamically evolving structures related to the variations of the background anomalous state, and that their shapes can be captured by BVs, especially during the strong 1997-1998 El Nino. Hindcast experiments starting from January 1997 with one pair of BVs achieve a significant improvement compared to the control (unperturbed) hindcast by capturing many important features of this event, including the westerly wind burst in early 1997.

Author

Air Water Interactions; Atmospheric General Circulation Models; Forecasting; Thermoclines; Perturbation; Estimating; Assimilation

20080039570 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Tropical Cyclones Feed More Heavy Rain in a Warmer Climate

Lau, K.-M.; Zhou, Y. P.; Wu, H.-T.; [2007]; 29 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The possible linkage of tropical cyclones (TC) to global warming is a hotly debated scientific topic, with immense societal impacts. Most of the debate has been focused on the issue of uncertainty in the use of non-research quality data for long-term trend analyses, especially with regard to TC intensity provided by TC forecasting centers. On the other hand, it is well known that TCs are associated with heavy rain during the processes of genesis and intensification, and that there are growing evidences that rainfall characteristics (not total rainfall) are most likely to be affected by global warming. Yet, satellite rainfall data have not been exploited in any recent studies of linkage between tropical cyclones (TC) and global warming. This is mostly due to the large uncertainties associated with detection of long-term trend in satellite rainfall estimates over the ocean. This problem, as we demonstrate in this paper, can be alleviated by examining rainfall distribution, rather than rainfall total. This paper is the first to use research-quality, satellite-derived rainfall from TRMM and GPCP over the tropical oceans to estimate shift in rainfall distribution during the TC season, and its relationships with TCs, and sea surface temperature (SST) in the two major ocean basins, the northern Atlantic and the northern Pacific for 1979-2005. From the rainfall distribution, we derive the TC contributions to rainfall in various extreme rainfall categories as a function to time. Our results show a definitive trend indicating that TCs are contributing increasingly to heavier rain events, i.e., intense TC's are more frequent in the last 27 years. The TC contribution to top 5% heavy rain has nearly doubled in the last two decades in the North Atlantic, and has increased by about 10% in the North Pacific. The different rate of increase in TC contribution to heavy rain may be related to the different rates of different rate of expansion of the warm pool (SST >25°C) area in the two oceans.

Author

Tropical Storms; Cyclones; Forecasting; Satellite Observation; Sea Surface Temperature; Global Warming

20080039573 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Retrieved Latent Heating from TRMM

Tao, Wei-Kuo; Smith, Eric A.; Houze Jr, Robert; To be submitted to the GEWEX Newsletter; [2008]; 5 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

The global hydrological cycle is central to the Earth's climate system, with rainfall and the physics of precipitation

formation acting as the key links in the cycle. Two-thirds of global rainfall occurs in the tropics with the associated latent heating (LH) accounting for three-fourths of the total heat energy available to the Earth's atmosphere. In addition, fresh water provided by tropical rainfall and its variability exerts a large impact upon the structure and motions of the upper ocean layer. In the last decade, it has been established that standard products of LH from satellite measurements, particularly TRMM measurements, would be a valuable resource for scientific research and applications. Such products would enable new insights and investigations concerning the complexities of convection system life cycles, the diabatic heating controls and feedbacks related to meso-synoptic circulations and their forecasting, the relationship of tropical patterns of LH to the global circulation and climate, and strategies for improving cloud parameterizations in environmental prediction models. The status of retrieved TRMM LH products, TRMM LH inter-comparison and validation project, current TRMM LH applications and critical issues/action items (based on previous five TRMM LH workshops) is presented in this article.

Author

Heat Transfer; Latent Heat; TRMM Satellite; Hydrological Cycle; Satellite Observation; Earth Atmosphere; Environment Models; Forecasting

20080039624 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Multi-scale Modeling System: Developments, Applications and Critical Issues

Tao, Wei-Kuo; Chern, Jiundar; Atlas, Robert; Randall, David; Lin, Xin; Khairoutdinov, Marat; Li, Jui-Lin; Waliser, Duane E.; Hou, Arthur; Peters-Lidard, Christa; Lau, William; Simpson, Joanne; [2006]; 53 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A04](#), Hardcopy

A multi-scale modeling framework (MMF), which replaces the conventional cloud parameterizations with a cloud-resolving model (CRM) in each grid column of a GCM, constitutes a new and promising approach. The MMF can provide for global coverage and two-way interactions between the CRMs and their parent GCM. The GCM allows global coverage and the CRM allows explicit simulation of cloud processes and their interactions with radiation and surface processes. A new MMF has been developed that is based the Goddard finite volume GCM (fvGCM) and the Goddard Cumulus Ensemble (GCE) model. This Goddard MMF produces many features that are similar to another MMF that was developed at Colorado State University (CSU), such as an improved surface precipitation pattern, better cloudiness, improved diurnal variability over both oceans and continents, and a stronger, propagating Madden-Julian oscillation (MJO) compared to their parent GCMs using conventional cloud parameterizations. Both MMFs also produce a precipitation bias in the western Pacific during Northern Hemisphere summer. However, there are also notable differences between two MMFs. For example, the CSU MMF simulates less rainfall over land than its parent GCM. This is why the CSU MMF simulated less overall global rainfall than its parent GCM. The Goddard MMF overestimates global rainfall because of its oceanic component. Some critical issues associated with the Goddard MMF are presented in this paper.

Author

Atmospheric Models; Cloud Physics; Clouds (Meteorology); Finite Volume Method; Simulation

20080039625 NASA Goddard Space Flight Center, Greenbelt, MD, USA

An Emerging Global Aerosol Climatology from the MODIS Satellite Sensors

Remer, Lorraine A.; Kleidman, Richard G.; Levy, Robert C.; Kaufman, Yoram J.; Tanre, Didier; Mattoo, Shana; Martins, J. Vandelei; Ichoku, Charles; Koren, Ilan; Hongbin, Yu; Holben, Brent N.; [2008]; 45 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The recently released Collection 5 MODIS aerosol products provide a consistent record of the Earth's aerosol system. Comparison with ground-based AERONET observations of aerosol optical depth (AOD) we find that Collection 5 MODIS aerosol products estimate AOD to within expected accuracy more than 60% of the time over ocean and more than 72% of the time over land. This is similar to previous results for ocean, and better than the previous results for land. However, the new Collection introduces a 0.015 offset between the Terra and Aqua global mean AOD over ocean, where none existed previously. Aqua conforms to previous values and expectations while Terra is high. The cause of the offset is unknown, but changes to calibration are a possible explanation. We focus the climatological analysis on the better understood Aqua retrievals. We find that global mean AOD at 550 nm over oceans is 0.13 and over land 0.19. AOD in situations with 80% cloud fraction are twice the global mean values, although such situations occur only 2% of the time over ocean and less than 1% of the time over land. There is no drastic change in aerosol particle size associated with these very cloudy situations. Regionally, aerosol amounts vary from polluted areas such as East Asia and India, to the cleanest regions such as Australia and the northern continents. In almost all oceans fine mode aerosol dominates over dust, except in the tropical Atlantic downwind of the Sahara and in some months the Arabian Sea.

Author

Climatology; Aerosols; MODIS (Radiometry); Optical Thickness; Satellite Instruments; Imaging Spectrometers; Calibrating

20080039632 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Apparent Bluing of Aerosols Near Clouds

Marshak, Alexander; February 25, 2008; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

Numerous studies based on satellite observations have reported that aerosol optical depths increase with increasing cloud cover. Part of the increase comes from the humidification and consequent growth of aerosol particles in the moist cloud environment, but part comes from 3D cloud-radiative transfer effects on the retrieved aerosol properties. Often, discerning whether the observed increases in aerosol optical depths are artifacts or real proves difficult. I describe a simple model that quantifies the enhanced illumination of cloud-free columns in the vicinity of clouds that are used in the aerosol retrievals. This model is based on the assumption that the enhancement in the cloud-free column radiance comes from enhanced Rayleigh scattering that results from the presence of the nearby clouds. This assumption leads to a larger increase of AOT for shorter wavelengths, or to a 'bluing' of aerosols near clouds. Examples from the MODIS observations that illustrate the apparent bluing of aerosols near clouds will be discussed.

Author

Aerosols; Cloud Cover; Optical Thickness; MODIS (Radiometry); Satellite Observation; Radiative Transfer

20080039639 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Deriving Tools from Real-Time Runs: A New CCMC Support for SEC and AFWA

Hesse, Michael; Rastatter, Lutz; MacNeice, Peter; Kuznetsova, Masha; April 23, 2007; 1 pp.; In English; Space Weather Week Workshop, 23-27 Apr. 2007, Boulder, Co, USA; No Copyright; Avail.: Other Sources; Abstract Only

The Community Coordinated Modeling Center (CCMC) is a US inter-agency activity aiming at research in support of the generation of advanced space weather models. As one of its main functions, the CCMC provides to researchers the use of space science models, even if they are not model owners themselves. In particular, the CCMC provides to the research community the execution of 'runs-on-request' for specific events of interest to space science researchers. Through this activity and the concurrent development of advanced visualization tools, CCMC provides, to the general science community, unprecedented access to a large number of state-of-the-art research models. CCMC houses models that cover the entire domain from the Sun to the Earth. In this presentation, we will provide an overview of CCMC modeling services that are available to support activities at the Space Environment Center, or at the Air Force Weather Agency.

Author

Space Weather; Models; Scientific Visualization; Computerized Simulation

20080039678 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Impacts of Weather Variations on Energy Consumption Efforts at U.S. Air Force Installations

Griffin, James S; Mar 2008; 126 pp.; In English

Report No.(s): AD-A482736; AFIT/GEM/ENV/08-M08; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482736>

Energy consumption is a national concern, as evidenced by federal laws aimed toward facility energy conservation measures for federal organizations. Factors, primarily weather variables, that significantly impact energy consumption must be addressed and understood to align resources and programs to meet federal energy reduction goals. An energy model was created and tested to produce an appropriate forecasting tool for energy consumption. Energy demand at Air Force installations primarily depends on climatic conditions, with a small portion attributed to a base level of non-climatic conditions, such as interior lighting and appliance loads. By gathering all energy consumption and meteorological data covering 22 years for 74 Air Force installations throughout the world, an overarching predictive model was created. Specifically, heating degree-days, cooling degree-days, wind speed, and relative humidity data were collected and analyzed to determine the influence on energy consumption. The model showed a predictive value with adjusted R² above 81%. Additionally, trend analysis conducted over the 22-year period provided insight into the significant use of heating load requirements during the winter months as compared to cooling load requirements in summer months. This information should encourage energy policy makers to allocate more resources into heating system requirements than into cooling requirements, taking advantage of major opportunities to reduce energy consumption.

DTIC

Energy Conservation; Energy Consumption; Forecasting; Meteorological Parameters

20080039878 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Mesospheric Water Vapor Retrieved from SABER/TIMED Measurements

Feofilov, Arte, G.; Yankovsky, Valentine A.; Marshall, Benjamin T.; Russell, J. M., III; Pesnell, W. D.; Kutepov, Alexander A.; Goldberg, Richard A.; Gordley, Larry L.; Petelina, Svetlana; Mauilova, Rada O.; Garaci-A-Comas, M.; December 09, 2007; 1 pp.; In English; 2007 Fall AGU meeting, 9-15 Dec. 2007, San Francisco, CA, USA; Original contains poor quality, truncated or crooked pages; Copyright; Avail.: Other Sources; Abstract Only

The SABER instrument on board the TIMED satellite is a limb scanning infrared radiometer designed to measure temperature and minor constituent vertical profiles and energetics parameters in the mesosphere and lower thermosphere (MLT). The H₂O concentrations are retrieved from 6.3 micron band radiances. The interpretation of this radiance requires developing a non-LTE H₂O model that includes energy exchange processes with the system of O₃ and O₂ vibrational levels populated at the daytime through a number of photoabsorption and photodissociation processes. We developed a research model based on an extended H₂O non-LTE model of Mauilova coupled with the novel model of the electronic kinetics of the O₂ and O₃ photolysis products suggested by Yankovsky and Mauilova. The performed study of this model helped us to develop and test an optimized operational model for interpretation of SABER 6.3 micron band radiances. The sensitivity of retrievals to the parameters of the model is discussed. The H₂O retrievals are compared to other measurements for different seasons and locations.

Author

Mesosphere; Oxygen; Ozone; Thermosphere; Water; Water Vapor; Atmospheric Models; Remote Sensing

20080040111 Universal Energy Systems, Inc., Dayton, OH USA

A Streamer-Like Atmospheric Pressure Plasma Jet (Postprint)

Sands, Brian L; Ganguly, Biswa N; Tachibana, Kunihide; Apr 2008; 5 pp.; In English

Contract(s)/Grant(s): FA8650-04-D-2404-0004; Proj-3145

Report No.(s): AD-A483072; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The properties of an atmospheric pressure plasma jet (APPJ) are examined in a single-cell dielectric capillary configuration. In contrast to some other flow-driven APPJs, this stable, cold plasma jet is electrically driven, composed of rapidly propagating ionization fronts with speeds of the order of 107 sq cm. Using spatially and temporally resolved optical diagnostics, it is demonstrated that the plasma jet is initiated independent of the dielectric barrier discharge inside the capillary. It is also shown that the properties and dynamics of this APPJ are directly analogous to those of positive corona streamer discharges.

DTIC

Atmospheric Pressure; Plasma Jets; Plasmas (Physics)

20080040135 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Improving Forecast Skill by Assimilation of Quality-controlled AIRS Temperature Retrievals under Partially Cloudy Conditions

Reale, O.; Susskind, J.; Rosenberg, R.; Brin, E.; Riishojgaard, L.; Liu, E.; Terry, J.; Jusem, J. C.; [2007]; 22 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): MAP/04-0180-0070; Copyright; Avail.: CASI: [A03](#), Hardcopy

The National Aeronautics and Space Administration (NASA) Atmospheric Infrared Sounder (AIRS) on board the Aqua satellite has been long recognized as an important contributor towards the improvement of weather forecasts. At this time only a small fraction of the total data produced by AIRS is being used by operational weather systems. In fact, in addition to effects of thinning and quality control, the only AIRS data assimilated are radiance observations of channels unaffected by clouds. Observations in mid-lower tropospheric sounding AIRS channels are assimilated primarily under completely clear-sky conditions, thus imposing a very severe limitation on the horizontal distribution of the AIRS-derived information. In this work it is shown that the ability to derive accurate temperature profiles from AIRS observations in partially cloud-contaminated areas can be utilized to further improve the impact of AIRS observations in a global model and forecasting system. The analyses produced by assimilating AIRS temperature profiles obtained under partial cloud cover result in a substantially colder representation of the northern hemisphere lower midtroposphere at higher latitudes. This temperature difference has a strong impact, through hydrostatic adjustment, in the midtropospheric geopotential heights, which causes a different representation of the polar vortex especially over northeastern Siberia and Alaska. The AIRS-induced anomaly propagates through the model's dynamics producing improved 5-day forecasts.

Author

Cloud Cover; Infrared Instruments; Northern Hemisphere; Temperature Profiles; Troposphere; Weather; Meteorology; Weather Forecasting; Satellite Observation

20080040137 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Comparison of NASA Team2 and AES-York Ice Concentration Algorithms Against Operational Ice Charts From the Canadian Ice Service

Shokr, Mohammed; Markus, Thorsten; IEEE Transactions on Geoscience and Remote Sensing; August 2006; ISSN 0196-2892; Volume 44, No. 8, pp. 2164-2175; In English; Original contains black and white illustrations

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ONLINE: <http://dx.doi.org/10.1109/TGRS.2006.872077>

Ice concentration retrieved from spaceborne passive-microwave observations is a prime input to operational sea-ice-monitoring programs, numerical weather prediction models, and global climate models. Atmospheric Environment Service (AES)- York and the Enhanced National Aeronautics and Space Administration Team (NT2) are two algorithms that calculate ice concentration from Special Sensor Microwave/Imager observations. This paper furnishes a comparison between ice concentrations (total, thin, and thick types) output from NT2 and AES-York algorithms against the corresponding estimates from the operational analysis of Radarsat images in the Canadian Ice Service (CIS). A new data fusion technique, which incorporates the actual sensor's footprint, was developed to facilitate this study. Results have shown that the NT2 and AES-York algorithms underestimate total ice concentration by 18.35% and 9.66% concentration counts on average, with 16.8% and 15.35% standard deviation, respectively. However, the retrieved concentrations of thin and thick ice are in much more discrepancy with the operational CIS estimates when either one of these two types dominates the viewing area. This is more likely to occur when the total ice concentration approaches 100%. If thin and thick ice types coexist in comparable concentrations, the algorithms' estimates agree with CIS'S estimates. In terms of ice concentration retrieval, thin ice is more problematic than thick ice. The concept of using a single tie point to represent a thin ice surface is not realistic and provides the largest error source for retrieval accuracy. While AES-York provides total ice concentration in slightly more agreement with CIS'S estimates, NT2 provides better agreement in retrieving thin and thick ice concentrations.

Author

Algorithms; Climate Models; Mathematical Models; Microwave Imagery; Numerical Weather Forecasting; Thickness; Sea Ice; Satellite Observation

20080040149 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Improved Atmospheric Soundings and Error Estimates from Analysis of AIRS/AMSU Data

Susskind, Joel; August 26, 2007; 11 pp.; In English; SPIE Symposium on Optical Engineering and Applications, 26-31 Aug. 2007, San Diego, CA, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040149>

The AIRS Science Team Version 5.0 retrieval algorithm became operational at the Goddard DAAC in July 2007 generating near real-time products from analysis of AIRS/AMSU sounding data. This algorithm contains many significant theoretical advances over the AIRS Science Team Version 4.0 retrieval algorithm used previously. Three very significant developments of Version 5 are: 1) the development and implementation of an improved Radiative Transfer Algorithm (RTA) which allows for accurate treatment of non-Local Thermodynamic Equilibrium (non-LTE) effects on shortwave sounding channels; 2) the development of methodology to obtain very accurate case by case product error estimates which are in turn used for quality control; and 3) development of an accurate AIRS only cloud clearing and retrieval system. These theoretical improvements taken together enabled a new methodology to be developed which further improves soundings in partially cloudy conditions, without the need for microwave observations in the cloud clearing step as has been done previously. In this methodology, longwave CO₂ channel observations in the spectral region 700 cm⁻¹ to 750 cm⁻¹ are used exclusively for cloud clearing purposes, while shortwave CO₂ channels in the spectral region 2195 cm⁻¹ to 2395 cm⁻¹ are used for temperature sounding purposes. The new methodology for improved error estimates and their use in quality control is described briefly and results are shown indicative of their accuracy. Results are also shown of forecast impact experiments assimilating AIRS Version 5.0 retrieval products in the Goddard GEOS 5 Data Assimilation System using different quality control thresholds.

Author

Atmospheric Sounding; Error Analysis; Algorithms; Atmospheric Temperature; Forecasting; Real Time Operation; Local Thermodynamic Equilibrium; Airborne Integrated Reconnaissance System

20080040176 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Comparisons of Instantaneous TRMM Ground Validation and Satellite Rain Rate Estimates at Different Spatial Scales

Wolff, David B.; Fisher, Brad L.; [2007]; 62 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNG07EJ50C; No Copyright; Avail.: CASI: A04, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040176>

This study provides a comprehensive inter-comparison of instantaneous rain rates observed by the two rain sensors aboard

the TRMM satellite with ground data from two regional sites established for long-term ground validation: Kwajalein Atoll and Melbourne, Florida. The satellite rain algorithms utilize remote observations of precipitation collected by the TRMM microwave imager (TMI) and the Precipitation Radar (PR) aboard the TRMM satellite. Three standard Level II rain products are generated from operational applications of the TMI, PR and Combined (COM) rain algorithms using rain information collected from the TMI and the PR along the orbital track of the TRMM satellite. In the first part of the study, 0.25 x 0.25 instantaneous rain rates obtained from the TRMM 3668 product were analyzed and compared to instantaneous GV rain rates gridded at a scale of 0.5deg x 0.5. In the second part of the study, TMI, PR, COM and GV rain rates were spatio-temporally matched and averaged at the scale of TMI footprint (~ 150 sq km). This study covered a six-year period 1999-2004 and consisted of over 50,000 footprints for each GV site. In the first analysis our results showed that all of the respective rain rate estimates agree well, with some exceptions. The more salient differences were associated with heavy rain events in which one or more of the algorithms failed to properly retrieve these extreme events. Also, it appears that there is a preferred mode of precipitation for TMI rain rates at or near 2 mm/hr over the ocean. This mode was noted over ocean areas of Kwajalein and Melbourne and has been observed in TRMM tropical-global ocean areas as well.

Author

Ground Truth; Meteorological Radar; TRMM Satellite; Satellite Observation; Precipitation (Meteorology); Rain; Ocean Surface

20080040177 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Satellite-based Assessment of Trans-Pacific Transport of Pollution Aerosol

Yu, Hongbin; Remer, Lorraine; Chin, Mian; Bian, Huisheng; Kleidman, Richard; Diehl, Thomas; [2007]; 50 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

It has been well documented that pollution aerosol and dust from East Asia can transport across the North Pacific basin, reaching North America and beyond. Such intercontinental transport extends the impact of aerosols for climate change, air quality, atmospheric chemistry, and ocean biology from local and regional scales to hemispheric and global scales. Long term, measurement-based studies are necessary to adequately assess the implications of these wider impacts. A satellite-based assessment can augment intensive field campaigns by expanding temporal and spatial scales and also serve as constraints for model simulations. Satellite imagers have been providing a wealth of evidence for the intercontinental transport of aerosols for more than two decades. Quantitative assessments, however, became feasible only recently as a result of the much improved measurement accuracy and enhanced new capabilities of satellite sensors. In this study, we generated a 4-year (2002 to 2005) climatology of optical depth for pollution aerosol (defined as a mixture of aerosols from urban/industrial pollution and biomass burning in this study) over the North Pacific from MODerate resolution Imaging Spectro-radiometer (MODIS) observations of fine- and coarse-mode aerosol optical depths. The pollution aerosol mass loading and fluxes were then calculated using measurements of the dependence of aerosol mass extinction efficiency on relative humidity and of aerosol vertical distributions from field campaigns and available satellite observations in the region. We estimated that about 18 Tg/year pollution aerosol is exported from East Asia to the northwestern Pacific Ocean, of which about 25% reaches the west coast of North America. The pollution fluxes are largest in spring and smallest in summer. For the period we have examined the strongest export and import of pollution particulates occurred in 2003, due largely to record intense Eurasia wildfires in spring and summer. The overall uncertainty of pollution fluxes is estimated at about 80%. A reduction of uncertainty can be achieved with a better characterization of pollution aerosol through integrating emerging A-Train measurements. Simulations by the Goddard Chemistry Aerosol Radiation and Transport (GOCART) and Global Modeling Initiative (GMI) models agree quite well with the satellite-based estimates of annual and latitude-integrated fluxes, with larger model-satellite differences in latitudinal variations of fluxes.

Author

Aerosols; Particulates; Dust; Radiation Transport; MODIS (Radiometry); Climate Change; Satellite Observation; Biomass Burning

20080040697 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Revised Method of Presenting Wavenumber-Frequency Power Spectrum Diagrams That Reveals the Asymmetric Nature of Tropical Large-scale Waves

Chao, Winston C.; Yang, Bo; Fu, Xiouhua; January 2007; 17 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The popular method of presenting wavenumber-frequency power spectrum diagrams for studying tropical large-scale waves in the literature is shown to give an incomplete presentation of these waves. The so-called 'convectively-coupled Kelvin (mixed Rossby-gravity) waves' are presented as existing only in the symmetric (antisymmetric) component of the diagrams.

This is obviously not consistent with the published composite/regression studies of ‘convectively-coupled Kelvin waves,’ which illustrate the asymmetric nature of these waves. The cause of this inconsistency is revealed in this note and a revised method of presenting the power spectrum diagrams is proposed. When this revised method is used, ‘convectively-coupled Kelvin waves’ do show anti-symmetric components, and ‘convectively-coupled mixed Rossby-gravity waves (also known as Yanai waves)’ do show a hint of symmetric components. These results bolster a published proposal that these waves be called ‘chimeric Kelvin waves,’ ‘chimeric mixed Rossby-gravity waves,’ etc. This revised method of presenting power spectrum diagrams offers a more rigorous means of comparing the General Circulation Models (GCM) output with observations by calling attention to the capability of GCMs in correctly simulating the asymmetric characteristics of the equatorial waves.

Author

Gravity Waves; Planetary Waves; Tropical Regions; Kelvin Waves; Atmospheric Circulation; Rossby Regimes

20080040743 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Have Tropical Cyclones Been Feeding More Extreme Rainfall?

Lau, K.-M.; Zhou, Y. P.; Wu, H.-T.; [2008]; 40 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

We have conducted a study of the relationship between tropical cyclone (TC) and extreme rain events using GPCP and TRMM rainfall data, and storm track data for July through November (JASON) in the North Atlantic (NAT) and the western North Pacific (WNP). Extreme rain events are defined in terms of percentile rainrate, and TC-rain by rainfall associated with a named TC. Results show that climatologically, 8% of rain events and 17% of the total rain amount in NAT are accounted by TCs, compared to 9% of rain events and 21% of rain amount in WNP. The fractional contribution of accumulated TC-rain to total rain, Omega, increases nearly linearly as a function of rainrate. Extending the analyses using GPCP pentad data for 1979-2005, and for the post-SSM/I period (1988-2005), we find that while there is no significant trend in the total JASON rainfall over NAT or WNP, there is a positive significant trend in heavy rain over both basins for the 1979-2005 period, but not for the post-SSM/I period. Trend analyses of Omega for both periods indicate that TCs have been feeding increasingly more to rainfall extremes in NAT, where the expansion of the warm pool area can explain slight more than 50% of the change in observed trend in total TC rainfall. In WNP, trend signals for Omega are mixed, and the long-term relationship between TC rain and warm pool areas are strongly influenced by interannual and interdecadal variability.

Author

Tropical Storms; Cyclones; Rain; TRMM Satellite; Accumulations

20080040777 NASA Goddard Space Flight Center, Greenbelt, MD, USA

An Analysis of Convective Transport and Parameter Sensitivity in a Single Column Version of the Goddard Earth Observation System, Version 5, General Circulation Model

Ott, Lesley E.; Bacmeister, Julio; Pawson, Steven; Pickering, Ken; Stenchikov, Georgiy; Suarez, max; Huntreiser, Heidi; Loewenstein, Max; Lopez, Jimena; Xueref-Remy, Irene; [2007]; 2 pp.; In English; Copyright; Avail.: Other Sources

Convection strongly influences the distribution of atmospheric trace gases. General circulation models (GCMs) use convective mass fluxes calculated by parameterizations to transport gases, but the results are difficult to compare with trace gas observations because of differences in scale. The high resolution of cloud-resolving models (CRMs) facilitates direct comparison with aircraft observations. Averaged over a sufficient area, CRM results yield a validated product directly comparable to output from a single global model grid column. This study presents comparisons of vertical profiles of convective mass flux and trace gas mixing ratios between CRM and single column model (SCM) simulations of storms observed during three field campaigns. In all three cases, SCM simulations underpredicted convective mass flux relative to CRM simulations. As a result, the SCM simulations produced lower trace gas mixing ratios in the upper troposphere in two of the three storms than did CRM simulations. The impact of parameter sensitivity in the moist physics schemes employed in the SCM has also been examined. Statistical techniques identified the most significant parameters influencing convective transport. Results show that altered parameter settings can substantially improve the comparison between SCM and CRM convective mass flux. Upper tropospheric trace gas mixing ratios were also improved in two storms. In the remaining storm, the SCM representation of CO₂ was not improved because of differences in entrainment and detrainment levels in the CRM and SCM simulations. Trace gas observations provide an additional constraint which can be used to improve the representation of physical processes in GCMs.

Author

Atmospheric Composition; Convection; Trace Contaminants; Trace Elements; Atmospheric General Circulation Models; Mixing Ratios; Remote Sensing

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*.

20080039362 Army Center for Health Promotion and Preventive Medicine (Provisional), Aberdeen Proving Ground, MD USA

Injury Reduction Effectiveness of Prescribing Running Shoes Based on Foot Shape in Basic Combat Training

Knapik, Joseph J; Swedler, David; Grier, Tyson; Hauret, Keith G; Bullock, Steven H; Williams, Kelly; Darakjy, Salima; Lester, Mark; Tobler, Steve; Clemmons, Nakia; Jones, Bruce H; Jun 2008; 100 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482502; USACHPPM-12-MA-05SB-08; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In Basic Combat Training (BCT), running shoes are prescribed based on plantar foot shape (reflecting longitudinal arch height). In response to a request from the Military Training Task Force of the Defense Safety Oversight Council, this study examined whether or not this prescription technique influenced injury risk. After foot examinations, BCT recruits in an experimental group (E, n=1,079 men, 456 women) were prescribed motion control, stability, or cushioned shoes for foot shapes judged to represent low, medium, or high arches, respectively. A control group (C, n=1,068 men, 464 women) received a stability shoe regardless of plantar foot shape. Injuries during BCT were determined from outpatient visits provided by the Army Medical Surveillance Activity. Other previously known injury risk factors (e.g., age, fitness, smoking) were obtained from a questionnaire and existing databases. Multivariate Cox regression controlling for other injury risk factors showed little difference between the E and C groups among men (risk ratio (C/E) = 1.11, 95% confidence interval = 0.91- 1.34) or women (risk ratio (C/E)=1.14, 95% confidence interval = 0.91-1.44). This prospective study demonstrated that prescribing shoes on the basis of the shape of the plantar foot surface had little influence on injury risk even after control of known injury risk factors.

DTIC

Combat; Education; Injuries; Shapes; Shoes

20080039609 Institut National de la Sante et de la Recherche Medicale, Montpellier, France

Recent Advances in Supramolecular Assemblies with Nucleic Acids

Barthelemy, Philippe; Aug 29, 2007; 31 pp.; In English

Contract(s)/Grant(s): W911NF-06-1-0286

Report No.(s): AD-A482592; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The workshop entitled 'Recent Advances in Supramolecular Assemblies with Nucleic Acids' was held in Bordeaux, France, on 16-17 Oct 2006. This event was organized at the European Institute of Chemistry and Biology (IECB), with financial support from the ARO.

DTIC

Nucleic Acids; Molecular Dynamics

20080039652 Illinois Univ., Chicago, IL USA

Understanding Factors Influencing The Propagation of Prions

Liebman, Susan W; Dec 28, 2007; 14 pp.; In English

Contract(s)/Grant(s): W911NF-05-1-0505

Report No.(s): AD-A482518; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Prions are altered conformations of a protein that have gained the ability to convert the normal form of the protein into the prion form. They are an infectious, misfolded and aggregated form of a protein. In mammals, prions are associated with neurodegenerative diseases that can be passed from one organism to another. Recent evidence has shown that the prion phenomenon is not limited to mammals but extends to yeast. We have investigated if any genes affect the propagation of the yeast prion [PIN+] and found that only two previously known deletions (rnq1 and hsp104) abolish [PIN+] maintenance. However, a deletion of CUE2, a gene implicated in the ubiquitin pathway, shows an altered [PIN+] phenotype. We are investigating the basis of this difference, which will provide clues to what genes are involved in the morphology of prion aggregates. We have also investigated various factors that might affect prion transmission across species. We have found that QN rich prions, but not non-QN rich prions and polyglutamine aggregates, enhance the appearance of a foreign prion.

Furthermore, we have found that a cellular factor, UBC4, involved in prion appearance might play a role in the prevention of transmission of a prion across species.

DTIC

Yeast; Proteins; Phenotype; Organisms

20080039653 Tulane Univ., New Orleans, LA USA

Tulane/Xavier Vaccine Development/Engineering Project

Clements, John D; Freytag, Lucy; John, Vijay; Mandal, Tarun; Feb 2008; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-07-1-0136

Report No.(s): AD-A482558; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Tulane/Xavier Biodefense Vaccine Development/Engineering project will develop new vaccines against biological threat agents to aid the war-fighter. Through the innovative use of nanotechnology, researchers and engineers from the Tulane University Schools of Medicine and Science & Engineering and the Xavier College of Pharmacy will fabricate nanoparticulate systems that are effective for transdermal and mucosal delivery of life-saving vaccines. One aim of this project will be to compare different nanocarriers (i.e., nanohydrogels, star copolymers, and spray-dried PLGA nanoparticles) for the ability to incorporate biological threat-relevant vaccine antigens and deliver those antigens through the stratum corneum to immune-responsive cells in the epidermis. The specialized assembly of each type of nanocarrier gives each unique properties and different interactions within the lipid channels of the stratum corneum. The use of nanocarriers for vaccine delivery is a platform technology, applicable to delivery of a variety of existing and potential vaccines.

DTIC

Vaccines; Infectious Diseases

20080039668 Cornell Univ., Ithaca, NY USA

A Hybrid Computational-Experimental Framework for Microbial Chemical Synthesis via Enzyme Channeling

DeLisa, Matthew; Dec 5, 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-07-1-0173

Report No.(s): AD-A482722; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482722>

The immediate scientific objectives, which have changed significantly from our original proposal due to overlap with a pre-existing ONR YIP Award, include: (1) To engineer metabolic enzymes into functional multi-protein assemblies. We have explored the use of eukaryotic signaling scaffolds for in vivo enzyme assembly. [Note: the original proposal focused on using TGase-mediated enzymatic cross-linking to accomplish enzyme assembly]. The efficacy of these channels will be demonstrated for efficient metabolic conversion of renewable resources (e.g., glycerol) to 1,2-propanediol. (2) Enable combinatorial channel engineering via intracellular metabolite sensors. We have engineered a protein conformational switch based on the green fluorescent protein [note: that the original proposal sought to develop RNA aptamer-based switches] that we expect will dynamically respond to a broad concentration range of specific metabolites including R-1,2-PD. (3) Computational design of optimal metabolic systems. We have shown through simulation that our synthetic channels locally improve the catalytic efficiency of the 1,2-propanediol enzyme assembly compared to the unchanneled case (Conrado et al., 2007 Metab Eng). To design optimal precursor flux to the 1,2-PD channel, we will develop new network design tools that can be used to computationally develop metabolic architectures that take full advantage of engineered assemblies.

DTIC

Biosynthesis; Enzymes; Metabolism; Microorganisms; Synthesis (Chemistry)

20080039680 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

Biodegradation and Oxidation Approaches for the Demilitarization of VX Hydrolysate

DeFrank, Joseph J; Guelta, Mark A; Jul 1, 2003; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482744; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482744>

Under U.S. law and the terms of the Chemical Weapons Convention (CWC), the U.S. Army is required to destroy its stockpile of chemical warfare agents (30,000 tons) by April 2007. Public and political opposition to incineration lead to evaluation of several alternative technologies, including biodegradation. These alternatives involved an initial chemical neutralization (hydrolysis) reaction that reduces the toxicity of the agents, followed by a secondary treatment that further

degrades and detoxifies the hydrolysis products, some of which are also covered by the CWC (Schedule 2) 2. Because of the recalcitrant nature of some of the products (as well as the hydrolyzed explosives/propellants that could be present), the use of advanced oxidations processes (AOP) was combined with biodegradation in a variety of configurations to determine whether complete removal and detoxification of the prohibited treaty materials could be achieved. Results using UV/Peroxide and Ozone treatments, prior to or after biodegradation of caustic hydrolyzed VX will be presented. Bioreactors evaluated included sequencing batch reactors (SBRs) and immobilized cell systems.

DTIC

Biodegradation; Oxidation

20080039681 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

Biodegradation of Hydrolyzed Mustard from An ACWA Projectile Washout Study

Guelta, Mark A; Fazekas-Carey, Laurie; Jul 1, 2003; 9 pp.; In English

Report No.(s): AD-A482745; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482745>

In 1996, public laws 104-208, 105-261, and 106-79 established and expanded the Assembled Chemical Weapons Assessment (ACWA) Program. To address public concerns over safe destruction of the U.S. chemical weapon stockpile; the ACWA program was tasked to identify two or more viable alternatives technologies to the baseline destruction method of incineration. Neutralization followed by biodegradation was one technology to be successfully demonstrated in a pilot facility at the Edgewood Chemical and Biological Center (ECBC) APG, MD. A successful Engineering Design Study (EDS) followed the demonstration and the Neutralization/Biodegradation process was subsequently approved for destruction of assembled chemical weapons stored at the Pueblo Chemical Depot. During the laboratory and pilot-scale studies hydrolyzed mustard taken from ton storage containers and tetrytol from storage was used to simulate the agent and explosive fills of the M60 chemical round. Presently, rocket cutting and washout engineering studies continue at PCD in preparation for eventual destruction of the chemical rounds. Concern has risen over the possible effect undissolved heel material may have on the biodegradability of the hydrolyzed payloads. This follow-on laboratory study uses mustard agent and tetrytol removed during rocket cutting and washout testing on actual chemical rounds stored at PCD.

DTIC

Biodegradation; Chemical Warfare; Projectiles

20080039683 Holy Name Hospital, Teaneck, NJ USA

The Effect of Real-time Clinical Monitoring and a 'Closed Loop' Medication System on Adverse Drug Event Detection

Mendelowitz, Paul C; Apr 2008; 66 pp.; In English

Contract(s)/Grant(s): W81XWH-06-2-0059

Report No.(s): AD-A482750; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482750>

Holy Name Hospital has undertaken a comprehensive redesign of medication management system including the introduction of pharmacy robotics; computerization of all phases of medication management including inventory, order entry with decision support, and electronic medication administration record; as well as beside bar code scanning of patient, staff and medications. The implementation of this comprehensive redesign has allowed us to conduct research to determine whether decision support will foster a reduction in adverse drug events. We have selected 5 commonly prescribed medications that are associated with well-known adverse events that manifest as laboratory abnormalities. The use of an electronic medication administration record which incorporates bar-code scanning at the bedside allows for display of pertinent laboratory results in real time during medication administration. Review of such results provides decision support that allows for dose adjustment or discontinuation in the face of adverse laboratory trends. Our project involves studying data for 6 months of medication administration prior to the introduction of pertinent laboratory display and comparing it to 6 months of data after pertinent lab studies were available for review at the time of administration. We will examine the frequency and severity of adverse drug events in this context.

DTIC

Clinical Medicine; Drugs; Information Systems; Pharmacology; Real Time Operation

20080039684 California Univ., Berkeley, CA USA

A Microfluidics Approach to Investigate Axon Guidance

Sohn, Lydia L; Mar 26, 2007; 10 pp.; In English

Contract(s)/Grant(s): W911NF-06-1-0078

Report No.(s): AD-A482752; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482752>

The purpose of this STR project was to demonstrate and explore the capabilities of a novel microfluidic concentration-gradient generator, as it relates to developmental and regenerative neurobiology. The device, consisting of a series of alternating cell-culture chambers and reagent channels that are interconnected via micro-channels, establishes and maintains steady concentration gradients within a static cell-culture chamber for neuronal culture. Concentration gradients of both small molecules (pharmaceutical agents and second messengers) and macromolecules (neurotrophins and other proteins) can be easily achieved and quantified in this device. Thus, quantitative studies of neuronal polarization and axon pathfinding of neurons in response to micro-environmental cues can be accomplished. Ultimately, the device can be integrated with (potentially implantable) solid-state devices and subsequently deliver the appropriate concentration gradient and combination of guidance cues to specific axons. In so doing, we will no doubt advance the next-generation prosthetics.

DTIC

Axons; Neurophysiology; Proteins

20080039685 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Optimization of Therapeutic Strategies for Organophosphate Poisoning

Seaman, Gregory G; Mar 2008; 88 pp.; In English

Report No.(s): AD-A482754; AFIT/GES/ENV/08-M06; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482754>

The National Preparedness Vision requires the U.S. be prepared to prevent, protect against, respond to, and recover from all hazards associated with a chemical attack. Results of this study demonstrate that we cannot protect service members and first responders as required following a nerve agent attack. The research presented herein aimed to construct a physiologically based pharmacokinetic model to determine optimal therapeutic strategies for organophosphate (nerve agent) poisoning. The constructed model integrated organophosphates and two antidotes, atropine and oximes. Model results reasonably mirrored literature data and anecdotal observations of organophosphate poisoning. Results suggest a symptoms-based dosing strategy of atropine and a time-based dosing strategy of oximes. For patients severely poisoned with organophosphorus nerve agents, model results support documented claims of oxime's inefficacy and tendency to heighten the severity of poisoning. The results strongly indicate that military personnel attacked with nerve agents are at a significant health risk if they employ their prescribed treatment as current doctrine dictates. Results presented herein suggest that oxime use be discontinued as currently prescribed within the context of nerve agent exposure; its use will not alter the effects of nerve agent exposure and may increase the adverse effects.

DTIC

Nerves; Organic Phosphorus Compounds; Pharmacology; Therapy

20080039692 Texas Technological Univ., Lubbock, TX USA

Mitigation of Ricin Contamination in Soils: Sorption and Degradation

Zartman, R; Green, C; San Francisco, M; Zak, J; James, W; Boroda, E; Jul 1, 2003; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482765; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482765>

Ricin is a highly toxic protein isolated from castor beans. Ricin is a weapon of choice for terrorists because large quantities of castor beans can be grown and the toxin readily separated from the beans. Soils contain a variety of inorganic minerals, organic matter and microorganisms. Soil inorganic minerals and organic matter are known to effectively sorb a wide variety of compounds, such as pesticides and other potential contaminants. Soil microorganisms are known to degrade a variety of organics, such as petroleum and pesticides. Because clay mineralogy, organic matter content and microbial populations differ in soils, it is important to identify minerals that strongly sorb ricin and characterize microorganisms that can effectively degrade the protein. The minerals, organic matter and microorganisms in some soils might be more effective in sorption and degradation of ricin than other soils. The objectives of this research were to examine the capacity of soil constituents and microbes to retain and degrade ricin that was released into the environment. To achieve these objectives, we

examined: (1) the ricin contents of soils in formerly and currently cropped castor fields; (2) the functional and taxonomic diversity of microbes in castor versus cotton field soils; (3) the capacity of soil microbes to degrade ricin; and (4) the capacity of soil minerals and other materials to sorb ricin.

DTIC

Contamination; Degradation; Sorption; Toxicity

20080039695 North Carolina Univ., Chapel Hill, NC USA

Evaluation of the Maxillary Dental Midline Relative to the Face

Rothas, David A; Jun 2008; 59 pp.; In English

Report No.(s): AD-A482774; AFIT-CI-08-0022; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482774>

A general principle of smile design is the maxillary dental midline should coincide with the center of the face. However, little data is available to indicate where to position the maxillary dental midline for patients with asymmetrical faces to optimize dentofacial esthetics. The first manuscript describes lay people and dentists' preferred maxillary dental midline position for symmetrical and asymmetrical faces. The results suggested that overall facial esthetics may be improved for patients with facial asymmetries by slightly deviating the maxillary dental midline from center. The second manuscript compares the concordance of twelve techniques for describing the position of the maxillary dental midline relative to the face with respondents' average preferred maxillary dental midline position for a symmetrical and 22 asymmetrical faces. A novel method that calculates the position of maxillary dental midline based on the position of the nose, cupid's bow, mouth and chin had the highest degree of concordance.

DTIC

Dentistry; Medical Science

20080039697 Monash Univ., Clayton, Australia

New Action of Inhibin Alpha Subunit in Advanced Prostate Cancer

Balanathan, Preetika; Feb 2008; 30 pp.; In English

Contract(s)/Grant(s): W81XWH-07-1-0112

Report No.(s): AD-A482777; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482777>

This project ultimately aims to identify the role of inhibin alpha subunit (INHA) in advanced prostate cancer (PCa). The hypothesis to be tested is that INHA is tumor promoting and pro-metastatic in advanced PCa. To date, we have made significant progress towards understanding the role of INHA in advanced prostate disease. We have demonstrated that increased INHA expression in highly aggressive and metastatic PCa cell line, PC3, further promotes its tumor growth and metastatic ability. Increase in metastasis was further evident by increase lymph vessel density and lymphatic invasion by the cancer cells. This was also accompanied by increase in VEGF-A and VEGF-C expression. Analysis of the clinical specimens demonstrated that INHA expression cannot be used to determine lymph node status in PCa patients. However, the results showed increased INHA expression in normal epithelium and intraepithelial neoplasia regions of the tissues from patient with lymph node metastasis compared to those with organ-confined disease suggesting that INHA may play an important role in promoting the spread of cancer cells to the lymph nodes. We will soon begin our work on understanding the mechanism through which INHA promotes tumor growth and metastasis. Whatever the outcomes of these experiments are, we are sure to contribute significantly to our understanding of the role of INHA in the process of prostate carcinogenesis.

DTIC

Cancer; Prostate Gland

20080039698 Minnesota Univ., Minneapolis, MN USA

CBP and p27KIP1 in Prostate Carcinogenesis

Hunag, Haojie; Feb 2008; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-07-1-0137

Report No.(s): AD-A482779; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482779>

CBP and p27KIP1 are two genes that are highly relevant to human prostate cancer. The objective of this proposal is to test the hypothesis that deletion of both alleles of CBP, in conjunction with deletion of one allele of p27KIP1, will result in the development of high-grade tumor in the prostate. The specific aims are to create CBP/p27KIP1 double knockout mice, to

determine whether they present enhanced tumor progression compared to CBP single knockout mice alone, and to determine whether the application of two drugs, bortezomib and suberoylanilide hydroxamic acid (SAHA), are effective for the treatment of prostate tumors developed in CBP/p27KIP1 mice. As scheduled in our proposal, we have generated CBP/p27KIP1 compound knockout mice in the past funding year. Moreover, more than 120 additional mice, including CBP/p27KIP1 double knockout male mice and their control littermates, are currently maintained in our laboratory in order to monitor tumor formation and progression.

DTIC

Cancer; Carcinogens; Genes; Prostate Gland

20080039699 Michigan Univ., Ann Arbor, MI USA

Decreased Expression of the Early Mitotic Gene, CHFR, Contributes to the Acquisition of Breast Cancer Phenotypes

Privette, Lisa M; Mar 2008; 61 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0332

Report No.(s): AD-A482780; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482780>

CHFR is an E3 ubiquitin ligase that reportedly delays mitosis in response to microtubule-targeting drugs (i.e. nocodazole and taxanes). Loss of CHFR mRNA expression has been reported in many cancers, including breast cancer, but the relevance of this to tumorigenesis remains unknown. The purpose of this study was to determine if CHFR was biologically relevant to breast cancer characteristics, progression, and genomic stability. As previously reported, nearly 40% of breast cancer show decreased CHFR expression compared to normal cells and tissues and the loss of CHFR expression by RNAi in cell culture models leads to the acquisition of several tumorigenic phenotypes. In particular, MCF10A IHMEC cells transfected with CHFR siRNA, became aneuploid and were analyzed for chromosome segregation defects. We observed increased aneuploidy, misaligned metaphase chromosomes, anaphase bridges, multipolar condensed spindles, multi-nucleated cells, and mislocalization of the mitotic spindle checkpoint proteins MAD2 and BUBR1. CHFR was found to interact with three crucial mitosis proteins, including MAD2 and Aurora A where CHFR loss led to Aurora A oncoprotein over-expression, but no change in MAD2 expression. -tubulin was identified as a novel target for CHFR-mediated ubiquitination after nocodazole treatment and decreased CHFR increased acetylated -tubulin, a mitotic spindle protein implicated in cellular response to taxane treatment. These data indicate that CHFR has tumor suppressive qualities and may be a biomarker for taxane chemoresponsiveness. CHFR also has a previously unrecognized role as a regulator of genomic stability. CHFR may be one of the few proteins that can control the cell cycle, chemotherapeutic response, and genomic stability - processes that go awry in breast cancer.

DTIC

Breast; Cancer; Genes; Mammary Glands; Mitosis; Ribonucleic Acids

20080039700 Texas Univ. Health Science Center, San Antonio, TX USA

Antioxidant Prophylaxis in the Prevention of Prostatic Intraepithelial Neoplasia (PIN)

Kumar, A P; Feb 2008; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0275

Report No.(s): AD-A482781; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482781>

Clinically significant prostate cancer usually occurs in men who are 65 and older although precursor lesions are known to exist many years prior to cancer diagnosis. Histopathological changes referred to as Prostatic Intraepithelial Neoplasia (PIN) are considered to be the most likely precursor of prostate cancer. The mechanism(s) involved in progression of indolent to active disease remains elusive although a role for age-related increase in oxidative stress has been proposed. There are a variety of reactive oxygen species (ROS) that ultimately cause oxidative stress and any particular oxidant has not been identified as being primarily involved. We rationalized that a combination of antioxidants may be necessary to neutralize the different classes of ROS to prevent the progression of latent precursor foci to active cancer. Therefore we devised a combination of antioxidants with varied antioxidant properties to determine whether such supplementation could prevent the progression of PIN in Noble rats that are stimulated to develop PIN with hormones. Results from this study show for the first time that dietary intervention with a combination of antioxidants caused a significant decrease ($p < 0.04$) in high grade PIN formation compared to animals on control diet. Levels of p65 (a component of NF B), Superoxide dismutase (SOD) and Cox-2 were elevated in the prostate from hormone-stimulated rats. These data provide evidence regarding the involvement of

oxidants in the progression of precursor lesions and the need to evaluate combinations of antioxidants as prostate cancer preventive agents.

DTIC

Antioxidants; Cancer; Health; Histology; Pathology; Pins; Prevention; Prophylaxis; Prostate Gland

20080039701 Texas Univ., Dallas, TX USA

Analysis of Morphogenic Effect of hDAB2IP on Prostate Cancer and Its Disease Correlation

Hsieh, Jer-Tsong; Feb 2008; 54 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0222

Report No.(s): AD-A482783; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482783>

DAB2IP was identified to be a DOC-2/DAB2 interactive protein from normal basal cell population of prostate. DAB2IP is a new member of RAS-GAP family that is known to modulate extracellular signal-elicited RAS pathways. In androgen-independent prostate cancer (AIPCa), RAS activation is often detected while DAB2IP is down regulated due to epigenetic control such as DNA methylation and histone acetylation or methylation. Genetic variation of DAB2IP is associated with the risk of aggressive PCa. In DAB2IP-knock out mouse, prostate hyperplasia is also noticed. Biochemical studies demonstrate that DAB2IP has a similar function as PTEN to modulate cell survival and apoptosis by interacting with critical proteins involved in these pathways. Thus, DAB2IP is a homeostatic complex controlling cell growth, differentiation and survival of prostate epithelia.

DTIC

Biochemistry; Cancer; Diseases; Prostate Gland; Proteins

20080039702 California Univ., Los Angeles, CA USA

Radiation-Induced Immune Modulation in Prostate Cancer

McBride, William H; Jan 2008; 72 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0126

Report No.(s): AD-A482784; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482784>

Radiotherapy is generally considered to be immunosuppressive, whereas we hypothesized that it modulates immune responses and has profound effects on the immune system rather than eliminating of lymphocytes. The goal of this study was to determine how radiation affects the presentation of prostate specific antigen (PSA), to investigate new potential mechanisms of altered immune function after radiation therapy, and to devise strategies to overcome radiation-induced immunosuppression in prostate cancer using treatment with IL-3 and/or GM-CSF. In addition, because of the high risk nature of the experiments and the high PSA expression levels in prostate cancer patients that might interfere with its efficacy, we developed a second model using survivin as an antigen, since it also is over-expressed in prostate and other cancers.

DTIC

Antigens; Cancer; Modulation; Prostate Gland; Radiation Effects

20080039703 Library of Congress, Washington, DC USA

The Cost of Iraq, Afghanistan, and Other Global War on Terror Operations Since 9/11

Belasco, Amy; May 30, 2008; 65 pp.; In English

Report No.(s): AD-A482785; CRS-RL33110; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482785>

With enactment of the FY2008 Consolidated Appropriations Act (H.R. 2764/P.L. 110-161) on December 26, 2007, Congress has approved a total of about \$700 billion for military operations, base security, reconstruction, foreign aid, embassy costs, and veterans health care for the three operations initiated since the 9/11 attacks: Operation Enduring Freedom (OEF) Afghanistan and other counter terror operations; Operation Noble Eagle (ONE), providing enhanced security at military bases; and Operation Iraqi Freedom (OIF). This \$700 billion total covers all war-related appropriations from FY2001 in supplementals, regular appropriations, and continuing resolutions including not quite half of the FY2008 request. Of that total, CRS estimates that Iraq will receive about \$526 billion (74%), OEF about \$140 billion (20%), and enhanced base security about \$28 billion (5%), with about \$5 billion that CRS cannot allocate (1%). About 94% of the funds are for DOD, 6% for foreign aid programs and embassy operations, and less than 1% for medical care for veterans. As of February 2008, DOD's monthly obligations for contracts and pay averaged about \$12.1 billion, including \$9.8 billion for Iraq, and \$2.3 billion for

Afghanistan. The Administration requested \$195.5 billion for war-related activities in DOD, State/USAID, and the Department of Veterans Affairs (VA) Medical programs for FY2008. Thus far, Congress has provided \$90.3 billion for war needs. Congress hopes to pass both the pending FY2008 supplemental request of \$105.2 billion and the amended FY2009 Bridge Fund of \$70 billion before the Memorial Day recess. For FY2009, the Administration requested about \$71.3 billion for war costs in baseline and bridge requests including \$66 billion for DOD, \$2.5 billion for State Department/USAID foreign and diplomatic operations, and \$1.3 billion for VA medical care for OIF and OEF veterans.

DTIC

Afghanistan; Costs; International Trade; Iraq; Medical Services; Military Operations; Warfare

20080039704 California Univ., Berkeley, CA USA

The Role of SnoN and Ski in Mammary Epithelial Cell Transformation

Pan, Deng; Dec 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0388

Report No.(s): AD-A482792; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482792>

Ski and SnoN are members of Ski oncoprotein family. Overexpression of Ski or SnoN can induce transformation of chicken embryonic fibroblast. Ski/SnoN is recently identified as a repressor of TGF signaling pathway which is an important tumor suppression pathway at the early stage of tumorigenesis. Higher level of Ski/SnoN is found in transformed mammary epithelial cells. Ski/SnoN might play a role in regulation of the transformation of mammary epithelial cell by antagonizing TGF signaling pathway. In my project, I try to explore the role of Ski/SnoN in the transformation of mammary epithelial cells.

DTIC

Breast; Cancer; Epithelium; Fibroblasts; Mammary Glands; Skis

20080039705 Colorado Univ., Aurora, CO USA

Muscle Contraction Arrests Tumor Growth

Westerlind, Kim C; Sep 2007; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0464

Report No.(s): AD-A482793; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482793>

We examined the hypothesis that a fatigue factor(s) is released by contracting muscle resulting in tumor inhibition. We used extracts from hind leg muscles stimulated (STIM) with moderate intensity to evaluate effects MCF7 and MDA MB 231 cells. The extracts were tested in vitro using 5-bromo-2-deoxyuridine incorporation and an apoptosis index based on morphology. STIM extracts increased apoptosis 127% (MCF7) and 190% (MDA MB 231) ($p = 0.05$) compared to SHAM, but had no effect on proliferation. No difference in effect was observed between cell lines. Based on the in vitro results, extracts were injected subcutaneously into female nude mice transplanted with breast tumor cells. Injections were daily for 4 weeks. Tumor size was measured 2x/wk and animals sacrificed after 4 wks. Tumors were excised, weighed and analyzed to determine proliferation and apoptotic indices. Tumors in animals treated with STIM extracts were significantly smaller (172 51mm³) than the SHAM (336 49mm³) and had increased apoptosis, by morphology and by TUNEL assay ($p < 0.03$). It appears that muscle contraction releases a factor which increased tumor cell apoptosis and caused smaller slower growing tumors. This may be one of the mechanisms by which exercise inhibits breast cancer development.

DTIC

Breast; Cancer; Contraction; Mammary Glands; Muscles; Muscular Function; Tumors

20080039706 New Mexico Univ., Albuquerque, NM USA

Curcumin Based Drug Screening for Inhibitors of NF kappa B in a Cell Model of Prostate Cancer Progression

Bisoffi, Marco; Feb 2008; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-07-1-0081

Report No.(s): AD-A482794; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482794>

We have identified structurally diverse chemical analogs of the polyphenolic phytochemical Curcumin with an enhanced inhibitory effect against hallmarks of prostate cancer progression. In the androgen independent and bone metastatic cell model of prostate cancer C4-2, these analogs inhibited (1) the activation of the nuclear transcription factor NF kappa B; (2) cell proliferation, (3) anchorage independent growth, (4) the expression of Interleukin-6, and (5) the activation of the androgen

receptor. In particular, polyphenols with 5-carbon linkers (analogs no. 48 and no. 50) and nitrogen side groups (analog no. 50) were more efficient than the mother compound Curcumin in inhibiting several hallmarks of prostate cancer progression. The analogs covered in this study display a variety of structural changes, including the length of the carbon chain, the nature of the side groups and the number of the aryl rings. This variety represents a platform for more refined screens of subtle variations of the analogs reported here; these screens will be performed in assays specific for the measurement of several molecular markers representing prostate cancer progression and bone metastasis, including the ones reported here and others, such as migration, invasion, adhesion to bone endothelial cells, and mineralization.

DTIC

Cancer; Drugs; Inhibitors; Prostate Gland

20080039709 Vanderbilt Univ., Nashville, TN USA

Laminin-5 gamma2 Chain in Breast Cancer Metastasis

Liu, Shanshan; Feb 2008; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0308

Report No.(s): AD-A482812; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482812>

Cancer cells have to break through basement membrane (BM) to metastasize. Laminin-5 is one of the major components of BM. It is composed of three chains alpha3, beta3 and gamma2. The DIII domain which could be released from Ln-5 gamma2 chain by MMPs processing, can bind to EGFR and activates the downstream signaling pathway. The role of Ln-5 in cancer progression is still unclear. There are paradoxical data in regard of the role of Ln-5 in cancer progression. Both increased and decreased expression levels of Ln-5 subchains are reported in the literature. The fact that gamma2 chain exists in two different forms (as a secreted monomer, or as a part of the Ln-5 heterotrimer) leads us to hypothesize that those two forms may play different roles in cancer progression. In this proposal we will determine whether Ln-5 gamma2 monomer is positively correlated with breast cancer tumorigenicity. We will also determine the role of Ln-5 gamma2 chain in cancer progression when it is in the context of Ln-5 heterotrimer.

DTIC

Breast; Cancer; Mammary Glands; Metastasis

20080039710 Hunter Coll., New York, NY USA

Discovery of Breast Cancer SERM Molecules: Novel Use of Fundamental Quantum Mechanics

Massa, Lou; Sep 2007; 6 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0658

Report No.(s): AD-A482813; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482813>

The background fact of this proposal recognizes that estrogen can cause breast cancer in susceptible women, but has beneficial effects elsewhere. Thus, we need to discover better selective estrogen receptor modulators (SERMs). We propose to discover SERMs through the topology of the electron density. Our rationale hypothesizes that topological pharmacophores exist in the molecular electron density as the fundamental identifying characteristics of SERMs. Our specific aim is to find SERM quantum pharmacophores by calculations of the electron density. We propose to compute the following topology characteristics of the molecular electron density: AIL (atomic interaction line), BCP (bond critical point), BP (bond path), CP (critical point), CCP (cage critical point), IAS (inter-atomic surface), (N)NA ((non)nuclear attractor), RCP (ring critical point). Each of the above topological characteristics is uniquely defined by the density, giving it existence at specific geometrical positions in the molecule. Quantum calculation of the electronic density over a drug molecule data base will uncover those topological pharmacophores having geometrical positions & orientations which closely match the cases of known estrogen mimics. This would provide a fundamental new methodology to discover improved SERM drugs, to prevent breast cancer, and promote general health, consonant with National Cancer Institute goals.

DTIC

Breast; Cancer; Estrogens; Mammary Glands; Molecules; Quantum Mechanics

20080039731 Chicago Univ., Chicago, IL USA

Detection and Evaluation of Early Breast Cancer via Magnetic Resonance Imaging: Studies of Mouse Models and Clinical Implementation

Jansen, Sanaz A; Mar 2008; 119 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0329

Report No.(s): AD-A482857; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482857>

The general goals of this research are to (i) improve the specificity of MRI to early cancer, particularly ductal carcinoma in situ (DCIS), by studying the MR presentation of early cancers compared with other malignant and benign lesions in women, (ii) to develop techniques for imaging DCIS and early invasive cancer in mice via MR imaging, and (iii) to use these techniques to study the progression of murine mammary cancer. The pre-clinical animal research proposed here can directly lead to clinical improvements in both early breast cancer detection, as well as effective breast cancer therapy. To date, we have performed a comprehensive evaluation of the MR kinetic and morphologic characteristics of DCIS and early invasive cancers compared with other lesions. We have also developed techniques to image early murine mammary cancer, including DCIS, using in vivo MRI. To our knowledge, this is the first report of the in vivo detection of murine DCIS with histopathologic correlation. We have also performed a longitudinal imaging experiment in 12 transgenic mice, following the development and progression of murine DCIS into invasive carcinoma. In this study we have found that some DCIS lesions have remained stable and did not progress to invasive cancer during the study window. These represent the first steps towards probing in vivo the radiologic and biologic changes that occur during the transition from in situ to invasive cancer.

DTIC

Breast; Cancer; Detection; Imaging Techniques; Magnetic Resonance; Mammary Glands; Mice

20080039732 Texas Univ., Houston, TX USA

Vasculature-Specific Adenovirus Vectors for Gene Therapy of Prostate Cancer

Krasnykh, Victor; Feb 2008; 26 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0200

Report No.(s): AD-A482858; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482858>

The goal of this project was to use the previously identified peptides with the reported specificity for neovasculature of prostate tumors to genetically modify the natural tropism of human adenovirus type 5 towards designing of tumor-selective gene therapy vectors. The study involved the design of peptide-modified Ad fiber proteins, their expression and characterization in vitro. A panel of recombinant adenovirus vector incorporating the most promising of these protein chimeras has been developed. These new vectors have been tested in vivo using human prostate xenografts established in nude mice as a model of target tumors. Biodistribution of the control and modified adenoviral vectors in these animals has been studied using non-invasive whole body imaging; measurements of the vector-encoded reporter activity in isolated organs and tumors; and also by qPCR-based detection of vector particles. This work showed, however, that none of the designed vectors possessed the tumor specificity expected based on the reported performance of chosen peptide ligands. Potential reasons for these unexpected findings are discussed.

DTIC

Adenoviruses; Cancer; Gene Therapy; Prostate Gland

20080039733 Massachusetts Univ. Medical Center, Worcester, MA USA

Flt-1 Function and Signaling in Breast Cancer

Harwood, Charlotte M; Oct 2007; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0728

Report No.(s): AD-A482859; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482859>

The VEGF receptor Flt-1 mediates VEGF survival signaling in cancer cells and has been correlated with a high risk metastasis and relapse in breast cancer. However, the function of Flt-1 in breast cancer is not yet known. Here we report an increase in Flt-1 expression in breast tumor cells exposed to a hypoxic environment. Interestingly, no increase in Flt-1 expression was observed in pre-malignant breast epithelial cells. Furthermore, Flt-1 was identified as a target of miR-10b, which is deregulated in breast cancer. We find that expression of mature miR-10b in breast cancer cells results in significant

down-regulation of Flt-1 expression. These findings will serve as a basis for functional studies of the role of Flt-1 and miR-10b in the etiology of breast cancer.

DTIC

Breast; Cancer; Mammary Glands

20080039734 Massachusetts Inst. of Tech., Cambridge, MA USA

A Data Mining Approach for Acoustic Diagnosis of Cardiopulmonary Disease

Flietstra, Bryan C; Jun 2008; 111 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482860; CI08-0011; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482860>

Variations in training and individual doctor's listening skills make diagnosing a patient via stethoscope based auscultation problematic. Doctors have now turned to more advanced devices such as x-rays and computed tomography (CT) scans to make diagnoses. However, recent advances in lung sound analysis techniques allow for the auscultation to be performed with an array of microphones, which send the lung sounds to a computer for processing. The computer automatically identifies adventitious sounds using time expanded waveform analysis We investigate three data mining techniques in order to diagnose a patient based solely on the sounds heard within the chest by a smart stethoscope. We achieve excellent recognition performance by using kappa nearest neighbors, neural networks, and support vector machines to make classifications in pair-wise comparisons. We also extend the research to a multi-class scenario and are able to separate patients with interstitial pulmonary fibrosis with 80% accuracy. Adding clinical data also improves recognition performance. Our results show that performing computerized lung auscultation offers a low-cost, non-invasive diagnostic procedure that gives doctors better clinical utility especially in situations when x-rays and CT scans are not available.

DTIC

Breathing; Cardiovascular System; Computer Aided Tomography; Data Mining; Diagnosis; Diseases; Heart Diseases; Heart Function; Information Retrieval; Physicians; Stethoscopes; X Rays

20080039735 Vanderbilt Univ., Nashville, TN USA

How MMPs Impact Bone Responses to Metastatic Prostate Cancer

Lynch, Conor C; Feb 2008; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-07-1-0208

Report No.(s): AD-A482861; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482861>

Using an animal model of prostate tumor progression in the bone we have previously shown that MMPs, namely MMP-2,-3,-9 and -13, are overexpressed at the tumor bone interface and these MMPs are for the most part expressed by the host cells of the bone. To test the contribution of MMPs in prostate tumor progression in the bone, we have generated mice that are immunocompromized and deficient for MMP-2,-3 and -9 during the current period. We have found that MMP-9 does not contribute to prostate tumor progression in the bone since no difference in osteolytic or osteoblastic responses between wild type and MMP-9 deficient animals were detected by Faxitron, CT, SPECT and histomorphometry. These results, while negative, are important for the generation of selective MMP inhibitors that lack the deleterious side effects associated with broad spectrum inhibitors. In addition, we have also identified PTHrP as an MMP substrate and postulate that MMP processing of PTHrP may be a mechanism through which MMPs can contribute to tumor induced osteolysis.

DTIC

Bones; Cancer; Metastasis; Prostate Gland

20080039751 Walter Reed Army Inst. of Research, Silver Spring, MD USA

WRAIR Protocols for Soldier Status and Readiness to Organophosphate Exposure: Unprocessed Whole Blood Cholinesterase and Pyridostigmine Bromide Quantification

Garcia, Gregory E; Feaster, Shawn R; Moorad, Deborah R; Doctor, Bhupendra P; Gordon, Richard K; Clark, Connie R; Smith, J R; Lukey, Brian J; Reitstetter, Raven E; Jul 1, 2003; 5 pp.; In English

Report No.(s): AD-A482892; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482892>

Exposure to nerve agents, OPs, pesticides, anesthetics, terrorists' chemical agents, and drugs of abuse such as cocaine, heroin, and some neuro-degenerative disease states selectively reduces AChE and/or BChE activity. Since urban terrorism is on the rise, Federal, State, and local authorities need a reliable, fast, inexpensive method for confirming such an assault to

initiate appropriate containment, decontamination, and treatment measures. Thus, we developed a semi-automated medical diagnostic microplate procedure capable of screening unprocessed whole blood samples for the concentrations of AChE and BChE (patent pending, WRAIR) to overcome limitations of current methods. We applied our technique to whole blood in man, non-human primates, and rodents. In addition, pyridostigmine bromide (PB) treatment is the only prophylactic treatment for troops who expect to be exposed to OPs. Thus, we developed a sensitive HPLC technique to quantify PB in human blood and also in Rhesus and rodent blood and tissue. The technique uses solid phase extraction, lyophilization for concentration, and HPLC of the reconstituted samples followed by strong-cation exchange chromatography via isocratic elution. These techniques will provide the soldier, field medic, hospital, company, or civilian organization with the ability to rapidly determine exposure to OPs and aid in treatment while the HPLC assay will aid in verifying troop compliance when required for PB prophylaxis against OPs.

DTIC

Blood; Bromides; Cholinesterase; Organic Phosphorus Compounds; Protocol (Computers)

20080039793 Vanderbilt Univ., Nashville, TN USA

A Myc-Driven in Vivo Model of Human Prostate Cancer

Hayward, Simon W; Oct 2007; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0867

Report No.(s): AD-A482907; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The long-term goal of the work proposed here is to generate, characterize and interrogate human epithelial cell-based in vivo models of prostatic carcinogenesis. These models will allow an examination of processes involved in carcinogenesis, tumor growth and metastasis. Since the tumors are themselves of human origin they represent an in vivo test bed to examine both tumor biology and the application of therapeutic agents. In the third year of funding we have completed a thorough study of metastatic spread of human prostatic epithelium from the orthotopic site using a model developed in year 2. We have generated and characterized two new normal prostatic epithelial cell lines which show promise for widespread applicability in prostate cancer research. We have continued to explore the use of lower dose Myc expressing constructs and have investigated the combination of lower levels of Myc with additional other genes commonly changed in prostate cancer to make more clinically relevant models. Specifically we have followed up on the suppression of PTEN described in the second report and have also combined suppression of PPAR. with expression of cMyc to produce enhancement of a mild myc-induced phenotype.

DTIC

Cancer; In Vivo Methods and Tests; Prostate Gland

20080039795 Johns Hopkins Univ., Baltimore, MD USA

Development of Antigen Presenting Cells for Adoptive Immunotherapy in Prostate Cancer

Oelke, Mathias; Dec 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81-XWH-05-1-0133

Report No.(s): AD-A482909; No Copyright; Avail.: Defense Technical Information Center (DTIC)

While adoptive immunotherapy holds promise as a treatment for cancer and infectious diseases, development has been impeded by the lack of reproducible methods for generating therapeutic numbers of antigen-specific CD8+ CTL. As a result, there are only limited reports of expansion of antigen-specific CTL to levels required for clinical therapy. Therefore, our groups has previously developed artificial Antigen-Presenting Cells (aAPC), made by coupling soluble HLA Ig and anti-CD28 to beads. These aAPC have successfully been used to induce and expand CTL specific for CMV or melanoma. For the current study we have proposed to used and further developed those aAPC for the generation of prostate cancer specific CTL. Our preliminary data demonstrate that aAPC loaded with the prostate cancer specific antigen EpHA2 have been used to generate functional active prostate cancer-specific CTL from peripheral blood healthy donors.

DTIC

Antigens; Cancer; Prostate Gland

20080039797 Washington Univ., Saint Louis, MO USA

Noninvasive Localization of Prostate Cancer via Diffusion Sensitive MRI

Xu, Junqian; Mar 2008; 42 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0210

Report No.(s): AD-A482920; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Diffusion tensor magnetic resonance imaging (DTI) measurements of prostate cancer (PCa) were performed in vivo, in

patients undergoing radical prostatectomy, and ex vivo, in the same patients' prostatectomy specimens. For the first time, the imaging data were co-registered to histological sections of the prostatectomy specimens, thereby enabling unambiguous characterization of diffusion parameters in cancerous and benign tissues. Through image co-registration and histological analysis, we have shown that increased cellularity, and thence decreased luminal spaces, in peripheral zone PCa leads to about 40 % and 50 % apparent diffusion coefficient (ADC) decrease compared to benign peripheral zone tissues in vivo and ex vivo, respectively. In contrast, no significant diffusion anisotropy differences between the cancerous and non-cancerous peripheral zone tissues were observed. The bundled fibromuscular tissues in prostate, such as stromal tissues in benign prostatic hyperplasia (BPH), exhibited high diffusion anisotropy facilitating the differentiation of PCa from BPH in central gland. A tissue classification method, combining DTI and T2w images, was proposed to provide more specific PCa detection. An ADC threshold for PCa was also established to provide unsupervised PCa localization. The PCa identified using this method correlate well with histologically identified PCa foci.

DTIC

Cancer; Diffusion; Imaging Techniques; Magnetic Resonance; Position (Location); Prostate Gland; Sensitivity

20080039798 Virginia Univ., Charlottesville, VA USA

A Novel Approach to the Development of Highly Specific Inhibitors of EFG, a Critical Transcription Factor in Prostate Cancer

Bushweller, John H; Kabzinski, Tomasz K; Mar 2008; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-07-1-0113

Report No.(s): AD-A482921; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have created a series of six constructs to express varying length fragments of ERG. Expression and purification protocols have been established for all six fragments. Using fluorescein-labeled oligonucleotides, we have developed a fluorescence polarization based assay for measuring the DNA binding of the ERG fragments to a functional DNA element. Using this assay, we have shown that longer fragments of ERG show decreased DNA binding, i.e. are auto-inhibited. Based on this data, we have focused efforts on producing one fragment in the labeled form necessary for NMR structural studies.

DTIC

Cancer; Inhibitors; Prostate Gland

20080039802 Loma Linda Univ., CA USA

Pim-1: A Molecular Target to Modulate Cellular Resistance to Therapy in Prostate Cancer

Lilly, Michael; Oct 2007; 67 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0887

Report No.(s): AD-A482927; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The contract supports studies to define the role of the PIM1 kinase in acquired resistance to chemotherapy by prostate cancer cells. Data to date for specific aim #1 define a signaling pathway induced by docetaxel involving sequential steps of STAT3 phosphorylation expression of PIM1 and activation of NFkB signaling. Blockade of this pathway prevents drug-induced upregulation of NFkB activity and sensitizes cells to docetaxel. Other studies (specific aim #2) focus on identifying a mechanism through which PIM1 activates NFkB. We have unambiguously identified S937 as the major PIM1 phosphorylation site on the NFkB1/p105 precursor protein through use of LCM/MS/MS analysis. We have now shown that phosphorylation at S937 potentiates NFkB transcriptional activity. Additional data (specific aim #3) have been published to describe a small molecule inhibitor of PIM1. This molecule can sensitize prostate cancer cells to the cytotoxic effects of docetaxel in an additive or synergistic manner. Pharmacophore analysis has identified future modifications of the inhibitor.

DTIC

Cancer; Enzymes; Phosphorus; Prostate Gland; Targets; Therapy

20080039804 Naval Research Lab., Washington, DC USA

Cellular Genomic Analysis with GMR Sensor Arrays

Tamanaha, C R; Mulvaney, S P; Wahowski, K A; Tondra, M C; Whitman, L J; Colton, R J; Oct 2003; 5 pp.; In English

Report No.(s): AD-A482929; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A new cellular genomic analysis device is introduced that integrates cell lysing microfluidics, and micromagnetic mRNA labeling and detection on one microfabricated substrate. The magnetic sensor, benzocyclobutene (BCB) microfluidics,

investigative genomic assay, magnetic labels, and surface chemistry development for the new cellular genomic analysis device are described.

DTIC

Benzoic Acid; Esters; Genome; Ribonucleic Acids

20080039806 Beth Israel Deaconess Medical Center, Boston, MA USA

New Approaches for Prostate Cancer Combination Therapy

Zerbini, Luiz F; Apr 2008; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0459

Report No.(s): AD-A482931; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The mechanisms underlying the antineoplastic actions of NSAIDs remain poorly understood. We started deciphering now the mechanisms by which NSAIDs induce programmed cell death and growth arrest in cancer. In this report we show that induction of the pro-apoptotic cytokine melanoma differentiation associated gene-7/Interleukin-24 (MDA-7/IL-24) and the expression of growth arrest and DNA damage inducible (GADD) 45 alpha and y by several NSAIDs is an essential step for G2/M growth arrest and apoptosis induction of cancer cells and inhibition of tumor growth in vivo. MDA-7/IL24 dependent upregulation of GADD45alpha and y expression is sufficient for cancer cell apoptosis since inhibition of GADD45alpha and y by small interfering RNA abrogates apoptosis and growth arrest induction by the NSAID blocks JNK activation and restores CDC2 kinase activity. Our results establish MDA-7/IL-24 and GADD45alpha and y as critical mediators of apoptosis and growth arrest in response to NSAIDs in cancer cells. Pharmacological inhibitors of NF-KB have a potent effect in apoptosis induction of prostate cancer cells as well as in combination with NSAIDs. This new treatment could be then tested in combination of inhibitors of NF-KB pathway which are already in clinical trials.

DTIC

Apoptosis; Cancer; Prostate Gland; Therapy

20080039807 Massachusetts General Hospital, Boston, MA USA

Long-Term Outcomes of Alternative Brachytherapy Techniques for Early Prostate Cancer

Talcott, James A; Jan 2008; 17 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0093

Report No.(s): AD-A482932; No Copyright; Avail.: Defense Technical Information Center (DTIC)

All active, potentially curative treatments for clinically localized prostate cancer damage quality of life. Brachytherapy, or radioactive seed implants, theoretically may increase the target radiation dose and thus improve control of cancer. It has been rapidly adopted in the U.S. despite limited long-term published outcomes, in part because of its convenience and apparently attractive toxicity profile. However, our recent survey of brachytherapy patients after longer follow-up found surprisingly frequent urinary incontinence and erectile dysfunction. Retrospective evidence suggests that reducing the radiation dose to the urethra may prevent later urinary incontinence. A recent refinement of conventional brachytherapy technique targets only the peripheral zone of the prostate, sharply reducing the dose to the urethra, and attempts to reduce radiation cold spots by using intraoperative feedback from real-time magnetic resonance imaging (MRI). Using our validated cancer-specific scales, our pilot data suggested that the altered brachytherapy technique had the intended benefit but also unexpected outcomes. We have extended our cohort study of 276 brachytherapy patients and now compare 3- and 24-month outcomes of this technique to standard ultrasounded-guided brachytherapy.

DTIC

Cancer; Imaging Techniques; Magnetic Resonance; Prostate Gland; Radiation Dosage; Urology

20080039808 California Univ., Livermore, CA USA

PSA-Based Screening Outcomes, Dietary Heterocyclic Amine Exposure, and Prostate Cancer Risk in African Americans

Bogen, Kenneth T; Jan 2008; 29 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0153

Report No.(s): AD-A482933; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Prostate cancer (PC) is the second leading cause of male U.S. cancer deaths, with African-Americans having the highest rate of PC mortality worldwide, as well as more abnormal results from screening tests that correlate with current or eventual PC. A 5-year prospective NIH-funded clinic-based study investigated whether prostate-specific antigen (PSA) and digital rectal exam (DRE) screening indicators of PC risk in 500 African-American men 50 to 70 years of age who underwent PC

screening in Oakland, CA (East Bay San Francisco area), were associated with estimated dietary exposures to 2-amino-1-methyl-6-phenylimidazo[4,5-b]pyridine (PhIP), which forms when meat is overcooked. The DOD-funded study expands that NIH-funded work by adding a new % -free-PSA test for 310 (108 from the NIH-funded study, plus 202 additional) men, results of which will be compared with PSA/ DRE results and PhIP exposures estimated by dietary interviews. For 392 men studied under the NIH protocol, an odds ratio (95% CL) of 32 (3.2, 720) for highly elevated PSA (≥ 20 ng/mL) was observed in the highest 15% vs. the lower 50% of estimated daily PhIP intakes. As of 09-01-07, a total of 310 men completed participation using the expanded protocol, for a combined total of 702 men. For the final analysis of all 702 men, the corresponding OR was found to be 10 (2.9, 58). This study will help define the potential value of improved screening and dietary/behavioral intervention to reduce PC risk.

DTIC

Africa; Amines; Cancer; Diets; Epidemiology; Exposure; Heterocyclic Compounds; Prostate Gland; Risk

20080039810 California Univ., San Francisco, CA USA

Gene Expression Analysis of Circulating Hormone Refractory Prostate Cancer Micrometastases

Rosenberg, Jonathan; Jan 2008; 31 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0175

Report No.(s): AD-A482935; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This annual report for the Physician Research Training Award focuses on progress in the genetic analysis of circulating hormone refractory prostate cancer micrometastases. As metastatic tissue is often inaccessible in advanced prostate cancer patients, analysis of circulating tumor cells may provide understanding of the biology of hormone refractory prostate cancer as well as chemotherapy resistance. Oligonucleotide array comparative genomic hybridization allows the assessment of genetic changes that may occur in the process of metastasis and chemotherapy resistance. Genomic profiling using this technology will go beyond cell counting, and circumvent technical complexities related to working with RNA. Work performed over the last year has perfected techniques to deal with small amounts of DNA isolated using the Vitatex cell isolation system. Preliminary data suggests that reproducible genomic alterations are observed in the circulating tumor cells isolated from patients with metastatic hormone refractory prostate cancer. During year 3, having ironed out the methodology of pursuing this work, we will ramp up collection of peripheral blood on patients with hormone refractory prostate cancer to isolate circulating tumor cells and perform genetic analyses.

DTIC

Cancer; Cells (Biology); Chemotherapy; Circulation; Gene Expression; Hormones; Oligomers; Prostate Gland; Refractories; Tumors

20080039811 Baylor Coll. of Medicine, Houston, TX USA

Unmasking Stem/Progenitor Cell Properties in Differentiated Epithelial Cells Using Short-term Transplantation

Lewis, Michael T; Aug 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0427

Report No.(s): AD-A482936; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Background: Prevailing models maintain that stem cells comprise a minority of epithelial cells. However, some data suggest the percentage of mammary stem cells may be underestimated using common assays. Rationale: Short term transplantation using fragments of mammary duct offer an opportunity to test the prevailing stem cell model. If division-competent stem cells represent a small percentage of all epithelial cells, the initial rate of cell division in transplanted fragments should be low. However, if stem cells can include more differentiated, yet division-competent cells, the initial rate of cell division in fragments should be high Objectives: 1) To determine the range of mammary stem cell types participating in gland regeneration. 2) To develop the short-term transplantation assay as a means by which critical regulators of stem and progenitor cell behavior can be discovered and evaluated. Relevance: Studies will provide a direct test of prevailing stem cell models.

DTIC

Epithelium; Mammary Glands; Stem Cells; Transplantation

20080039815 North Carolina State Univ., Raleigh, NC USA

Development and Evaluation of realistic Microbioassays in Droplets on a Chip

Velev, Orlin D; Oct 27, 2007; 42 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-1-0466

Report No.(s): AD-A482942; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We developed a novel technique for biomolecular detection in microliter droplets floating on the surface of high density

oil. Each droplet was captured and manipulated dielectrophoretically and was used as a site for a microscopic bioassay based on agglutination of antibody-conjugated particles. The results were read out by the pattern of agglomerated gold nanoparticles collected on the droplet surface. Two formats of bioassays, namely GOAgg (Gold Only Agglutination) and GLAgg (Gold and Latex Agglutination), were investigated experimentally by varying analyte concentration, particle size and concentration, number of antigen binding sites per particle, time for incubation and rate of particle collection on the droplet surface. The microbioassays performance was also evaluated with Ricin antibodies and compared to the Army Ricin assays in field use. We estimate that the droplet based assays require 100 times smaller sample volume and are ten times more sensitive, though they require longer times to complete. The experiments were interpreted by modeling the kinetics of particle agglutination and mass transfer processes inside the droplets. The results could allow for development of efficient immunoassays on a chip requiring even smaller sample volumes.

DTIC

Agglutination; Chips; Drops (Liquids)

20080039820 Pennsylvania Univ., Philadelphia, PA USA

Multiplex Quantitative Histologic Analysis of Human Breast Cancer Cell Signaling and Cell Fate

Lee, William M; Roysam, Badrinath; May 2008; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-07-1-0325

Report No.(s): AD-A482956; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Many molecular events and cellular processes are preserved in fixed human tumor specimens, and access to this wealth of information about human cancers in authentic context awaits a method for them to be quantified and analyzed. Some, such as cell signaling and cell fate decisions, are prognostically and therapeutically important, and can be revealed by immunohistological staining. We are developing a novel platform for immunohistological study of breast cancer specimens that will retrieve multiplex quantitative molecular information about tumor cells at a cytologic level. The platform will use multispectral microscopy to examine breast cancer specimens that have been immunostained for multiple structural and functional antigens using different chromogens and fluorophores. Staining for structural antigens (nuclei, epithelial cytokeratins, E-cadherin), allows cells to be identified and classified as breast cancer cells. Staining for cell signaling and fate antigens (p-ERK, p-AKT, Ki-67) reports on these important biological processes and events in cells. Multispectral microscopy permits staining for individual antigens to be distinguished and separated from staining for other antigens in multiplex-stained slides. The other component of the proposed platform is software for analyzing multispectral images individually and associatively. Algorithms will identify and classify cells in images, attribute signaling and cell fate events and processes to each cell, and reveal relationships among events through analysis of association among their stains.

DTIC

Breast; Cancer; Histology; Mammary Glands; Multiplexing; Quantitative Analysis

20080039821 Wyoming Univ., Laramie, WY USA

BRCA 1-Mediated Histone Monoubiquitylation: Effect on Nucleosome Dynamics

Zlatanova, Jordanka; Feb 2008; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0664

Report No.(s): AD-A482957; No Copyright; Avail.: Defense Technical Information Center (DTIC)

BRCA1, the protein product of the Breast Cancer Susceptibility Gene (BRCA1) has been implicated in multiple pathways that preserve genome stability, including cell cycle control, DNA repair, transcription, and chromatin remodeling. BRCA1, in complex with another RING-domain protein BARD1, possesses ubiquitin-ligase activity. Only a few targets for this activity have been identified in vivo. Nucleosomal histones may be among these targets since they can be modified by BRCA1/BARD1 in vitro. Here we demonstrate that the BRCA1/BARD1 complex can ubiquitylate both free H2A and H2B histones and histones in the context of nucleosomal particles. We have also investigated the possibility that BRCA1/BARD1 can attach ubiquitin to H2A and H2B residing on the same particle. These results raise the possibility that BRCA1/BARD1 can directly affect nucleosomal structure, dynamics, and function through its ability to modify nucleosomal histones.

DTIC

Breast; Cancer; Mammary Glands

20080039822 California Univ., Los Angeles, CA USA

Radiation Effects on the Immune Response to Prostate Cancer

McBride, William H; Feb 2008; 42 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-07-1-0135

Report No.(s): AD-A482958; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Radiation therapy (RT) is the front line treatment for prostate cancer in the early stages but is relatively ineffective against large tumor volumes and it is difficult to use it against micrometastatic disease. Immunotherapy (IT) has become popular as an alternative treatment since the discovery of prostate tumor-associated antigens (TAA) and of corresponding tumor-specific T cells in prostate cancer patients. However, IT is not a very effective modality on its own due to multiple tumor escape mechanisms and probably would benefit from combination with other therapies, such as RT. At least in theory, a potential advantage is that radiation affects the immune system by upregulating MHC class I and co-stimulatory molecules, which could promote T cell filtration into tumors and T cell activation. On the other hand, we recently showed that radiation affects proteasome function, which could affect antigen processing, and appears to have other effects on DC antigen presentation. In the first year of this study, we have been constructing cell lines to examine this in prostate cancer. We have also examined the effects of radiation on DC processing PSA either endogenously or exogenously as well as on proteasome and immunoproteasome function in DCs. The final goal of the proposal is to determine if radiation affects the hierarchy of antigenic peptide presented by DCs and tumor cells and to devise better strategies in combination treatments of RT and IT.

DTIC

Cancer; Immunity; Physiological Responses; Prostate Gland; Radiation Effects

20080039823 Vanderbilt Univ., Nashville, TN USA

Investigating the Role of TBX2 in the Inhibition of Senescence in Prostate Cancer

Nandana, Srinivas; Mar 2008; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-07-1-0155

Report No.(s): AD-A482959; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The aim of this project is to dissect the role of Tbx2 in prostate cancer progression. In the present study we have found that by reducing the expression of Tbx2 in prostate cancer cell lines reduces proliferation in vitro. Further, utilizing tissue recombination techniques we found that the grafts obtained from NeoTag-2 mouse prostate cancer cells containing the dominant negative Tbx2 construct are more differentiated as compared to controls. These findings suggest that inducing senescence by down-regulating Tbx2 may reduce tumorigenesis and hence Tbx2 plays an important role in prostate cancer progression.

DTIC

Aging (Biology); Cancer; In Vitro Methods and Tests; Prostate Gland

20080039826 Boston Univ., Boston, MA USA

Neuropsychological Functioning in Gulf War Veterans Exposed to Pesticides and Pyridostigmine Bromide

Krengel, Maxine; Feb 2008; 63 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0118

Report No.(s): AD-A482966; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report reviews the third year of research on the diagnostic utility of psychophysiological indict that may predict the current and future functional efficiency of the soldier. The research focuses especially on the measurement of cerebral bloodflow velocity (CBFV) using transcranial Doppler sonography (TCD), together with additional indices including salivary cortisol and subjective state. Two studies at the University of Cincinnati demonstrated that CBFV declines during cognitive vigilance and during simulated driving, extending prior results from sensory vigilance tasks. In addition, phasBloodflow responses to a short task battery predicted cognitive vigilance. Predictive validity was increased by including subjective state measures in a multivariate model. Research at Georgia State University, employing simulated military tasks representing sentry duty, peacekeeping operations, and tactical decision making. These studies confirmed that CBFV correlates with various performance indices, indicating that the technique may have diagnostic utility not just for vigilance, but also military decision-making. Attentional skills and eye movement indices were also found to have diagnostic utility. The report concludes with a summary of the main findings from the three years of research, and recommendations for future studies to translate the research into applied techniques fodiagnostic monitoring and prediction in military environments.

DTIC

Bromides; Gulfs; Neurology; Persian Gulf; Pesticides; Psychology; Warfare

20080039827 Army Medical Dept. Center and School, Fort Sam Houston, TX USA

US Army Medical Department Journal, January - March 2008. Warriors in Transition; Healing with Dignity and Determination

Aldridge, Don; Aquino, Janet; Burton, Richard; Mar 2008; 77 pp.; In English; Original contains color illustrations
Report No.(s): AD-A482968; PB8-08-1/2/3; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Clinical and nonclinical professional information designed to keep U.S. Army Medical Department personnel informed of health care, research, and combat and doctrine development information.

DTIC

Healing; Medical Services; Military Operations; Periodicals

20080039845 California Univ., Davis, CA USA

Characterization of MHC-Related Volatile Organic Compounds in Heterologous Expression Systems: Role of Infection in Odor Compound Generation

Davis, Cristina; Nov 25, 2007; 17 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W911NF-06-1-0272

Report No.(s): AD-A482999; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Major histocompatibility complex (MHC) human leukocyte antigen (HLA) in humans plays significant role in mate selection and kin recognition mainly through apparition of organism specific odor recognized by other individuals. However a mechanism of the relationship between unique MHC genetic combination of an organism and generation of the specific organism odor is not understood. We are showing here that human B cells produce volatile organic (odor) compounds measurable by GC/MS technique. More importantly, our results evidence that a presence of specific HLA allele in the cells is related to apparition of specific cell odor fingerprint. This work demonstrates for the first time that HLA influences production of specific odor.

DTIC

Antigens; Genetics; Infectious Diseases; Leukocytes; Lymphocytes; Odors; Volatile Organic Compounds

20080039854 Harvard School of Public Health, Boston, MA USA

The Infectious Pathogenesis of Prostate Cancer

Adami, Hans-Olov; Mucci, Lorelei A; Mar 2008; 10 pp.; In English
Contract(s)/Grant(s): W81XWH-07-1-0238

Report No.(s): AD-A483035; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Accumulating evidence points to a role of chronic inflammation in the pathogenesis and progression of cancers including prostate. Infections are important agents in the genesis of inflammation. For prostate cancer several lines of evidence point to a role of infections as important agents although no specific infection has consistently been identified. In this project we are examining two specific infectious agents with respect to prostate cancer: T vaginal is the most common non-viral sexually transmitted infection, and the recently identified retrovirus XMRV. The aims of this study are 1-) To assess the role of the newly identified XMRV virus in prostate carcinogenesis and progression; 2-) To characterize the role of the infectious protozoa T. vaginalis in prostate carcinogenesis and progression. The current study is nested within the Swedish Watchful Waiting Cohort a population-based cohort of 1256 Swedish men diagnosed with localized prostate cancer. During 28 years of follow-up 320 men have died of cancer and thus this is a powerful population in which to examine determinants of prostate cancer progression. A tumor repository from archival tissue specimens have been collected from all men in the cohort and will be used to assay for presence of the infections.

DTIC

Cancer; Pathogenesis; Prostate Gland

20080039855 Medicine and Dentistry Univ. of New Jersey, Newark, NJ USA

Spiritual-Based Intervention for African American Women with Breast Cancer

Brown, Diane R; Jul 2007; 143 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0494

Report No.(s): AD-A483039; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Because social support has been shown to have value in decreasing morbidity and possibility in increasing length of survival in cancer patients, the objectives of the study are: 1) to utilize a network of oncology services, churches, and community organizations to recruit African American women diagnosed with breast cancer for project participation; 2) to

implement the spiritual-based intervention; 3) to assess the efficacy of the intervention to positively impact treatment-related outcomes; and 4) to refine the intervention for broader dissemination. The intervention involved an experimental/control group design approach. The experimental support group (intervention group) received the Spiritual-based support intervention. There were two control groups: control group A included participants in a traditional support group model and control group B included individuals who received the standard care consisting of no additional structured support. Data were gathered through a pre-test at baseline (T1), a post test at the conclusion of the 7 month intervention (T2), and at a three-month follow-up at the end of the support group sessions (T3). Findings suggest a positive influence of the spiritual support group on mental well-being, with the impact diminishing over time.

DTIC

Africa; Breast; Cancer; Females; Mammary Glands

20080039856 L-3 Communications Corp., San Diego, CA USA

Overuse Injury Assessment Model

Stuhmiller, James H; Shen, Weixin; Aug 2007; 276 pp.; In English

Contract(s)/Grant(s): DAMD17-02-C-0073

Report No.(s): AD-A483040; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The research conducted under this contract has provided critical model, data, hardware, and software products to assist the MOMRP effort to provide research solutions to reduce injuries and improve performance outcomes during military training. This report summarizes those products in the following areas: Training, Overuse Injury, and Performance (TOP) modeling, Bone stress fracture research, Biomechanical modeling, and Mobile biomechanical measurements.

DTIC

Computer Programs; Injuries

20080039857 Duke Univ., Durham, NC USA

The Effects of Information Displays in Decisions about Tamoxifen Use for Breast Cancer Chemoprevention

Lipkus, Isaac; Sep 2006; 6 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0382

Report No.(s): AD-A483042; No Copyright; Avail.: Defense Technical Information Center (DTIC)

During this reporting period, the focus has been on continued recruitment and completing the laboratory and follow up surveys. No analyses have been performed during this period. No significant changes were made to study design or instruments. No adverse events or study deviations occurred. Two protocol deviations from prior years that were not previously reported are indicated here. Recruitment and study numbers are updated for the reporting period.

DTIC

Breast; Cancer; Display Devices; Estrogens; Hormones; Mammary Glands

20080039859 Army Command and General Staff Coll., Fort Leavenworth, KS USA

Medical Diplomacy in the USA Army: A Concept Whose Time Has Come

Krueger, Mary V; Jun 13, 2008; 107 pp.; In English; Original contains color illustrations

Report No.(s): AD-A483047; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Prior to the attacks of September 11th the USA Military founded defense plans on a threat-based model, with the nation being prepared to conquer adversaries with the most advanced combat power. The 2001 attacks and subsequent Global War on Terrorism have led to a new geopolitical reality, where military planners must increase US combat effectiveness in a new way by denying refuge to the terrorists who wish to defeat US troops, as well as the Western way of life. Medical diplomacy is a nonlethal tool used in combination with economic and diplomatic efforts to achieve this end. The Army has engaged in activities labeled as medical humanitarian assistance throughout the 20th century with varying degrees of success. The current, continuous, low-level conflict makes a consistent, effective plan for leveraging medical diplomacy, a directed form of humanitarian assistance, of paramount importance. When utilized effectively, medical diplomacy can alleviate suffering, as well as provide stability, through economic development, and legitimacy to the supported government. These actions collectively deny refuge to terrorists. This thesis will define medical diplomacy, review its history in Army medicine, and determine through qualitative analysis the characteristics of effective medical diplomacy. These characteristics will then be used to create a framework with which to evaluate current Army doctrine and lessons learned observations from OIF/OEF in regards to their adherence to sound principles of medical diplomacy.

DTIC

Medical Science; Medical Services; Military Operations; United States

20080039860 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

Comparison of the Immune Response To Coxiella burnetii and Burkholderia mallei in Balb/C Mice: A Differential Response by Two Diverse Biological Agents

Amemiya, Kei; Bush, Gary V; DeShazer, David; Waag, David M; Jul 1, 2003; 8 pp.; In English
Report No.(s): AD-A483048; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We compared the immune response of BALB/c mice to two biological agents, Coxiella burnetii and Burkholderia mallei. Both C. burnetii and B. mallei cell preparations induced a proliferative and a mixed Th1- and Th2-like cytokine response in splenocytes from vaccinated mice. B. mallei cell preparations induced higher levels of IgG and IgM than did C. burnetii. The ratio of the subclasses IgG2a over IgG1 from C. burnetii vaccinated mice was higher than 1.0, while the ratio from B. mallei was lower than 1.0. The difference in the Th1-like response of the Ig subclasses may be part of the reason why vaccination with the C. burnetii can lead to a protective response, while vaccination with B. mallei does not.

DTIC

Immunity; Microorganisms; Physiological Responses

20080039861 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

Conformational Analysis of the Acyl Pocket Loop in Acetylcholinesterase Computed by Monte Carlo Methods With a Generalized Born Model of Solvation

Carlacci, Louis; Olson, Mark; Millard, Charles B; Jul 1, 2003; 9 pp.; In English
Report No.(s): AD-A483050; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Acetylcholinesterase catalyzes the hydrolysis of the neurotransmitter, called acetylcholine. Based on X-ray crystallography, the acyl pocket loop (APL; residues 287 to 290) was observed in two conformations, the native conformation (2ACE) and an alternative conformation (2DFP), which the APL interacts with an irreversible inhibitor. The free energy of the 2DFP state was 4 kcal/mol higher than that of the 2ACE state. The native state has a more favorable solvation free energy, due primarily to Arg 289 interactions. The information should be useful in the development of antidotes against biological and chemical warfare agents that target AChE.

DTIC

Acetyl Compounds; Biological Weapons; Chemical Warfare; Cholinesterase; Monte Carlo Method; Solvation

20080039865 Massachusetts Univ. Medical Center, Worcester, MA USA

Centrosome Defects, Genetic Instability and Breast Cancer Progression

Mirabelle, Stephaine; Doxsey, Stephen; Aug 2006; 84 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0565

Report No.(s): AD-A483057; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Breast cancer is the most prevalent of all cancers and it is the second most common cause of cancer death amongst women. Centrosome defects have been implicated in cancer formation and can be detected very early in this process. The centrosome protein pericentrin is overexpressed in many cancers including breast cancer. We found that down regulation of pericentrin leads to cytokinesis defects and aneuploidy. Pericentrin overexpression leads to an increase in the number of multinucleated cells, suggesting a defect in cytokinesis. In addition to the cytokinesis defects, pericentrin knock down also induce a G0/G1 arrest that is p53-p38 dependent. Moreover, pericentrin knockdown affects cilia formation in epithelial cells. Also, knock down of several other centrosome proteins leads to aG1 arrest and affects cilia formation in epithelial cells. We conclude that pericentrin affects cytokinesis, G1progression and differentiation. Defects during mitosis, as well as loss of checkpoints and uncontrolled cell division are the first steps in cancer formation. Understanding those events will be a major advance in breast cancer research.

DTIC

Breast; Cancer; Defects; Genetics; Mammary Glands

20080039866 Duke Univ., Durham, NC USA

The Effects of Information Displays in Decisions about Tamoxifen Use for Breast Cancer Chemoprevention

Lipkus, Isaac; Sep 2007; 162 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0382

Report No.(s): AD-A483059; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We sought to test as part of 2 x 2 factorial design whether varying the numerical format of presenting breast cancer risk information using the Gail Score (percentage versus frequencies) and Tamoxifen's (percentage versus frequency)risks and

benefits would affect among women eligible for Tamoxifen their perceptions of breast cancer risk, paying attention to and weighing of Tamoxifen's risks and benefits, interesting and using Tamoxifen, and their willingness to talk to their physician about Tamoxifen. Overall, there was no effect for formats across these outcomes. Overall, about half of the participants could not accurately state whether Tamoxifen's benefits exceeded the risks or vice versa. The majority (~70%) decided not take Tamoxifen; about 30% decided to delay making a decision. These data suggest that more research is needed to improve women's accuracy of weighing Tamoxifen's risk and benefits and exploring further why many decide not to take Tamoxifen, even among those who viewed they would personally benefit from its usage. Numerical display format played no role in these processes.

DTIC

Breast; Cancer; Display Devices; Mammary Glands

20080039871 North Carolina Univ., Chapel Hill, NC USA

Replicating Viral Particles and other Shape-controlled, Functional Particles for Targeted Delivery Applications Using Nano-molding Techniques

DeSimone, Joseph; Samulski, Jude; Frelinger, Jeffrey; Sheiko, Sergio; Oct 23, 2007; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-1-0343

Report No.(s): AD-A483073; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The main focus of the work was to explore engineered PRINT particles to elicit an immunological response. The primary objective was to test the idea that engineered PRINT particles could facilitate different T and B cell immune responses. A secondary objective was to use PRINT to make particles from biological and man-made master templates to afford particles of controlled shape down to <1 nm resolution and functionality. Molecular templating agents and viral-envelope proteins were investigated to augment the shape-specificity of our molded nanoparticles. Several strategies for conjugation a wide variety of ligands to the surface of the PRINT particles, including strategies for the binding of nitrophenyl, pneumococcal polysaccharide-C and streptavidin-biotin conjugates were developed. A major advantage of PRINT delivery is the ability to target the cargo to professional antigen presenting cells. Specific and effective targeting to dendritic cells was observed. Also explored was the particle uptake and release of cargo in vitro. PRINT particles have been fabricated that are comprised of disulfide cross-linkers that are sensitive to the reducing environment which allows them to dissolve in cellular vesicles. The results and progress over the period of the grant July, 2006 to July, 2007 are described.

DTIC

Coating; Shapes; Viruses

20080039875 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

Antibody Engineering for Expression in Insect Cells and Larvae

Anderson, Patricia E; Valdes, James J; O'Connell, Kevin P; van Beek, Nikolai A; Liu, Yi; Davis, David; Bentley, William; Chase, Terry E; Jul 1, 2003; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A483080; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Antibodies are currently deployed as the recognition component of sensors that detect biological threat agents. Previously, we developed an anti-botulinum toxin antibody using a bacterial host. However, antibodies expressed in bacteria lack molecular modifications made post-translationally by animal (eukaryotic) cells. It was therefore desirable to express Fab fragment antibody genes in insect cell lines and larvae. In this study, we improved an existing baculovirus expression vector by inserting the reporter gene DsRed, then modified and inserted the heavy and light chain genes encoding an anti-botulinum toxin-binding Fab antibody. The structures of all plasmids constructed were verified by restriction analysis and sequencing. Preliminary data demonstrate that DsRed and anti-botulinum Fab are both strongly expressed in larvae of *Trichoplusia ni*, suggesting that this system may be an economical manufacturing process for recombinant antibodies.

DTIC

Antibodies; Insects; Larvae

20080039877 Walter Reed Army Inst. of Research, Silver Spring, MD USA

Botulinum Toxin Type A Targets RhoB to Inhibit Lyso-phosphatidic Acid-Stimulated Actin Reorganization and Acetylcholine Release in NGF-Treated Differentiated PC12 Cells

Ishida, Hiroshi; Zhang, Xieping; Ray, Prabhati; Jul 1, 2003; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A483082; No Copyright; Avail.: Defense Technical Information Center (DTIC)

It is generally accepted that Botulinum toxin cleaves the 25-kDa synaptosomal-associated protein to inhibit acetylcholine

release (neuroexocytosis). Since several reports suggest another mechanism, we investigated possibility that inhibition of neuroexocytosis by the toxin occurs through the RhoB signaling which controls actin cytoskeletal organization. We found that the G-protein activator lysophosphatidic acid (LPA) triggers actin reorganization followed by acetylcholine release in PC12 cells, and that botulinum toxin blocks both events through ubiquitin-dependent degradation of PhoB by the proteasome. Overexpression of wild-type RhoB caused actin reorganization and enhanced release of acetylcholine, and overcame the toxin's inhibitory effect on actin reorganization and exocytosis.

DTIC

Acetyl Compounds; Acetylcholine; Bacteria; Choline; Clostridium Botulinum; Targets; Toxins and Antitoxins

20080039886 New Mexico Univ., Albuquerque, NM USA

Advances in Phylogeny Reconstruction from Gene Order and Content Data

Moret, Bernard M; Warnow, Tandy; Oct 18, 2004; 27 pp.; In English

Contract(s)/Grant(s): NBCH30390004

Report No.(s): AD-A483097; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Genomes can be viewed in terms of their gene content and the order in which the genes appear along each chromosome. Evolutionary events that affect the gene order or content are 'rare genomic events' (rarer than events that affect the composition of the nucleotide sequences) and have been advocated by systematists for inferring deep evolutionary histories. This chapter surveys recent developments in the reconstruction of phylogenies from gene order and content, focusing on their performance under various stochastic models of evolution. Because such methods are currently quite restricted in the type of data they can analyze, we also present current research aimed at handling the full range of whole-genome data.

DTIC

Genes; Genome; Nucleotides

20080039894 Medical Coll. of South Carolina, Charleston, SC USA

Measles Virus Nucleocapsid (MVNP) Gene Expression and RANK Receptor Signaling in Osteoclast Precursors, Osteoclast Inhibitors Peptide Therapy for Paget's Disease

Reddy, Sakamuri V; Oct 2004; 33 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0763

Report No.(s): AD-A483109; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Paget's disease (PD) of bone occurs in 3-4% of population over the age of 50. We have identified expression of measles virus nucleocapsid transcripts in osteoclast (OCL) precursors and that MVNP expression induces pagetic phenotype in osteoclasts with increased bone resorption activity as seen in patients with Paget's disease. We previously cloned and identified osteoclast inhibitory peptide-1 (OIP-1/hSca) which inhibits osteoclast formation and bone resorption. We hypothesize that MVNP expression in osteoclast precursors modulates RANK receptor signaling leading to Pagetic OCL development. OIP-1 blocks these signaling events and inhibits MVNP induced osteoclastogenesis and elevated bone resorption activity. We demonstrated that MVNP increases TNF-alpha induced OCL differentiation and activation by increasing NF-kB signaling through increased expression of p62, and IKK-gamma and increased MAPK signaling. Our results also suggest that MVNP's effects on TNF-alpha signaling contribute to the increased OCL formation in PD. Furthermore, expression of MVNP gene in OCL in vivo induces a pagetic-like phenotype. RANKL stimulation of OIP-1 mice derived bone marrow cells resulted in significantly decreased osteoclast formation. Furthermore, OIP-1 transgenic mouse bones demonstrated an osteopetrotic phenotype. These data suggest that OIP-1 is an important physiologic regulator of osteoclast development and bone resorption in vivo and may have therapeutic utility to control excess bone turnover in patients with Paget's disease.

DTIC

Bone Demineralization; Diseases; Gene Expression; Inhibitors; Peptides; Therapy; Viruses

20080040126 Army Command and General Staff Coll., Fort Leavenworth, KS USA

Split Forward Surgical Teams

Ball, Michael A; Jun 13, 2008; 67 pp.; In English

Report No.(s): AD-A483038; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In the last 20 years, the Army's Field and Combat Support Hospitals have found it difficult to deploy rapidly and to keep pace with maneuver forces. The Forward Surgical Team (FST) was the bridge for this gap in capabilities. Until recently, the FST had not been deployed and utilized in combat. With the recent conflicts in Afghanistan and Iraq, FSTs have been extensively utilized. Using the data and experiences from these conflicts, should updates to the doctrine be made? One

unexpected outcome from these conflicts was the use of split FSTs in Afghanistan. Using the data from evacuation logs from Afghanistan, the Joint Trauma Center, and the recent experiences of FST staffs the effectiveness of split FSTs was investigated based on the Died of Wounds (DOW) rate and evacuation times. Additionally the personnel, Doctrinal employment, and equipment were investigated to determine if significant changes were needed to employ split FSTs or what would prevent split FSTs being written into doctrine? From the data collected, split FSTs had DOW rates that were lower than the DOW rate at the end of Vietnam, which is considered the standard. As such, the split FSTs in Afghanistan were determined to be effective and the doctrine could be changed with minimal additional cost in equipment. The split FST would give commanders another option to employ FSTs with the risks having been already studied. The benefits of the split FST would be the ability to serve wider areas of coverage with limited resources and possibly the ability to get surgical units on the ground earlier in entry operations due to having smaller transportation requirements.

DTIC

Surgery; Personnel; Ground Operational Support System

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*.

20080039838 CSA Engineering, Inc., Mountain View, CA USA

Validation of Systems for Human Thermal Control

Sneed, Ralph C; Mar 19, 2007; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-C-0079

Report No.(s): AD-A482985; CSA-2007523; No Copyright; Avail.: Defense Technical Information Center (DTIC)

DARPA has invested substantial funds in the development of technologies for controlling the temperature of the warfighter. In hot environments, and in certain types of protective clothing and equipment, there is value in rapid removal of heat from the warfighter. In certain situation involving cold environments, including underwater ones, there is value in adding heat. One approach developed by Stanford University and others under DARPA funding makes use of heat transfer sites on the palm of the hand to effect temperature control of the human core. This method is based on exploitation of physiology that combines substantial blood flow with heat transferring structures within the hands.

DTIC

Heat Transfer; Manual Control; Temperature Control

20080039858 Army Command and General Staff Coll., Fort Leavenworth, KS USA

PTSD Type Symptoms and CGSC class 08-01, a Study of Field Grade Officers and Implications for the Future

Dixon, Jr, Richard L; Jun 13, 2008; 93 pp.; In English; Original contains color illustrations

Report No.(s): AD-A483044; No Copyright; Avail.: Defense Technical Information Center (DTIC)

With the emergence of the Global War on Terror (GWOT), the mental illness of Post Traumatic Stress Disorder (PTSD) is increasingly identified in returning veterans. A 2006 mental health study released by the Pentagon found 11% of returning OEF veterans and 19% of returning OIF veterans have mental health issues. Of the veterans sampled, 5% were Army Officers and 2% were Marine Officers. Thus, the primary research question was: Are the combat veterans of CGSC Class 08-01 representative of the Army's statistics on returning veterans with PTSD type symptoms? Using the Post Traumatic Stress Disorder Checklist-Military Version (PCL-M) and a demographic questionnaire, a survey sample of 297 field grade officers from a population of 584 combat veterans found 35% of single tour OEF veterans and 41% of single tour OIF veterans had PTSD type symptoms. 41% of multiple tour veterans had PTSD type symptoms. 50% of the survey sample believed mental health counseling would damage their careers and the percentage increased to 70% among those with PTSD type symptoms.

DTIC

Signs and Symptoms

20080040712 NASA Johnson Space Center, Houston, TX, USA

Midodrine Exacerbates Promethazine-induced Akathisia

Platts, Steven H.; Shi, Shang-Jin; Meck, Janice V.; [2006]; 5 pp.; In English

Contract(s)/Grant(s): NAS997005; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040712>

The study of physiological changes during spaceflight, and the pursuit of remedies to counteract those changes, often

requires unique research protocols that lead to unexpected findings; some with important clinical implications. In our research into the development of treatments to counteract the detrimental cardiovascular effects of spaceflight, we have discovered an important drug interaction between promethazine and midodrine.

Author

Cardiovascular System; Promethazine; Antiemetics and Antinauseants; Spacecraft Landing; Orthostatic Tolerance

54

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*.

20080039214 Duke Univ., Durham, NC USA

Evaluation of the Implications of Nanoscale Architectures on Contextual Knowledge Discovery and Memory: Self-Assembled Architectures and Memory

Dwyer, Chris; May 2008; 82 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-05-2-0018; Proj-459T

Report No.(s): AD-A482388; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482388>

Computing systems with advanced situational awareness and the ability to use contextual knowledge to interpret sensor data have the potential to be instrumental in many contexts. This project developed three systems to query a database with immense numbers of objects and rich sets of contextual relationships. In particular, large-scale content addressable memory systems provide a better solution to the knowledge discovery problem than conventional general-purpose memory systems. This project studied three systems: 1) a conventional system, 2) a conventional system optimized for online (i.e. real-time) use, and 3) a novel DNA self assembled nanoelectronic system. The project developed tools for DNA self-assembly to provide simulation capabilities for evaluating the three systems and the data has shown that significant performance enhancements can be achieved by optimization. Further, when self-assembling technologies mature they will be able to achieve greater performance due to the massive parallelism inherent in the knowledge discovery problem.

DTIC

Computer Storage Devices; Data Mining; Deoxyribonucleic Acid; Knowledge Based Systems

20080039253 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Biologically-Inspired Concepts for Self-Management of Complexity

Sterritt, Roy; Hinchey, G.; August 14, 2006; 6 pp.; In English; 11th IEEE International Conference on Engineering of Complex Computer Systems (IEEE ICECCS 2006), 14-18 Aug. 2006, Stanford, CA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

Inherent complexity in large-scale applications may be impossible to eliminate or even ameliorate despite a number of promising advances. In such cases, the complexity must be tolerated and managed. Such management may be beyond the abilities of humans, or require such overhead as to make management by humans unrealistic. A number of initiatives inspired by concepts in biology have arisen for self-management of complex systems. We present some ideas and techniques we have been experimenting with, inspired by lesser-known concepts in biology that show promise in protecting complex systems and represent a step towards self-management of complexity.

Author

Computer Techniques; Autonomic Nervous System; Automatic Control; Biomimetics; Human Factors Engineering

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*.

20080039424 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Callable Virtual Observatory Functionality: Sample Use Cases

Gurman, Joseph B.; December 10, 2007; 1 pp.; In English; American Physical Union meeting, 10-15 Dec. 2007, San Francisco, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

A virtual observatory with an Application Programming Interface (API) can become a powerful tool in analysis and

modeling. In particular, an API that integrates time selection on such criteria as ‘most recent’ and closest to a given absolute time simplifies the user-end programming considerably. We examine three types of use cases (nowcasting, data assimilation input, and user-defined sampling rates) for such functionality in the Virtual Solar Observatory (VSO).

Author

Application Programming Interface; Virtual Memory Systems; Solar Observatories; Assimilation; Nowcasting

20080039509 Black Lowe and Graham, PLLC, Seattle, WA, USA; Boeing Co., Long Beach, CA, USA

Switch Card Apparatus and Methods

Kubinski, R. A., Inventor; Phan, T. T., Inventor; Smith, G. H., Inventor; Nguyen, H. N., Inventor; 28 Oct 04; 12 pp.; In English
Contract(s)/Grant(s): HQ0006-01-C-0001

Patent Info.: Filed Filed 28 Oct 04; US-Patent-Appl-SN-10-975 858

Report No.(s): PB2008-101658; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Switch card apparatus are disclosed. In one embodiment, a circuit includes a first portion having a first switch adapted to be coupled to a first voltage, a second portion including a second switch, and a third portion including a third switch. The first portion activates the first switch to couple the first voltage to the second portion. Similarly, the second portion activates the second switch in response to a second input signal and the first voltage to couple a second voltage to the third portion. Finally, the third portion activates the third switch in response to a third input signal and in response to the second voltage from the second portion to couple a control voltage to a load. Embodiments of the invention provide the desired reliability suitable for a variety of electrical systems, including arming and firing applications over a wide voltage and wide current range.

NTIS

Cards; Patent Applications; Switches

20080039525 Akerman Senterfit, West Palm Beach, FL, USA

Optimal Control of CPR Procedure

Lenhart, S. M., Inventor; Protopopescu, V. A., Inventor; Jung, E., Inventor; 29 Sep 04; 9 pp.; In English

Contract(s)/Grant(s): DE-AC05-00OR22725

Patent Info.: Filed Filed 29 Sep 04; US-Patent-Appl-SN-10-953 217

Report No.(s): PB2008-101648; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A method for determining a chest pressure profile for cardiopulmonary resuscitation (CPR) includes the steps of representing a hemodynamic circulation model based on a plurality of difference equations for a patient, applying an optimal control (OC) algorithm to the circulation model, and determining a chest pressure profile. The chest pressure profile defines a timing pattern of externally applied pressure to a chest of the patient to maximize blood flow through the patient. A CPR device includes a chest compressor, a controller communicably connected to the chest compressor, and a computer communicably connected to the controller. The computer determines the chest pressure profile by applying an OC algorithm to a hemodynamic circulation model based on the plurality of difference equations.

NTIS

Chest; Hemodynamic Responses; Optimal Control; Patent Applications; Pressure Distribution; Resuscitation

20080039578 George Mason Univ., Fairfax, VA, USA

Fragile Watermarks (PAT-APPL-11-250 460)

Jajodia, S., Inventor; Guo, H., Inventor; Li, Y., Inventor; 17 Oct 05; 26 pp.; In English

Contract(s)/Grant(s): NSF-CCR-0113515; NSF-IIS-0242237

Patent Info.: Filed Filed 17 Oct 05; US-Patent-Appl-SN-11-250 460

Report No.(s): PB2008-103493; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Disclosed is a fragile watermarking scheme for detecting and localizing malicious alterations made to a database relation with categorical attributes without introducing distortions to cover data. A watermark for a tuple group may be inserted by selectively switching the position of tuples in tuple pairs using a tuple hash associated with each tuple in the tuple pair; and a corresponding bit in a watermark derived from the tuple group using an embedding key, a primary key and hash functions.

NTIS

Cryptography; Image Processing; Patent Applications

20080039579 California Univ., Berkeley, CA, USA

Embedded Systems Building Blocks

Vahid, F., Inventor; Lysecky, S., Inventor; 10 May 05; 37 pp.; In English

Contract(s)/Grant(s): NSF-CCR-0311026

Patent Info.: Filed Filed 10 May 05; US-Patent-Appl-SN-11-127 035

Report No.(s): PB2008-103494; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Stand-alone modules or blocks for use in creating low-power sensor-based monitor/control systems. Each module performs a pre-defined function, and when included in a monitor/control network operates as a node on the network and automatically communicates with one or more connected nodes using a uni-directional packet-based protocol. One class of such predefined nodes communicates Boolean values, for example, with input sensor nodes detecting the presence or absence of environmental phenomena (e.g., motion, light, sound, water, button presses, etc.), intermediate nodes transforming those Boolean values using combinational or sequential logic, and output nodes converting the resulting Boolean values to environmental phenomena (e.g., beeping, light, electric relay activation, etc.) or to data for further processing by a computer. Another class of nodes communicates integer or number values.

NTIS

Computer Networks; Patent Applications

20080039590 Baum (Eric), Rancho Palos Verdes, CA, USA

Algorithm for Retrieval of Ocean Surface Temperature, Wind Speed and Wind Direction from Remote Microwave Radiometric Measurements

Baum, E., Inventor; 17 Sep 04; 4 pp.; In English

Patent Info.: Filed Filed 17 Sep 04; US-Patent-Appl-SN-10-943 671

Report No.(s): PB2008-101927; No Copyright; Avail.: CASI: [A01](#), Hardcopy

This invention is an improved algorithm for retrieving the sea surface temperature, wind speed and wind direction from a suite of remote microwave radiometer measurements of the brightness temperature of a patch of ocean. Advantages of the method over the prior art are: (1) improved spatial resolution, (2) reduced measurement noise and, (3) removal of a source of error in the modeled wind-direction-dependence of the brightness temperature.

NTIS

Algorithms; Atmospheric Temperature; Data Retrieval; Microwave Radiometers; Patent Applications; Radiometers; Remote Sensing; Sea Surface Temperature; Wind (Meteorology); Wind Direction; Wind Velocity

20080039651 NASA Langley Research Center, Hampton, VA, USA

Domain Decomposition By the Advancing-Partition Method

Pirzadeh, Shahyar Z.; September 2008; 23 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.07.20.02

Report No.(s): NASA/TM-2008-215350; L-19508; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039651>

A new method of domain decomposition has been developed for generating unstructured grids in subdomains either sequentially or using multiple computers in parallel. Domain decomposition is a crucial and challenging step for parallel grid generation. Prior methods are generally based on auxiliary, complex, and computationally intensive operations for defining partition interfaces and usually produce grids of lower quality than those generated in single domains. The new technique, referred to as 'Advancing Partition,' is based on the Advancing-Front method, which partitions a domain as part of the volume mesh generation in a consistent and 'natural' way. The benefits of this approach are: 1) the process of domain decomposition is highly automated, 2) partitioning of domain does not compromise the quality of the generated grids, and 3) the computational overhead for domain decomposition is minimal. The new method has been implemented in NASA's unstructured grid generation code VGRID.

Author

Unstructured Grids (Mathematics); Domains; Decomposition; Grid Generation (Mathematics)

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*.

20080039211 Lockheed Martin Advanced Technology Labs., Cherry Hill, NJ USA

The Design of a Polymorphous Cognitive Agent Architecture (PCAA)

Amduka, Mohammed; Russo, Jon; Jha, Krishna; DeHon, Andre; Lethin, Richard; Springer, Jonathan; Manohar, Rajit; Melhem, Rami; Wray, Bob; Lebiere, Christian; May 2008; 218 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-04-C-0266; DARPA ORDER-S822; Proj-S822

Report No.(s): AD-A482357; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482357>

Lockheed Martin Advanced Technology Laboratories (LM-ATL) led a highly qualified and motivated team to research, develop, and validate the Polymorphous Cognitive Agent Architecture (PCAA) as part of DARPA's Architecture for Cognitive Information Processing (ACIP). Our team investigated essential 'Cognitive Information Processing' aspects of the architecture ranging from pure cognitive research into the essentials of human level reasoning to computing infrastructures that are essential to be able to transition PCAA into application domains that have a crucial need for this technology. PCAA is a dynamic, adaptive cognitive architecture that makes previously intractable approximation tasks tractable for NP-hard cognitive problems. PCAA consists of: linear composable cognitive agents, a cognitive mark-up language for cognitive behavior definition, a cognitive layer for derivation of cognitive services and specialized cognitive agents, and a next generation polymorphic hardware and software layer for runtime composition and instantiation of cognitive agents.

DTIC

Architecture (Computers); Cognition; Polymorphism

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.

20080039191 Naval Postgraduate School, Monterey, CA USA

High-Assurance System Support through 3-D Integration

Huffmire, Theodore; Levin, Timothy; Irvine, Cynthia; Nguyen, Thuy; Valamehr, Jonathan; Kastner, Ryan; Sherwood, Timothy; Nov 9, 2007; 26 pp.; In English

Report No.(s): AD-A482458; NPS-CS-07-016; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482458>

While hardware resources, in the form of both transistors and full microprocessor cores, are now fairly abundant, economic factors continue to prevent the integration into commodity parts of specialized hardware mechanisms required for secure processing. Multi-core processors, due to their wide adoption, impressive performance, and low cost, are very attractive platforms for computation. Unfortunately, highly secure processing of sensitive information on such platforms is extremely difficult to achieve due to extensive resource sharing and the lack of strong security primitives. In this paper we propose that commodity integrated circuits, with some very minor modifications, could be enhanced with a separate silicon layer used to enforce strong isolation, reference monitoring, and other useful security properties. A separate layer, stacked using 3-D integration, allows us to decouple the function and economics of high assurance policy enforcement mechanisms from the underlying high-performance computing hardware. We describe 3-D integration, how the host layer may be modified, and as our working example, we show how the problem of cache-based side channels can be addressed by re-routing signals from the computation layer through a cache manager in the control layer.

DTIC

Integrated Circuits; Microprocessors; Security

20080039205 Solid State Scientific Corp., Hollis, NH USA

Power-Law Radon-Transformed Superimposed Inverse Filter Synthetic Discriminant Correlator for Facial Recognition

Haji-saeed, Bahareh; Khoury, Jed; Woods, Charles L; Kierstead, John; Mar 2008; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-2305

Report No.(s): AD-A482314; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482314>

A power-law correlation based on an inverse filter Fourier-Radon-transform synthetic discriminant function (SDF) for facial recognition is proposed. In order to avoid spectral overlap and nonlinear crosstalk, superposition of rotationally variant sets of inverse filter Fourier-transformed Radon-processed templates is used to generate the SDF. For the inverse filter, the Fourier transform of M projections (Radon Transform) from one training image is combined with (N-1) M Fourier transform of M projections taken from another N-1 training image. This synthetic SDF filter has a very high discrimination capability; however, it is not noise robust. To overcome this problem, a power-law dynamic range compression is added to the correlation process. The proposed filter has three advantages: (1) high discrimination capability as an inverse filter, (2) noise robustness due to dynamic range compression, and (3) crosstalk-free nonlinear processing. The filter performance was evaluated by established metrics, such as peak-to-correlation energy (PCE), Horner efficiency, and correlation-peak intensity. The results showed significant improvement as the power-law filter compression increased.

DTIC

Correlators; Image Processing; Pattern Recognition; Photomapping; Radon

20080039271 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Using Sequence Diagrams to Detect Communication Problems Between Systems

Lindvall, Mikael; Ackermann, Chris; Stratton, William C.; Sibol, Deane E.; Ray, Arnab; Yonkwa, Lyly; Kresser, Jan; Godfrey, Sally H.; Knodel, Jens; March 2008; 28 pp.; In English; 2008 IEEE Aerospace Conference, 1-8 Mar. 2008, Big Sky, MT, USA; Original contains black and white illustrations

Report No.(s): IEEEAC Paper #1099; Copyright; Avail.: CASI: A03, Hardcopy

Many software systems are evolving complex system of systems (SoS) for which inter-system communication is both mission-critical and error-prone. Such communication problems ideally would be detected before deployment. In a NASA-supported Software Assurance Research Program (SARP) project, we are researching a new approach addressing such problems. In this paper, we show that problems in the communication between two systems can be detected by using sequence diagrams to model the planned communication and by comparing the planned sequence to the actual sequence. We identify different kinds of problems that can be addressed by modeling the planned sequence using different level of abstractions.

Author

Computer Programs; Telecommunication; Deployment; Software Engineering; Complex Systems

20080039367 National Steel and Shipbuilding Co., San Diego, CA USA

Nested Material Manufacturing Technology Improvement

Mar 18, 2008; 24 pp.; In English

Report No.(s): AD-A482561; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this project was to develop an automated planning and control system in the GD NASSCO Pipe Shop that enabled the efficient handling of pipe spool fabrication in a flexible manufacturing environment. The solution to improved efficiency in Pipe Shop operations was to implement an automated pipe spool planning process that had the ability to apply defined rules for pipe part routing and nesting, but could accept late input changes to the work plans to accommodate emerging schedule changes and shop level loading requirements. This process would include a dynamic pipe nesting component. The project plan included a benchmarking analysis of pipe spool fabrication practices and software applications at a major international shipyard known to have successfully implemented dynamic nesting of pipe. A detailed specification and production implementation plan was then prepared, followed by application development, testing and a pilot implementation on NASSCO's T-AKE Program. The return on investment for this project is defined by three production goals; scrap rate reduction, reduced cost of pipe nesting and work planning, and increased efficiency in pipe spool fabrication. The total cost avoidance over a five year period is projected to be \$5.5M with a calculated Present Value Return on Investment of 9.5:1.

DTIC

Fabrication; Management Systems; Manufacturing; Marine Technology; Pipes (Tubes); Ships; Shops; Software Development Tools; Spools

20080039435 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Radiation Test Challenges for Scaled Commercial Memories

LaBel, Kenneth A.; Ladbury, Ray L.; Cohn, Lewis M.; Oldham, Timothy; September 10, 2007; 15 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

As sub-100nm CMOS technologies gather interest, the radiation effects performance of these technologies provide a significant challenge. In this talk, we shall discuss the radiation testing challenges as related to commercial memory devices. The focus will be on complex test and failure modes emerging in state-of-the-art Flash non-volatile memories (NVMs) and synchronous dynamic random access memories (SDRAMs), which are volatile. Due to their very high bit density, these device types are highly desirable for use in the natural space environment. In this presentation, we shall discuss these devices with emphasis on considerations for test and qualification methods required.

Author

Random Access Memory; Radiation Effects; Computer Storage Devices; Aerospace Environments; Failure Modes

20080039658 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Using Selection Pressure as an Asset to Develop Reusable, Adaptable Software Systems

Berrick, Stephen; Lynnes, Christopher; December 07, 2007; 1 pp.; In English; American Geophysical Union Fall Meeting, 10-14 Dec. 2007, San Francisco, CA, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039658>

The Goddard Earth Sciences Data and Information Services Center (GES DISC) at NASA has over the years developed and honed several reusable architectural components for supporting large-scale data centers with a large customer base. These include a processing system (S4PM) and an archive system (S4PA) based upon a workflow engine called the Simple Scalable Script based Science Processor (S4P) and an online data visualization and analysis system (Giovanni). These subsystems are currently reused internally in a variety of combinations to implement customized data management on behalf of instrument science teams and other science investigators. Some of these subsystems (S4P and S4PM) have also been reused by other data centers for operational science processing. Our experience has been that development and utilization of robust interoperable and reusable software systems can actually flourish in environments defined by heterogeneous commodity hardware systems the emphasis on value-added customer service and the continual goal for achieving higher cost efficiencies. The repeated internal reuse that is fostered by such an environment encourages and even forces changes to the software that make it more reusable and adaptable. Allowing and even encouraging such selective pressures to software development has been a key factor in the success of S4P and S4PM which are now available to the open source community under the NASA Open source Agreement

Author

Computer Programming; Management Methods; On-Line Systems; Software Engineering; Software Reuse; Software Reliability; Software Development Tools

20080039713 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Using Hierarchical Temporal Memory for Detecting Anomalous Network Activity

Bonhoff, Gerod M; Mar 2008; 157 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482820; AFIT/GCS/ENG/08-04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482820>

This research is motivated by the creation of intelligently autonomous cybercraft to reside in the intangible environment of cyberspace and maintain domain superiority. Specifically, this paper offers 7 challenges to the development of such a cybercraft. The focus is analysis of the claims Hierarchical Temporal Memory (HTM). In particular, HTM theory claims to facilitate intelligence in machines via accurate predictions. It further claims to be able to make accurate predictions of unusual worlds, like cyberspace. The primary objective is to provide evidence that HTM facilitates accurate predictions of unusual worlds. The second objective is to lend evidence that prediction is a good indication of intelligence. A commercial implementation of HTM theory is tested as an anomaly detection system and its ability to define network traffic (a major aspect of cyberspace) as benign or malicious is evaluated. Through the course of testing the performance of this implementation is poor. An independent algorithm is developed from a variant understanding of HTM theory. This alternate algorithm is independent of cyberspace and developed solely (but also in a contrived abstract world) to lend credibility to the use of prediction as a method of testing intelligence.

DTIC

Anomalies; Computer Storage Devices; Detection; Hierarchies; Networks

20080039748 California Univ., Los Angeles, CA USA

A Remote Code Update Mechanism for Wireless Sensor Networks

Stathopoulos, Thanos; Heidemann, John; Estrin, Deborah; Nov 2003; 16 pp.; In English

Contract(s)/Grant(s): 442511-ED-25621

Report No.(s): AD-A482887; CENS-TR-30; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482887>

Wireless sensor networks consist of collections of small, low-power nodes that interface or interact with the physical environment. The ability to add new functionality or perform software maintenance without having to physically reach each individual node is already an essential service, even at the limited scale at which current sensor networks are deployed. TinyOS supports single-hop over-the-air reprogramming today, but the need to reprogram sensors in a multi-hop network will become particularly critical as sensor networks mature and move toward larger deployment sizes. In this paper we present Multihop Over-the-Air Programming (MOAP), a code distribution mechanism specifically targeted for Mica-2 Motes. We discuss and analyze the design goals, constraints, choices and optimizations focusing in particular on dissemination strategies and retransmission policies. We have implemented MOAP on Mica-2 motes and we evaluate that implementation using both emulation and testbed experiments. We show that our dissemination mechanism obtains a 60-90% performance improvement in terms of required transmissions compared to flooding. We also show that a very simple windowed retransmission tracking scheme is nearly as effective as arbitrary repairs and yet is much better suited to energy and memory constrained embedded systems.

DTIC

Communication Networks; Computer Programming; Detectors; Networks

20080039791 Defence Science and Technology Organisation, Salisbury, Australia

Managing Software Complexity

Calder, P F; Jul 1986; 51 pp.; In English

Report No.(s): AD-A482905; ERL-0372-RE; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report examines the methodologies and tools available to the manager and programmer for assisting in the development of large software projects.

DTIC

Computer Programming; Software Development Tools

20080039824 Carnegie-Mellon Univ., Pittsburgh, PA USA

SQUARE-Lite: Case Study on VADSoft Project

Gayash, Ashwin; Viswanathan, Venkatesh; Padmanabhan, Deepa; Meed, Nancy R; Jun 2008; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A482962; CMU/SEI-2008-SR-017; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This special report is the first by the Software Engineering Institute focusing on the practical application of the SQUARE-Lite security requirements engineering method. Three case study reports about application of the Security Quality Requirements Engineering (SQUARE) process from which SQUARE-Lite is derived were published previously. In this report, the SQUARE and SQUARE-Lite methods are briefly described and a student team presents the results of working with a client using SQUARE-Lite to develop security requirements for a financial application.

DTIC

Computer Programming; Security; Software Engineering

20080039863 Army Command and General Staff Coll., Fort Leavenworth, KS USA

Preparing for Beslan: Anti-Terrorism Recommendations for an American School

Mittman, Gregory D; Jun 13, 2008; 121 pp.; In English; Original contains color illustrations

Report No.(s): AD-A483052; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The 2004 terrorist attack on a Beslan, Russia middle school left more than a hundred innocent schoolchildren dead and many more injured. In this tragedy's wake, numerous security experts offered American school officials recommendations on how to protect children in the USA. This study asks, 'What anti-terrorism measures would be feasible, suitable, and acceptable in protecting an American school from an attack similar to the one that occurred in Beslan, Russia?' Examination of the Beslan attack enabled the creation of a model to replicate a similar threat undertaken against an American school. Compiling

recommended anti-terrorism measures determined how a school could prevent and prepare for such an attack. Field research conducted at a confidential subject school included a site assessment and unstructured interviews with staff. Analysis includes how each identified anti-terrorism measure could affect the subject school in terms of cost, instruction, or school climate. Recommendations are made for school officials to implement anti-terrorism measures found to be feasible, suitable, and acceptable.

DTIC

Access Control; Numerical Control; Schools; Terrorism

20080039885 Illinois Univ., Urbana-Champaign, IL USA

CUTE: A Concolic Unit Testing Engine for C

Sen, Koushik; Marinov, Darko; Agha, Gul; Jan 2005; 13 pp.; In English

Contract(s)/Grant(s): N00014-02-1-0715

Report No.(s): AD-A483094; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In unit testing, a program is decomposed into units which are collections of functions. A part of unit can be tested by generating inputs for a single entry function. The entry function may contain pointer arguments, in which case the inputs to the unit are memory graphs. The paper addresses the problem of automating unit testing with memory graphs as inputs. The approach used builds on previous work combining symbolic and concrete execution, and more specifically, using such a combination to generate test inputs to explore all feasible execution paths. The current work develops a method to represent and track constraints that capture the behavior of a symbolic execution of a unit with memory graphs as inputs. Moreover, an efficient constraint solver is proposed to facilitate incremental generation of such test inputs. Finally, CUTE, a tool implementing the method is described together with the results of applying CUTE to real-world examples of C code.

DTIC

C (Programming Language); Program Verification (Computers)

20080039916 NASA Goddard Space Flight Center, Greenbelt, MD, USA

General Mission Analysis Tool (GMAT): Mission, Vision, and Business Case

Hughes, Steven P.; August 02, 2007; 4 pp.; In English; No Copyright; Avail.: CASI: [A01](#), Hardcopy

The Goal of the GMAT project is to develop new space trajectory optimization and mission design technology by working inclusively with ordinary people, universities businesses and other government organizations; and to share that technology in an open and unhindered way. GMAT's a free and open source software system; free for anyone to use in development of new mission concepts or to improve current missions, freely available in source code form for enhancement or future technology development.

Derived from text

Mission Planning; Open Source Licensing (Computers); Trajectory Optimization; NASA Programs; Software Engineering; Computer Programming

20080039927 NASA Goddard Space Flight Center, Greenbelt, MD, USA

C++ Coding Standards and Style Guide

Hughes, Steven; Jun, Linda; Shoan, Wendy; May 24, 2005; 40 pp.; In English; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039927>

This document is based on the 'C Style Guide' (SEL-94-003). It contains recommendations for C++ implementations that build on, or in some cases replace, the style described in the C style guide. Style guidelines on any topics that are not covered in this document can be found in the 'C Style Guide.' An attempt has been made to indicate when these recommendations are just guidelines or suggestions versus when they are more strongly encouraged. Using coding standards makes code easier to read and maintain. General principles that maximize the readability and maintainability of C++ are: (1) Organize classes using encapsulation and information hiding techniques. (2) Enhance readability through the use of indentation and blank lines. (3) Add comments to header files to help users of classes. (4) Add comments to implementation files to help maintainers of classes. (5) Create names that are meaningful and readable.

Derived from text

C++ (Programming Language); Manuals; Computer Programming; Software Engineering; Standards

20080040057 Army Tank-Automotive Research and Development Command, Warren, MI USA

TARDEC Ground Vehicle Power and Mobility Strategic Planning FY08. Task N.0491

Alef, Jason; Van Scoyo, Susan; Jun 2, 2008; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482897; TARDEC-18878; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482897>

This project supports the Tank-Automotive Research Development and Engineering Center (TARDEC) Power & Energy (P&E) Strategy Objectives. These strategy objectives are to: 1) Develop an integrated strategy to meet the power and energy requirements of current and future modular force. 2) Allow science and technology investments to be prioritized and focused on products that can transition. 3) Allows program managers to plan and resource for technology insertion. 4) Allows the development of the required people, tools, and facilities. The project provides a framework and formalized process for strategic planning.

DTIC

Management Planning; Mobility; Technology Transfer

20080040107 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

An Exploratory Examination of Social Website Quality

Werling, Joseph; Mar 2008; 145 pp.; In English; Original contains color illustrations

Report No.(s): AD-A483036; AFIT/GIR/ENV/08-M23; No Copyright; Avail.: Defense Technical Information Center (DTIC)

With websites becoming the frontend for numerous systems, the system's benefits require customers to have a favorable evaluation of the site and an intention to re-use it. It must be considered to be of high quality. With websites increasing adding collaborative technologies (such as tools for social networking, forums, and blogging) a new instrument to evaluate the quality of these types of sites is needed. Before such an instrument is developed, an understanding of the applicable theories is needed. This study offers that background. First the potential benefits of this research and its guiding questions are presented. Next is a literature review outlining possible constructs upon which an instrument to evaluate the quality of social websites could be based. Then the focus group's background and details are provided along with the analysis strategy, content analysis. After that, each constructs is discussed with the supporting/non-supporting evidence from the groups. Finally, the discussion concludes with discussions of limitations and suggestions for follow-on research. From this investigation, nine constructs (Ease of Understanding, Intuitive Operation, Informational Fit-to-task, Relative Advantage, Trust, Response Time, Visual Appeal, Innovativeness, and Social Presence) were discovered which could provide the basis for an instrument to measure social website quality.

DTIC

Computer Networks; Websites

20080040129 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

US Army Edgewood Chemical Biological Center Chemical Biological Agent Simulant Knowledge (ASK) V2.0 Database

Ashman, William P; Jablonski, Raymond E; Harrah, Mark; Jul 1, 2003; 9 pp.; In English

Report No.(s): AD-A483084; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper describes the US Army's Edgewood Chemical Biological Center (ECBC) computerized Agent/Simulant Knowledge (ASK) V2.0 Data Base. ASK V2.0 contains structural, physical-chemical and toxicological properties, environmental fates, and simulant applications (uses) information modules for approximately 1300 chemical biological (CB) agents, tested or proposed candidate CB simulants, and other CB related materials. Additionally, using the ASK V2.0 database's chemical agent physicochemical-toxicological property module's data retrieval and analysis user interface, an immediate agent versus simulant properties comparison can be obtained. Currently, the ASK V2.0 database utilizes MicroSoft Windows Access, Excel, and a stand-alone Java application. The ASK V2.0 database framework will be summarized and the current version of the data base tool will be described.

DTIC

Data Bases; Data Retrieval; Java (Programming Language); Knowledge Based Systems

20080040207 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

An Analysis of the Factors Affecting Training Transfer within the Work Environment

Williams, Daniel J; Mar 2008; 93 pp.; In English

Report No.(s): AD-A483010; AFIT/GIR/ENV/08-M25; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A meta-analysis of 34 studies was performed to explore the magnitude in which work environment manipulates training

transfer. The independent variables for this study included supervisor support, subordinate support, peer support, transfer climate, relapse prevention, goal setting, continuous learning culture, task constraints, and frequency of use. This study performed a moderator analysis to compare the effect these independent variables had on management and non-management training; and self-reporting versus supervisor or peer reporting; and training versus development. Results revealed that relapse prevention (.65) had the highest levels of correlation of all independent variables to training transfer. The results also showed that managerial training (.32) had higher levels of correlation to training transfer as compared to non-managerial training (.20). Self-reporting (.28) showed higher levels of training transfer than did supervisor or peer reporting (.16). Training (.30) showed higher levels of training transfer compared to development (.16). Finally, limitations and future research are discussed.

DTIC

Education; Factor Analysis; Transfer of Training

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.

20080039257 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Managing the Evolution of an Enterprise Architecture using a MAS-Product-Line Approach

Pena, Joaquin; Hinchey, Michael G.; Resinas, manuel; Sterritt, Roy; Rash, James L.; June 26, 2006; 7 pp.; In English; International Workshop on System and Software Architectures (IWSSA 2006), 26-30 Jun. 2006, Las Vegas, NV, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

We view an evolutionary system as being a software product line. The core architecture is the unchanging part of the system, and each version of the system may be viewed as a product from the product line. Each 'product' may be described as the core architecture with some agent-based additions. The result is a multiagent system software product line. We describe an approach to such a Software Product Line-based approach using the MaCMAS Agent-Oriented methodology. The approach scales to enterprise architectures as a multiagent system is an appropriate means of representing a changing enterprise architecture and the interaction between components in it.

Author

Complex Systems; Architecture (Computers); Systems Engineering; Autonomic Nervous System

20080039419 NASA Goddard Space Flight Center, Greenbelt, MD, USA

An Overview of the EOS Data Dissemination Systems

Ramapriyan, H.K.; Pfister, Robin; Weinstein, Beth; January 2008; 17 pp.; In English; Original contains color illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039419>

The Earth Observing System Data and Information System (EOSDIS) is the primary data system serving the broad-scope of NASA's Earth Observing System (EOS) program and a significant portion of the 'heritage' Earth science data. EOSDIS was designed to support the Earth sciences within NASA's Science Mission Directorate (previously the Earth Science Enterprise (ESE) and Mission to Planet Earth). The EOS Program was NASA's contribution to the USA Global Change Research Program (USGCRP) enacted by Congress in 1990 as part of the Global Change Act. ESE's objective was to launch a series of missions to help answer fundamental global change questions such as 'How is Earth changing?' and 'What are the consequences for life on Earth?' resulting support of this objective, EOSDIS distributes a wide variety of data to a diverse community.

Derived from text

Data Systems; Earth Observing System (EOS); EOS Data and Information System; Mission to Planet Earth; Remote Sensing; Satellite Observation

20080039586 Carnegie-Mellon Univ., Pittsburgh, PA USA

Survivability Assurance for System of Systems

Ellison, Robert J; Goodenough, John; Weinstock, Charles; Woody, Carol; May 2008; 64 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A482312; CMU/SEI-2008-TR-008; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482312>

Complexity and change pervade today's organizations. Organizational and technology components that must work together may be created, managed, and maintained by different entities. Net-centric operations and service-oriented architectures will push this trend further, increasing the layers of people, processes, and systems. Existing analysis mechanisms do not provide a way to (1) focus on challenges arising from integrating multiple systems, (2) consider architecture trade-offs carrying impacts beyond a single system, and (3) consider the linkage of technology to critical organizational functions. In response, a team at the Software Engineering Institute (SEI) built an analysis framework to evaluate the quality of the linkage among roles, dependencies, constraints, and risks for critical technology capabilities in the face of change. The Survivability Analysis Framework (SAF), a structured view of people, process, and technology, was developed to help organizations analyze and understand stresses and gaps to survivability for operational and proposed business processes. The SAF is designed to * identify potential problems with existing or near-term interoperations among components within today's network environments * highlight the impact on survivability as constrained interoperation moves to more dynamic connectivity * increase assurance that mission threads can survive in the presence of stress and possible failure.

DTIC

Organizations; Linkages; Software Engineering; Service Oriented Architecture

20080039674 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

A Multiple Case Study Analysis of Digital Preservation Techniques Across Government, Private, and Public Service Organizations

Gough, David; Mar 2008; 136 pp.; In English

Report No.(s): AD-A482730; AFIT/GIR/ENV/08-M08; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482730>

The process of record keeping has evolved through time. As our technology advances, so does our ability to manage information. We have progressed from paper-based records to new digital techniques and formats to store records. However, digital storage is not the 'Holy Grail' answer to preservation and storage problems. Digital storage is confounded by multiple problems, also. Some of these problems are, but not limited to, lack of standardization and legal guidance, proprietary formats, and the fragility of the digital medium. This research examines several organizations that are deeply involved in digital preservation and tries to identify common practices and problems across the industry.

DTIC

Digital Systems; Digital Techniques; Migration; Organizations; Preserving

20080039693 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Suspicion Modeling in Support of Cyber-Influence Operations/Tactics

Paguirigan, Henry G; Mar 2008; 124 pp.; In English

Contract(s)/Grant(s): AFIT/GIR/ENV/08-M17

Report No.(s): AD-A482769; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482769>

Understanding the cognitive process of IT user suspicion may assist organizations in development of network protection plans, personnel training, and tools necessary to identify and mitigate nefarious intrusions of IT systems. Exploration of a conceptual common ground between psycho-social and technology-related concepts of suspicion are the heart of this investigation. The complexities involved in merging these perspectives led to the overall research question: What is the nature of user suspicion toward IT: The research problem/phenomenon was addressed via extensive literature review, and use of the

Interactive Qualitative Analysis problem/phenomenon. Analysis of the system led to the development of a model of IT suspicion as a progenitor for future experimental constructs that measure or assess behavior as a result of cyber attacks.
DTIC

Data Processing; Tactics; Technology Assessment

20080039711 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Applying Automated Theorem Proving to Computer Security

McElroy, Kelly; Mar 2008; 130 pp.; In English

Report No.(s): AD-A482816; AFIT/GCS/ENG/08-16; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482816>

While more and more data is stored and accessed electronically, better access control methods need to be implemented for computer security. Formal modelling and analysis have been successfully used in certain areas of computer systems, such as verifying the security properties of cryptographic and authentication protocols. However, formal models for computer systems in cyberspace, like networks, have hardly advanced. A highly regarded graduate textbook cites the Take-Grant model created in 1977 as one of the 'current' examples of security modelling and analysis techniques. This model is rarely used in practice though. This research implements the Take-Grant Protection model's four de jure rules and Can Share predicate in the Prototype Verification System (PVS) which automates model checking and theorem proving. This facilitates the ability to test a given Take-Grant model against many systems which are modelled using digraphs. Two models, one with error checking and one without, are created to implement take-grant rules. The first model that does not have error checking incorporated requires manual error checking. The second model uses recursion to allow for the error checking. The Can Share theorem requires further development.

DTIC

Computer Information Security; Security; Theorem Proving; Theorems

20080039740 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

A United Framework for Solving Multiagent Task Assignment Problems

Cousin, Kevin; Dec 2007; 230 pp.; In English

Report No.(s): AD-A482872; AFIT/DCS/ENG/08-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482872>

This research presents a unified approach to representing and solving the multiagent task assignment problem for complex problem domains using ideas central to multiagent task allocation, project scheduling, constraint satisfaction, and coalition formation, forming the basis of the constrained multiagent task scheduling (CMTS) problem. The CMTS descriptor represents a wide range of classical and modern problems, such as job shop scheduling, the traveling salesman problem, vehicle routing, and cooperative multi-object tracking. Problems using the CMTS representation are solvable by a suite of algorithms ranging from simple random scheduling to state-of-the-art biologically inspired approaches incorporating evolutionary algorithms, dynamic coalition formation, auctioning, and behavior-based robotics to highlight different solution generation strategies. The framework includes a distributed process to show how to scale adapted algorithms to solve increasingly larger domain problems. This approach introduces several methods for problem decomposition and recomposition without significantly compromising solution quality. Decomposition techniques show methods to reduce the search space by several orders of magnitude allowing for improved search efficiency.

DTIC

Algorithms; Allocations; Distributed Processing; Scheduling

20080039813 Army Construction Engineering Research Lab., Champaign, IL USA

Development of an Open Building Automation System Specification Based on ANSI/ASHRAE 135-2004 (BACnet(Registered) Communications Protocol): A Technical Assessment

Schwenk, David M; Briggs, Stephen J; Underwood, David M; Bush, Joseph; Feb 2007; 38 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482939; ERDC/CERL-TR-07-3; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This work assessed the potential for development of a building automation system (BAS) specification (for heating, ventilating, and air conditioning systems, etc.) based on the BACnet communications protocol. Although BACnet is widely supported, no building automation system (BAS) specification exists that implements BACnet as an Open System. The BACnet protocol is detailed, includes comprehensive requirements, and also provides options in how individual vendors might

choose to implement it. Such vendor-specific choices can effectively close the system to future open bid procurements, or result in incompatible systems. This work concluded that implementing BACnet in an Open manner will require extensively prescriptive requirements with a large amount of design and contract documentation. The resulting system may not integrate as tightly as desired and may therefore not be as user friendly to Army installation operations and maintenance (O&M) staff as other equivalent systems due mainly to the need for multiple configuration tools. This work recommends that development of BAS specifications based on BACnet continue and that a source selection process that pre-qualifies BACnet contractors be developed to help obtain open systems in accordance with those specifications.

DTIC

Air Conditioning Equipment; Automatic Control; Heat; Protocol (Computers); Specifications; Ventilation

20080039817 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Priority Based Buffering over Multiple Lossy Links Using TCP Aware Link Layer Buffering

Savidge, Kevin J; Mar 27, 2008; 83 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-ENG-08-175

Report No.(s): AD-A482951; AFIT/GCE/ENG/08-10; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Wireless military information systems require high reliability, which is difficult to achieve in adverse conditions. To provide high reliability one must overcome packet loss across multiple wireless hops. Buffering packets in a lossy environment is well explored; however, the ability to selectively buffer TCP traffic across multiple lossy links is a new area of research. This document seeks to explore the delivery of high priority traffic in a lossy environment and conclude that prioritized buffering can increase the probability that a high priority download will finish, where others will fail. It is shown that buffering provides six times the throughput in a network with each link experiencing 25% loss. Prioritizing TCP packet flows provides a varied outcome, as it can not overcome the TCP mechanisms, when the packet loss recovery time is greater than the retransmission timeout event. However, the future work in chapter 6 may provide roadmap to gaining control authority of the challenged network.

DTIC

Priorities; Protocol (Computers)

20080039876 Maryland Univ., College Park, MD USA

Multi-Node Cooperative Resource Allocation to Improve Coverage Area in Wireless Networks

Sadek, Ahmed K; Han, Zhu; Liu, K J; Nov 2005; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-01-2-0011

Report No.(s): AD-A483081; No Copyright; Avail.: Defense Technical Information Center (DTIC)

It is of great importance for service providers to improve the coverage area without cost of more infrastructure in wireless networks especially in rural areas. Recently, cooperative communication has brought a new communication paradigm. In this paper, multi-node cooperative resource allocation is studied to schedule the transmission time slots so as to maximize the network overall rate 'or the coverage area' under the Quality of Services constraints. To optimize the performance, first, the performance of the multi-node cooperative transmission is analyzed. Then a protocol is constructed between the mobiles and the base station for the resource allocation. From the simulation results, the proposed scheme can increase the user's rate by 5% for large cell sizes and improve the coverage by 180%, compared with the traditional scheme without cooperative transmission.

DTIC

Allocations; Communication Networks; Protocol (Computers); Resource Allocation; Wireless Communication

20080040203 Toronto Univ., Ontario Canada

Shake, Rattle and Roles: Lessons from Experimental Earthquake Engineering for Incorporating Remote Users in Large-Scale E-Science Experiments

Birnholtz, Jeremy P; Horn, Daniel B; Jan 2007; 34 pp.; In English

Contract(s)/Grant(s): NSF CMS-0117853

Report No.(s): AD-A482950; No Copyright; Avail.: Defense Technical Information Center (DTIC)

While there has been substantial interest in using e-science and cyberinfrastructure technologies to enable synchronous remote participation in experimental research, the details of such participation are in question. On the one hand, there is a desire to give remote participants the same views and capabilities that they would have as local participants. On the other hand, there are settings where experimental specimens and apparatus are large and difficult to manipulate effectively or view from

a remote vantage point. This article argues for more novel forms of remote participation by drawing on exploratory interview and observation data gathered in civil engineering laboratories. It is shown that, while experiments are in progress, the engineers studied focus primarily on detecting and preventing specimen failures, and that their unease about remote participation stems from doubts about the ability of remote participants to detect failures adequately. It is argued that this presents the opportunity to consider novel roles for remote participants that exploit the features of e-science technologies.

DTIC

Earthquakes; Remote Control

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*.

20080039209 Solid State Scientific Corp., Hollis, NH USA

Two-Beam Coupling Correlation Synthetic Aperture Radar Image Recognition with Power-law Scattering Centers Pre-Enhancement

Haji-saeed, Bahareh; Khoury, Jed; Woods, Charles L; Kierstead, John; Mar 2008; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-2305

Report No.(s): AD-A482334; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482334>

Synthetic radar image recognition is an area of interest for military applications including automatic target recognition, air traffic control, and remote sensing. Here a dynamic range compression two-beam coupling joint transform correlator for detecting synthetic aperture radar (SAR) targets is utilized. The joint input image consists of a pre-power-law, enhanced scattering center of the input image and a linearly synthesized power-law enhanced scattering center template. Enhancing the scattering center of both the synthetic template and the input image furnishes the conditions for achieving dynamic range compression correlation in two-beam coupling. Dynamic range compression: (a) enhances the signal to noise ratio, (b) enhances the high frequencies relative to low frequencies, and (c) converts the noise to high frequency components. This improves the correlation peak intensity to the mean of the surrounding noise significantly. Dynamic range compression correlation has already been demonstrated to outperform many optimal correlation filters in detecting signals in severe noise environments. The performance is evaluated via established metrics, such as peak-to-correlation energy (PCE), Horner efficiency and correlation peak intensity. The results showed significant improvement as the power increased.

DTIC

Augmentation; Data Correlation; Pattern Recognition; Radar Data; Radar Imagery; Scattering; Synthetic Aperture Radar

20080039718 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Dynamic Behavior Sequencing in a Hybrid Robot Architecture

Duffy, Jeffrey P; Mar 2008; 141 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-JON-07-107/07-138

Report No.(s): AD-A482829; AFIT/GCE/ENG/08-03; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482829>

Hybrid robot control architectures separate plans, coordination, and actions into separate processing layers to provide deliberative and reactive functionality. This approach promotes more complex systems that perform well in goal-oriented and dynamic environments. In various architectures, the connections and contents of the functional layers are tightly coupled so system updates and changes require major changes throughout the system. This work proposes an abstract behavior representation, a dynamic behavior hierarchy generation algorithm, and an architecture design to reduce this major change incorporation process. The behavior representation provides an abstract interface for loose coupling of behavior planning and execution components. The hierarchy generation algorithm utilizes the interface allowing dynamic sequencing of behaviors based on behavior descriptions and system objectives without knowledge of the low-level implementation or the high-level goals the behaviors achieve. This is accomplished within the proposed architecture design, which is based on the Three Layer Architecture (TLA) paradigm. The design provides functional decomposition of system components with respect to levels of

abstraction and temporal complexity. The layers and components within this architecture are independent of surrounding components and are coupled only by the linking mechanisms that the individual components and layers allow.

DTIC

Artificial Intelligence; Dynamic Characteristics; Dynamic Response; Robotics; Robots; Sequencing

64

NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20080039722 Naval Undersea Warfare Center, Newport, RI USA

Response of a Beam on a Highly Elastic Foundation

Hull, Andrew J; Feb 24, 2008; 26 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-08-WX2-0092

Report No.(s): AD-A482838; NUWC-NPT-TR-11; 856; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482838>

This report develops and analyzes the equations of motion of an infinite Euler-Bernoulli beam that is in contact with a set of periodic support beams. The support beams are modeled as Euler-Bernoulli beams in their transverse directions and modeled using the wave equation in their axial directions. This new formulation allows the support beam models to admit wave propagation so that the dynamic effects of a long foundation can be understood. Three different loading cases are analyzed and the results are discussed.

DTIC

Equations of Motion; Wave Equations; Wave Propagation

20080039842 Pennsylvania State Univ., University Park, PA USA

Formal-Language-Theoretic Control & Coordination of Mobile Robots

Ray, Asok; Oct 29, 2007; 57 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-1-0469

Report No.(s): AD-A482995; FR-CSF07001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of this research is to enhance control and coordination of heterogeneous robots that include both Unmanned Ground Vehicles (UGVs) and Unmanned Aerial Vehicles (UAVs), supported by communication of onboard sensor and ancillary information among individual platforms and human users. The research has formulated and experimentally validated robust adaptive algorithms and software codes for decision and control of mobile robotic platforms, as applied to real-time computation and execution of combat mission strategies. These algorithms are executable within a general-purpose programming language environment and make use of the generative power of formal-language-theoretic models instead of ad-hoc rule-based expert systems. Future Plans: 1) Formulation of operational intelligence models in a formal-language-theoretic setting. 2) Algorithm development for intelligent coordination of autonomous agent teams to accomplish complex mission tasks.

DTIC

Automata Theory; Coordination; Information Theory; Languages; Programming Languages; Robotics; Robots

20080039848 Colorado Univ., Boulder, CO USA

Separated Representations and Fast Algorithms for Materials Science

Beylkin, Gregory; Monzon, Lucas; Perez, Fernando; Oct 29, 2007; 80 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-1-0254

Report No.(s): AD-A483004; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Our goal (within the time-frame of the grant) was to finish the development of algorithms and software for applying Green's functions (and other operators) and to develop and test algorithms for computing multiparticle wave functions both based on representing operators and functions of many variables as short sums of separable functions the so-called separated representations Our approach is different from the Fast

DTIC

Algorithms; Green's Functions; Schroedinger Equation

20080039893 Battelle-Edgewood Operations, Edgewood Arsenal, MD USA

Rotational Spectra of Chemical Warfare Agents and Simulants using Fourier-Transform Microwave Spectroscopy

DaBell, Ryan S; Suenram, R D; Jensen, James O; Samuels, Alan C; Jul 1, 2003; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A483108; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Using Fourier-transform microwave spectroscopy, the rotational spectra of diethyl methylphosphonate, diethyl ethylphosphonate, and diisopropyl methylphosphonate have been acquired. Rotational constants have been derived, and high level ab initio calculations have been carried out in order to determine the nature of the conformers that were identified using the spectral information. Continued efforts in development of FTMW spectroscopy as a quantitative tool for gas-phase chemical agent analysis is also discussed.

DTIC

Chemical Warfare; Fourier Transformation; Microwave Spectra; Protection; Rotational Spectra; Spectroscopy

20080039897 Naval Research Lab., Washington, DC USA

Initial-Value-Problem Solution for Isolated Rippled Shock Fronts in Arbitrary Fluid Media

Bates, Jason W; Jun 22, 2004; 40 pp.; In English

Report No.(s): AD-A483114; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Following the work of Roberts (Los Alamos Scientific Laboratory Report No. LA-299, 1945) we investigate the effect of small two-dimensional perturbations on an isolated, planar shock front moving steadily through an inviscid fluid medium with an arbitrary equation of state (EOS). In the context of an initial-value problem, we derive explicit analytical expressions for the linearized, time-dependent Fourier coefficients associated with an initial corrugation of the front. The temporal evolution of these coefficients superficially resembles the attenuated 'ringing' of a damped harmonic oscillator, but with the important distinctions that the frequency of oscillation is not constant, and that the damping factor is not simply an exponential function of time t . It is shown that at least two three-parameter families of stable solutions exist, one more strongly damped than the other. In both cases, we find that the envelope of oscillations decays asymptotically as $t^{-3/2}$, with shorter wavelengths dying out earlier than longer ones. For a particular perturbed shock system, the strength of the front and the EOS properties of the material through which it propagates determine the applicable family of solutions. Theoretical predictions agree well with FAST2D numerical simulations for several examples derived from the CALEOS library.

DTIC

Boundary Value Problems; Equations of State; Inviscid Flow; Perturbation; Shock Fronts

20080039899 Naval Research Lab., Washington, DC USA

Modeling Fluid Instabilities in Inertial Confinement Fusion Hydrodynamics Codes

Zalesak, Steven T; Schmitt, Andrew J; Velikovich, A L; Gardner, J H; Jan 2005; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A483118; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The numerical tools typically used to model the evolution of fluid instabilities in inertial confinement fusion (ICF) hydrodynamics codes are examined, and some are found to have properties which would seem to be incompatible with the accurate modeling of small-amplitude perturbations, i.e., perturbations in the linear stage of evolution. In particular a 'differentiability condition' which is satisfied by the physics in such situations is not necessarily satisfied by the numerical algorithms in typical use. It is demonstrated that it is possible to remove much of the non-differentiability in many cases, and that substantial improvement in one's ability to accurately model the evolution of small amplitude perturbations can result. First a simple example involving a non-differentiable radiation transport algorithm is shown, and then the non-differentiabilities introduced by the use of upwind and 'high resolution' hydrodynamics algorithms are analyzed.

DTIC

Hydrodynamics; Inertial Confinement Fusion; Perturbation; Stability

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20080039233 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Efficient Kriging via Fast Matrix-Vector Products

Memarsadeghi, Nargess; Raykar, Vikas C.; Duraiswami, Ramani; Mount, David M.; March 2008; 7 pp.; In English; 2008 IEEE Aerospace Conference, 1-8 Mar. 2008, Big Sky, MT, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NSF CCR-06-35099; No Copyright; Avail.: CASI: [A02](#), Hardcopy
ONLINE: <http://hdl.handle.net/2060/20080039233>

Interpolating scattered data points is a problem of wide ranging interest. Ordinary kriging is an optimal scattered data estimator, widely used in geosciences and remote sensing. A generalized version of this technique, called cokriging, can be used for image fusion of remotely sensed data. However, it is computationally very expensive for large data sets. We demonstrate the time efficiency and accuracy of approximating ordinary kriging through the use of fast matrix-vector products combined with iterative methods. We used methods based on the fast Multipole methods and nearest neighbor searching techniques for implementations of the fast matrix-vector products.

Author

Kriging; Remote Sensing; Geophysics; Iterative Solution; Rangefinding; Vectors (Mathematics)

20080039481 Forest Products Lab., Madison, WI USA

Confidence Bounds and Hypothesis Tests for Normal Distribution Coefficients of Variation

Verrill, S. P.; Johnson, R. A.; Sep. 2007; 60 pp.; In English
Report No.(s): PB2008-101744; FPL-RP-638; No Copyright; Avail.: CASI: [A04](#), Hardcopy

For normally distributed populations, we obtain confidence bounds on a ratio of two coefficients of variation, provide a test for the equality of k coefficients of variation, and provide confidence bounds on a coefficient of variation shared by k populations. To develop the test and the confidence bounds, we first establish that estimators based on Newton steps from $(\text{square root})n$ -consistent estimators may be used in place of efficient solutions of the likelihood equations in likelihood ratio, Wald, and Rao tests. Taking a quadratic mean differentiability approach, Lehmann and Romano have outlined proofs of similar results. We take a Cramer condition approach and make the conditions and their use explicit.

NTIS

Coefficients; Confidence Limits; Hypotheses; Normal Density Functions; Variance (Statistics)

20080039676 University of Southern California, Los Angeles, CA USA

Spatio-Temporal Nonlinear Filtering with Applications to Information Assurance and Counter Terrorism

Rozovsky, Boris; Tartakovsky, Alexander; Galstyan, A; Bertozzi, A; Cohen, P; Medioni, G; Papadopolous, C; Veeravalli, V; Sep 2006; 52 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W911NF-06-1-0094
Report No.(s): AD-A482732; FPTR-CAMS-1-06; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: <http://hdl.handle.net/100.2/ADA482732>

The objective of this MURI project is to develop a general and systematic foundation and algorithms for spatial-temporal statistical inference and for fusion of heterogeneous information from multi-source, multi-sensor distributed sensor networks. Immediate applications of the proposed work are Network Centric Warfare, where new and emerging systems such as MASINT and FORCENet collect but do not adequately interpret vast amounts of data; and homeland security applications, including video monitoring, and near-field and far-field intelligence analysis. Our research will solve three central problems: (a) nonstationary, (b) integrating metric and symbolic information, and (c) very high dimensionality. Current methods for pattern recognition in monitoring and surveillance are designed for stationary patterns, and cannot cope with new patterns in ever-changing environments. We develop new statistical methods for the nonstationary environment, particularly spatio-temporal nonlinear filtering, change-point detection, and advanced fusion methods. A distinctive feature of our approach is that the spaces in which estimation, classification and tracking is performed are both metric and symbolic. Just as a moving vehicle may be tracked in a metric coordinate space by conventional filters, so can an unfolding terrorist plan be tracked in plan space by a hybrid metric-symbolic nonlinear filter.

DTIC

Nonlinear Filters; Nonlinearity; Terrorism

20080039696 Massachusetts Inst. of Tech., Lexington, MA USA

Statistical Inference in Graphical Models

Gimpel, K; Rudoy, D; Jun 17, 2008; 71 pp.; In English; Original contains color illustrations

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

Report No.(s): AD-A482775; TR-1115; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482775>

Graphical models fuse probability theory and graph theory in such a way as to permit efficient representation and computation with probability distributions. They intuitively capture statistical relationships among random variables and provide a succinct formalism that allows for the development of tractable algorithms for statistical inference. In recent years, certain types of graphical models, particularly Bayesian networks and dynamic Bayesian networks (DBNs), have been applied to various problems in missile defense that involve decision making under uncertainty and estimation in dynamic systems, such as data association, multitarget tracking, and classification. While the set of problems addressed in the missile defense arena is quite diverse, all require mathematically sound machinery for dealing with uncertainty. The graphical model regime provides a robust, flexible framework for representing and computationally handling uncertainty in real-world problems. While the graphical model regime is relatively new, it has deep roots in many fields, as the formalism generalizes many commonly used stochastic models, including Kalman filters and hidden Markov models. In this report, we describe the mathematical foundations of graphical models and statistical inference, focusing on the concepts and techniques that are most useful to the problem of decision making in dynamic systems under uncertainty. In general, statistical inference on a graphical model is an NP-Hard problem, so there have been large research efforts that involve developing algorithms for performing inference efficiently for certain classes of models, or obtaining approximations for quantities of interest using algorithms for approximate inference. Due to the breadth of problems, a broad class of algorithms has been of interest to researchers over the past several years. As such, the need arose for an extensible and efficient software library for performing statistical inference on graphical models.

DTIC

Bayes Theorem; Inference; Mathematical Models; Software Development Tools

20080040158 NASA Langley Research Center, Hampton, VA, USA

Logistics Modeling for Lunar Exploration Systems

Andraschko, Mark R.; Merrill, R. Gabe; Earle, Kevin D.; September 09, 2008; 9 pp.; In English; AIAA Space 2008 Conference & Exposition, 9-11 Sep. 2008, San Diego, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 329231.01.12.04.01; Copyright; Avail.: CASI: [A02](#), Hardcopy

The extensive logistics required to support extended crewed operations in space make effective modeling of logistics requirements and deployment critical to predicting the behavior of human lunar exploration systems. This paper discusses the software that has been developed as part of the Campaign Manifest Analysis Tool in support of strategic analysis activities under the Constellation Architecture Team - Lunar. The described logistics module enables definition of logistics requirements across multiple surface locations and allows for the transfer of logistics between those locations. A key feature of the module is the loading algorithm that is used to efficiently load logistics by type into carriers and then onto landers. Attention is given to the capabilities and limitations of this loading algorithm, particularly with regard to surface transfers. These capabilities are described within the context of the object-oriented software implementation, with details provided on the applicability of using this approach to model other human exploration scenarios. Some challenges of incorporating probabilistics into this type of logistics analysis model are discussed at a high level.

Author

Lunar Exploration; Logistics; Object-Oriented Programming; Deployment

20080040159 NASA Langley Research Center, Hampton, VA, USA

A Comparison of Probabilistic and Deterministic Campaign Analysis for Human Space Exploration

Merrill, R. Gabe; Andraschko, Mark; Stromgren, Chel; Cirillo, Bill; Earle, Kevin; Goodliff, Kandyce; September 09, 2008; 10 pp.; In English; AIAA Space 2008 Conference and Exposition, 9-11 Sep. 2008, San Diego, CA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 329231.01.12.04.01; Copyright; Avail.: CASI: [A02](#), Hardcopy

Human space exploration is by its very nature an uncertain endeavor. Vehicle reliability, technology development risk, budgetary uncertainty, and launch uncertainty all contribute to stochasticity in an exploration scenario. However, traditional strategic analysis has been done in a deterministic manner, analyzing and optimizing the performance of a series of planned missions. History has shown that exploration scenarios rarely follow such a planned schedule. This paper describes a

methodology to integrate deterministic and probabilistic analysis of scenarios in support of human space exploration. Probabilistic strategic analysis is used to simulate 'possible' scenario outcomes, based upon the likelihood of occurrence of certain events and a set of pre-determined contingency rules. The results of the probabilistic analysis are compared to the nominal results from the deterministic analysis to evaluate the robustness of the scenario to adverse events and to test and optimize contingency planning.

Author

Space Exploration; Stochastic Processes; Robustness (Mathematics); Launching; Risk

20080040183 NASA Langley Research Center, Hampton, VA, USA

Approximation of Failure Probability Using Conditional Sampling

Giesy, Daniel P.; Crespo, Luis G.; Kenney, Sean P.; September 10, 2008; 17 pp.; In English; 12th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference, 10-12 Sep. 2008, Victoria, Canada; Original contains color illustrations

Contract(s)/Grant(s): WBS 457280; Copyright; Avail.: CASI: [A03](#), Hardcopy

In analyzing systems which depend on uncertain parameters, one technique is to partition the uncertain parameter domain into a failure set and its complement, and judge the quality of the system by estimating the probability of failure. If this is done by a sampling technique such as Monte Carlo and the probability of failure is small, accurate approximation can require so many sample points that the computational expense is prohibitive. Previous work of the authors has shown how to bound the failure event by sets of such simple geometry that their probabilities can be calculated analytically. In this paper, it is shown how to make use of these failure bounding sets and conditional sampling within them to substantially reduce the computational burden of approximating failure probability. It is also shown how the use of these sampling techniques improves the confidence intervals for the failure probability estimate for a given number of sample points and how they reduce the number of sample point analyses needed to achieve a given level of confidence.

Author

Estimating; Failure; Probability Theory; Sampling; Statistical Analysis

20080040776 NASA Goddard Space Flight Center, Greenbelt, MD, USA

SEE Rate Estimation: Model Complexity and Data Requirements

Ladbury, Ray; April 16, 2008; 8 pp.; In English; 2008 Single Event Effects Symposium, 15-17 Apr. 2008, Long Beach, CA, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040776>

Statistical Methods outlined in [Ladbury, TNS20071] can be generalized for Monte Carlo Rate Calculation Methods Two Monte Carlo Approaches: a) Rate based on vendor-supplied (or reverse-engineered) model SEE testing and statistical analysis performed to validate model; b) Rate calculated based on model fit to SEE data Statistical analysis very similar to case for CREME96. Information Theory allows simultaneous consideration of multiple models with different complexities: a) Model with lowest AIC usually has greatest predictive power; b) Model averaging using AIC weights may give better performance if several models have similar good performance; and c) Rates can be bounded for a given confidence level over multiple models, as well as over the parameter space of a model.

Author

Statistical Analysis; Monte Carlo Method; Information Theory; Rates (Per Time)

66

SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20080039364 Defence Science and Technology Organisation, Edinburgh, Australia

A Review of Accident Modelling Approaches for Complex Critical Sociotechnical Systems

Qureshi, Zahid H; Jan 2008; 72 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482543; DSTO-TR-2094; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The increasing complexity in highly technological systems such as aviation, maritime, air traffic control, telecommunications, nuclear power plants, defence and aerospace, chemical and petroleum industry, and healthcare and patient safety is leading to potentially disastrous failure modes and new kinds of safety issues. Traditional accident modelling approaches are not adequate to analyse accidents that occur in modern sociotechnical systems, where accident causation is not

the result of an individual component failure or human error. This report provides a review of key traditional accident modelling approaches and their limitations, and describes new system-theoretic approaches to the modelling and analysis of accidents in safety-critical systems. It also discusses current research on the application of formal (mathematically-based) methods to accident modelling and organisational theories on safety and accident causation. This report recommends new approaches to the modelling and analysis of complex systems that are based on systems theory and interdisciplinary research, in order to capture the complexity of modern sociotechnical systems from a broad systemic view for understanding the multidimensional aspects of safety and accident causation.

DTIC

Accidents; Complex Systems; Models; Systems Analysis

20080039694 Air Force Research Lab., Eglin AFB, FL USA

Polynomial-Time Identification of Optimal Robust Network Flows Under Certain Arc Failures (Preprint)

Commander, Clayton W; Boginski, Vladimir; Jun 2008; 12 pp.; In English

Contract(s)/Grant(s): Proj-2068

Report No.(s): AD-A482772; AFRL-RW-EG-TP-2008-7414; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482772>

Network flow problems have a wide variety of important applications in many areas. Although deterministic formulations of these problems are well-studied, in many practical situation one has to deal with uncertainties associated with possible failures of network components (e.g., each arc has a probability of failure). Formulations and optimal solutions of these problems need to be adjusted to take into account these uncertainty factors. The main difficulty arising in addressing these issues is the dramatic increase in the computational complexity of the resulting optimization problems. We propose LP-based solution methods for network flow problems under a set of failure scenarios, which allow for robust solutions to be found in polynomial time. We justify this fact by proving that for network flow problems under certainty with linear loss functions, the number of scenarios required to approximate the mean of the loss distribution for any fixed $\epsilon > 0$ with probability $(1-\alpha)$, for a $c(0,1)$, is polynomial with respect to the size of the network. {See paper for actual formulas.}

DTIC

Failure; Linear Programming; Network Analysis; Polynomials

20080039723 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

A Hybrid Multi-Robot Control Architecture

Hooper, Daylond J; Dec 2007; 116 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482841; AFIT/GCS/ENG/08-02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482841>

Multi-robot systems provide system redundancy and enhanced capability versus single robot systems. Implementations of these systems are varied, each with specific design approaches geared towards an application domain. Some traditional single robot control architectures have been expanded for multi-robot systems, but these expansions predominantly focus on the addition of communication capabilities. Both design approaches are application specific and limit the generalizability of the system. This work presents a redesign of a common single robot architecture in order to provide a more sophisticated multi-robot system. The single robot architecture chosen for application is the Three Layer Architecture (TLA). The primary strength of TLA is in the ability to perform both reactive and deliberative decision making, enabling the robot to be both sophisticated and perform well in stochastic environments. The redesign of this architecture includes incorporation of the Unified Behavior Framework (UBF) into the controller layer and an addition of a sequencer-like layer (called a Coordinator) to accommodate the multi-robot system. These combine to provide a robust, independent, and taskable individual architecture along with improved cooperation and collaboration capabilities, in turn reducing communication overhead versus many traditional approaches. This multi-robot systems architecture is demonstrated on the RoboCup Soccer Simulator showing its ability to perform well in a dynamic environment where communication constraints are high.

DTIC

Robot Control; Robotics

20080039749 Massachusetts Inst. of Tech., Cambridge, MA USA

Analysis and Optimization of the Emergency Department at Beth Israel Deaconess Medical Center via Simulation

Noyes, Clay W; Jun 2008; 69 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482890; MIT-CI08-0013; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482890>

We develop a simulation model based on patient data from 2/1/05 to 1/31/06 that represents the operations of the Emergency Department at Beth Israel Deaconess Medical Center, a Harvard teaching hospital and a leading medical institution. The model uses a multiclass representation of patients, a time-varying arrival process module that uses multivariate regression to predict future patient arrivals, and a service module that takes into account the fact that service times decrease and capacity increases when the system becomes congested. We show that the simulation model results in predictions of waiting times that closely match those observed in the data. Most importantly, we use the simulation model to propose and analyze new policies such as increasing the number of beds, reducing the downtime between patients, and introducing a point of care lab testing device. The model predicts that incorporating a suite of these proposed changes will result in 21% reduction in waiting times.

DTIC

Emergencies; Hospitals; Israel; Operations Research; Optimization; Simulation

20080040123 Massachusetts Inst. of Tech., Cambridge, MA USA

System Analysis and Design of a Low-Cost Micromechanical Seeker System

Nagle, Brian J; Jun 2008; 141 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482873; CI08-0019; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482873>

Precision guided targeting systems have been in use by the U.S. military for the last half-century. The desire for high targeting accuracies while maintaining minimal collateral damage has driven the implementation of guidance systems on a myriad of different platforms. Current seeker systems using global positioning system (GPS)-aided technology offer good accuracy, but are limited by an adversary's signal jamming capabilities and the dynamic nature of the military target environment. Furthermore, ultra-accurate inertial measurement units (IMU) that serve as stand-alone guidance systems are very expensive and offer no terminal guidance enhancement. As a result, it is cost prohibitive to equip some platforms with precision guidance capability. The demand for high accuracy at low cost has prompted substantial recent development of micro-electromechanical systems (MEMS) IMU s and optical focal plane arrays (FPA). The resulting decreasing device size and production costs coupled with higher unit performance have created opportunities for implementing seeker-enabled systems on platforms previously deemed impractical. As a result, the author proposes a design methodology to develop a low-cost system while satisfying stringent performance requirements. The methodology is developed within the context of a strap-down seeker system for tactical applications. The design tenets of the optical sensor, the inertial sensor, and projectile flight dynamics were analyzed in-depth for the specific scenario. The results of each analysis were combined to formulate a proposed system. The system was then modeled to produce system miss distance estimates for differing engagement situations. The system demonstrated 3 sigma miss distance estimates that were less than the maximum allowable error in each case. The system cost was tabulated and a production price was approximated.

DTIC

Cost Analysis; Focal Plane Devices; Global Positioning System; Homing Devices; Low Cost; Microelectromechanical Systems; Micromechanics; Systems Analysis

20080040124 Army Engineer Waterways Experiment Station, Vicksburg, MS USA

Concepts in Sediment Budgets

Rosati, Julie D; Mar 2005; 18 pp.; In English

Report No.(s): AD-A482879; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482879>

The sediment budget is fundamental in coastal science and engineering. Budgets allow estimates to be made of the volume or volume rate of sediment entering and exiting a defined region of the coast and the surplus or deficit remaining in that region. Sediment budgets have been regularly employed with variations in approaches to determine the sources and sinks through application of the primary conservation of mass equation. Historically, sediment budgets have been constructed and displayed on paper or maps. Challenges in constructing a sediment budget include determining the appropriate boundaries of the budget and interior cells; defining the possible range of sediment transport pathways, and the relative magnitude of each; representing the uncertainty associated with values and assumptions in the budget; and testing the sensitivity of the series of budgets to

variations in the unknown and temporally-changing values. These challenges are usually addressed by representing a series of budget alternatives that are ultimately drawn on paper, maps, or graphs. Applications of the methodology include detailed local-scale sediment budgets, such as for an inlet or beach fill project, and large-scale sediment budgets for the region surrounding the study area. The local-scale budget has calculation cells representing features on the order of 10s to 100s of meters, and it must be shown separately from the regional sediment budget, with cells ranging from 100s of meters to kilometers. This paper reviews commonly applied sediment budget concepts and introduces new considerations intended to make the sediment budget process more reliable, streamlined, and understandable. The need for both local and regional sediment budgets is discussed, and the utility of combining, or collapsing, cells is shown to be beneficial for local budgets within a regional system.

DTIC

Sediments; Budgeting

20080040186 NASA Langley Research Center, Hampton, VA, USA

Strategic Analysis Overview

Cirillo, William M.; Earle, Kevin D.; Goodliff, Kandyce E.; Reeves, J. D.; Stromgren, Chel; Andraschko, Mark R.; Merrill, R. Gabe; September 09, 2008; 17 pp.; In English; AIAA Space 2008 Conference and Exposition, 9-11 Sep. 2008, San Diego, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 329231.01.12.04.01; Copyright; Avail.: CASI: [A03](#), Hardcopy

NASA's Constellation Program employs a strategic analysis methodology in providing an integrated analysis capability of Lunar exploration scenarios and to support strategic decision-making regarding those scenarios. The strategic analysis methodology integrates the assessment of the major contributors to strategic objective satisfaction performance, affordability, and risk and captures the linkages and feedbacks between all three components. Strategic analysis supports strategic decision making by senior management through comparable analysis of alternative strategies, provision of a consistent set of high level value metrics, and the enabling of cost-benefit analysis. The tools developed to implement the strategic analysis methodology are not element design and sizing tools. Rather, these models evaluate strategic performance using predefined elements, imported into a library from expert-driven design/sizing tools or expert analysis. Specific components of the strategic analysis tool set include scenario definition, requirements generation, mission manifesting, scenario lifecycle costing, crew time analysis, objective satisfaction benefit, risk analysis, and probabilistic evaluation. Results from all components of strategic analysis are evaluated a set of pre-defined figures of merit (FOMs). These FOMs capture the high-level strategic characteristics of all scenarios and facilitate direct comparison of options. The strategic analysis methodology that is described in this paper has previously been applied to the Space Shuttle and International Space Station Programs and is now being used to support the development of the baseline Constellation Program lunar architecture. This paper will present an overview of the strategic analysis methodology and will present sample results from the application of the strategic analysis methodology to the Constellation Program lunar architecture.

Author

Cost Analysis; Decision Making; Risk; Management Methods; Decision Theory; Management Planning; Feasibility Analysis; Management Analysis; Mission Planning; Project Management

20080040731 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Analyzing and Detecting Problems in Systems of Systems

Lindvall, Mikael; Ackermann, Christopher; Stratton, William C.; Sibol, Deane E.; Godfrey, Sally; September 09, 2008; 32 pp.; In English; 2008 Conference and Exposition, 9-11 Sep. 2008, San Diego, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): NSF CCF-048933; Copyright; Avail.: CASI: [A03](#), Hardcopy

Many software systems are evolving complex system of systems (SoS) for which inter-system communication is mission-critical. Evidence indicates that transmission failures and performance issues are not uncommon occurrences. In a NASA-supported Software Assurance Research Program (SARP) project, we are researching a new approach addressing such problems. In this paper, we are presenting an approach for analyzing inter-system communications with the goal to uncover both transmission errors and performance problems. Our approach consists of a visualization and an evaluation component. While the visualization of the observed communication aims to facilitate understanding, the evaluation component automatically checks the conformance of an observed communication (actual) to a desired one (planned). The actual and the planned are represented as sequence diagrams. The evaluation algorithm checks the conformance of the actual to the planned

diagram. We have applied our approach to the communication of aerospace systems and were successful in detecting and resolving even subtle and long existing transmission problems.

Author

Software Engineering; Computer Systems Programs; Complex Systems; Aerospace Systems; Detection; Errors; Telecommunication; Computer Programs

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THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20080039659 Illinois Univ., Urbana-Champaign, IL USA

Equational Abstractions

Meseguer, Jose; Palomino, Miguel; Marti-Oliet, Narciso; Jan 2007; 37 pp.; In English

Contract(s)/Grant(s): N00014-02-1-0715; F30602-02-C-0130

Report No.(s): AD-A482411; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482411>

Abstraction reduces the problem of whether an infinite state system satisfies a temporal logic property to model checking that property on a finite state abstract version. The most common abstractions are quotients of the original system. We present a simple method of defining quotient abstractions by means of equations collapsing the set of states. Our method yields the minimal quotient system together with a set of proof obligations that guarantee its executability and can be discharged with tools such as those in the Maude formal environment.

DTIC

Computers; Equations; Logic Design; Mathematical Logic; Quotients; Temporal Logic

20080039726 Naval Research Lab., Washington, DC USA

Frenkel-Kontorova Model of Vacancy-Line Interactions on Ga/Si(112)

Erwin, S C; Baski, A A; Whitman, L J; Rudd, R E; Aug 30, 1999; 5 pp.; In English

Report No.(s): AD-A482844; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482844>

We develop an exactly solvable microscopic model for analyzing the strain-mediated interaction of vacancy lines in a pseudomorphic adsorbate system. The model is applied to Ga/Si(112) by extracting values for the microscopic parameters from total-energy calculations. The results, which are in good agreement with experimental observations, reveal an unexpectedly complex interplay between compressive and tensile strain within the mixed Ga-Si surface layer.

DTIC

Equations of Motion; Tensile Stress

20080039741 Massachusetts Inst. of Tech., Cambridge, MA USA

Inertially Stabilized Platforms for SATCOM On-The-Move Applications: A Hybrid Open/Closed-Loop Antenna Pointing Strategy

Marsh, Eric A; Jun 2008; 217 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482874; CI08-0015; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482874>

The increasing need for timely information in any environment has led to the development of mobile SATCOM terminals. SATCOM terminals seeking to achieve high data-rate communications require inertial antenna pointing to within fractions of a degree. The base motion of the antenna platform complicates the pointing problem and must be accounted for in mobile SATCOM applications. Antenna Positioner Systems (APSs) provide Inertially Stabilized Platforms (ISPs) for accurate antenna pointing and may operate in either an open or closed-loop fashion. Closed-loop antenna pointing strategies provide greater inertial pointing accuracies but typically come at the expense of more complex and costly systems. This thesis defines a nominal two-axis APS used on an EHF SATCOM terminal on a 707 aircraft. The nominal APS seeks to accomplish mobile SATCOM using the simplest possible system; therefore, the system incorporates no hardware specific to closed-loop pointing. This thesis demonstrates that the nominal APS may achieve accurate antenna pointing for an airborne SATCOM application using a hybrid open/closed-loop pointing strategy. The nominal APS implements the hybrid pointing strategy by employing an open-loop pedestal feedback controller in conjunction with a step-tracking procedure. The open-loop feedback controller

is developed using optimal control techniques, and the pointing performance of the controller with the nominal APS is determined through simulation. This thesis develops closed-loop step-tracking algorithms to compensate for open-loop pointing errors. The pointing performance of several step-tracking algorithms is examined in both spatial pull-in and tracking simulations in order to determine the feasibility of employing hybrid pointing strategies on mobile SATCOM terminals.

DTIC

Antennas; Communication Satellites; Equations of Motion; Feedback Control; Loop Antennas; Stabilized Platforms

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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*.

20080039373 Seagate Technology, LLC, Shrewsbury, NJ, USA

Coupling Grating for Focusing Light Within a Waveguide for Heat Assisted Magnetic Recording

Rausch, T., Inventor; 15 Nov 04; 10 pp.; In English

Contract(s)/Grant(s): 70NANB1H3056

Patent Info.: Filed Filed 15 Nov 04; US-Patent-Appl-SN-10-988 970

Report No.(s): PB2008-103601; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A method and apparatus for focusing light within a waveguide is provided. The waveguide includes a curved grating adapted to focus light incident thereon to a focused spot proximate a first end of the waveguide. In another embodiment, the first end of the waveguide has a thickness greater than a portion of the waveguide containing the grating. The waveguide is suitable for focusing light onto a magnetic storage medium and the like, making the waveguide suitable for heat-assisted magnetic recording (HAMR) applications.

NTIS

Focusing; Laser Outputs; Magnetic Recording; Patent Applications; Waveguides

20080039451 Woodcock Washburn, LLP, Philadelphia, PA, USA

Carbon Nanotubes: High Solids Dispersions and Nematic Gels Thereof

Yodh, A. G., Inventor; Islam, M. F., Inventor; Ali, A. M., Inventor; 21 May 03; 35 pp.; In English

Contract(s)/Grant(s): NSF-DMR-0079909

Patent Info.: Filed Filed 21 May 03; US-Patent-Appl-SN-10-526 941

Report No.(s): PB2008-103543; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Disclosed are high weight fraction carbon nanotube dispersions including an aqueous medium, carbon nanotubes, and at least one surfactant, the surfactant having an aromatic group, an alkyl group having from about 4 to about 30 carbon atoms, and a charged head group. Also disclosed are ultrasonication processes capable of providing stable dispersions of carbon nanotubes having reduced breakage of the carbon nanotubes. The preparation of nematic nanotube gels from the carbon nanotube dispersions are also disclosed. A variety of uses and applications of the carbon nanotube dispersions and nematic nanotube gels are provided.

NTIS

Carbon; Carbon Nanotubes; Gels; Liquid Crystals; Patent Applications; Solids

20080039455 Fermi National Accelerator Lab., Batavia, IL, USA; Joint Inst. for Nuclear Research, Dubna, Russian Federation; Illinois Univ. at Urbana-Champaign, Urbana, IL, USA

Radiation Requirements and Testing of Cryogenic Thermometers for the ILC

Barnett, T.; Filippov, Y. P.; Mokhov, N. V.; Nakao, N.; Klebaner, A. L.; Jul. 01, 2007; 8 pp.; In English

Contract(s)/Grant(s): DE-AC02-76CH03000

Report No.(s): DE2007-915549; FERMILAB-CONF-07-355-AD; No Copyright; Avail.: Department of Energy Information Bridge

Large quantity of cryogenic temperature sensors will be used for operation of the International Linear Collider (ILC). Most of them will be subject to high radiation doses during the accelerator lifetime. Understanding of particle energy spectra, accumulated radiation dose in thermometers and its impact on performance are vital in establishing technical specification of cryogenic thermometry for the ILC. Realistic MARS15 computer simulations were performed to understand the ILC radiation

environment. Simulation results were used to establish radiation dose requirements for commercially available cryogenic thermometers. Two types of thermometers, Cernox and TVO, were calibrated prior to irradiation using different technique. The sensors were subjected then to up to 200 kGy electron beam irradiation with kinetic energy of 5 MeV, a representative of the situation at the ILC operation. A post-irradiation behavior of the sensors was studied. The paper describes the MARS15 model, simulation results, cryogenic test set-up, irradiation tests, and cryogenic test results.

NTIS

Cryogenics; Particle Accelerators; Thermometers

20080039456 Fermi National Accelerator Lab., Batavia, IL, USA

Design Considerations of a Pair of Power Leads for Fast-Cycling Superconducting Accelerator Magnets Operating at 2 Tesla and 100 kA

Huang, Y.; Hays, S.; Piekarz, H.; de Rijk, G.; Rossi, L.; Aug. 01, 2007; 4 pp.; In English

Contract(s)/Grant(s): DE-AC02-76CH03000

Report No.(s): DE2007-915550; FERMILAB-CONF-07-439-TD; No Copyright; Avail.: Department of Energy Information Bridge

Recently proposed injector accelerator, Low Energy Ring (LER) for the LHC and fast cycling accelerators for the proton drivers (SF-SPS at CERN and DSF-MR at Fermilab) require that a new magnet technology be developed. In support of this accelerator program, a pair of power leads needs to be developed to close the loop between the power supply and accelerator system. The magnet proposed to be used will be a modified transmission line magnet technology that would allow for accelerator quality magnetic field sweep of 2 T/s. The transmission line conductor will be using HTS technology and cooled with supercritical helium at 5 K. The power leads consist of two sections; upper one is a copper and lower section will be using HTS tapes. The accelerator magnet will be ramped to 100 kA in a second and almost immediately ramped down to zero in one second. This paper outlines the design considerations for the power leads to meet the operational requirements for the accelerator system. The power leads thermal analysis during the magnet powering cycle will be included.

NTIS

Cycles; Particle Accelerators; Superconducting Magnets

20080039457 Fermi National Accelerator Lab., Batavia, IL, USA

Design Considerations of a Power Supply System for Fast Cycling Superconducting Accelerator Magnets of 2 Tesla b-field Generated by a Conductor of 100 kA Current

Hays, S.; Piekarz, H.; Pfeffer, H.; Claypool, B.; Jun. 01, 2007; 4 pp.; In English

Contract(s)/Grant(s): DE-AC02-76CH03000

Report No.(s): DE2007-915551; FERMILAB-CONF-07-408-AD; No Copyright; Avail.: Department of Energy Information Bridge

Recently proposed fast cycling accelerators for proton drivers (SF-SPS, CERN and SF-MR, SF-BOOSTER, FNAL) neutrino sources require development of new magnet technology. In support of this magnet development a power supply system will need to be developed that can support the high current and high rate of power swing required by the fast cycling (1 sec rise and fall in the SF-MR, 5Hz in Booster). This paper will outline a design concept for a +/- 2000 V and 100,000 A fast ramping power supply system. This power supply design is in support of a 6.44 km magnet system at 0.020 H and 330 m 5 Hz, 0.00534 H superconducting loads. The design description will include the layout and plan for extending the present FNAL Main Injector style ramping power supply to the higher currents needed for this operation. This will also include the design for a harmonic filter and power factor corrector that will be needed to control the large power swings caused by the fast cycle time. A conceptual design for the current regulation system and control will also be outlined. The power circuit design will include the bridge, filter and transformer plan based on existing designs.

NTIS

Conductors; Cycles; Particle Accelerators; Power Supply Circuits; Superconducting Magnets

20080039458 Fermi National Accelerator Lab., Batavia, IL, USA

Diffraction Effects in the Coherent Transition Radiation Bunch Length Diagnostics

Kazakevich, G.; Lebedev, V.; Nagaitsev, S.; Aug. 01, 2007; 4 pp.; In English

Contract(s)/Grant(s): DE-AC02-76CH03000

Report No.(s): DE2007-915553; FERMILAB-CONF-07-424-AD; No Copyright; Avail.: National Technical Information Service (NTIS)

Diffraction effects in the Coherent Transition Radiation (CTR) bunch length diagnostics are considered for the A0

Photoinjector and the New Muon Laboratory (NML) injection module. The effects can cause a noticeable distortion of the measured CTR spectra depending on the experimental setup and the bunch parameters and resulting in errors of the bunch length measurements. Presented calculations show possible systematic errors in the bunch length in measurements based on the CTR spectra at A0 Photo injector and the NML injection module.

NTIS

Bunching; Coherent Radiation; Diagnosis; Diffraction Radiation; Particle Accelerators

20080039461 Stanford Linear Accelerator Center, Stanford, CA, USA

e(caret)+e(caret)- Annihilations into Quasi-two-body Final States at 10.58 GeV

Yi, K.; Sep. 21, 2007; 7 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-915362; SLAC-PUB-12820; No Copyright; Avail.: Department of Energy Information Bridge

No abstract available

Annihilation Reactions; Hadrons

20080039462 Stanford Linear Accelerator Center, CA, USA; Stanford Univ., Stanford, CA USA; Costa Rica Univ., San Jose, Costa Rica

AdS/CFT and Exclusive Processes in QCD

Brodsky, S. J.; de Teramond, G. F.; Sep. 01, 2007; 25 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-915370; SLAC-PUB-12804; No Copyright; Avail.: Department of Energy Information Bridge

The AdS/CFT correspondence between string theory in AdS space and conformal field theories in physical space-time leads to an analytic, semi-classical model for strongly-coupled QCD which has scale invariance and dimensional counting at short distances and color confinement at large distances. One can use holography to map the amplitude describing the hadronic state in the fifth dimension of Anti-de Sitter space AdS₅ to the light-front wavefunctions of hadrons in physical space-time, thus providing a relativistic description of hadrons in QCD at the amplitude level. In particular, we show that there is an exact correspondence between the fifth-dimensional coordinate of AdS space z and a specific impact variable which measures the separation of the quark and gluonic constituents within the hadron in ordinary space-time. New relativistic light-front equations in ordinary space-time can then be derived which reproduce the results obtained using the 5-dimensional theory. The effective light-front equations possess elegant algebraic structures and integrability properties. This connection between the AdS and the light-front representations allows one to compute the analytic form of the frame-independent light-front wavefunctions, the fundamental entities which encode hadron properties and allow the computation of decay constants, form factors, deeply virtual Compton scattering, exclusive heavy hadron decays and other exclusive scattering amplitudes.

NTIS

Quantum Chromodynamics; String Theory; Holography; Invariance; Wave Functions

20080039463 Stanford Linear Accelerator Center, CA, USA; Massachusetts Inst. of Tech., Cambridge, MA, USA

How well do we know the Unitarity Triangle. An Experimental Review

Sciolla, G.; Sep. 01, 2007; 9 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-915378; SLAC-PUB-12801; No Copyright; Avail.: National Technical Information Service (NTIS)

In the past 10 years our knowledge of the parameters r and h of the Cabibbo-Kobayashi-Maskawa matrix has improved substantially. This article reviews the measurements that contributed to this advance, and discusses their implication in terms of understanding CP violation in the Standard Model and beyond.

NTIS

Triangles; CP Violation

20080039466 Stanford Linear Accelerator Center, CA, USA; Cornell Univ., Ithaca, NY, USA

ILC Electron Source Injector Simulations

Lakshmanan, M.; Aug. 24, 2007; 13 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-915383; SLAC-TN-07-014; No Copyright; Avail.: Department of Energy Information Bridge

As part of the global project aimed at proposing an efficient design for the ILC (International Linear Collider), we

simulated possible setups for the electron source injector, which will provide insight into how the electron injector for the ILC should be designed in order to efficiently accelerate the electron beams through the bunching system. This study uses three types of software: E-Gun to simulate electron beam emission, Superfish to calculate solenoidal magnetic fields, and GPT (General Particle Tracer) to trace charged particles after emission through magnetic fields and subharmonic bunchers. We performed simulations of the electron source injector using various electron gun bias voltages (140kV--200kV), emitted beam lengths (500ps--1ns) and radii (7mm--10mm), and electromagnetic field strengths of the first subharmonic buncher (5--20 MV/m). The results of the simulations show that for the current setup of the ILC, a modest electron gun bias voltage (approx. 140kV) is sufficient to achieve the required bunching of the beam in the injector. Extensive simulations of parameters also involving the second subharmonic buncher should be performed in order to gain more insight into possible efficient designs for the ILC electron source injector.

NTIS

Electron Sources; Injectors; Linear Accelerators; Simulation

20080039467 Stanford Linear Accelerator Center, CA, USA

Photonic Crystal Laser-Driven Accelerator Structures

Cowna, B. M.; Aug. 22, 2007; 120 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-915385; SLAC-R-877; No Copyright; Avail.: National Technical Information Service (NTIS)

Laser-driven acceleration holds great promise for significantly improving accelerating gradient. However, scaling the conventional process of structure-based acceleration in vacuum down to opticalerent kind of structure. We require an optical waveguide that (1) is constructed out of dielectric materials, (2) has transverse size on the order of a wavelength, and (3) supports a mode with speed-of-light phase velocity in vacuum. Photonic crystal--structures whose electromagnetic properties are spatially periodic--can meet these requirements. We discuss simulated photonic crystal accelerator structures and describe their properties. We begin with a class of two-dimensional structures which serves to illustrate the design considerations and trade-offs involved. We then present a three-dimensional structure, and describe its performance in terms of accelerating gradient and efficiency. We discuss particle beam dynamics in this structure, demonstrating a method for keeping a beam confined to the waveguide. We also discuss material and fabrication considerations. Since accelerating gradient is limited by optical damage to the structure, the damage threshold of the dielectric is a critical parameter.

NTIS

Crystal Lattices; Crystals; Lasers; Photons

20080039468 Stanford Linear Accelerator Center, CA, USA; Daresbury Lab., UK; Lancaster Univ., UK; Manchester Univ., UK

Design of the ILC Crab Cavity System

Adolphsen, C.; Beard, C.; Bellantoni, L.; Burt, G.; Carter, R.; Aug. 15, 2007; 25 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-915387; SLAC-PUB-12751; No Copyright; Avail.: National Technical Information Service (NTIS)

The International Linear Collider (ILC) has a 14 mrad crossing angle in order to aid extraction of spent bunches. As a result of the bunch shape at the interaction point, this crossing angle at the collision causes a large luminosity loss which can be recovered by rotating the bunches prior to collision using a crab cavity. The ILC baseline crab cavity is a 9-cell superconducting dipole cavity operating at a frequency of 3.9 GHz. In this paper the design of the ILC crab cavity and its phase control system, as selected for the RDR1 in February 2007 is described in fuller detail.

NTIS

Cavities; Linear Accelerators

20080039470 Fermi National Accelerator Lab., Batavia, IL, USA

Observation of the Sigma (sub b) Baryons at CDF

Pursley, J.; January 2007; 4 pp.; In English

Report No.(s): DE2007-917427; FERMILAB-CONF-07-167-E; No Copyright; Avail.: National Technical Information Service (NTIS)

The authors present a measurement of four new bottom baryons in proton-antiproton collisions.

NTIS

Baryons; Detectors

20080039475 Stanford Linear Accelerator Center, CA, USA; Fermi National Accelerator Lab., Batavia, IL, USA

Status of the ILC Main LINAC Lattice Design

Valishev, A.; Solyak, N.; Woodley, M.; January 2007; 3 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-917742; SLAC-PUB-12853; FERMILAB-CONF-07-293-AD; No Copyright; Avail.: Department of Energy Information Bridge

The report describes the present design of the ILC Main Linac lattice. The topics covered include basic element layout, optical functions, and issues centered around the linac following of the Earth's curvature.

NTIS

Linear Accelerators; Layouts

20080039476 Stanford Linear Accelerator Center, Menlo Park, CA, USA

Simulating Dark Current in NLC Structures

Ng, C. K.; Fowell, N.; Guetz, A.; Ivanov, V.; Lee, L. Q.; January 2007; 4 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-917745; SLAC-PUB-12878; No Copyright; Avail.: National Technical Information Service (NTIS)

Dark current generation and capture are of great importance in high gradient accelerating structure R&D especially for the NLC which aims to operate at 65 MV/m with specific limits on dark current and RF breakdown rates. Although considerable effort has been devoted to building and testing various types of structures to meet these requirements, few theoretical studies have been done to understand these effects in actual structures. This paper focuses on the simulation of dark current in a NLC test structure for which experimental data are available. The parallel time-domain field solver Tau3P and the parallel particle tracking code Track3P are used together to simulate, for the first time, a dark current pulse to compare with the data measured downstream. Results from SLAC X-band 30-cell constant impedance structure for RF drive pulses with different rise times are presented and discussed.

NTIS

Dark Current; Particle Accelerators; Simulation

20080039477 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA

Deeply Virtual Compton Scattering at JLAB Hall A

Voutier, E.; January 2007; 4 pp.; In English

Report No.(s): DE2007-917746; No Copyright; Avail.: National Technical Information Service (NTIS)

The deeply virtual Compton scattering reaction has been investigated in the Hall A of the Jefferson Laboratory by measuring longitudinally polarized ($e,e'\gamma$) cross sections, in the valence quark region, for protons and neutrons. In the proton channel, experimental results strongly support the factorization of the cross section at Q² as low as 2 GeV², opening the path to systematic measurements of generalized parton distributions (GPDs). In the neutron case, preliminary data show sensitivity to the angular momentum of quarks

NTIS

Compton Effect; Electron Scattering

20080039479 Tokai Univ., Hiratsuka, Japan; Argonne National Lab., IL USA; Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA; Tokyo Woman's Christian Univ., Japan

Polarized Structure Functions of Nucleons and Nuclei

Bentz, W.; Cloeot, I. C.; Ito, T.; Thomas, A. W.; Yazaki, K.; Oct. 16, 2007; 8 pp.; In English

Report No.(s): DE2007-917780; No Copyright; Avail.: National Technical Information Service (NTIS)

We determine the quark distributions and structure functions for both unpolarized and polarized DIS of leptons on nucleons and nuclei. The scalar and vector mean fields in the nucleus modify the motion of the quarks inside the nucleons. By taking into account this medium modification, we are able to reproduce the experimental data on the unpolarized EMC effect, and to make predictions for the polarized EMC effect. We discuss examples of nuclei where the polarized EMC effect could be measured. We finally present an extension of our model to describe fragmentation functions.

NTIS

Nucleons; Polarization; Nuclei

20080039507 Palmer (John), Los Angeles, CA, USA

NMR and MRI Apparatus and Method

Clarke, J., Inventor; Kelso, N., Inventor; Lee, S., Inventor; Moessle, M., Inventor; Myers, W., Inventor; 3 Nov 04; 23 pp.; In English

Contract(s)/Grant(s): DE-AC03-76SF00098

Patent Info.: Filed Filed 3 Nov 04; US-Patent-Appl-SN-10-980 984

Report No.(s): PB2008-103111; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Nuclear magnetic resonance (NMR) signals are detected in microtesla fields. Prepolarization in millitesla fields is followed by detection with an untuned dc superconducting quantum interference device (SQUID) magnetometer. Because the sensitivity of the SQUID is frequency independent, both signal-to-noise ratio (SNR) and spectral resolution are enhanced by detecting the NMR signal in extremely low magnetic fields, where the NMR lines become very narrow even for grossly inhomogeneous measurement fields. Additional signal to noise benefits are obtained by use of a low noise polarization coil, comprising litz wire or superconducting materials. MRI in ultralow magnetic field is based on the NMR at ultralow fields. Gradient magnetic fields are applied, and images are constructed from the detected NMR signals.

NTIS

Imaging Techniques; Magnetic Resonance; Nuclear Magnetic Resonance; Patent Applications; SQUID (Detectors)

20080039516 Schwartz (Ansel M), Pittsburgh, PA, USA

VacuMag Magnetic Separator and Process

Brandner, E. D., Inventor; Jamison, R. E., Inventor; 11 Oct 05; 17 pp.; In English

Contract(s)/Grant(s): DMI-9983422

Patent Info.: Filed Filed 11 Oct 05; US-Patent-Appl-SN-11-248 941

Report No.(s): PB2008-103500; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An apparatus for separating a stream of particles with individual sizes smaller than 300 μm and magnetic properties ranging from collective magnetism as in ferromagnetism to paramagnetism to diamagnetism. The apparatus includes a plurality of stages for separating a stream of particles. The apparatus includes a magnetic component producing a magnetic force associated with each stage. The apparatus includes an aerodynamic component producing an aerodynamic force associated with each stage, where the more magnetic component or components of a feed of particles for each stage is separated and either or both the less magnetic product and the more magnetic product of each stage are the feed for separate succeeding stages with each stage and where the magnetic and aerodynamic forces along with gravimetric forces of each stage are chosen to separate more strongly magnetic particles from less magnetic particles. A method for separating a stream of particles with individual sizes smaller than 300 μm and magnetic properties ranging from collective magnetism as in ferromagnetism to paramagnetism to diamagnetism.

NTIS

Magnetic Properties; Patent Applications; Separators

20080039526 Sparkman (Klarquist), LLP, Portland, OR, USA

Novel Class of Superlattice Materials and Superlattice Precursors, and Method for Their Manufacture and Use

Harris, F. R., Inventor; Johnson, D. C., Inventor; 28 Jul 03; 25 pp.; In English

Contract(s)/Grant(s): NSF-DMR-9813726; NSF-DMR-0103409

Patent Info.: Filed Filed 28 Jul 03; US-Patent-Appl-SN-10-522 346

Report No.(s): PB2008-101652; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present disclosure concerns novel materials comprising at least two crystalline materials. In certain embodiments, at least one of the crystalline materials is a diffusion barrier, and at least one material has a high power factor. The disclosed materials are particularly useful as superlattices, particularly thermoelectric superlattices, and superlattice precursors. A method for synthesizing such superlattices is provided. An embodiment of the method includes using Modulated Elemental Reactants (MER) to deposit layers of superlattice precursor materials, followed by annealing to yield bulk superlattice materials.

NTIS

Patent Applications; Superlattices

20080039533 Pennington (Joan), Chicago, IL, USA; Chicago Univ., Chicago, IL USA

Laparoscopic Tumor Therapy Using High Energy Electron Irradiation

Lewellen, J. W., Inventor; Noonan, J., Inventor; 2 Jun 05; 30 pp.; In English

Contract(s)/Grant(s): W-31-109-ENG-38

Patent Info.: Filed Filed 2 Jun 05; US-Patent-Appl-SN-11-143 837

Report No.(s): PB2008-102087; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A laparoscopic tumor therapy method and an articulated electron beam transport system are provided for use with a high power, long focus electron source for tumor therapy. The high power, long focus electron source generates an e-beam. The e-beam is transported through a laparoscopic tube proximate a target tumor for electron irradiation therapy.

NTIS

Cancer; Electron Beams; Electron Irradiation; High Energy Electrons; Patent Applications; Therapy; Tumors

20080039534 California Univ., Lawrence Livermore Lab., Livermore, CA, USA

Flexible Composite Radiation Detector

Cooke, D. W., Inventor; Bennett, B. L., Inventor; Muenchausen, R. E., Inventor; Wroblewski, D. A., Inventor; Orier, E. B., Inventor; 21 Sep 04; 9 pp.; In English

Contract(s)/Grant(s): W-7405-ENG-36

Patent Info.: Filed Filed 21 Sep 04; US-Patent-Appl-SN-10-946 025

Report No.(s): PB2008-102089; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The invention relates to radiation detection using a flexible composite scintillator prepared by mixing fast, bright, dense rare-earth doped powdered oxyorthosilicate (such as LSO:Ce, LSO:Sm, and GSO:Ce) scintillator with a polymer binder. The binder is transparent to the scintillator emission. The composites are seamless and can be made large and in a wide variety of shapes. Importantly, the composite can be tailored to emit light in a spectral region that matches the optimum response of photomultipliers (about 400 nanometers) or photodiodes (about 600 nanometers), which maximizes the overall detector efficiency.

NTIS

Patent Applications; Radiation Detectors; Scintillation Counters

20080039596 Brookhaven National Lab., Upton, NY, USA

Low-Fidelity Cross Section Covariances for 219 Fission Products in the Fast Neutron Region

Pigni, M. T.; Herman, M.; Oblozinsky, P.; Rochman, D.; Aug. 27, 2007; 56 pp.; In English

Contract(s)/Grant(s): DE-AC02-98CH10886

Report No.(s): DE2007-915433; BNL-79261-2007-IR; No Copyright; Avail.: National Technical Information Service (NTIS)

An extensive set of covariances for neutron cross sections in the energy range 5 keV-20 MeV has been developed to provide initial, low-fidelity but consistent uncertainty data for nuclear criticality safety applications. The methodology for the determination of such covariances combines the nuclear reaction model code EMPIRE, which calculates sensitivity to nuclear reaction model parameters, and the Bayesian code KALMAN to propagate uncertainty of the model parameters to cross sections. Taking into account the large scale of the project (219 fission products), only partial reference to experimental data has been made. Therefore, the covariances are, to a large extent, derived from the perturbation of several critical model parameters selected through the sensitivity analysis. These parameters define optical potential, level densities and pre-equilibrium emission. This work represents the first attempt ever to generate nuclear data covariances on such a scale.

NTIS

Covariance; Fast Neutrons; Fission Products

20080039666 New Mexico State Univ., Las Cruces, NM USA

Experimental Verification of a Systematic Method for Identifying Contact-Dynamics Model Parameters

Ma, Ou; Kim, Jong; Martinez, Lucas; Jul 31, 2007; 39 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-1-0492

Report No.(s): AD-A482720; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482720>

This project is aimed at conducting an experimental test of a new and systematic method for identifying the key parameters of a general multiple-point contact dynamics model using a robotics-based experimental testbed. The hypothesis verified in this project is that the identification method is capable of identifying the stiffness, damping, and friction parameters all together from a same hardware test. Such an identification capability is very appealing to physical simulation practice because the existing technologies allow identify these parameters from hardware test only one at a time using special equipment. Therefore, the new method can significantly increase the efficiency and convenience of simulation practice. The

theoretical part of the method was developed earlier and it had also been tested using computer simulations. In this short-term project, the method was experimentally investigated using a specially designed hardware setup. Because of the time limitations of the STIR program, the test could only be done with one- and two-point contact cases. Nevertheless, these tests have experimentally demonstrated the feasibility of the method.

DTIC

Identifying; Independent Variables; Models; Parameter Identification

20080039833 Army Research Lab., Adelphi, MD USA

New Technology for Microfabrication and Testing of a Thermoelectric Device for Generating Mobile Electrical Power

Taylor, Patrick J; Dhar, Nibir K; Morgan, Brian; Geil, Bruce; Jun 2008; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482975; ARL-TR-4480; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We report the results of the fabrication and testing of a thermoelectric power generation module. The module was fabricated using a new flip-chip module assembly technique that is scalable, modular, and results in a low value of contact resistivity (less or equal to $10(5)$ $\Omega\text{-cm}(2)$). It can be used to leverage new advances in thin-film and nanostructured materials for the fabrication of new miniature thermoelectric devices. It may also enable monolithic integration of large devices or tandem arrays of devices on flexible or curved surfaces. Under mild testing, a power of 22 mW/cm^2 was obtained from small ($<100 \text{ K}$) temperature differences. At higher, more realistic temperature differences, $\sim 500 \text{ K}$, where the efficiency of these materials greatly improves, this power density would scale to between 0.5 and 1 W/cm^2 . These results highlight the excellent potential for the generation and scavenging of electrical power of practical and usable magnitude for remote military applications using thermoelectric power generation technologies.

DTIC

Microminiaturization; Thermoelectricity

20080039835 Physical Sciences, Inc., Andover, MA USA

Cooling Glove Study

Rosen, David I; Magill, John C; Legner, Hartmut H; Mar 2007; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-C-0076

Report No.(s): AD-A482978; PSI-1516/TR-2193; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Soldiers operating in the desert wearing body armor and other heavy clothing cannot adequately dissipate heat. Both physical and mental functions are impaired when body core temperature increases. Performance can be enhanced and health risks reduced with the aid of the body core cooling device being developed in this program. The development described here builds on successful demonstrations by Heller et al. at Stanford University, which showed that heat can be extracted from the body core through the palm of the hand - up to 65 W for individuals with vasodilation and mild hyperthermia. In the present DARPA-sponsored research program, Physical Sciences Inc. (PSI) began the engineering of a practical hand cooling device that could be deployed in combat vehicles. The report describes an engineering thermal analysis of the hand, calorimetry experiments, and the design and testing of a thermoelectric hand cooling device representative of a device that might be deployed.

DTIC

Armor; Combat; Cooling; Gloves; Thermal Analysis; Thermoelectricity

20080039844 Materials Research Society, Warrendale, PA USA

Symposium I: Nanoscale Magnetic Materials and Applications. Held in Boston, Massachusetts on November 25-30, 2007

Liu, J P; Jun 2008; 55 pp.; In English

Contract(s)/Grant(s): N00014-07-1-0660; N00014-07-1-1186

Report No.(s): AD-A482998; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Nanostructured magnets share many of the basic principles as for other nanostructured materials such as geometric confinement, physical proximity, and chemical self organization. These principles are illustrated by means of several examples drawn from the quests for ultrastrong permanent magnets, ultrahigh-density magnetic information storage, and biomedical applications. This symposium addresses the challenges and scientific problems in magnetic nanostructures, from the fundamental issues to fabrication and applications. This symposium has provided a forum for physicists, chemists and materials scientists/engineers and bio-physicists, to present current research on advanced magnetic materials and applications

and to initiate collaborative interactions between them. This symposium has also been a good opportunity for young scientists (graduate students and postdoctoral fellows) to present their research results and interact with established members of their own and other scientific fields.

DTIC

Conferences; Magnetic Materials; Nanostructures (Devices)

20080040049 L-3 Communications Corp., San Carlos, CA USA

Operation of a Low-Voltage High-Transconductance Field Emitter Array TWT

Whaley, D R; Duggal, R; Armstrong, C M; Bellew, C L; Holland, C E; Spindt, C A; Jun 2008; 38 pp.; In English

Contract(s)/Grant(s): FA8651-04-9-0001; Proj-2068

Report No.(s): AD-A482840; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482840>

Implementation of 'cold cathodes' as an electron source for RF vacuum devices can have a significant impact on many aspects of device operation. Cold Cathode Impact on RF Device Operation: No cathode wearout mechanism * Room temperature operation * Eliminate heater power * High current density operation * Instant turn-on * Eliminate HV modulator * Multi-mode operation * Infinite ON/OFF isolation * Device miniaturization * Increased interaction efficiency * Improved linearity * Decreased harmonic power.

DTIC

Emitters; Field Emission; Low Voltage; Transconductance; Traveling Wave Tubes

20080040690 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Scientific Uses and Directions of SPDF Data Services

Fung, Shing, et al.; December 10, 2007; 2 pp.; In English; 2007 AGU Fall meeting, 10-14 Dec. 2007, San Francisco, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

From a science user's perspective, the multi-mission data and orbit services of NASA's Space Physics Data Facility (SPDF) project perform as a working and highly functional heliophysics virtual observatory. CDAWeb enables plots, listings and file downloads for current data across the boundaries of missions and instrument types (and now including data from THEMIS and STEREO), VSPO access to a wide range of distributed data sources. SSCWeb, Helioweb and our 3D Animated Orbit Viewer (TIPSOD) provide position data and query logic for most missions currently-important to heliophysics science. OMNIWeb with its new extension to 1- and 5- minute resolution provides interplanetary parameters at the Earth's bow shock as a unique value-added data product. To enable easier integrated use of our capabilities by developers and by the emerging heliophysics VxOs, our data and services are available through webservice-based APIs as well as through our direct user interfaces. SPDF has also now developed draft descriptions of its holdings in SPASE-compliant XML In addition to showcasing recent enhancements to SPDF capabilities, we will use these systems and our experience in developing them: to demonstrate a few typical science use cases; to discuss key scope and design issues among users, service providers and end data providers; and to identify key areas where existing capabilities and effective interface design are still inadequate to meet community needs.

Author

Atmospheric Physics; Shock Waves; Elastic Properties; Document Markup Languages; Bow Waves

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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*.

20080039637 NASA Langley Research Center, Hampton, VA, USA

Re-active Passive (RAP) Devices for Control of Noise Transmission through a Panel

Carneal, James P.; Giovanardi, Marco; Fuller, Chris R.; Palumbo, Daniel L.; [2008]; 28 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): 23-781-10-13; Copyright; Avail.: CASI: [A03](#), Hardcopy

Re-Active Passive (RAP) devices have been developed to control low frequency (<1000 Hz) noise transmission through a panel. These devices use a combination of active, re-active, and passive technologies packaged into a single unit to control a broad frequency range utilizing the strength of each technology over its best suited frequency range. The RAP device uses

passive constrained layer damping to cover the relatively high frequency range (>200 Hz), reactive distributed vibration absorber) to cover the medium frequency range (75 to 250 Hz), and active control for controlling low frequencies (<200 Hz). The device was applied to control noise transmission through a panel mounted in a transmission loss test facility. Experimental results are presented for the bare panel, and combinations of passive treatment, reactive treatment, and active control. Results indicate that three RAP devices were able to increase the overall broadband (15-1000 Hz) transmission loss by 9.4 dB. These three devices added a total of 285 grams to the panel mass of 6.0 kg, or approximately 5%, not including control electronics.

Author

Active Control; Low Frequencies; Frequency Ranges; Broadband; Noise (Sound); Transmission Loss; Reactivity

20080039661 Woods Hole Oceanographic Inst., MA USA

Measuring the Behavior and Response to Sound of Beaked Whales Using Recording Tags

Johnson, Mark; Tyack, Peter; Jan 2004; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): OCE-0427577

Report No.(s): AD-A482696; XB-ERD(N45); No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482696>

The goals of this project are to understand the reasons for, and to help reduce, the strandings of two little-known species of beaked whales related to mid-frequency navy sonars. Although they are widely distributed, these cryptic species have proven extremely difficult to study and, until recently, almost nothing was known about their subsurface behavior or vocalizations. The current project combines an advanced acoustic and orientation recording tag with methods of visual survey, photo-identification, and habitat characterization in proven productive field sites. Using these tools, the authors aim to provide a thorough characterization of the movement patterns, vocalizations, foraging styles, and preferred habitat of the two species. The resulting baseline data will greatly expand their understanding of these animals and of the deep prey on which they feed, both of which are poorly understood. Understanding of these factors is critical to designing, and evaluating the success of, any mitigation measure. Results from the study are directed at two strategies to reduce beaked whale mortality. First, with a specification of how and when these animals vocalize, it may be possible to develop systems for passive acoustic detection of beaked whales. Since beaked whales are so difficult to sight, acoustic detection is a critical method to monitor for the presence of these sensitive species before and during sonar trials. The second, longer-term strategy is to determine what factors heighten the risk of stranding and to identify opportunities to minimize these. If risk assessments continue to highlight an urgent need to define safe exposure limits for beaked whales, they propose to plan a pilot study on the behavioral responses of beaked whales to low levels of sonar-like sounds. Recognizing that research priorities may change as new data come to light, they will work with an international community of stakeholders to evaluate new opportunities.

DTIC

Acoustic Measurement; Animals; Environment Protection; Habitats; Sound Detecting and Ranging; Whales

20080039688 Washington Univ., Seattle, WA USA

Arctic Acoustic Measurements at 50 kHz

Francois, R E; Nodland, W E; Aug 31, 1973; 42 pp.; In English

Contract(s)/Grant(s): N00017-71-C-1305

Report No.(s): AD-A482759; APL-UW-7313; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482759>

An acoustic transmission experiment was conducted in conjunction with development operations of the Unmanned Arctic Research Submersible (UARS) system off Fletcher's Ice Island (T-3). Transmissions from a low directivity, 50-kHz projector on the submersible (part of the UARS acoustic tracking system) were received at transducers suspended beneath the ice and then recorded. The profile of the ice immediately above the UARS was measured throughout the run and the UARS acoustic tracking system provided complete knowledge of the changing measurement geometry. The data were analyzed to yield the amplitude reflection coefficient as a function of the nominal grazing angle with the ice undersurface and the shift in reflection area, the sea water attenuation coefficient, and signal fluctuation statistics. The amplitude reflection coefficient was found to be highly variable and independent of grazing angle for angles from 10 deg to 40 deg; the reflected signal had short-term fluctuations with a standard deviation on the order of 5 dB. The mean coefficient, however, varied about unity by typically +/- 6 dB in a somewhat periodic manner which was related to a secondary 50 to 100 foot wavelength component present in the measured ice roughness spectra. The measured attenuation coefficient at a frequency of 50 kHz, a temperature of -1.62 deg C, a salinity of 31.9%, and a pressure of 4.8 atmospheres was 11.0 dB per kiloyard. This value confirms Greene's arctic measurements but is some 5 dB less than that predicted by Schulkin and Marsh. The standard error of this measurement was

0.72 dB, which indicates that over the ranges used in the experiment (500-yd maximum) the direct path signal fluctuations ascribable to the medium were small.

DTIC

Acoustic Measurement; Acoustics; Arctic Regions; Audio Equipment; Tracking (Position)

20080039789 Naval Postgraduate School, Monterey, CA USA

Assessment of Ocean Prediction Model for Naval Operations Using Acoustic Preset

Chu, Peter C; Amezaga, Guillermo; Gottshall, Eric L; Cwalina, David S; Jan 2005; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482902; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The outcome of a battlefield engagement is often determined by the advantages and disadvantages held by each adversary. On the modern battlefield, the possessor of the best technology often has the upper hand, but only if that advanced technology is used properly and efficiently. In order to exploit this advantage and optimize the effectiveness of high technology sensor and weapon systems, it is essential to understand the impact on them by the environment. In the arena of Anti--Submarine Warfare (ASW), the ocean environment determines the performance of the acoustic sensors employed and the success of any associated weapon systems. Since acoustic sensors detect underwater sound waves, understanding how those waves propagate is crucial to knowing how the sensors will perform and being able to optimize their performance in a given situation.

DTIC

Acoustics; Mathematical Models; Military Operations; Ocean Models; Signal Detectors

20080039794 Naval Postgraduate School, Monterey, CA USA

Detection of Suspended Sediment Effect on Sidescan Sonar Imagery Using the Navy's CASS-GRAB Model

Chu, P C; Cornelius, M; Wegstaff, M; Jan 2005; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482908; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Sidescan sonar detects objects buried in the seafloor through generating images of ordnance such as sea mine buried in sediments. The sonar operates by illuminating a broad swath of the seabed using a line array of acoustic projectors while acoustic backscattering from the illuminated sediment volume is measured. The effect of suspended sediment on the sonar imagery depends on the volume scattering strength of the suspended sediment layer. Understanding the acoustic characteristics of suspended sediment layer can aid the Navy in the detection of mines using the sonar imagery. This study describes a combined experimental and modeling effort on the volume scattering strength on the burial object detection. A range of critical values of volume scattering strength for the buried object detection were discovered through repeated model simulations.

DTIC

Imagery; Mine Detectors; Sediments; Sonar

20080039832 Weapons Research Establishment, Salisbury, Australia

Theoretical Assessment of DEMON Performance

d'Assumpcao, H A; Jul 1970; 15 pp.; In English

Report No.(s): AD-A482974; TM-CPD-169; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Ships and submarines frequently radiate sounds underwater which exhibit distinct amplitude modulation. For example, the noise from a cavitating propeller is usually modulated at a frequency equal to the blade rate (i.e., the rate of rotation of the shaft multiplied by the number of blades of the propeller). This noise can be received by a passive sonar, and with training and in conjunction with other sounds, an operator can often, from the modulation, identify the type of vessel and estimate its speed. The operator can be greatly assisted by rectifying the sonar signals to extract the modulation and spectrum analyzing the result. This is termed 'DEMON' processing. A block diagram of a DEMON processor is shown in figure 1. The writer is not aware of any published mathematical analysis of this processor. In this memorandum, an expression of its theoretical performance is derived. It should be pointed out that the processor shown in figure 1 is not necessarily the optimum detector for such modulated signals. Tuteur(1) has made an attempt to determine the optimum processor and its performance, but the simplifying assumptions he makes are unrealistic, and as a consequence his results should be regarded as useful only in giving an upper bound to the performance which might be achieved. The present writer has not yet succeeded in determining the optimum processor under realistic assumptions.

DTIC

Propellers; Sonar

20080039849 Cornell Lab. of Ornithology, Ithaca, NY USA

Acoustics in the Cetaceans Environment: A Multimedia Educational Package

Dantzker, Marc S; Jan 2004; 6 pp.; In English; Original contains color illustrations

Report No.(s): AD-A483017; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Macaulay Library is home to the world's largest collection of animal sounds, including a growing collection of marine sounds whose archival is funded by the Office of Naval Research. The Macaulay Library has an 80 year history of archiving sounds and using those sounds to educate and inform the public about biological diversity and animal communication. In the last few years, the Library has added video production to its public outreach functions. This project, for which we use the working title 'Sea-of-Sound' is our most ambitious video outreach project to date. We are developing a documentary on use of sound in the marine environment, both natural and anthropogenic. While many people are aware that whales produce songs, clicks, and whistles, most don't know the extent to which marine mammals use sounds to communicate, survey their environment, and find food. More surprising to many is that the sea is alive with sounds of all kinds, from bubbles in breaking waves and rambling undersea volcanoes, to croaking fish, snapping shrimp, and rasping mollusks. The general public has a poor understanding of how the behavior of sound in marine environments compares with our terrestrial world. They also know little about the critical role sound plays in marine research and marine mammal conservation. While there is increasing public concern over rising levels of anthropogenic noise in the marine environment, there is a lack of comprehensive, broadly disseminated information about sound in the sea. This makes it difficult for the public to make informed decisions about sound-related marine issues. Working with our partners we will be creating a DVD and web site for classrooms and teachers, as well as the general public. These deliverables will be available in the third year of this project, the beginning of calendar year 2007.

DTIC

Acoustics; Animals; Education; Marine Biology; Marine Mammals; Multimedia

20080040769 Naval Research Lab., Washington, DC USA

Observation of Rayleigh-Taylor Growth to Short Wavelengths on Nike

Pawley, C J; Bodner, S E; Dahlburg, J P; Obenschain, S P; Schmitt, A J; Sethian, J D; Sullivan, C A; Gardner, J H; Aglitskiy, Y; Chan, Y; Jan 1999; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A483113; XB-NRL/MR/6700; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The uniform and smooth focal profile of the Nike KrF laser [S. Obenschain, et. al., Phys. Plasmas 3, 1996 (2008)] was used to ablatively accelerate 40 micrometer thick polystyrene planar targets with pulse shaping to minimize shock heating of the compressed material. The foils had imposed small amplitude sinusoidal wave perturbations of 60, 30, 20, and 12.5 micrometer wavelength. The shortest wavelength is near the ablative stabilization cutoff for Rayleigh-Taylor growth. Modification of saturated wave structure due to random laser imprint was observed. Excellent agreement was found between the two dimensional simulations and experimental data for most cases where laser imprint was not dominant.

DTIC

Taylor Instability; Wavelengths

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ATOMIC AND MOLECULAR PHYSICS

Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see 73 *Nuclear Physics*.

20080039752 EAI Corp., Abingdon, MD USA

Study of Detection Limits and Quantitation Accuracy Using 300 Mhz NMR

Creasy, William R; McGarvey, David J; Rice, Jeffrey S; O'Connor, Richard; Durst, H D; Jul 1, 2003; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAM01-97-0005

Report No.(s): AD-A482893; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482893>

The analytical precision and accuracy of 300 MHz nuclear magnetic resonance (NMR) spectrometers was determined. The instruments that were used include a Bruker AC-300, a Bruker Avance 300, and a Varian 300. The minimum detection limits for proton (H1) and phosphorus (P31) were determined and compared for different instruments. The Minimum Detection Limits (MDL) for proton measurements were in the range of 3-10 microg/g. The MDL for phosphorus

measurements were in the range of 50-70 microg/g. The quantitation accuracy for purity determinations was measured to be in the range of 1% relative to an internal standard. Specific MDL values should be determined for each particular matrix, internal standard, and instrument conditions.

DTIC

Detection; Nuclear Magnetic Resonance; Spectrometers

20080039796 Signal Innovations Group, Inc., Durham, NC USA

Classifier Design for Multi-aspect Low-Frequency Broadband Target Signatures

Carin, Lawrence; Rabenold, Patrick; Jun 25, 2008; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-06-C-0026

Report No.(s): AD-A482918; SIG-CDRL-A005; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The early classification algorithms developed for the Low Frequency Broadband (LFBB) mine identification program were implemented using signal features that treat each target aspect independently. This approach results in a trained classifier that ignores any spatial correlation between sequential target responses. This motivated the design of a correlation-based kernel that combines the advantages of a discriminative approach and the sequential nature of the data. The resulting correlation kernel directly evaluates the similarity between two sequences of spectral responses. The computed correlation coefficients are used as the kernel values for training a classifier.

DTIC

Broadband; Classifiers; Kernel Functions; Low Frequencies; Signatures; Targets

20080040750 NASA Goddard Space Flight Center, Greenbelt, MD, USA

NASA GSFC Science Symposium on Atomic and Molecular Physics

Bhatia, Anand K., Editor; January 2007; 259 pp.; In English; NASA GSFC Science Symposium on Atomic and Molecular Physics, 18 Nov. 2005, Greenbelt, MD, USA; See also 20080040751 - 20080040763; Original contains black and white illustrations

Report No.(s): NASA/CP-2006-214146; Rept-2007-00168-0; Copyright; Avail.: CASI: [A12](#), Hardcopy

This document is the proceedings of a conference on atomic and molecular physics in honor of the retirements of Dr. Aaron Temkin and Dr. Richard Drachman. The conference contained discussions on electron, positron, atomic, and positronium physics, as well as a discussion on muon catalyzed fusion. This proceedings document also contains photographs taken at the symposium, as well as speeches and a short biography made in tribute to the retirees.

Author

Atomic Physics; Muons; Positronium; Positrons; Electrons

20080040751 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Application of the Finite Element Method in Atomic and Molecular Physics

Shertzer, Janine; NASA GSFC Science Symposium on Atomic and Molecular Physics; January 2007, pp. 91-102; In English; See also [20080040750](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The finite element method (FEM) is a numerical algorithm for solving second order differential equations. It has been successfully used to solve many problems in atomic and molecular physics, including bound state and scattering calculations. To illustrate the diversity of the method, we present here details of two applications. First, we calculate the non-adiabatic dipole polarizability of H_i by directly solving the first and second order equations of perturbation theory with FEM. In the second application, we calculate the scattering amplitude for e-H scattering (without partial wave analysis) by reducing the Schrodinger equation to set of integro-differential equations, which are then solved with FEM.

Author

Finite Element Method; Differential Equations; Atomic Physics; Algorithms

20080040752 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Muon Catalyzed Fusion

Armour, Edward A.G.; NASA GSFC Science Symposium on Atomic and Molecular Physics; January 2007, pp. 211 - 226; In English; See also [20080040750](#); Copyright; Avail.: CASI: [A03](#), Hardcopy

Muon catalyzed fusion is a process in which a negatively charged muon combines with two nuclei of isotopes of hydrogen, e.g, a proton and a deuteron or a deuteron and a triton, to form a muonic molecular ion in which the binding is so tight that nuclear fusion occurs. The muon is normally released after fusion has taken place and so can catalyze further fusions.

As the muon has a mean lifetime of 2.2 microseconds, this is the maximum period over which a muon can participate in this process. This article gives an outline of the history of muon catalyzed fusion from 1947, when it was first realised that such a process might occur, to the present day. It includes a description of the contribution that Drachman has made to the theory of muon catalyzed fusion and the influence this has had on the author's research.

Author

Nuclear Fusion; Molecular Ions; Muons; Protons; Deuterons; Catalysis

20080040753 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Photodetachment of Ps ion and Low-Energy e(+) -H Collisions

Ward, S.J.; NASA GSFC Science Symposium on Atomic and Molecular Physics; January 2007, pp. 137 - 143; In English;

See also [20080040750](#); Original contains black and white illustrations

Contract(s)/Grant(s): NSF-PHY-0440565; Copyright; Avail.: CASI: [A02](#), Hardcopy

Two calculations in the area of positron collisions are presented. The first is the calculation of the photodetachment cross section of the positronium negative ion (Ps-) using accurate variational wave functions for both the initial bound-state and the final P continuum state. The second is the calculation of partial wave cross sections for Ps(1s)-formation in e(-)-H(1s) collisions using the hyperspherical hidden crossing method. Since the S-wave Stüickelberg phase is close to pi, the very small S-wave Ps(1s) formation cross section can be understood in terms of destructive interference. Other examples in positron collisions are given where it is either known or expected that destructive interference is the cause of the small S-wave Ps(1s) formation cross section. In addition, examples are presented of processes in atomic physics where the Stüickelberg phase is a multiple of pi/2.

Author

Positrons; Atomic Physics; Particle Collisions; Positronium; Negative Ions; Photodetachment

20080040754 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Asymptotic Energies and QED Shifts for Rydberg States of Helium

Drake, G.W.F.; NASA GSFC Science Symposium on Atomic and Molecular Physics; January 2007, pp. 145 - 163; In English;

See also [20080040750](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper reviews progress that has been made in obtaining essentially exact solutions to the nonrelativistic three-body problem for helium by a combination of variational and asymptotic expansion methods. The calculation of relativistic and quantum electrodynamic corrections by perturbation theory is discussed, and in particular, methods for the accurate calculation of the Bethe logarithm part of the electron self energy are presented. As an example, the results are applied to the calculation of isotope shifts for the short-lived 'halo' nucleus He-6 relative to He-4 in order to determine the nuclear charge radius of He-6 from high precision spectroscopic measurements carried out at the Argonne National Laboratory. The results demonstrate that the high precision that is now available from atomic theory is creating new opportunities to create novel measurement tools, and helium, along with hydrogen, can be regarded as a fundamental atomic system whose spectrum is well understood for all practical purposes.

Author

Helium; Asymptotic Series; Electron Energy; Quantum Electrodynamics; Perturbation Theory; Helium Isotopes; Atomic Theory

20080040755 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Buffer-Gas Positron Accumulator and Resonances in Positron-Molecule Interactions

Surko, C.M.; NASA GSFC Science Symposium on Atomic and Molecular Physics; January 2007, pp. 165 - 186; In English;

See also [20080040750](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

This is a personal account of the development of our buffer-gas positron trap and the new generation of cold beams that these traps enabled. Dick Drachman provided much appreciated advice to us from the time we started the project. The physics underlying trap operation is related to resonances (or apparent resonances) in positron-molecule interactions. Amusingly, experiments enabled by the trap allowed us to understand these processes. The positron-resonance 'box score' to date is one resounding 'yes,' namely vibrational Feshbach resonances in positron annihilation on hydrocarbons; a 'probably' for positron-impact electronic excitation of CO and NZ; and a 'maybe' for vibrational excitation of selected molecules. Two of these processes enabled the efficient operation of the trap, and one almost killed it in infancy. We conclude with a brief

overview of further applications of the trapping technology discussed here, such as ‘massive’ positron storage and beams with meV energy resolution.

Author

Positrons; Trapping; Accumulators; Hydrocarbons; Positron Annihilation; Molecules

20080040756 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Low-energy Scattering of Positronium by Atoms

Ray, Hasi; NASA GSFC Science Symposium on Atomic and Molecular Physics; January 2007, pp. 121 - 135; In English; See also [20080040750](#); Original contains black and white illustrations

Contract(s)/Grant(s): SR/FTP/PS-80/2001; Copyright; Avail.: CASI: [A03](#), Hardcopy

The survey reports theoretical studies involving positronium (Ps) - atom scattering. Investigations carried out in last few decades have been briefly reviewed in this article. A brief description of close-coupling approximation (CCA), the first-Born approximation (FBA) and the Born-Oppenheimer approximation (BOA) for Ps-Atom systems are made. The CCA codes of Ray et al [1-6] are reinvestigated using very fine mesh-points to search for resonances. The article advocates the need for an extended basis set & a systematic study using CCAs.

Author

Born Approximation; Computational Grids; Scattering; Positronium; Born-Oppenheimer Approximation

20080040757 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Double Photoionization Near Threshold

Wehlitz, Ralf; NASA GSFC Science Symposium on Atomic and Molecular Physics; January 2007, pp. 85 - 89; In English; See also [20080040750](#); Original contains black and white illustrations

Contract(s)/Grant(s): NSF-DMR-0084402; Copyright; Avail.: CASI: [A01](#), Hardcopy

The threshold region of the double-photoionization cross section is of particular interest because both ejected electrons move slowly in the Coulomb field of the residual ion. Near threshold both electrons have time to interact with each other and with the residual ion. Also, different theoretical models compete to describe the double-photoionization cross section in the threshold region. We have investigated that cross section for lithium and beryllium and have analyzed our data with respect to the latest results in the Coulomb-dipole theory. We find that our data support the idea of a Coulomb-dipole interaction.

Author

Photoionization; Beryllium; Lithium; Electrons

20080040758 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Calculations of Positron and Positronium Scattering

Walters, H.R.J.; Starrett, C.; NASA GSFC Science Symposium on Atomic and Molecular Physics; January 2007, pp. 187 - 210; In English; See also [20080040750](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Progress in the theoretical treatment of positron - atom and positronium - atom scattering within the context of the coupled - pseudostate approximation is described.

Author

Positronium; Positrons; Electron Scattering; S Waves; Atomic Physics; Atoms

20080040759 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Electron-Molecule Collisions: Quantitative Approaches, and the Legacy of Aaron Temkin

Schneider, B.I.; NASA GSFC Science Symposium on Atomic and Molecular Physics; January 2007, pp. 65 - 83; In English; See also [20080040750](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

This article, on electron-molecule collisions, is dedicated to the legacy of my good friend and sometime collaborator, Aaron Temkin on his retirement from the NASA-Goddard Space Flight Center after many years of work at the highest intellectual level in the theoretical treatment of electron-atom and electron-molecule scattering. Aaron's contributions to the manner in which we think about electron-molecule collisions is clear to all of us who have worked in this field. I doubt that the great progress that has occurred in the computational treatment of such complex collision problems could have happened without these contributions. For a brief historical account, see the discussion of Temkin's contribution to electron-molecule scattering in the first article of this volume by Dr. A. K. Bhatia. In this article, I will concentrate on the application of the so called, non-adiabatic R-matrix theory, to vibrational excitation and dissociative attachment, although I will also present some

results applying the Linear Algebraic and Kohn-Variational methods to vibrational excitation. As a starting point for almost all computationally effective approaches to electron-molecule collisions, is the fixed nuclei approximation. That is, one recognizes, just as one does with molecular bound states, that there is a separation of electronic(fast) and nuclear(slow) degrees of freedom. This separation makes it possible to ‘freeze’ the nuclei in space, calculate the collision parameters for the frozen molecule and then, somehow to add back the vibrations and rotations. The manner in which this is done, depends on the details of the collision problem. It is the work of Aaron and a number of other researchers that has provided the guidance necessary to resolve these issues.

Author

Electron Scattering; Molecular Collisions; Collision Parameters; Excitation; Degrees of Freedom; Rotation

20080040760 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Convergent Close-Coupling Approach to Electron-Atom Collisions

Bray, Igor; Stelbovics, Andris; NASA GSFC Science Symposium on Atomic and Molecular Physics; January 2007, pp. 59 - 64; In English; See also [20080040750](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

It was with great pleasure and honour to accept the invitation to make a presentation at the symposium celebrating the life-long work of Aaron Temkin and Richard Drachman. The work of Aaron Temkin was particularly influential on our own during the development of the CCC method for electron-atom collisions. There are a number of key problems that need to be dealt with when developing a general computational approach to such collisions. Traditionally, the electron energy range was subdivided into the low, intermediate, and high energies. At the low energies only a finite number of channels are open and variational or close-coupling techniques could be used to obtain accurate results. At high energies an infinite number of discrete channels and the target continuum are open, but perturbative techniques are able to yield accurate results. However, at the intermediate energies perturbative techniques fail and computational approaches need to be found for treating the infinite number of open channels. In addition, there are also problems associated with the identical nature of electrons and the difficulty of implementing the boundary conditions for ionization processes. The beauty of the Temkin-Poet model of electron-hydrogen scattering is that it simplifies the full computational problem by neglecting any non-zero orbital angular momenta in the partial-wave expansion, without losing the complexity associated with the above-mentioned problems. The unique nature of the problem allowed for accurate solution leading to benchmark results which could then be used to test the much more general approaches to electron-atom collision problems. The immense value of the Temkin-Poet model is readily summarised by the fact that the initial papers of Temkin and Poet have been collectively cited around 250 times to date and are still being cited in present times. Many of the citations came from our own work during the course of the development of the CCC method, which we now describe.

Author

Atomic Collisions; Electron Scattering; Electron Energy; Hydrogen; Ionization; Angular Momentum

20080040761 NASA Goddard Space Flight Center, Greenbelt, MD, USA

General Forms of Wave Functions for Dipositronium, Ps₂

Schrader, D.M.; NASA GSFC Science Symposium on Atomic and Molecular Physics; January 2007, pp. 103 - 110; In English; See also [20080040750](#); Copyright; Avail.: CASI: [A02](#), Hardcopy

The consequences of particle interchange symmetry for the structure of wave functions of the states of dipositronium was recently discussed by the author [I]. In the present work, the methodology is simply explained, and the wave functions are explicitly given.

Author

Wave Functions; Hamiltonian Functions; Angular Momentum; Coordinates; Positronium

20080040762 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Doubly Excited Resonances in the Positronium Negative Ion

Ho, Y.K.; NASA GSFC Science Symposium on Atomic and Molecular Physics; January 2007, pp. 111 - 120; In English; See also [20080040750](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

The recent theoretical studies on the doubly excited states of the Ps⁻ ion are described. The results obtained by using the method of complex coordinate rotation show that the three-lepton system behaves very much like an XYX tri-atomic molecule. Furthermore, the recent investigation on the positronium negative ion embedded in Debye plasma environments is

discussed. The problem is modeled by the use of a screened Coulomb potential to represent the interaction between the charge particles.

Author

Charged Particles; Negative Ions; Positronium; Leptons; Excitation; Atoms

20080040763 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Introduction to the Contributions of A. Temkin and R. J. Drachman to Atomic Physics

Bhatia, A.K.; NASA GSFC Science Symposium on Atomic and Molecular Physics; January 2007, pp. 1 - 57; In English; See also [20080040750](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A04](#), Hardcopy

Their work, as is the work of most atomic theorists, is concerned with solving the Schroedinger equation accurately for wave function in cases where there is no exact analytical solution. In particular, Temkin is associated with electron scattering from atoms and ions. When he started there already were a number of methods to study the scattering of electrons from atoms. Derived from text

Schroedinger Equation; Wave Functions; Electron Scattering; Atomic Physics

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*.

20080039719 Library of Congress, Washington, DC USA

Navy Nuclear-Powered Surface Ships: Background, Issues, and Options for Congress

O'Rourke, Ronald; May 22, 2008; 31 pp.; In English

Report No.(s): AD-A482831; CRS-RL33946; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482831>

Some Members of Congress, particularly on the House Armed Services Committee, have expressed interest in expanding the use of nuclear power to a wider array of Navy surface ships, starting with the Navy's planned CG(X) cruiser, the first of which the Navy wants to procure in FY2011. Section 1012 of the FY2008 Defense Authorization Act makes it U.S. policy to construct the major combatant ships of the Navy, including the CG(X), with integrated nuclear power systems, unless the Secretary of Defense submits a notification to Congress that the inclusion of an integrated nuclear power system in a given class of ship is not in the national interest. The Navy has studied nuclear power as a design option for the CG(X), but has not yet announced whether it would prefer to build the CG(X) as a nuclear-powered ship. Procurement of a nuclear-powered CG(X) in FY2011 would, under normal budgeting practices, involve funding the ship's long lead time nuclear-propulsion components in FY2009. A 2006 Navy study concluded the following: (1) In constant FY2007 dollars, building a Navy surface combatant with nuclear power rather than conventional power would add roughly \$600-\$800 million to its procurement cost; (2) The total life-cycle cost of a nuclear-powered medium-size surface combatant would equal that of a conventionally powered medium-size surface combatant if the cost of crude oil averages \$70-\$225 per barrel over the life of the ship; (3) Nuclear power should be considered for near-term applications for medium-size surface combatants; and (4) Compared to conventionally powered ships, nuclear-powered ships have advantages in terms of both time needed to surge to a distant theater of operation for a contingency, and in terms of time on station in the theater of operation. Regarding this issue, Congress needs to consider cost, operational effectiveness, ship construction, ship maintenance and repair, crew training, ports calls and forward homeporting, and environmental impact.

DTIC

Life Cycle Costs; Navy; Nuclear Powered Ships; Procurement

20080039818 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

A General Quantum Mechanical Method to Predict Positron Spectroscopy

Adamson, Paul E; Jun 2007; 206 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-F1ATA06096J001

Report No.(s): AD-A482954; AFIT/DS/ENP/07-04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The nuclear-electronic orbital (NEO) method was modified and extended to positron systems. NEO - second-order Moeller-Plesset perturbation (MP2) energies and annihilation rates were calculated for the positronium hydride (PsH) system,

and the effects of basis set size on correlation energies captured with the NEO-MP2 and NEO-full configuration interaction (FCI) methods are compared and discussed. Equilibrium geometries and vibrational energy levels were computed for the LiX and e+LiX (X = H, F, Cl) systems at the MP2 and NEO-MP2 levels. It was found that anharmonicity plays a significant role, specifically in the differences between the vibrational energy levels of the LiX and e+LiX systems. The implications of these results with respect to VFR for these systems is discussed. The positron lifetime in potassium dodecahydrododecaborate methanolate, K₂B₁₂H₁₂.CH₃OH, was measured to be 0.2645 +/- 0.0077 ns. Quantum mechanical calculations reveal a spherically symmetric positronic wavefunction, with a peak in the positron density at the outside edge of the hydrogen atom cage. The experimentally determined annihilation rate corresponds to an effective number of electrons of 1.88, indicating that there is significant positron density both inside and outside of the dodecahydrododecaborate dianion, B₁₂H₁₂⁽²⁻⁾, cage.

DTIC

Positrons; Quantum Theory; Spectroscopy

20080039872 Army Soldier and Biological Chemical Command, Aberdeen Proving Ground, MD USA

Detection and Identification of Bacteria Using Inductively Coupled Plasma Mass Spectroscopy

Gikunju, Carolyne M; Lev, Steven; Schaefer, David M; Birenzvege, Ammon; Jul 1, 2003; 6 pp.; In English

Report No.(s): AD-A483076; NSF-DMR-MRI-011619; NSF-EEC-0086218; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this study, an inductively coupled plasma mass spectrometer (ICP-MS) was used for the inorganic chemical characterization of biological materials. ICP-MS has the advantage of subnanogram/gram detection limits for most elements making it a sensitive tool for the detection and characterization of aerosolized biological material. Microgram-sized samples of *Bacillus subtilis* spores (BG), *Bacillus subtilis* vegetative cells (Bg) and *Bacillus thuringiensis* (Bt) were analyzed and exhibit significant differences in selected elemental ratios (i.e.: Pb/Ba, Mg/Ba, Mn/Ba, P/Ba, Cu/Ba, Sr/Ba, Zn/Ba, V/Ba, and Co/Ba). These results demonstrate a unique signature reflecting the processing history of each organism.

DTIC

Aerosols; Bacteria; Detection; Inductively Coupled Plasma Mass Spectrometry; Mass Spectroscopy

20080039895 Naval Research Lab., Washington, DC USA

High-Gain Direct-Drive Target Design for Laser Fusion (Preprint)

Bodner, S E; Colombant, D G; Schmitt, A J; Klapisch, M; Jan 2000; 6 pp.; In English

Report No.(s): AD-A483111; XB-NRL/MR/6700; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A new laser fusion target concept is presented with a predicted energy gain of 125 using a 1.3 MJ KrF laser. This energy gain is sufficiently high for an economically attractive fusion reactor. X-rays from high- and low-Z materials are used in combination with a low-opacity ablator to spatially tune the isentrope, thereby providing both high fuel compression and a reduction of the ablative Rayleigh-Taylor instability.

DTIC

Drives; High Gain; Laser Fusion; Mechanical Drives; Targets; Taylor Instability

20080040102 Library of Congress, Washington, DC USA

Iran's Nuclear Program: Status

Kerr, Paul K; Jun 23, 2008; 20 pp.; In English

Report No.(s): AD-A482789; CRS-RL34544; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482789>

Although Iran claims that its nuclear programs are exclusively for peaceful purposes, they have generated considerable concern that Tehran is pursuing a nuclear weapons program. Indeed, the UN Security Council has responded to Iran's refusal to suspend work on its uranium enrichment and heavy-water nuclear reactor programs by adopting several resolutions, most recently in March 2008, which imposed sanctions on Tehran. Despite this pressure, Iran continues at its Natanz centrifuge facility to enrich uranium, expand the number of operating centrifuges, and conduct research on new types of centrifuges. Tehran has also continued to produce centrifuge feedstock, as well as work on its heavy-water reactor and associated facilities. Whether Iran is pursuing a nuclear weapons program is, however, unknown. A National Intelligence Estimate made public in December 2007 assessed that Tehran halted its nuclear weapons program, defined as Iran's nuclear weapon design and weaponization work and covert uranium conversion-related and uranium enrichment related work, in 2003. The estimate, however, also assessed that Tehran is keeping open the option to develop nuclear weapons and that any decision to end a nuclear weapons program is inherently reversible. Although Iran has cooperated with the International Atomic Energy Agency

(IAEA) to an extent, the agency says that Tehran has not gone far enough to alleviate all of the agency's concerns about Iran's enrichment and heavy-water reactor programs. The IAEA continues to investigate the program, particularly evidence that Tehran may have conducted procurement activities and research directly applicable to nuclear weapons development.

DTIC

International Relations; Nuclear Energy

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*.

20080039216 Air Force Research Lab., Hanscom AFB, MA USA

Towards Silicon-Based Longwave Integrated Optoelectronics (LIO)

Soref, Richard A; Jan 21, 2008; 14 pp.; In English

Contract(s)/Grant(s): Proj-2305

Report No.(s): AD-A482400; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482400>

The vision of longwave silicon photonics articulated in the Journal of Optics A, vol. 8, pp 840-848, 2006 has now come into sharper focus. There is evidence that newly designed silicon-based optoelectronic circuits will operate at any wavelength within the wide 1.6 to 200 micrometers range. Approaches to that LWIR operation are reviewed here. A long-range goal is to manufacture LWIR OEIC chips in a silicon foundry by integrating photonics on-chip with CMOS, bipolar, or BiCMOS micro-electronics. A principal LWIR application now emerging is the sensing of chemical and biological agents with an OE laboratory-on-a-chip. Regarding on-chip IR sources, the hybrid evanescent-wave integration of III-V interband-cascade lasers and quantum-cascade lasers on silicon (or Ge/Si) waveguides is a promising technique, although an alternative all-group-IV solution is presently taking shape in the form of silicon-based Ge/SiGeSn band-to-band and inter-subband lasers. There is plenty of room for creativity in developing a complete suite of LWIR components. Materials modification, device innovation, and scaling of waveguide dimensions are needed to implement microphotonic, plasmonic and photonic-crystal LWIR devices, both active and passive. Such innovation will likely lead to significant LIO applications

DTIC

Electro-Optics; Optical Waveguides; Silicon

20080039273 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Some Considerations for Precision Metrology of Thin X-Ray Mirrors

Lehan, J. P.; Saha, T.; Zhang, W. W.; Rohrbach, S.; Chan, K.-W.; Hadjimichael, T.; Hong, M.; Davis, W.; June 23, 2008; 8 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

Determination of the shape of very thin x-ray mirrors employed in spaced-based telescopes continues to be challenging. The mirrors shapes are not readily deduced to the required accuracy because the mount induced distortions are often larger than the uncertainty tolerable for the mission metrology. In addition to static deformations, dynamic and thermal considerations are exacerbated for this class of mirrors. We report on the performance of one temporary mounting scheme for the thin glass mirrors for the Constellation-X mission and prospects for deducing their undistorted shapes.

Author

Metrology; X Ray Astronomy; Telescopes; Glass; Distortion; Static Deformation

20080039299 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Toward a Complete Metrological Solution for the Mirrors for the Constellation-X Spectroscopy X-ray Telescope

Lehan, John; Owens, S.; Hadjimichael, T.; Hong, M.; Chan, K.-W.; Saha, T. T.; Reid, P.; Zhang, W. W.; August 26, 2007; 8 pp.; In English; SPIE Conference: Optics and Photonics 2007, 26-30 Aug. 2007, San Diego, CA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NNG06EO90A; Copyright; Avail.: CASI: [A02](#), Hardcopy

We present an overview update of the metrological approach to be employed for the segmented mirror fabrication for

Constellation-X spectroscopy x-ray telescope. We compare results achieved to date with mission requirements. This is discussed in terms of inherent capability versus in-practice capability.

Author

Constellation-X; Metrology; Segmented Mirrors; X Ray Telescopes; Functional Design Specifications; Optical Properties

20080039300 California Univ., Berkeley, CA, USA; Lawrence Livermore National Lab., Livermore, CA USA

Feedback Controlled Laser Machining System

Shirk, M., Inventor; Furmanski, J., Inventor; 10 Nov 05; 11 pp.; In English

Contract(s)/Grant(s): DE-W-7405-ENG-48

Patent Info.: Filed 10 Nov 05; US-Patent-Appl-SN-11-271 454

Report No.(s): PB2008-103587; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A system for machining a workpiece to desired finished workpiece specifications. The system comprises a system for producing a laser beam; a system for positioning the workpiece relative to the laser beam; a system for measuring the topography of the work piece and producing workpiece topography data; and a computer and control system operatively connected to the system for producing a laser beam, to the system for positioning the workpiece relative to the laser beam, and to the system for measuring the topography of the work piece and producing workpiece topography data. The computer and control system compares the workpiece topography data with the desired finished workpiece specifications and controls the system for positioning the workpiece relative to the laser beam so that the workpiece is moved with respect to the laser beam in a desirable fashion, within certain velocity, acceleration, and distance constraints. The computer and control system controls the system for producing a laser beam so that the laser beam machines the workpiece to the desired finished workpiece specifications.

NTIS

Computer Aided Manufacturing; Feedback; Laser Machining; Lasers; Machining; Patent Applications

20080039301 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Testing of the Mirrors for the Constellation-X Spectroscopy X-ray Telescope with a Refractive Null

Lehan, John; Hadimichael, T.; Skocik, C.; August 26, 2007; 8 pp.; In English; SPIE Conference: Optics and Photonics 2007.

Program Track: Astronomical Optics and Instrumentation, 26-30 Aug. 2007, San Diego, CA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NNG06EO90A; Copyright; Avail.: CASI: [A02](#), Hardcopy

We present an introduction to the use of a refractive null lens for testing grazing incidence x-ray mirrors for the Constellation-X mission. The singular role of mirror mounting in glass shell mirror metrology is also touched upon. We compare results achieved to date with mission requirements along with some of the unique properties of the null lens. Additionally, uses beyond mirror metrology are briefly discussed.

Author

X Ray Telescopes; Spectroscopy; Constellation-X; Mirrors; Lenses; Refractivity; Optical Properties; Grazing Incidence; Metrology; Mounting

20080039305 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Beam Combination for Stellar Imager and its Application to Full-Aperture Imaging

Mozurkewich, D.; Carpenter, K. G.; Lyon, R. G.; August 26, 2007; 8 pp.; In English; SPIE Optics and Photonics meeting, 26-29 Aug. 2007, San Diego, CA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NNX07CA49P; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039305>

Stellar Imager (SI) will be a Space-Based telescope consisting of 20 to 30 separated apertures. It is designed for UV/Optical imaging of stellar surfaces and asteroseismology. This report describes details of an alternative optical design for the beam combiner, dubbed the Spatial Frequency Remapper (SFR). It sacrifices the large field of view of the Fizeau combiner. In return, spectral resolution is obtained with a diffraction grating rather than an array of energy-resolving detectors. The SFR design works in principle and has been implemented with MIRC at CHARA for a small number of apertures. Here, we show the number of optical surfaces can be reduced and the concept scales gracefully to the large number of apertures needed for Stellar Imager. We also describe a potential application of this spatial frequency remapping to improved imaging with filled aperture systems. For filled-aperture imaging, the SFR becomes the core of an improved aperture masking system. To date, aperture-masking has produced the best images with ground-based telescopes but at the expense of low sensitivity due to short

exposures and discarding most of the light collected by the telescope. This design eliminates the light-loss problem previously claimed to be inherent in all aperture-masking designs. We also argue that at least in principle, the short-integration time limit can also be overcome. With these improvements, it becomes an ideal camera for TPF-C; since it can form speckle-free images in the presence of wavefront errors, it should significantly relax the stability requirements of the current designs.

Author

Spaceborne Telescopes; Apertures; Optical Properties; Imaging Techniques; Spectral Resolution; Interferometry; Beams

20080039311 Thomas, Kayden, Horstemeyer and Risley, LLP, Atlanta, GA, USA

Fourier Transform Volume Holographic Spectrometer

Adibi, A., Inventor; Hsieh, C. R., Inventor; Karbaschi, A., Inventor; Momtaham, O., Inventor; 12 Oct 05; 8 pp.; In English
Contract(s)/Grant(s): NIH-N01AA23013

Patent Info.: Filed 12 Oct 05; US-Patent-Appl-SN-11-248 866

Report No.(s): PB2008-103594; No Copyright; Avail.: CASI: [A02](#), Hardcopy

One embodiment of a system includes a volume hologram for dispersing a general diffuse beam of light provided as input; a detector for receiving and detecting light dispersed by the volume hologram; and a Fourier transforming lens for forming the Fourier transform of the light dispersed from the volume hologram onto the detector. Other systems and methods are also provided.

NTIS

Fourier Transformation; Holography; Lenses; Patent Applications; Spectrometers

20080039313 Pietragallo, Bosick and Gordon, LLP, Pittsburg, PA, USA

Laser Beam Dump (PAT-APPL-10-989 169)

Gregoire, J. G., Inventor; 15 Nov 04; 6 pp.; In English

Contract(s)/Grant(s): N61331-00-C-0022

Patent Info.: Filed 15 Nov 04; US-Patent-Appl-SN-10-989 169

Report No.(s): PB2008-103596; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A laser beam dump dissipates laser energy. The laser dump includes a cradle for holding the laser and an open cavity lined with a laser energy absorbing material. Laser emissions are directed from the laser into the laser dump cavity where the laser energy is dissipated.

NTIS

Laser Beams; Lasers; Patent Applications

20080039314 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Opto-Mechanics of the Constellation-X SXT Mirrors: Challenges in Mounting and Assembling the Mirror Segments

Chan, Kai-Wing; Zhang, William W.; Saha, Timo; Lehan, John P.; Mazzarella, James; Lozipone, Lawrence; Hong, Melinda; Byron, Glenn; June 23, 2008; 9 pp.; In English; SPIE Meeting, 23-28 Jun. 2008, Marseille, France; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNG06EO90A; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1117/12.789019>

The Constellation-X Spectroscopy X-Ray Telescopes consists of segmented glass mirrors with an axial length of 200 mm, a width of up to 400 mm, and a thickness of 0.4 mm. To meet the requirement of less than 15 arc-second half-power diameter with the small thickness and relatively large size is a tremendous challenge in opto-mechanics. How shall we limit distortion of the mirrors due to gravity in ground tests, that arises from thermal stress, and that occurs in the process of mounting, affixing and assembling of these mirrors? In this paper, we will describe our current opto-mechanical approach to these problems. We will discuss, in particular, the approach and experiment where the mirrors are mounted vertically by first suspending it at two points.

Author

Constellation-X; Spectroscopy; X Ray Telescopes; Optical Properties; Segmented Mirrors; Mounting; Functional Design Specifications; Design Optimization

20080039417 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Recent Advances in Photonic Devices for Optical Computing and the Role of Nonlinear Optics-Part II

Abdeldayem, Hossin; Frazier, Donald O.; Witherow, William K.; Banks, Curtis E.; Paley, Mark S.; [2007]; 2 pp.; In English; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A01](#), Hardcopy

The twentieth century has been the era of semiconductor materials and electronic technology while this millennium is

expected to be the age of photonic materials and all-optical technology. Optical technology has led to countless optical devices that have become indispensable in our daily lives in storage area networks, parallel processing, optical switches, all-optical data networks, holographic storage devices, and biometric devices at airports. This chapter intends to bring some awareness to the state-of-the-art of optical technologies, which have potential for optical computing and demonstrate the role of nonlinear optics in many of these components. Our intent, in this Chapter, is to present an overview of the current status of optical computing, and a brief evaluation of the recent advances and performance of the following key components necessary to build an optical computing system: all-optical logic gates, adders, optical processors, optical storage, holographic storage, optical interconnects, spatial light modulators and optical materials.

Derived from text

Optoelectronic Devices; Photonics; Nonlinear Optics

20080039418 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Nonlinear Optics and Applications

Abdeldayem, Hossin A., Editor; Frazier, Donald O., Editor; [2007]; 10 pp.; In English; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Nonlinear optics is the result of laser beam interaction with materials and started with the advent of lasers in the early 1960s. The field is growing daily and plays a major role in emerging photonic technology. Nonlinear optics play a major role in many of the optical applications such as optical signal processing, optical computers, ultrafast switches, ultra-short pulsed lasers, sensors, laser amplifiers, and many others. This special review volume on Nonlinear Optics and Applications is intended for those who want to be aware of the most recent technology. This book presents a survey of the recent advances of nonlinear optical applications. Emphasis will be on novel devices and materials, switching technology, optical computing, and important experimental results. Recent developments in topics which are of historical interest to researchers, and in the same time of potential use in the fields of all-optical communication and computing technologies, are also included. Additionally, a few new related topics which might provoke discussion are presented. The book includes chapters on nonlinear optics and applications; the nonlinear Schrodinger and associated equations that model spatio-temporal propagation; the supercontinuum light source; wideband ultrashort pulse fiber laser sources; lattice fabrication as well as their linear and nonlinear light guiding properties; the second-order EO effect (Pockels), the third-order (Kerr) and thermo-optical effects in optical waveguides and their applications in optical communication; and, the effect of magnetic field and its role in nonlinear optics, among other chapters.

Author

Nonlinear Optics; Photonics; Laser Applications; Technology Assessment

20080039426 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Mechanical and Thermal Analysis of the Spectroscopy X-ray Telescopes for the Constellation-X Mission

Chan, Kai-Wing; Bolognese, Jeffrey; Saha, Timo; Sturm, James; Zhang, William; August 26, 2007; 11 pp.; In English; SPIE Conference: Optics and Photonics 2007. Program Track - Astronomical Optics and Instrumentation, 26-30 Aug. 2007, San Diego, CA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NNG06EO90A; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039426>

Area and mass requirements for the Constellation-X Spectroscopy X-Ray Telescopes restrict the thickness of the mirror segment to below a mm. Requirement of angular resolution of 15' over the soft x-ray band implies that allowable optic deformation is sub-micrometer for these thin segments. These requirements place stringent constraint on the mounting, alignment and affixing of these mirror segments in both the metrology and integration processes. We present analyses and optimization of the Constellation-X mirrors under relevant mechanical and thermal environments.

Author

Constellation-X; X Ray Telescopes; Thermal Analysis; Mirrors; Thickness; Angular Resolution; Metrology

20080039486 Harness, Dickey and Pierce, P.L.C., Bloomfield Hills, MI, USA

Reconfigurable Linescan Illumination

Abramovich, G., Inventor; Warlick, Z., Inventor; Koren, Y., Inventor; 1 Nov 04; 15 pp.; In English

Contract(s)/Grant(s): EEC-959125

Patent Info.: Filed Filed 1 Nov 04; US-Patent-Appl-SN-10-978 805

Report No.(s): PB2008-103112; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A reconfigurable illumination system for illuminating an object, and associated method. The illumination system comprises a cylindrical diffuser having a longitudinal aperture, a linescan camera positioned for having a direct line of sight to the object through the aperture of the diffuser, a base, and an illuminator supported on the base and positioned between the diffuser and the object, wherein the illuminator is selectively reconfigurable in a plurality of configurations, each configuration corresponding to a manufacturing process that requires visual inspection of the object.

NTIS

Inspection; Patent Applications; Visual Observation

20080039513 Birnbaum (Lester H.), Macungie, PA, USA

Fabrication of Optical Waveguide Devices

Koch, T. L., Inventor; Pafchek, R. M., Inventor; Webster, M. A., Inventor; 3 Nov 05; 11 pp.; In English

Patent Info.: Filed Filed 3 Nov 05; US-Patent-Appl-SN-11-265 931

Report No.(s): PB2008-103053; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Disclosed is a method of fabricating an optical waveguide device including the steps of forming a mask over a waveguide core material layer so as to leave a portion of the layer exposed, and exposing the structure to an oxidizing environment to form an oxide layer on the waveguide core material layer at least in the exposed portion thereby defining the lateral dimension of the waveguide core. The resulting waveguide core has extremely smooth surfaces for low optical losses.

NTIS

Fabrication; Optical Equipment; Optical Waveguides; Patent Applications; Waveguides

20080039521 Evan Law Group, LLC, Chicago, IL, USA

Decal Transfer Lithography (PAT-APPL-10-965 279)

Nuzzo, R. G., Inventor; Childs, W. R., Inventor; Motala, M. J., Inventor; Lee, K. J., Inventor; 14 Oct 04; 22 pp.; In English

Contract(s)/Grant(s): CHE-0097096; FA8650-04-C-7101

Patent Info.: Filed Filed 14 Oct 04; US-Patent-Appl-SN-10-965 279

Report No.(s): PB2008-103158; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method of making a microstructure includes selectively activating a portion of a surface of a silicon-containing elastomer, contacting the activated portion with a substance, and bonding the activated portion and the substance, such that the activated portion of the surface and the substance in contact with the activated portion are irreversibly attached. The selective activation may be accomplished by positioning a mask on the surface of the silicon-containing elastomer, and irradiating the exposed portion with UV radiation.

NTIS

Lithography; Patent Applications

20080039532 Lucent Technologies, Inc., USA

Optically Measuring Electric Field Intensities

Mitrofanov, O., Inventor; 8 Nov 04; 10 pp.; In English

Contract(s)/Grant(s): HR0011-04-C-0048

Patent Info.: Filed Filed 8 Nov 04; US-Patent-Appl-SN-10-983 864

Report No.(s): PB2008-101660; No Copyright; Avail.: CASI: [A02](#), Hardcopy

An apparatus includes an optical resonator and a passive optical device. The optical resonator has first and second optical reflectors and an optical cavity interposed between the reflectors. The optical resonator includes an electro-optically responsive material. One of the reflectors is a distributed Bragg reflector. A passive optical device is configured to direct light through the first optical reflector. The optical resonator is configured to return a portion of the light through the first reflector.

NTIS

Electric Fields; Optical Equipment; Patent Applications

20080039535 Department of the Army, Fort Belvoir, VA, USA

Total Internal Reflecting Laser Pump Cavity

Nettleton, J. E., Inventor; Barr, D. N., Inventor; 19 Aug 04; 6 pp.; In English

Patent Info.: Filed Filed 19 Aug 04; US-Patent-Appl-SN-10-921 200

Report No.(s): PB2008-102099; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A laser device in accordance with the present invention includes a diode pump for generating pump light and a pump cavity for receiving the pump light for conversion into an output laser beam. The pump cavity is formed as a trapezoidal prism, or a prism having bases with trapezoidal perimeters, rectangular sides, a rectangular input end and a rectangular output end. The trapezoidal prism has a decreasing taper, from a maximum width at the input end to a minimum width at the output end of the trapezoidal prism. The trapezoidal prism is formed by fixing a rectangular prism that is made of doped lasing material between two triangular prism portions that are made of undoped material. To facilitate ease of manufacture, a pallet is provided, and the diode pump and trapezoidal prism can be fixed to the pallet so that the diode pump is immediately proximate the input end of the trapezoidal prism.

NTIS

Laser Cavities; Laser Pumping; Patent Applications; Reflection

20080039543 Britt (Trask), Salt Lake City, UT, USA

Process for Forming Sharp Silicon Structures

Zhang, T., Inventor; 7 Mar 05; 12 pp.; In English

Contract(s)/Grant(s): MDT-00010-95-42

Patent Info.: Filed Filed 7 Mar 05; US-Patent-Appl-SN-11-074 187

Report No.(s): PB2008-103181; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method of forming a sharp silicon structure, such as a silicon field emitter, includes oxidizing the silicon structure to form an oxide layer thereon, then removing the oxide layer. Oxidizing may occur at a low temperature and form a relatively thin (e.g., about 20 ANG to about 40 ANG) oxide layer on the silicon field emitter. The oxide layer may be removed by etching. A silicon field emitter that has been fabricated in accordance with the method is substantially free of crystalline defects and may include an emitter tip having a diameter as small as about 40 ANG to about 20 ANG or less.

NTIS

Patent Applications; Silicon

20080039630 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Fabrication of MEMS Microshutter Arrays for Cryogenic Applications

Denis Kevin; Amatucci, Edward; Beamesderfer, Michael; Bajikar, Sateesh; Ewin, Audrey; Fettig, Rainer; Franz, Dave; Hess, Larry; Jhabvala, Murzy; Kelly, Dan; King, Todd; Kletetschkar, Gunther; Kuttyrev, Alexander; Li, Mary J.; Loughlin, Jim; Moseley, Harvey; Oh, Lance; Ray, Chris; Schulte, Eric; Smith, Wayne; Snodgrass, Steve; Valeriano, Veronica; Zheng, Yun; Zincke, Chris; September 17, 2006; 2 pp.; In English; Eurosensors XX, 17-20 Sep. 2006, Goteberg, Sweden; Original contains black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

Two-dimensional MEMS microshutter arrays are being developed for use as a high contrast field selector for the Near Infrared Spectrograph (NIRSpec) on the James Webb Space Telescope (JWST). We present details of microshutter array fabrication and give results of work done to optimize the flatness of microshutter elements through film stress control for both room temperature and cryogenic (35K) operation.

Author

James Webb Space Telescope; Near Infrared Radiation; Flatness; Fabrication; Microelectromechanical Systems; Cryogenics

20080039717 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Analysis of Non-Uniform Gain for Control of a Deformable Mirror in an Adaptive-Optics System

Vitayaudom, Kevin P; Mar 2008; 131 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-ENG-08-295

Report No.(s): AD-A482827; AFIT/GE/ENG/08-35; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482827>

The objective of this research was to develop and experimentally verify the use of spatially varying gain maps on the servo-loop controller of a deformable mirror for improvements in the performance of an adaptive optics system and the mitigation of instabilities that can occur over edge actuators of a deformable mirror. The edge subapertures of a Shack-Hartmann wavefront sensor have lower signal-to-noise ratios and are more susceptible to measurement errors than fully illuminated center subapertures. Spatially varying gain maps were then developed to compensate for edge effects by having lower filter gains beta on the edge actuators. This lowered the bandwidth over the edge actuators which are the most

susceptible to the edge effects. A gain map of lower filter gains beta over just the outer actuators was experimentally shown to increase the overall Strehl ratio of the AO system in all of the tested turbulence conditions. Experiments were also conducted in regimes where instabilities formed over the edge actuators of the DM. Gaussian gain maps significantly reduce the overall residual phase variance over the edge actuators reducing the formation of the instabilities.

DTIC

Adaptive Optics; Deformable Mirrors; Nonuniformity

20080040117 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Tightly Integrating Optical And Inertial Sensors For Navigation Using The UKF

Ebcin, Sedat; Mar 2008; 75 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482871; AFIT/GE/ENG/08-09; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482871>

The motivation of this research is to address the benefits of tightly integrating optical and inertial sensors where GNSS signals are not available. The research begins with describing the navigation problem. Then, error and measurement models are presented. Given a set of features, a feature detection and projection algorithm is developed which utilizes inertial measurements to predict vectors in the feature space between images. The unscented Kalman filter is applied to the navigation system using the inertial measurements and feature matches to estimate the navigation trajectory. Finally, the image-aided navigation algorithm is tested using a simulation and an experiment. As a result, the optical measurements combined with the inertial sensors result in improved performance for non-GNSS based navigation.

DTIC

Computer Vision; Inertial Navigation; Kalman Filters; Optical Measuring Instruments

20080040727 NASA Goddard Space Flight Center, Greenbelt, MD, USA

New Worlds Observer Telescope and Instrument Optical Design Concepts

Howard, Joseph M.; Noecker, Charlie; Kendrick, Steve; Woodgate, Bruce; Kilstron, Steve; Cash, Webster; August 10, 2008; 9 pp.; In English; SPIE Conference, 10-14 Aug. 2008, San Diego, CA, USA; Original contains color illustrations; Copyright;

Avail.: CASI: [A02](#), Hardcopy

Optical design concepts for the telescope and instrumentation for NASA's New Worlds Observer program are presented. A four-meter multiple channel telescope is discussed, as well as a suite of science instrument concepts. Wide field instrumentation (imager and spectrograph) would be accommodated by a three-mirror-anastigmat telescope design. Planet finding and characterization, and a UV instrument would use a separate channel that is picked off after the first two mirrors (primary and secondary). Guiding concepts are also discussed.

Author

Design Analysis; Optical Equipment; Telescopes; Mirrors

20080040771 NASA Goddard Space Flight Center, Greenbelt, MD, USA

MEMS Microshutter Array System for James Webb Space Telescope

Li, Mary J.; Adachi, Tomoko; Allen, Christine; Babu, Sachi; Bajikar, Sateesh; Beamesderfer, Michael; Bradley, Ruth; Denis, Kevin; Costen, Nick; Ewin, Audrey; Franz, Dave; Hess, Larry; Hu, Ron; Jackson, Kamili; Jhabvala, Murzy; Kelly, Dan; King, Todd; Kletetschka, Gunther; Kutyrev, Alexander; Lynch, Barney; Miller, Timothy; Moseley, Harvey; Mikula, Vilem; Mott, Brent; Oh, Lance; June 2008; 3 pp.; In English; Hilton Head Workshop 2008: A Solid-State Sensors, Actuators and Microsystems Workshop, 1 - 5 Jun. 2008, Georgia, USA; Original contains black and white illustrations

Report No.(s): P-0166; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040771>

A complex MEMS microshutter array system has been developed at NASA Goddard Space Flight Center (GSFC) for use as a multi-object aperture array for a Near-Infrared Spectrometer (NIRSpec). The NIRSpec is one of the four major instruments carried by the James Webb Space Telescope (JWST), the next generation of space telescope after the Hubble Space Telescope retires. The microshutter arrays (MSAs) are designed for the selective transmission of light with high efficiency and high contrast. It is demonstrated in Figure 1 how a MSA is used as a multiple object selector in deep space. The MSAs empower the NIRSpec instrument simultaneously collect spectra from more than 100 targets therefore increases the instrument efficiency 100 times or more. The MSA assembly is one of three major innovations on JWST and the first major MEMS devices serving observation missions in space. The MSA system developed at NASA GSFC is assembled with four quadrant fully addressable 365x171 shutter arrays that are actuated magnetically, latched and addressed electrostatically. As

shown in Figure 2, each MSA is fabricated out of a 4' silicon-on-insulator (SOI) wafer using MEMS bulk-micromachining technology. Individual shutters are close-packed silicon nitride membranes with a pixel size close to 100x200 pm (Figure 3). Shutters are patterned with a torsion flexure permitting shutters to open 90 degrees with a minimized mechanical stress concentration. In order to prevent light leak, light shields are made on to the surrounding frame of each shutter to cover the gaps between the shutters and the frame (Figure 4). Micro-ribs and sub-micron bumps are tailored on back walls and light shields, respectively, to prevent sticktion, shown in Figures 4 and 5. JWST instruments are required to operate at cryogenic temperatures as low as 35K, though they are to be subjected to various levels of ground tests at room temperature. The shutters should therefore maintain nearly flat in the entire temperature range between 35K and 300K. Through intensive numerical simulations and experimental studies, an optically opaque and electrically conductive metal-nitride thin film was selected as a coating material deposited on the shutters with the best thermal-expansion match to silicon nitride - the shutter blade thin film material. A shutter image shown in Figure 6 was taken at room temperature, presenting shutters slightly bowing down as expected. Shutters become flat when the temperature decreases to 35K. The MSAs are then bonded to silicon substrates that are fabricated out of 6' single-silicon wafers in the thickness of 2mm. The bonding is conducted using a novel single-sided indium flip-chip bonding technology. Indium bumps fabricated on a substrate are shown in Figure 7. There are 180,000 indium bumps for bonding a flight format MSA array to its substrate. Besides a MSA, each substrate houses five customer-designed ASIC (Application Specific Integrated Circuit) multiplexer/address chips for 2-dimensional addressing, twenty capacitors, two temperature sensors, numbers of resistors and all necessary interconnects, as shown in Figure 8. Complete MSA quadrant assemblies have been successfully manufactured and fully functionally tested. The assemblies have passed a series of critical reviews required by JWST in satisfying all the design specifications. The qualification tests cover programmable 2-D addressing, life tests, optical contrast tests, and environmental tests including radiation, vibration, and acoustic tests. A 2-D addressing pattern with 'ESA' letters programmed in a MSA is shown in Figure 9. The MSAs passed 1 million cycle life tests and achieved high optical contrast over 10,000. MSA teams are now making progress in final fabrication, testing and assembly (Figure 10). The delivery of flight-format MSA system is scheduled at the end of 2008 for being integrated to the focal plane of the NIRSpec detectors.

Author

James Webb Space Telescope; Microelectromechanical Systems; Shutters; Arrays; Infrared Spectrometers

20080040790 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Comparative Mirror Cleaning Study: 'A Study on Removing Particulate Contamination'

Houston, Karrie; July 17, 2007; 34 pp.; In English; Contamination and Coatings Workshop, 17 - 19 Jul. 2007, Columbia, Maryland, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040790>

The cleanliness of optical surfaces is recognized as an industry-wide concern for the performance of optical devices such as mirrors and telescopes, microscopes and lenses, lasers and interferometers, and prisms and optical filters. However, no standard has been established for optical cleaning and there is no standard definition of a 'clean' optical element. This study evaluates the effectiveness of commonly used optical cleaning techniques based on wafer configuration, contamination levels, and the number and size of removed particles. It is concluded that cleaning method and exposure time play a significant factor in obtaining a high removal percentage. The detergent bath and solvent rinse method displayed an increase in effective removal percentage as the contamination exposure increased. Likewise, CO₂ snow cleaning showed a relatively consistent cleaning effectiveness. The results can help ensure mission success to flight projects developed for the NASA Origins Program. Advantages and disadvantages of each of the optical cleaning methods are described.

Derived from text

Cleaning; Optical Equipment

75

PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20080039454 Idaho National Engineering Lab., Idaho Falls, ID, USA

Occupational Radiation Exposure Analysis of US ITER DCLL TBM

Merrill, B. J.; Cadwallader, L. C.; Dagher, M.; Aug. 2007; 39 pp.; In English

Contract(s)/Grant(s): DE-AC07-05ID14517

Report No.(s): DE2007-915541; INL/EXT-07-13073; No Copyright; Avail.: National Technical Information Service (NTIS)

This report documents an Occupational Radiation Exposure (ORE) analysis that was performed for the US International

Thermonuclear Experimental Reactor (ITER) Dual Coolant Lead Lithium (DCLL) Test Blanket Module (TBM). This analysis was performed with the QADMOD dose code for anticipated maintenance activities for this TBM concept and its ancillary systems. The QADMOD code was used to model the PbLi cooling loop of this TBM concept by specifying gamma ray source terms that simulated radioactive material within the piping, valves, heat exchanger, permeator, pump, drain tank, and cold trap of this cooling system. Estimates of the maintenance tasks that will have to be performed and the time required to perform these tasks were developed based on either expert opinion or on industrial maintenance experience for similar technologies. This report details the modeling activity and the calculated doses for the maintenance activities envisioned for the US DCLL TBM.

NTIS

Dosage; Exposure; Fusion Reactors; Lithium; Radiation Dosage; Reactor Materials; Thermonuclear Reactions

20080039585 Los Alamos National Lab., NM USA

Processing Materials Inside an Atmospheric-Pressure Radiofrequency Nonthermal Plasma Discharge

Selwyn, G. S., Inventor; Henins, I., Inventor; Park, J., Inventor; Hermann, H. W., Inventor; 14 Dec 05; 9 pp.; In English

Contract(s)/Grant(s): DE-W-7405-ENG-36

Patent Info.: Filed 14 Dec 05; US-Patent-Appl-SN-11-304 257

Report No.(s): PB2008-103499; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Apparatus for the processing of materials involving placing a material either placed between an radio-frequency electrode and a ground electrode, or which is itself one of the electrodes. This is done in atmospheric pressure conditions. The apparatus effectively etches or cleans substrates, such as silicon wafers, or provides cleaning of spools and drums, and uses a gas containing an inert gas and a chemically reactive gas.

NTIS

Atmospheric Pressure; Patent Applications; Plasma Jets; Plasma Physics

20080040104 Tech-X Corp., Boulder, CO USA

Influence of the Electron Seed Properties on the Discharge Characteristics of a Pseudospark (Preprint)

Cetiner, S O; Stoltz, P; Messmer, P; Cambier, J L; Nov 4, 2007; 13 pp.; In English

Contract(s)/Grant(s): FA8650-04-C-2511; Proj-50260542

Report No.(s): AD-A483022; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An investigation is put forth concerning the extent to which the pseudospark discharge characteristics are controlled by the mean injection velocity of the seed electrons when the bulk of the initial plasma generation occurs independently of the influence of the initial penetrating electric field from the anode-cathode voltage difference. The study is performed using the two-dimensional kinetic plasma simulation code OOPIC Pro. The discharge is seeded by injecting a current pulse for a period of one nanosecond along the axis from the hollow cavity back wall over a range of mean speeds corresponding to 100 to 900 V accelerations. It is shown that the mean seed injection energy strongly influences the rate of growth of the virtual anode with the neutral gas pressure and the magnitude of the peak electron current to the anode generated in the breakdown phase.

DTIC

Electric Fields; Electrons; Seeds

76

SOLID-STATE PHYSICS

Includes condensed matter physics, crystallography, and superconductivity. For related information see also *33 Electronics and Electrical Engineering*; and *36 Lasers and Masers*.

20080039363 Air Force Research Lab., Hanscom AFB, MA USA

Molecular Beam Epitaxy on Gas Cluster Ion Beam Prepared GaSb Substrates: Towards Improved Surfaces and Interfaces

Krishnaswami, Kannan; Vangala, Shivashankar R; Dauplaise, Helen M; Allen, Lisa P; Dallas, Gordon; Bakken, Daniel; Bliss, David F; Goodhue, William D; Dec 14, 2007; 9 pp.; In English

Contract(s)/Grant(s): Proj-2305

Report No.(s): AD-A482541; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We report results of a surface modification process for (100) GaSb using gas cluster ion beams(GCIB) that removes chemical mechanical polish (CMP) induced surface damage and replaces the native oxide with an engineered surface oxide,

the composition of which depends on the reactive gas employed. X-ray photoelectron spectroscopy of O₂-, CF₄/O₂-, and HBr-GCIB surface oxides is presented indicating the presence of mixed Ga- and Sb-oxides, with mostly Ga-oxides at the interface, desorbing at temperatures ranging 530 degrees C to 560 degrees C. Cross-sectional transmission electron microscopy of molecular beam epitaxy grown GaSb/AlGaSb layers showed that the HBr-GCIB surface produced a smooth dislocation-free substrate-to-epi transition with no discernable interface. Topography of epi surfaces, using atomic force microscopy, showed that GCIB surfaces resulted in characteristic step-terrace formations comprising monatomic steps and wide terraces. The HBr-GCIB process can be easily adapted to a large scale manufacturing process to produce epi-ready GaSb substrates.

DTIC

Clusters; Gallium Antimonides; Ion Beams; Ions; Molecular Beam Epitaxy; Substrates

20080039459 National Inst. of Standards and Technology, Gaithersburg, MD USA; Maryland Univ., College Park, MD, USA; Thomas Jefferson National Accelerator Facility, Newport News, VA, USA

Investigations of Residual Stresses and Mechanical Properties of Single Crystal Niobium for SRF Cavities

Gnaupel-Herold, T.; Myneni, G. R.; Ricker, R. E.; January 2006; 10 pp.; In English

Report No.(s): DE2007-902779; No Copyright; Avail.: National Technical Information Service (NTIS)

This work investigates properties of large grained, high purity niobium with respect to the forming of superconducting radio frequency (SRF) cavities from such large grained sheets. The yield stresses were examined using tensile specimens that were essentially single crystals in orientations evenly distributed in the standard projection triangle. No distinct yield anisotropy was found, however, vacuum annealing increased the yield strength by a factor 2..3. The deep drawing forming operation of the half cells raises the issues of elastic shape changes after the release of the forming tool (springback) and residual stresses, both of which are indicated to be negligible. This is a consequence of the low yield stress (< 100 MPa) and the large thickness (compared to typical thicknesses in sheet metal forming). However, the significant anisotropy of the transversal plastic strains after uniaxial deformation points to potentially critical thickness variations for large grained / single crystal half cells, thus raising the issue of controlling grain orientation or using single crystal sheet material.

NTIS

Anisotropy; Cavities; Mechanical Properties; Niobium; Residual Stress; Single Crystals; Superconducting Cavity Resonators

20080040695 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Simulation of SEU Cross-sections using MRED under Conditions of Limited Device Information

Lauenstein, J. M.; Reed, R. A.; Weller, R. A.; Mendenhall, M. H.; Warren, K. M.; Pellish, J. A.; Schrimpf, R. D.; Sierawski, B. D.; Massengill, L. W.; Dodd, P. E.; Shaneyfelt, M. R.; Felix, J. A.; Schwank, J. R.; November 15, 2007; 11 pp.; In English; NEPP Program Review, 15 Nov. 2007, Nashville, TN, USA; Original contains black and white illustrations; Copyright;

Avail.: CASI: [A03](#), Hardcopy

This viewgraph presentation reviews the simulation of Single Event Upset (SEU) cross sections using the membrane electrode assembly (MEA) resistance and electrode diffusion (MRED) tool using 'Best guess' assumptions about the process and geometry, and direct ionization, low-energy beam test results. This work will also simulate SEU cross-sections including angular and high energy responses and compare the simulated results with beam test data for the validation of the model. Using MRED, we produced a reasonably accurate upset response model of a low-critical charge SRAM without detailed information about the circuit, device geometry, or fabrication process

CASI

Single Event Upsets; Radiation Damage; Computerized Simulation; Mathematical Models; Radiation Dosage

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*.

20080039432 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Measurement and Simulation of the Variation in Proton-Induced Energy Deposition in Large Silicon Diode Arrays

Howe, Christina L.; Weller, Robert A.; Reed, Robert A.; Sierawski, Brian D.; Marshall, Paul W.; Marshall, Cheryl J.; Mendenhall, Marcus H.; Schrimpf, Ronald D.; July 23, 2007; 5 pp.; In English; Nuclear Space and Radiation Effects

Conference, 23-27 Jul. 2007, Honolulu, HI, USA; Original contains poor quality, truncated or crooked pages; Copyright; Avail.: CASI: [A01](#), Hardcopy

The proton induced charge deposition in a well characterized silicon P-i-N focal plane array is analyzed with Monte Carlo based simulations. These simulations include all physical processes, together with pile up, to accurately describe the experimental data. Simulation results reveal important high energy events not easily detected through experiment due to low statistics. The effects of each physical mechanism on the device response is shown for a single proton energy as well as a full proton space flux.

Author

P-I-N Junctions; Focal Plane Devices; Proton Energy; Protons; Deposition; Energy Transfer; Monte Carlo Method

20080039862 Avacore Technologies, Ann Arbor, MI USA

Developing and Testing RTX Hand Devices

Smith, Mark A; Coleman, James H; Mar 26, 2007; 36 pp.; In English; Original contains color illustrations

Report No.(s): AD-A483051; W911NF-06-C-0173; No Copyright; Avail.: Defense Technical Information Center (DTIC)

AVAcore Technologies in conjunction with Stanford University has developed RTX (Rapid Thermal eXchange) technology for the purpose of enhancing heat transfer with the body core of a mammal. Application of an optimal thermal load and slight negative pressure to certain areas of a mammal containing arteriovenous anastomoses and venous plexus has been shown to increase heat exchange significantly. Previous versions of RTX required insertion of a hand or foot into a sealed rigid chamber. The current work funded by DARPA through ARO was to design and build RTX devices that incorporate maximum contact to the palmar surface of a hand at rest, provide topical vacuum (no chamber) and a thermal load for ease of use in field applications. Design criteria were established to accommodate the fifth through ninety fifth percentile hand, be rugged enough to withstand transport in military vehicles during combat operations, and operate regardless of their mounting orientation (vertical or horizontal). Bench testing was performed using a simulated hand to compare heat exchange rates with previous versions of RTX. A 33% increase in heat exchange was observed with the new RTX design. Nine units were built for human testing by others.

DTIC

Cooling; Heat Transfer; Temperature Control

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*.

20080039315 NASA Goddard Space Flight Center, Greenbelt, MD, USA

International Education Opportunities during the IHY: Bridging the Geographic, Cultural and Linguistic Divide between Participating IHY Nations

Thompson, B.J.; Morrow, C.A.; Rabello-Soares, M.C.; Smith, R.W.; December 11, 2006; 1 pp.; In English; AGU Fall Meeting, 11 - 17 Dec. 2006, California, USA; Copyright; Avail.: Other Sources; Abstract Only

Currently there are over 70 U.N. Member States participating in the International Heliophysical Year (IHY 2007- 8), and most of these nations do not use English as their primary language. The IHY contains four main program elements: Science, Observatory Development, Outreach, and History. For these elements to be successful, each requires successful communication within and adaptation for the individual member states. The IHY Outreach program contains many educational activities targeting a wide range of languages and contexts. The other three program elements, however, offer a means to extend the impact of the educational programs and reinforce educational activities. IHY's scientific activities involve partnerships with institutions and observatories, many of which have outreach activities in their local communities. Scientists and participation programs from around the world have begun translating materials into their local languages and adapting educational tools for use in their communities. IHY's Observatory Development program, which began deploying instrumentation worldwide in 2004, encourages a strong educational component to each new observatory site as a means of ensuring long-lasting viability of the research program. The history program gathers important information and educates the public about the development of space science. This presentation will discuss efforts occurring within the IHY program that support cross-cultural communication and education and present opportunities to reach new audiences.

Author

Culture (Social Sciences); Education; Linguistics; Sun; Solar Physics

20080040136 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Chapter 1: Introduction to SQL

McGlynn, T.; Santisteban, M.; [2007]; 10 pp.; In English; Copyright; Avail.: CASI: [A02](#), Hardcopy

This chapter provides a very brief introduction to the Structured Query Language (SQL) for getting information from relational databases. We make no pretense that this is a complete or comprehensive discussion of SQL. There are many aspects of the language that will be completely ignored in the presentation. The goal here is to provide enough background so that users understand the basic concepts involved in building and using relational databases. We also go through the steps involved in building a particular astronomical database used in some of the other presentations in this volume.

Derived from text

Query Languages; Relational Data Bases; Information Retrieval

81

ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20080039312 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Development of a NASA Integrated Technical Workforce Career Development Model Entitled Requisite Occupation Competencies and Knowledge -- the ROCK

Menrad, Robert J.; Larson, Wiley J.; August 29, 2008; 12 pp.; In English; 2008 International Astronautical Conference, 29 Sep. - 3 Oct. 2008, Glasgow, Scotland, UK; Original contains black and white illustrations

Report No.(s): IAC-08-D1.3.7; Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper shares the findings of NASA's Integrated Learning and Development Program (ILDLP) in its effort to reinvent the HANDS-ON practice of space systems engineering and project/program management through focused coursework, training opportunities, on-the-job learning and special assignments. Prior to March 2005, NASA responsibility for technical workforce development (the program/project manager, systems engineering, discipline engineering, discipline engineering and associated communities) was executed by two parallel organizations. In March 2005 these organizations merged. The resulting program-ILDLP was chartered to implement an integrated competency-based development model capable of enhancing NASA's technical workforce performance as they face the complex challenges of Earth science, space science, aeronautics and human spaceflight missions. Results developed in collaboration with NASA Field Centers are reported on. This work led to definition of the agency's first integrated technical workforce development model known as the Requisite Occupation Competence and Knowledge (the ROCK). Critical processes and products are presented including: 'validation' techniques to guide model development, the Design-A-CURriculum (DACUM) process, and creation of the agency's first systems engineering body-of-knowledge. Findings were validated via nine focus groups from industry and government, validated with over 17 space-related organizations, at an estimated cost exceeding \$300,000 (US). Masters-level programs and training programs have evolved to address the needs of these practitioner communities based upon these results. The ROCK reintroduced rigor and depth to the practitioner's development in these critical disciplines enabling their ability to take mission concepts from imagination to reality.

Author

NASA Programs; Personnel Development; Personnel Management

20080040704 NASA Langley Research Center, Hampton, VA, USA

Framework for the Parametric System Modeling of Space Exploration Architectures

Komar, David R.; Hoffman, Jim; Olds, Aaron D.; Seal, Mike D., II; September 09, 2008; 21 pp.; In English; AIAA Space 2008 Conference & Exposition, 9-11 Sep. 2008, San Diego, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 986249.01.13.04.20

Report No.(s): AIAA-Paper 2008-7845; Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper presents a methodology for performing architecture definition and assessment prior to, or during, program formulation that utilizes a centralized, integrated architecture modeling framework operated by a small, core team of general space architects. This framework, known as the Exploration Architecture Model for IN-space and Earth-to-orbit (EXAMINE), enables: 1) a significantly larger fraction of an architecture trade space to be assessed in a given study timeframe; and 2) the complex element-to-element and element-to-system relationships to be quantitatively explored earlier in the design process. Discussion of the methodology advantages and disadvantages with respect to the distributed study team approach typically used within NASA to perform architecture studies is presented along with an overview of EXAMINE's functional components

and tools. An example Mars transportation system architecture model is used to demonstrate EXAMINE's capabilities in this paper. However, the framework is generally applicable for exploration architecture modeling with destinations to any celestial body in the solar system.

Author

Models; Space Exploration; Management Methods; NASA Programs; Mission Planning

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*.

20080039292 Ryan, Mason and Lewis, LLP, Locust Valley, NY, USA

Methods and Apparatus for Interval Query Indexing

Chen, S. K., Inventor; Wun, K. L., Inventor; Yu, P. S. L., Inventor; 5 Nov 04; 14 pp.; In English

Contract(s)/Grant(s): H98230-04-3-0001

Patent Info.: Filed 5 Nov 04; US-Patent-Appl-SN-10-982 570

Report No.(s): PB2008-103510; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Interval query indexing techniques for use in accordance with data stream processing systems are disclosed. For example, in an illustrative aspect of the invention, a technique for use in processing a data stream comprises the following steps/operations. First, an attribute range of query intervals associated with the data stream is partitioned into one or more segments. Then, a set of virtual intervals is defined for each of the one or more segments. A query interval index is then built using the set of virtual intervals. The query interval index may be built by decomposing each query interval into one or more of the virtual intervals, and associating a query identifier with the decomposed virtual intervals.

NTIS

Data Flow Analysis; Patent Applications

20080039293 Ryan, Mason and Lewis, LLP, Locust Valley, NY, USA

Methods and Apparatus for Performing Structural Joins for Answering Containment Queries

Chen, S. K., Inventor; Wu, K. L., Inventor; Yu, P. S. L., Inventor; 5 Nov 04; 15 pp.; In English

Contract(s)/Grant(s): H98230-04-3-0001

Patent Info.: Filed 5 Nov 04; US-Patent-Appl-SN-10-982 583

Report No.(s): PB2008-103511; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Techniques are provided for performing structural joins for answering containment queries. Such inventive techniques may be used to perform efficient structural joins of two interval lists which are neither sorted nor pre-indexed. For example, in an illustrative aspect of the invention, a technique for performing structural joins of two element sets of a tree-structured document, wherein one of the two element sets is an ancestor element set and the other of the two element sets is a descendant element set, and further wherein each element is represented as an interval representing a start position and an end position of the element in the document, comprises the following steps/operations. An index is dynamically built for the ancestor element set. Then, one or more structural joins are performed by searching the index with the interval start position of each element in the descendant element set.

NTIS

Containment; Document Markup Languages; Information Retrieval; Patent Applications

20080039552 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Data Standards and the Synthesis of Magnetograms

MacNeice, P. J.; November 04, 2007; 1 pp.; In English; 4th CCMC Community Workshop, 4-8 Nov. 2007, arecibo, Puerto Rico; No Copyright; Avail.: Other Sources; Abstract Only

A key component of future models of coronal evolution will be the high resolution vector magnetograms that drive the models. Much of this data will have limited field of view, and so will need to be supplemented from other sources, particularly when a global context is needed. I will discuss our plans to develop a tool capable of synthesizing magnetograms from multiple sources. This will rely heavily on the CCMC's KAMELEON data formatter and interpolator.

Author

Magnetic Signatures; Field of View; Coronas; Synthesis; Standards; Data Management

20080039592 Department of Defense, Washington, DC USA

Enabling Net-Centric Operations

Apr 2006; 6 pp.; In English

Report No.(s): AD-A481757; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA481757>

The early days of the 21st century reinforced what the nation already was beginning to understand. We have entered an era of uncertainty. The challenges to national security and global stability will vary greatly. They will involve asymmetric operations, a wide range of partners, compressed timelines, world-wide visibility, and non-state enemies who seek to destroy our free way of life. Succeeding in this new strategic environment requires levels of responsiveness and agility never before demanded of our forces. Our forces must move from a peacetime tempo, to a wartime sense of urgency. They must adjust to an era of surprise and uncertainty, and leave behind the reasonable predictability of the past. Given the uncertainties of the new era, we must be able to respond to crises, as well as be proactive and shape the future. Unlike the static defense and garrison forces of the Post Cold War, we must become accustomed to mobile, expeditionary operations. Most important, we must transform our emphasis on ships, guns, tanks, and planes, and instead focus on information, knowledge and timely, actionable intelligence. In short, we must move from our Industrial Age mindset, and transform to a 21st century force. Our path lies in our ability to conduct Net-Centric Operations.

DTIC

Information Systems; Computer Networks; Warfare

20080039611 Army War Coll., Carlisle Barracks, PA USA

Wars of Ideas and the War of Ideas

Echevarria, II, Antulio J; Jun 2008; 64 pp.; In English

Report No.(s): AD-A482587; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Despite widespread emphasis on the importance of winning 'the' war of ideas in recent strategic literature, one finds few analytical studies of wars of ideas as such. With that in mind, this monograph offers a brief examination of four common types of wars of ideas, and uses that as a basis for analyzing how the USA and its allies and strategic partners might proceed in the current war of ideas. Simply put, a war of ideas is a clash of visions, concepts, and images, and -- especially -- the interpretation of them. They are, indeed, genuine wars, even though the physical violence might be minimal, because they serve a political, socio-cultural, or economic purpose, and they involve hostile intentions or hostile acts. Wars of ideas can assume many forms, but they tend to fall into four general categories (though these are not necessarily exhaustive): (1) intellectual debates, (2) ideological wars, (3) wars over religious dogma, and (4) advertising campaigns. All of them are essentially about power and influence, just as with wars over territory and material resources, and their stakes, can run very high indeed. An analytical study of wars of ideas, to the extent they are wars, would enhance one's understanding of such conflicts and how they might be approached. With that in mind, this monograph, which is necessarily limited in scope, does two things. First, it offers a brief examination of what appear to be the four basic types of wars of ideas found in history. Second, it uses that examination as a start point for analyzing the principal approaches in the current war of ideas.

DTIC

Warfare; Military Operations; Terrorism; Defense Program

20080039673 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Comparing Information Assurance Awareness Training for End-Users: A Content Analysis Examination of Air Force and Defense Information Systems Agency User Training Modules

Fruge, John W; Mar 2008; 69 pp.; In English

Report No.(s): AD-A482729; AFIT/GIR/ENV/08-M07; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482729>

Today, the threats to information security and assurance are great. While there are many avenues for IT professionals to safeguard against these threats, many times these defenses prove useless against typical system users. Mandated by laws and regulations, all government agencies and most private companies have established information assurance (IA) awareness programs, most of which include user training. Much has been given in the existing literature to laying out the guidance for the roles and responsibilities of IT professionals and higher level managers, but less is specified for 'everyday' users of information systems. This thesis attempts to determine the content necessary to educate system users of their roles and responsibilities for IA. Using the NIST Special Publication 800-50 as a guide, categories of threats and knowledge areas are established and the literature is analyzed and separated into the categories. The thesis closes with a comparison of the IA

awareness training modules of the United State's Air Force and Defense Information Systems Agency and a discussion of areas of further research concerning IA awareness training.

DTIC

Education; Information Systems; Modules; Security; User Requirements

20080039675 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

An Analysis of Information Asset Valuation (IAV) Quantification Methodology for Application with Cyber Information Mission Impact Assessment (CIMIA)

Hellesen, Denzil L; Mar 2008; 134 pp.; In English

Report No.(s): AD-A482731; AFIT/GIR/ENV/08-M11; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482731>

The purpose of this research is to develop a standardized Information Asset Valuation (IAV) methodology. The IAV methodology proposes that accurate valuation for an Information Asset (InfoA) is the convergence of information tangible, intangible, and flow attributes to form a functional entity that enhances mission capability. The IAV model attempts to quantify an InfoA to a single value through the summation of weighted criteria. Standardizing the InfoA value criteria will enable decision makers to comparatively analyze dissimilar InfoAs across the tactical, operational, and strategic domains. This research develops the IAV methodology through a review of existing military and non-military valuation methodologies. IAV provides the Air Force (AF) and Department of Defense (DoD) with a standardized methodology that may be utilized enterprise wide when conducting risk and damage assessment and risk management. The IAV methodology is one of the key functions necessary for the Cyber Incident Mission Impact Assessment (CIMIA) program to operationalize a scalable, semi-automated Decision Support System (DSS) tool. The CIMIA DSS intends to provide decision makers with near real-time cyber awareness prior to, during, and post cyber incident situations through documentation of relationships, interdependencies, and criticalities among information assets, the communications infrastructure, and the operations mission impact.

DTIC

Damage Assessment; Impact; Information Systems; Security

20080039679 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Bibliometrically Mapping Team Cognition Literature: A Co-citation Analysis

Howell, Ryan A; Mar 2008; 217 pp.; In English

Report No.(s): AD-A482738; AFIT/GEM/ENV/08-M10; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482738>

Researchers investigating team cognition must source and review a challenging set of relevant, mature literature from a diverse array of academic disciplines. Such disciplines may include psychology, management, information science, military science, anthropology, and nursing science, etc. This thesis summarizes an effort to bibliometrically map team cognition literature using an author co-citation analysis methodology. The work began with a traditional literature review that identified key authors who were published in peer-reviewed journals. These authors were contacted and asked to provide their own listings of key researchers in the field, which were used in conjunction with the Social Sciences Citation Index (SSCI) to construct a co-citation matrix of authors. Using factor analysis and multi-dimensional analysis techniques, visual maps were constructed that highlight the influence of specific authors, the relationships between authors, and the branching of sub-domains in the literature over time. The overall goals of the research were to provide team cognition researchers with a tool they could use to better inform their efforts, and to provide an explicit mapping of the field in terms of where it has been, and where it may be going.

DTIC

Cognition; Mapping; Periodicals; Quantitative Analysis; Surveys

20080039728 Department of Homeland Security, Washington, DC USA

Department of Homeland Security Information Sharing Strategy

Apr 18, 2008; 10 pp.; In English

Report No.(s): AD-A482853; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482853>

The President and Congress have directed the Department of Homeland Security (DHS) to perform an essential and

multi-faceted mission: prevent and protect against terrorist attacks; respond to both man-made and natural disasters; perform the law enforcement and other crucial functions of the Department's component agencies; and play a central role in augmenting the Nation's ability to gather, analyze, and disseminate information and intelligence. To ensure that information and intelligence flow where and when they should, DHS must foster information sharing, consistent with law, regulation, and policy, in each of the following ways: (1) internally within DHS; (2) horizontally within the U.S. Government between both law enforcement agencies and the intelligence community; (3) vertically with State, local, territorial, tribal, and private sector partners; and (4) horizontally with the law enforcement and intelligence agencies of foreign allies and appropriate international institutions. The foundation for DHS's key role with respect to information sharing has been established by statute, regulation, Executive Order, and Secretarial directive. The Department has made significant contributions to the Nation's information sharing capability since its inception, but critical work remains to be done. This Information Sharing Strategy for DHS builds on that foundation and sets out DHS's strategy for achieving its information sharing objectives. This Strategy consists of the following components: Background, Transformation Statement, Guiding Principles, Critical Challenges, Objectives, Information Sharing Standards, Information Sharing Security and Privacy, Performance Measures, and Communication and Outreach.

DTIC

Information Systems; Intelligence; Security

20080039841 Diabetes Technology Society, Foster City, CA USA

The Fourth Annual Clinical Diabetes Technology Meeting

Klonoff, David C; Sep 2008; 13 pp.; In English

Contract(s)/Grant(s): W81XWH-08-1-0294

Report No.(s): AD-A482992; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Fourth Annual Clinical Diabetes Technology Meeting was presented by the Diabetes Technology Society at the Orlando Florida Hyatt Regency Hotel on April 11-12 2008. The first day covered Technologies for Diabetes Monitoring and the second day covered Technologies for Diabetes Therapy. On April 11 2008 which was the Technologies for Diabetes Monitoring day, the first presentation was made by Barry Ginsberg M.D. Ph.D., on the topic 'Self-Monitoring of Blood Glucose.' He explained the use of self monitoring of blood glucose for clinical decision making and addressed issues with glucose monitoring including common user errors that can interfere with accuracy. Howard Wolpert, MD., presented an overview of Continuous Glucose Monitoring (CGM) technology. He described how metabolic monitoring with continuous glucose monitoring can provide information about nutritional and metabolic status that is unavailable with spot glucose testing. Jennifer Block, R.N., CDE, discussed the concept of CGM as a behavior modification tool. She explained how, to modify eating habits and exercise habits based on CGM and also achieve improved medication compliance with CGM. She discussed how with CGM patients must confront seeing all of their glucose readings demonstrated for days at a time and she referred to this phenomenon as 'naked diabetes.'

DTIC

Clinical Medicine; Glucose; Metabolic Diseases

20080039883 Massachusetts Inst. of Tech., Cambridge, MA USA

Proceedings of the Workshop on Mobility and Control in Challenging Environments

Iagnemma, Karl; Sep 20, 2007; 496 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-1-0374

Report No.(s): AD-A483092; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The attached is a compilation of presentations from the Workshop on Mobility and Control in Challenging Environments which was held on Oct 5-6 2006 at Olin College in Needham, MA. Since written paper submissions were not required for the workshop these presentations comprise the workshop proceedings.

DTIC

Conferences; Mobility

ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

20080040193 Government Accountability Office, Washington, DC, USA

Space Acquisitions: Uncertainties in the Evolved Expendable Launch Vehicle Program Pose Management and Oversight Challenges

September 2008; 45 pp.; In English; Original contains black and white illustrations

Report No.(s): GAO-08-1039; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The Department of Defense (DOD) plans to spend over \$27 billion acquiring launch services through the Evolved Expendable Launch Vehicle (EELV) program over the next 12 years. The EELV program uses two families of commercially owned and operated vehicles to launch satellites. Partly because the commercial space market did not develop as expected, the EELV program has undergone significant changes. These include: adoption of a new acquisition strategy in 2005 that sought to ensure the viability of the two EELV launch vehicle providers, Boeing and Lockheed Martin; the subsequent decision by those two companies to form a joint venture called the United Launch Alliance (ULA); and a 10-year increase in the life of the program. In light of these changes, GAO was asked to (1) determine what uncertainties DOD faces in the EELV program and in the transition to ULA, and (2) assess how DOD is positioned to manage and oversee the effort. To accomplish this, GAO reviewed a wide variety of DOD documents and interviewed DOD and program officials. GAO recommends the Secretary of Defense take actions to: ensure the regular reporting of key information on program status, produce an independent life-cycle cost estimate, and ensure the program's staffing meets its needs. DOD concurred with the recommendations.

Derived from text

Cost Estimates; Defense Program; Launch Vehicles; Launching; Life Cycle Costs

LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes aviation law; space law and policy; international law; international cooperation; and patent policy.

20080039408 Center for Naval Analyses, Alexandria, VA USA

Assessment of the Impact of 1206 Funded Projects in Lebanon, Pakistan, Yemen, Sao Tome and Principe

Thompson, Eric; Asfura-Heim, Patricio; May 2008; 57 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-05-D-0500

Report No.(s): AD-A482627; CRM-D0017988.A2; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study examines the operational effects of 1206 'global train and equip' programs in Lebanon, Pakistan, Yemen, Sao Tome and Principe.

DTIC

Lebanon; Pakistan; Yemen

20080039589

Space Foundation, Colorado Springs, CO, USA

ITAR and the U.S. Space Industry

September 30, 2008; 2 pp.; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

The paper examines the effect of the International Traffic in Arms Regulations (ITAR), which govern the export of space technology. Concerns about ITAR's impact on the business practices and cost structures of the space industry prompted the paper, which combines data from government and industry sources. The paper weighs the balance of vital national security measures and a healthy trade environment for the U.S. space economy as it competes in the world market. Findings of the report include the impact of ITAR compliance on companies of different sizes, the implications for the U.S. space economy, and the effect on space technology innovation here and abroad. The report proposes steps to modernize ITAR, enabling the regulations to accomplish their original purpose of protecting important security technologies while allowing more U.S. space companies to compete successfully in the global economy.

Derived from text

Aerospace Engineering; Commerce; Regulations; Security

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.

20080040708 NASA Langley Research Center, Hampton, VA, USA

Schedule Risks Due to Delays in Advanced Technology Development

Reeves, John D. Jr.; Kayat, Kamal A.; Lim, Evan; September 09, 2008; 12 pp.; In English; AIAA Space 2008 Conference and Exposition, 9 - 11 Sep. 2008, San Diego, California, USA; Original contains color and black and white illustrations
Report No.(s): AIAA-2008-7709; Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper discusses a methodology and modeling capability that probabilistically evaluates the likelihood and impacts of delays in advanced technology development prior to the start of design, development, test, and evaluation (DDT&E) of complex space systems. The challenges of understanding and modeling advanced technology development considerations are first outlined, followed by a discussion of the problem in the context of lunar surface architecture analysis. The current and planned methodologies to address the problem are then presented along with sample analyses and results. The methodology discussed herein provides decision-makers a thorough understanding of the schedule impacts resulting from the inclusion of various enabling advanced technology assumptions within system design.

Author

Aerospace Systems; Complex Systems; Systems Engineering; Technological Forecasting; Time Lag; Production Planning; Delay

SPACE SCIENCES (GENERAL)

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through 93*.

20080039326 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Whistlers Observed Outside the Plasmasphere: Correlation to Plasmaspheric/Plasmapause Features and Implications for the Scattering of Radiation-Belt Electrons

Adrian, Mark L.; Gallagher, D. L.; December 10, 2007; 1 pp.; In English; 2007 American Geophysical Union (AGU) Fall Meeting, 10-14 Dec, 2007, San Francisco, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

Magnetospherically reflected, lightning-generated whistler waves are an important potential contributor to pitch-angle scattering loss processes of the electron radiation belts. While lightning-generated whistlers are a common feature at, and just inside, the plasmapause, they are infrequently observed outside the plasmasphere. As such, their potential contribution to outer radiation belt loss processes is more tenuous. Recently, Platino et al. [2005] has reported on whistlers observed outside the plasmasphere by Cluster. Here, we present correlative global observations of the plasmasphere, for the reported periods of Cluster-observed whistlers outside the plasmasphere, using IMAGE-EUV data. The intent of this study is to seek the underlying mechanisms that result in whistlers outside the plasmasphere and consequently the anticipated morphology and significance these waves may have on radiation belt dynamics.

Author

Extreme Ultraviolet Radiation; Electron Radiation; Whistlers; Plasmasphere

20080039330 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Living with a Star Radiation Belt Storm Probes Mission and Related Missions of Opportunity

Sibeck, David G.; Mauk, Barry H.; Grebowsky, Joseph M.; Fox, Nicola J.; December 11, 2006; 1 pp.; In English; 2006 American Geophysical Union meeting, 11-15 Dec. 2006, San Francisco, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

This presentation provides an overview of the Living With a Star (LWS) Radiation Belt Storm Probes (RBSP) mission in the context of the broader Geospace program. Missions to Geospace offer an opportunity to observe in situ the fundamental processes that operate throughout the solar system and in particular those that generate hazardous space weather effects in the vicinity of Earth. The recently selected investigations on NASA's LWS program's RBSP will provide the measurements needed to characterize and quantify the processes that supply and remove energetic particles from the Earth's Van Allen

radiation belts. Instruments on the RBSP spacecraft will observe charged particles that comprise the Earth's radiation belts over the full energy range from 1 eV to more than 10 MeV (including composition), the plasma waves which energize them, the electric fields which transport them, and the magnetic fields which guide their motion. The two-point measurements by the RBSP spacecraft will enable researchers to discriminate between spatial and temporal effects, and therefore between the various proposed mechanisms for particle acceleration and loss. The measurements taken by the RBSP spacecraft will be used in data modeling projects in order to improve the understanding of these fundamental processes and allow better predictions to be made. NASA's LWS program has also recently selected three teams to study concepts for Missions of Opportunity that will augment the RBSP program, by (1) providing an instrument for a Canadian spacecraft in the Earth's radiation belts, (2) quantifying the flux of particles precipitating into the Earth's atmosphere from the Earth's radiation belts, and (3) remotely sensing both spatial and temporal variations in the Earth's ionosphere and thermosphere.

Author

Radiation Belts; Terrestrial Radiation; Space Weather; Plasma Waves; Energetic Particles; Temporal Distribution; Electric Fields; Magnetic Fields; Earth Ionosphere

20080039349 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Using Arctic Data for Magnetospheric Modeling: Current State and Future Perspectives

Hesse, Michael; May 03, 2007; 1 pp.; In English; Greenland International Polar Year (IPY) 2007 Space Science, 3-10 May 2007, Kangerlussuaq, Greenland; No Copyright; Avail.: Other Sources; Abstract Only

Geomagnetic storms are the most dramatic manifestations of solar influences on the magnetosphere. Storms are accompanied by substantial Space Weather effects. For these, as well as for scientific reasons, storms have been a special target of magnetospheric modeling for quite some time. Accordingly, there has been considerable interest and success in improving the application of magnetospheric models to storm-time dynamics, and to compare to data from arctic observatories. In this presentation, we present an overview of CCMC-studies of storm-time model capabilities, and we will provide an overall assessment of capabilities. In addition, we will present an analysis of future challenges, and we will suggest strategies for future model development.

Author

Magnetospheric Instability; Magnetic Storms; Arctic Regions; Space Weather

20080039425 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Pickup Ion Phase Space Distributions at Titan in a Three Dimensional Exosphere

Hartle, Richard; Sittler, Edward; Journal of Geophysical Research; October 07, 2006; Volume 112; 1 pp.; In English; Division of Planetary Sciences meeting, 7-13 Oct. 2006, Orlando, FL, USA; Original contains poor quality, truncated or crooked pages; No Copyright; Avail.: Other Sources; Abstract Only
ONLINE: <http://dx.doi.org/10.1029/2006JA012157>

The composition and structure of neutral exospheres imbedded in moving plasmas can be determined by measurements of the velocity distributions of their pickup ion progeny. In turn, the velocity distributions are dependent on the spatial structure of the neutral source gases. Since Titan's neutral exosphere extends into the Saturn's magnetosphere (or solar wind) and well above its ionopause, it serves as a good place to analyze such characteristics. They are analyzed using pickup ion measurements made by the Cassini Plasma Spectrometer (CAPS) at Titan [e.g., Hartle et al., 2006] and an ion kinetic model. An early version of the model [Hartle and Sittler, 2007] is an expression describing the phase space density of pickup ions, which is derived from the Vlasov equation with an ion source that explicitly accounts for the velocity and spatial variation of the exosphere source gases. The current version used here includes exosphere source gases in three dimensions. A fundamental parameter of the phase space densities is the ratio of the gyroradius to the neutral scale height $\alpha = r(\text{sub } g)/H$. Titan's exosphere structure yields pickup ions whose phase space distributions are beam-like when $\alpha \gg 1$ and fluid-like when $\alpha \ll 1$. Downstream from the source peak, the light pickup ions, with $\alpha \ll 1$, are easily observed because their phase space densities are almost uniform over the orbit phases. On the other hand, the phase space distributions of the heavier ions, with $\alpha \gg 1$, peak over narrow velocity and spatial ranges. This beam-like nature makes it considerably more difficult to observe heavy ions because their downstream positions and viewing directions are narrowly constrained. Examples of these extremes will be discussed.

Author

Exosphere; Ion Sources; Neutral Gases; Light Ions; Scale Height; Space Density; Vlasov Equations; Heavy Ions

20080039433 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Mid-Infrared OPO for High Resolution Measurements of Trace Gases in the Mars Atmosphere

Yu, Anthony W.; Numata, Kenji; Riris, Haris; Abshire, James B.; Allan, Graham; Sun, Xiaoli; Krainak, Michael A.; March 17, 2008; 3 pp.; In English; Laser Applications to Chemical, Security and Environmental Analysis (LACSEA) Conference, 17-20 Mar. 2008, Saint Petersburg, FL, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

The Martian atmosphere is composed primarily (>95%) of CO₂ and N₂ gas, with CO, O₂, CH₄, and inert gases such as argon comprising most of the remainder. It is surprisingly dynamic with various processes driving changes in the distribution of CO₂, dust, haze, clouds and water vapor on global scales in the meteorology of Mars atmosphere [1]. The trace gases and isotopic ratios in the atmosphere offer important but subtle clues as to the origins of the planet's atmosphere, hydrology, geology, and potential for biology. In the search for life on Mars, an important process is the ability of bacteria to metabolize inorganic substrates (H₂, CO₂ and rock) to derive energy and produce methane as a by-product of anaerobic metabolism. Trace gases have been measured in the Mars atmosphere from Earth, Mars orbit, and from the Mars surface. The concentration of water vapor and various carbon-based trace gases are observed in variable concentrations. Within the past decade multiple groups have reported detection of CH₄, with concentrations in the 10's of ppb, using spectroscopic observations from Earth [2]. Passive spectrometers in the mid-infrared (MIR) are restricted to the sunlit side of the planet, generally in the mid latitudes, and have limited spectral and spatial resolution. To accurately map the global distribution and to locate areas of possibly higher concentrations of these gases such as plumes or vents requires an instrument with high sensitivity and fine spatial resolution that also has global coverage and can measure during both day and night. Our development goal is a new MIR lidar capable of measuring, on global scales, with sensitivity, resolution and precision needed to characterize the trace gases and isotopic ratios of the Martian atmosphere. An optical parametric oscillator operating in the MIR is well suited for this instrument. The sufficient wavelength tuning range of the OPO can extend the measurements to other organic molecules, CO₂, atmospheric water vapor, clouds, temperature, dust, and aerosols, as well as possibly polar-cap properties. Our OPO-approach may allow a new capability for active remote sensing of the outer planets and moons, where the weaker sunlight further limit passive instruments. Here we report on the OPO development effort for this lidar instrument.

Author

Mars Atmosphere; Trace Elements; Carbon Dioxide; Hydrogen; Gas Analysis; Remote Sensing; High Resolution; Atmospheric Composition

20080039819 Naval Observatory, Washington, DC USA

Investigation of Change in the Computational Technique of the Sun's Physical Ephemeris in The Astronomical Almanac

Urban, Sean E; Kaplan, George H; Mar 22, 2007; 9 pp.; In English

Report No.(s): AD-A482955; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In The Astronomical Almanac, the heliographic latitude and longitude of the sub-Earth point are printed for each day of the year at 0h TT. Prior to the 2009 edition, neither the light-time correction nor a correction for aberration were applied to the rotation. Having both the light-time and aberration compensated for in the zero point of the meridian is possible only for the Sun since the Sun is essentially always the same distance from the Earth and the aberration correction is nearly constant, therefore the differences in light-time and aberration between perigee and apogee are small. This brought about a situation where the computation technique of the Sun's rotation has always been different from that of the other Solar System bodies. During the 2006 IAU General Assembly, the Working Group on Cartographic Coordinates and Rotational Elements (hereafter known simply as the group) decided that computing the Sun's rotation differently has detrimental effects. First, it confuses many people which has led to erroneous computations. Second, the method used previously is only valid at the Earth. Third, the accuracy is compromised because neither the light-time nor aberration is constant since the Earth-Sun distance varies. To make the computation consistent and applicable anywhere, the group recommends that the Wo value for the Sun, the angle of the prime meridian at the standard epoch, be foredated by an amount which approximately corresponds to the light-travel time. Using this new value, the computation must take into account the light travel time; that is, the rotation is antedated. The combination of foredating and antedating should have little effect on the values computed for locations on or near the Earth, but would make the computation technique more consistent with the other objects and be suitable anywhere in the Solar System. This paper documents the changes in the computational technique as suggested by the working group.

DTIC

Astronomy; Ephemerides; Rotation; Sun

20080040154 NASA Langley Research Center, Hampton, VA, USA

Preliminary Structural Design Considerations and Mass Efficiencies for Lunar Surface Manipulator Concepts

Dorsey, John T.; Mikulas, Martin M.; Doggett, William R.; September 09, 2008; 17 pp.; In English; AIAA Space 2008 Conference & Exposition, 9-11 Sep. 2008, San Diego, CA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 431731.04.02.04

Report No.(s): AIAA-2008-7916; LAR-17528-1; Copyright; Avail.: CASI: [A03](#), Hardcopy

The mass and sizing characteristics of manipulators for Lunar and Mars planetary surface applications are investigated by analyzing three structural configurations: a simple cantilevered boom with a square tubular cross-section; a hybrid cable/boom configuration with a square tubular cross-section support structure; and a hybrid cable/boom configuration with a square truss cross-section support structure. Design procedures are developed for the three configurations and numerical examples are given. A new set of performance parameters are developed that relate the mass of manipulators and cranes to a loading parameter. These parameters enable the masses of different manipulator configurations to be compared over a wide range of design loads and reach envelopes (radii). The use of these parameters is demonstrated in the form of a structural efficiency chart using the newly considered manipulator configurations. To understand the performance of Lunar and Mars manipulators, the design procedures were exercised on the three manipulator configurations assuming graphite/epoxy materials for the tubes and trusses. It is also assumed that the actuators are electric motor, gear reduction systems. Numerical results for manipulator masses and sizes are presented for a variety of manipulator reach and payload mass capabilities. Results are presented that demonstrate the sensitivity of manipulator mass to operational radius, tip force, and actuator efficiency. The effect of the value of gravitational force on the ratio of manipulator-mass to payload-mass is also shown. Finally, results are presented to demonstrate the relative mass reduction for the use of graphite/epoxy compared to aluminum for the support structure.

Author

Lunar Surface; Manipulators; Structural Design; Planetary Surfaces; Mars Surface; Loads (Forces)

20080040726 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Advanced Imaging for Space Science

Lyon, Richard G.; [2008]; 1 pp.; In English; Frontiers in Optics 2008, 19-23 Oct. 2008, Rochester, NY, USA; No Copyright; Avail.: Other Sources; Abstract Only

Future NASA interferometric missions will realize high-resolution with less mass and volume compared to filled-apertures thus saving in cost over comparable filled-aperture systems. However, interferometric aperture systems give reduced sensitivity requiring longer integration times to achieve a desired signal-to-noise ratio but is likely the only cost effective path forward for high-resolution space imaging.

Author

NASA Programs; Imaging Techniques; High Resolution; Signal to Noise Ratios; Interferometry; Apertures

20080040737 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Topological Evolution of a Fast Magnetic Breakout CME in 3-Dimensions

Lynch, B. J.; Antiochos, S. K.; DeVore, C. R.; Luhmann, J. G.; Zurbuchen, T. H.; [2008]; 40 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NSF ATM-0621725; Copyright; Avail.: CASI: [A03](#), Hardcopy

We present the extension of the magnetic breakout model for CME initiation to a fully 3-dimensional, spherical geometry. Given the increased complexity of the dynamic magnetic field interactions in 3-dimensions, we first present a summary of the well known axisymmetric breakout scenario in terms of the topological evolution associated with the various phases of the eruptive process. In this context, we discuss the completely analogous topological evolution during the magnetic breakout CME initiation process in the simplest 3-dimensional multipolar system. We show that an extended bipolar active region embedded in an oppositely directed background dipole field has all the necessary topological features required for magnetic breakout, i.e. a fan separatrix surface between the two distinct flux systems, a pair of spine fieldlines, and a true 3-dimensional coronal null point at their intersection. We then present the results of a numerical MHD simulation of this 3-dimensional system where boundary shearing flows introduce free magnetic energy, eventually leading to a fast magnetic breakout CME. The eruptive flare reconnection facilitates the rapid conversion of this stored free magnetic energy into kinetic energy and the associated acceleration causes the erupting field and plasma structure to reach an asymptotic eruption velocity of greater than or approx. equal to 1100 km/s over an approx. 15 minute time period. The simulation results are discussed using the topological

insight developed to interpret the various phases of the eruption and the complex, dynamic, and interacting magnetic field structures.

Author

Magnetic Fields; Magnetohydrodynamics; Coronal Mass Ejection; Coronas; Bipolarity; Kinetic Energy

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ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20080039262 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Cassini Observations of Saturn's Dawn-Magnetotail Region: Preliminary Results

Sittler, Edward C.; EPSC Abstracts; 2007; Volume 2; 1 pp.; In English; European Planetary (Europlanet) Science Congress 2007, 20-24 Aug. 2007, Potsdam, Germany

Report No.(s): EPSC2007-A-00428; Copyright; Avail.: Other Sources; Abstract Only

Using Cassini thermal plasma, hot plasma and magnetic field observations for several intervals between the dawn meridian of Saturn's outer magnetosphere and Saturn's magnetotail region, we investigate the structure of the magnetotail, plasma and magnetic field properties within tail-like current sheet regions and ion flows within the dawn to magnetotail regions. We use Cassini Plasma Spectrometer (CAPS) Ion Mass Spectrometer (IMS) and Electron Plasma Spectrometer (ELS) observations and MIMI LEMMS ion and electron observations to characterize the plasma environment. LMS observations are used to measure plasma flow velocities from which one can infer rotation versus convective flows. IMS composition measurements are used to trace the source of plasma from the inner magnetosphere (protons, H²⁺) and water group ions) versus an external solar wind source (protons and He⁺⁺ ions). A critical parameter for both models is the strength of the convection electric field with respect to the rotational electric field for the large scale magnetosphere. For example, are there significant return flows (i.e., negative radial velocities, $V(\text{sub } R) < 0$) and/or plasmoids ($V(\text{sub } R) > 0$) within the magnetotail region?

Author

Cassini Mission; Saturn (Planet); Magnetohydrodynamic Flow; Thermal Plasmas; Planetary Magnetotails; Magnetic Fields; Ions; Mass Spectrometers; High Temperature Plasmas

20080039265 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Virtual Energetic Particle Observatory for the Heliospheric Data Environment

Cooper, J. F.; Armstrong, T. P.; Hill, M. E.; Lal, N.; McGuire, R. E.; McKibben, R. B.; Narock, T. W.; Szabo, A.; Tranquille, C.; December 10, 2007; 2 pp.; In English; Fall 2007 AGU Meeting, 10-14 Dec. 2007, San Francisco, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

The heliosphere is pervaded by interplanetary energetic particles, traditionally also called cosmic rays, from solar, internal heliospheric, and galactic sources. The particles species of interest to heliophysics extend from plasma energies to the GeV energies of galactic cosmic rays still measurably affected by heliospheric modulation and the still higher energies contributing to atmospheric ionization. The NASA and international Heliospheric Network of operational and legacy spacecraft measures interplanetary fluxes of these particles. Spatial coverage extends from the inner heliosphere and geospace to the heliosheath boundary region now being traversed by Voyager 1 and soon by Voyager 2. Science objectives include investigation of solar flare and coronal mass ejection events, acceleration and transport of interplanetary particles within the inner heliosphere, cosmic ray interactions with planetary surfaces and atmospheres, sources of suprathermal and anomalous cosmic ray ions in the outer heliosphere, and solar cycle modulation of galactic cosmic rays. The Virtual Energetic Particle Observatory (VEPO) will improve access and usability of selected spacecraft and sub-orbital NASA heliospheric energetic particle data sets as a newly approved effort within the evolving heliophysics virtual observatory environment. In this presentation, we will describe current VEPO science requirements, our initial priorities and an overview of our strategy to implement VEPO rapidly and at minimal cost by working within the high-level framework of the Virtual Heliospheric Observatory (VHO). VEPO will also leverage existing data services of NASA's Space Physics Data Facility and other existing capabilities of the U.S. and international heliospheric research communities.

Author

Cosmic Rays; Energetic Particles; Ions; Heliosphere; Solar Flares; Coronal Mass Ejection; Galactic Cosmic Rays; Mass Transfer

20080039336 NASA Goddard Space Flight Center, Greenbelt, MD, USA

EUNIS-07: First Look

Rabin, Douglas M.; Thomas, Roger J.; Brosius, Jeffrey W.; May 26, 2008; 1 pp.; In English; AGU/SPD Conference, 26-30 May 2008, Fort Lauderdale, FL, USA; Copyright; Avail.: Other Sources; Abstract Only

The Extreme Ultraviolet Normal Incidence Spectrograph (EUNIS) sounding rocket instrument is a two-channel imaging spectrograph that observes the solar corona with high spectral resolution and a rapid cadence made possible by unprecedented sensitivity. EUNIS flew for the first time on 2006 April 12 (EUNIS-06), returning over 140 science exposures at a cadence of 2.1 s; each exposure comprises six 1K x 1K active pixel sensor (APS) images, three for each wavelength channel (170-205 Å and 300-370 Å). Analysis of EUNIS-06 data has so far shed new light on the nature of coronal bright points, cool transients, and coronal loop arcades and has enabled calibration updates for TRACE and SOHO's CDS and EIT. EUNIS flew successfully again on 2007 November 6 (EUNIS-07). Because the APS's were operated in video rather than snapshot mode, a faster cadence of 1.3 s was possible (97% duty cycle), resulting in 276 science exposures. We present an overview of the EUNIS-07 spectra and describe the coordinated observing program executed by the Hinode Extreme ultraviolet Imaging Spectrograph (EIS) that will, in conjunction with the absolute radiometric calibration of EUNIS-07, result in the first on-orbit radiometric calibration of EIS. EUNIS data are freely available to the solar physics community. EUNIS is supported by the NASA Heliophysics Division through its Low Cost Access to Space Program in Solar and Heliospheric Physics.

Author

Ultraviolet Spectrometers; Solar Physics; Coronal Loops; Imaging Techniques; Sounding Rockets; Solar Corona

20080039427 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Aura Mission

Schoeberl, Mark R.; February 05, 2008; 1 pp.; In English; SORCE Science Meeting 2008, 5-7 Feb. 2008, Santa Fe, NM, USA; No Copyright; Avail.: Other Sources; Abstract Only

Aura was designed to probe the chemistry of the troposphere as well as the stratosphere. Two instruments, the Microwave Limb Sounder, the Tropospheric Emission Spectrometer (TES) and the Ozone Monitoring Instrument (OMI) have provided some remarkable information on pollution, long range pollution transport and strat-trop exchange. This talk will review some of the more startling observations and some new science that we are seeing in the Aura data.

Author

Aura Spacecraft; Troposphere; Ozone; Microwave Sounding; Stratosphere

20080039429 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Interplanetary Dust Clouds Near 1AU Detected by STEREO

Kaiser; Goetz; Saint Cyr; Bale; Maksimovic; December 10, 2007; 1 pp.; In English; 2007 Fall AGU meeting, 10-14 Dec. 2007, San Francisco, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

For a 21 day interval beginning on Jan 28, 2007, the radio and plasma wave instruments (S/WAVES) on the twin STEREO spacecraft detected intense impulse-like emissions in both the time-domain receivers and the low end of the frequency-domain receivers. These emissions were much more intense on the STEREO Ahead instrument, but were detected by both. During that interval, the two STEREO spacecraft were only separated by about 0.1deg in heliocentric longitude. All attempts to understand the emissions in terms of electrical disturbances onboard the spacecraft were unsuccessful and, since the impulsive events essentially ceased on Feb 18, 2007, the entire study was put on lower priority. However, beginning abruptly on July 20, 2007, a very similar and more intense episode of impulses was detected exclusively by S/WAVES on the STEREO Ahead spacecraft, now separated from Behind by more than 20deg of heliocentric longitude. This new episode lasted nearly as long as the Jan-Feb episode, some 20 days, ending on Aug. 9. On Aug. 13, 2007, the STEREO Behind spacecraft arrived at the same heliocentric longitude as the Ahead spacecraft was at on July 20 and the S/WAVES instrument abruptly started detecting impulsive events, although at lower intensities than those on Ahead. The individual waveform of the detected impulses is very similar to signals recorded by the Voyager plasma wave (PWS) and radio astronomy (PRA) instruments and more recently by the Cassini radio and plasma wave science (RPWS) instrument when those spacecraft plunged through Saturn's rings. Those Saturnian signals are attributed to micron-sized dust particle impacts on the spacecraft which creates a temporary plasma cloud which, in turn, induces an electrical signal on the antennas. We reanalyzed the STEREO episodes along the lines of the Saturnian ring plane analyses and have concluded that the STEREO impulses are very likely due to similar dust impacts with bands or clouds of dust of cometary or, more generally, zodiacal light material near 1 AU. The distribution of these clouds of small dust particles is significantly different than theoretical models of interplanetary dust distribution

Author

Interplanetary Dust; Plasma Clouds; Radio Waves; Plasma Waves; STEREO (Observatory); Radio Astronomy; S Waves; Microparticles; Detection

20080039442 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Construction of a Penrose Diagram for a Spatially Coherent Evaporating Black Hole

Brown, Beth A.; Lindesay, James; To be submitted to *Classical and Quantum Gravity*; [2007]; 12 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

A Penrose diagram is constructed for an example black hole that evaporates at a steady rate as measured by a distant observer, until the mass vanishes, yielding a final state Minkowski space-time. Coordinate dependencies of significant features, such as the horizon and coordinate anomalies, are clearly demonstrated on the diagram. The large-scale causal structure of the space-time is briefly discussed.

Author

Black Holes (Astronomy); Evaporation; Coordinates

20080039443 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Symbiotic System SS73 17 seen with Suzaku

Smith, Randall K.; Mushotzky, Richard; Kallman, Tim; Tueller, Jack; Mukai, Koji; Markwardt, Craig; To be published in *Astronomical Society of Japan*; [2007]; 6 pp.; In English; Original contains black and white illustrations

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We observed with Suzaku the symbiotic star SS73 17, motivated by the discovery by the INTEGRAL satellite and the Swift BAT survey that it emits hard X-rays. Our observations showed a highly-absorbed X-ray spectrum with $NH > 10^{23}$ cm⁻², equivalent to $A_V > 26$, although the source has B magnitude 11.3 and is also bright in UV. The source also shows strong, narrow iron lines including fluorescent Fe K as well as Fe xxv and Fe XXVI. The X-ray spectrum can be fit with a thermal model including an absorption component that partially covers the source. Most of the equivalent width of the iron fluorescent line in this model can be explained as a combination of reprocessing in a dense absorber plus reflection off a white dwarf surface, but it is likely that the continuum is partially seen in reflection as well. Unlike other symbiotic systems that show hard X-ray emission (CH Cyg, RT Cru, T CrB, GX1+4), SS73 17 is not known to have shown nova-like optical variability, X-ray flashes, or pulsations, and has always shown faint soft X-ray emission. As a result, although it is likely a white dwarf, the nature of the compact object in SS73 17 is still uncertain. SS73 17 is probably an extreme example of the recently discovered and relatively small class of hard X-ray emitting symbiotic systems.

Author

Cygnus Constellation; Symbiotic Stars; Binary Stars; X Rays; Continuum; Fluorescence

20080039444 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Discovery of the Accretion-Powered Millisecond Pulsar SWIFT 51756.9-2508 with a Low-Mass Companion

Krimm, H.A.; Markwardt, C.B.; Deloye, C.J.; Romano, P.; Chakrabarty, S.; Campana, S.; Cummings, J.C.; Galloway, D.K.; Gehrels, N.; Hartman, J.M.; Kaaret, P.; Morgan, E.H.; Tueller, J; Submitted to *Astrophysical Journal Letters*; August 17, 2007; 13 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNG06EO90A; ASI I/011/070/0; PRIN 2005025417; CXC TM7-800; Copyright; Avail.: CASI: [A03](#), Hardcopy

We report on the discovery by the Swift Gamma-Ray Burst Explorer of the eighth known transient accretion-powered millisecond pulsar: SWIFT J1756.9-2508, as part of routine observations with the Swift Burst Alert Telescope hard X-ray transient monitor. The pulsar was subsequently observed by both the X-Ray Telescope on Swift and the Rossi X-Ray Timing Explorer Proportional Counter Array. It has a spin frequency of 182 Hz (5.5 ms) and an orbital period of 54.7 minutes. The minimum companion mass is between 0.0067 and 0.0086 Solar Mass, depending on the mass of the neutron star, and the upper limit on the mass is 0.030 Solar Mass (95% confidence level). Such a low mass is inconsistent with brown dwarf models, and comparison with white dwarf models suggests that the companion is a He-dominated donor whose thermal cooling has been at least modestly slowed by irradiation from the accretion flux. No X-ray bursts, dips, eclipses or quasi-periodic oscillations were detected. The current outburst lasted approx. 13 days and no earlier outbursts were found in archival data.

Author

X Ray Timing Explorer; Pulsars; White Dwarf Stars; Swift Observatory; Brown Dwarf Stars; Confidence Limits; Stellar Mass; Gamma Ray Bursts; Neutron Stars

20080039445 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Swift X-Ray Telescope: Status and Performance

Burrows, David N.; Kennea, J.A.; Abbey, A.F.; Beardmore, A.; Campana, S.; Capalbi, M.; Chincarini, G.; Cusumano, G.; Evans, P.A.; Hill, J.E.; Giommi, P.; Goad, M.; Godet, O.; Moretti, A.; Morris, D.C.; Osborne, J.P.; Pagani, C.; Page, K.L.; Perri, M.; Racusin, J.; Romano, P.; Starling, R.L.C.; Tagliaferri, G.; Tamburelli, F.; Tyler, L.G.; Submitted to SPIE Proceedings; [2007]; 9 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAS500136; NNG06EO90A; Copyright; Avail.: CASI: [A02](#), Hardcopy

We present science highlights and performance from the Swift X-ray Telescope (XRT), which was launched on November 20, 2004. The XRT covers the 0.2-10 keV band, and spends most of its time observing gamma-ray burst (GRB) afterglows, though it has also performed observations of many other objects. By mid-August 2007, the XRT had observed over 220 GRB afterglows, detecting about 96% of them. The XRT positions enable followup ground-based optical observations, with roughly 60% of the afterglows detected at optical or near IR wavelengths. Redshifts are measured for 33% of X-ray afterglows. Science highlights include the discovery of flaring behavior at quite late times, with implications for GRB central engines; localization of short GRBs, leading to observational support for compact merger progenitors for this class of bursts; a mysterious plateau phase to GRB afterglows; as well as many other interesting observations such as X-ray emission from comets, novae, galactic transients, and other objects.

Author

X Ray Telescopes; Gamma Ray Bursts; Afterglows; Near Infrared Radiation; Visual Observation; Detection; Comets

20080039446 NASA Goddard Space Flight Center, Greenbelt, MD, USA

High-Resolution N-Band Observations of the Nova RS Ophiuchi with the Keck Interferometer Nuller

Barry, R. K.; Danchi, W. C.; Sokoloski, J. L.; Koresko, C.; Wisniewski, J. P.; Serabyn, E.; Traub, W.; Kuchner, M.; Greenhouse, M. A.; [2007]; 31 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNH06CC03B; Copyright; Avail.: CASI: [A03](#), Hardcopy

We report new observations of the nova RS Ophiuchi (RS Oph) using the Keck Interferometer Nulling Instrument, approximately 3.8 days following the most recent outburst that occurred on 2006 February 12. The Keck Interferometer Nuller (KIN) operates in K-band from 8 to 12.5 μm in a nulling mode, which means that the central broad-band interference fringe is a dark fringe - with an angular width of 25 mas at mid band - rather than the bright fringe used in a conventional optical interferometer. In this mode the stellar light itself is suppressed by the destructive fringe, effectively enhancing the contrast of the circumstellar material located near the star. By subsequently shifting the neighboring bright fringe onto the center of the source brightness distribution and integrating, a second spatial regime dominated by light from the central portion of the source is almost simultaneously sampled. The nulling technique is the sparse aperture equivalent of the conventional coronagraphic technique used in filled aperture telescopes. By fitting the unique KIK inner and outer spatial regime data, we have obtained an angular size of the mid-infrared continuum of 6.2, 4.0, or 5.4 mas for a disk profile, gaussian profile (fwhm), and shell profile respectively. The data show evidence of enhanced neutral atomic hydrogen emission located in the inner spatial regime relative to the outer regime. There is also evidence of a 9.7 micron silicate feature seen outside of this region. Importantly, we see spectral lines excited by the nova flash in the outer region before the blast wave reaches these regions. These lines are from neutral, weakly excited atoms which support the following interpretation. We discuss the present results in terms of a unifying model of the system that includes an increase in density in the plane of the orbit of the two stars created by a spiral shock wave caused by the motion of the stars through the cool wind of the red giant star. These data show the power and potential of the nulling technique which has been developed for the detection of Earth-like planets around nearby stars for the Terrestrial Planet Finder Mission and Darwin missions.

Author

Brightness Distribution; Stellar Envelopes; Red Giant Stars; Optical Measuring Instruments; High Resolution; Detonation Waves; Neutral Gases; Broadband

20080039556 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Drift-Resonant Interaction of Magnetospheric Relativistic Electrons with Ultra-Low Frequency (ULF) Waves: Comparison between Observations and Simulations

Fung, Shing, et al.; December 10, 2007; 2 pp.; In English; 2007 Fall AGU meeting, 10-14 Dec. 2007, San Francisco, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

By analyzing CRRES and GOES observations on Aug. 27 1991, Tan et al. [2004] reported evidence of magnetospheric relativistic electron acceleration by resonant interactions with PC5 ULF waves. The event showed strong ULF wave activities after a storm sudden commencement (SSC) and energetic electron fluxes were enhanced in 2 hours. The electron flux peak

observed in energy channels (0.6 - 1.1 MeV) were modulated by local electric field observed by CRRES. In this study, we set up a drift-resonant interaction model between ULF wave and magnetospheric relativistic electrons to model the observed electron flux in the event. In this model, the poloidal mode wave is concentrated in the dayside and the toroidal mode wave is concentrated in two flanks. The toroidal mode waves in the dawn and dusk flanks are in anti-phase. We found that electron can be accelerated jointly by the poloidal wave in the dayside and toroidal wave in flanks. The dayside poloidal wave serves as the dominant source of electron acceleration. The simulated electron flux variations agree well with observations both in fine details and long period behavior. These agreements in electron behavior indicate that the ULF wave plays an important role in accelerating MeV relativistic electrons around the geosynchronous orbit.

Author

Relativistic Particles; High Energy Electrons; Extremely Low Frequencies; Geosynchronous Orbits; Electron Acceleration; CRRES (Satellite)

20080039557 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Development and Operation of the Microshutter Array System

Jhabvala, M. D.; Franz, D.; King, T.; Kletetschka, G.; Kutyrev, A. S.; Li, M. J.; March 16, 2008; 17 pp.; In English; SPIE Defense and Security, 16-20 mar. 2008, Orlando, FL, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The microshutter array (MSA) is a key component in the James Webb Space Telescope Near Infrared Spectrometer (NIRSpec) instrument. The James Webb Space Telescope is the next generation of a space-borne astronomy platform that is scheduled to be launched in 2013. However, in order to effectively operate the array and meet the severe operational requirements associated with a space flight mission has placed enormous constraints on the microshutter array subsystem. This paper will present an overview and description of the entire microshutter subsystem including the microshutter array, the hybridized array assembly, the integrated CMOS electronics, mechanical mounting module and the test methodology and performance of the fully assembled microshutter subsystem. The NIRSpec is a European Space Agency (ESA) instrument requiring four fully assembled microshutter arrays, or quads, which are independently addressed to allow for the imaging of selected celestial objects onto the two 4 mega pixel IR detectors. Each microshutter array must have no more than approx. 8 shutters which are failed in the open mode (depending on how many are failed closed) out of the 62,415 (365x171) total number of shutters per array. The driving science requirement is to be able to select up to 100 objects at a time to be spectrally imaged at the focal plane. The spectrum is dispersed in the direction of the 171 shutters so if there is an unwanted open shutter in that row the light from an object passing through that failed open shutter will corrupt the spectrum from the intended object.

Author

Infrared Detectors; James Webb Space Telescope; Near Infrared Radiation; Imaging Techniques

20080039561 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Catalog of Galaxy Clusters Observed by XMM-Newton

Snowden, S. L.; Mushotzky, R. M.; Kuntz, K. D.; Davis, David S.; [2007]; 66 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A04](#), Hardcopy

Images and the radial profiles of the temperature, abundance, and brightness for 70 clusters of galaxies observed by XMM-Newton are presented along with a detailed discussion of the data reduction and analysis methods, including background modeling, which were used in the processing. Proper consideration of the various background components is vital to extend the reliable determination of cluster parameters to the largest possible cluster radii. The various components of the background including the quiescent particle background, cosmic diffuse emission, soft proton contamination, and solar wind charge exchange emission are discussed along with suggested means of their identification, filtering, and/or their modeling and subtraction. Every component is spectrally variable, sometimes significantly so, and all components except the cosmic background are temporally variable as well. The distributions of the events over the FOV vary between the components, and some distributions vary with energy. The scientific results from observations of low surface brightness objects and the diffuse background itself can be strongly affected by these background components and therefore great care should be taken in their consideration.

Author

Galactic Clusters; Catalogs (Publications); XMM-Newton Telescope; Solar Wind; Particle Emission; Data Reduction; Charge Exchange; Brightness

20080039563 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Swift-XRT imaging Performances and Serendipitous Survey

Moretti, A.; Perri, M.; Capalbi, M.; Abbey, A.F.; Angelini, L.; Beardmore, A.; Burrows, D.N.; Campana, S.; Chincaini, G.; Citterio, O.; Cusumano, G.; Evans, P.A.; Giommi, P.; Godet, O.; Guidorzi, C.; Grupe, D.; Hill, J.E.; Kennea, J.A.; La Parola, V.; Mangano, V.; Mineo, T.; Morris, D.C.; Nousek, J.A.; Osborne, J.P.; Page, K.L.; To be submitted to SPIE Proceedings/SPIE; [2007]; 10 pp.; In English; Original contains poor quality, truncated or crooked pages

Contract(s)/Grant(s): NNG06EO90A; Copyright; Avail.: CASI: [A02](#), Hardcopy

We are exploiting the Swift X-ray Telescope (XRT) deepest GR.B follow-up observations to study the cosmic X-Ray Background (XRB) population in the 0.2-10 keV energy band. We present some preliminary results of a serendipitous survey performed on 221 fields observed with exposure longer than 10 ks. We show that the XRT is a profitable instrument for surveys and that it is particularly suitable for the search and observation of extended objects like clusters of galaxies. We used the brightest serendipitous sources and the longest observations to test the XRT optics performance and the background characteristics all over the field of view, in different energy bands during the first 2.5 years of fully operational missions.

Author

X Ray Telescopes; Galactic Clusters; Imaging Techniques; Field of View; Background Radiation

20080039565 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Variations of the Mid-IR Aromatic Features Inside and Among Galaxies

Galliano, F.; Madden, S.C.; Tielens, A. G. G. M.; Peeters, E.; Jones, A. P.; To be submitted to Astrophysical Journal.; [2007]; 63 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A04](#), Hardcopy

We present the results of a systematic study of mid-IR spectra of Galactic regions, Magellanic H II regions, and galaxies of various types (dwarf, spiral, starburst), observed by the satellites ISO and Spitzer. We study the relative variations of the 6.2, 7.7, 8.6 and 11.3 micron features inside spatially resolved objects (such as M 82, M 51, 30 Doradus, M 17 and the Orion bar), as well as among 90 integrated spectra of 50 objects. Our main results are that the 6.2, 7.7 and 8.6 micron bands are essentially tied together, while the ratios between these bands and the 11.3 micron band varies by one order of magnitude. This implies that the properties of the PAHs are remarkably universal throughout our sample, and that the relative variations of the band ratios are mainly controlled by the fraction of ionized PAHs. In particular, we show that we can rule out the modification of the PAH size distribution as an explanation of these variations. Using a few well-studied Galactic regions (including the spectral image of the Orion bar), we give an empirical relation between the $I(6.2)/I(11.3)$ ratio and the ionization/recombination ratio $G_0/n(\text{sub } e) \times \text{square root of}(T(\text{sub } \text{gas}))$. Finally, we discuss the physical interpretation of the $I(6.2)/I(11.3)$ ratio, on galactic size scales.

Author

Polycyclic Aromatic Hydrocarbons; Starburst Galaxies; Size Distribution; Infrared Radiation; Magellanic Clouds; Ionization

20080039614 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Orbital Observatory GLAST - New Step in the Study of Cosmic Gamma Radiation: Mission Overview

Moiseev, Alexander; June 02, 2008; 31 pp.; In English; 30th Russian Cosmic Ray Conference, 2-7 Jul. 2008, Saint Petersburg, Russia; Original contains color illustrations

Contract(s)/Grant(s): NNG06EO90A; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039614>

This viewgraph presentation is a overview of the Gamma-ray Large Area Space Telescope (GLAST), now named Fermi Space Telescope. The new telescope is scheduled for launch in the middle of 2008. It contains the high energy gamma-ray telescope LAT (Large Area Telescope) and the GMB (GLAST Burst Monitor). The science objectives of GLAST cover almost every area of high energy astrophysics, including Active Galactic Nuclei (AGN), including Extragalactic background light (EBL), Gamma-ray bursts (GRB), Pulsars, Diffuse gamma-radiation, EGRET unidentified sources, Solar physics, Origin of Cosmic Rays and, Dark Matter and New Physics. Also included in this overview is a discussion of the preparation to the analysis of the science data.

CASI

Spaceborne Telescopes; Fermi Gamma-Ray Space Telescope; Gamma Ray Astronomy; Spaceborne Astronomy; Satellite-Borne Instruments

20080039623 NASA Goddard Space Flight Center, Greenbelt, MD, USA

POET: Polarimeters for Energetic Transients

Hill, J. E.; McConnell, M. L.; Bloser, P.; Legere, J.; Macri, J.; Ryan, J.; Barthelmy, S.; Angelini, L.; Sakamoto, T.; Black, J. K.; Hartmann, D. H.; Kaaret, P.; Zhang, B.; Ioka, K.; Nakamura, T.; Toma, K.; Yamazaki, R.; Wu, X.; [2008]; 7 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

POET (Polarimeters for Energetic Transients) is a Small Explorer mission concept proposed to NASA in January 2008. The principal scientific goal of POET is to measure GRB polarization between 2 and 500 keV. The payload consists of two wide FoV instruments: a Low Energy Polarimeter (LEP) capable of polarization measurements in the energy range from 2-15 keV and a high energy polarimeter (Gamma-Ray Polarimeter Experiment - GRAPE) that will measure polarization in the 60-500 keV energy range. Spectra will be measured from 2 keV up to 1 MeV. The POET spacecraft provides a zenith-pointed platform for maximizing the exposure to deep space. Spacecraft rotation will provide a means of effectively dealing with systematics in the polarization response. POET will provide sufficient sensitivity and sky coverage to measure statistically significant polarization for up to 100 GRBs in a two-year mission. Polarization data will also be obtained for solar flares, pulsars and other sources of astronomical interest.

Author

Polarimeters; Solar Flares; Astronomy; Exposure; Pulsars

20080040145 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Operation and Evolution of the Swift X-ray Telescope

Kennea, Jamie; Burrows, D. N.; Pagani, C.; Hill, Joanne; Racusin, J. L.; Morris, D. C.; Abbey, A. F.; Beardmore, A. P.; Campana, G.; Chincarini, G.; Cusumano, G.; Evans, P. A.; Gehrels, N.; Godet, O.; Mineo, T.; LaParola, V.; Mangano, V.; Moretti, A.; Nousek, J. A.; Osborne, J. P.; Page, K. L.; Perri, M.; Starling, R. L. C.; Tagliaferri, G.; Tamburelli, F.; [2007]; 8 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAS500136; NNG06EO90A; PPA/G/S/00524; PPA/Z/S/2003/00507; ASI I/011/07/0; Copyright;

Avail.: CASI: [A02](#), Hardcopy

The Swift X-ray Telescope (XRT) is a CCD based X-ray telescope designed for localization, spectroscopy and long term light curve monitoring of Gamma-Ray Bursts and their X-ray afterglows. Since the launch of Swift in November 2004, the XRT has undergone significant evolution in the way it is operated. Shortly after launch there was a failure of the thermo-electric cooler on the XRT CCD, which led to the XRT team being required to devise a method of keeping the XRT CCD temperature below 50C utilizing only passive cooling by minimizing the exposure of the XRT radiator to the Earth. We present in this paper an update on how the modeling of this passive cooling method has improved in first -1000 days since the method was devised, and the success rate of this method in day-to-day planning. We also discuss the changes to the operational modes and onboard software of the XRT. These changes include improved rapid data product generation in order to improve speed of rapid Gamma-Ray Burst response and localization to the community; changes to the way XRT observation modes are chosen in order to better fine tune data acquisition to a particular science goal; reduction of 'mode switching' caused by the contamination of the CCD by Earth light or high temperature effects.

Author

X Ray Telescopes; Charge Coupled Devices; Gamma Ray Bursts; Afterglows; Cooling; Light Curve; Temperature Effects

20080040146 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Burst Chasing X-ray Polarimeter

Hill, Joanne E.; Barthelmy, Scott; Black, J. Kevin; Deines-Jones, Philip; Jahoda, Keith; Sakamoto, Takanori; Kaaret, Philip; McConnell, Mark L.; Bloser, Peter F.; Macri, John R.; Legere, Jason S.; Ryan, James M.; Smith, Billy R., Jr.; Zhang, Bing; [2007]; 12 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNG06EO90A; Copyright; Avail.: CASI: [A03](#), Hardcopy

Gamma-ray bursts are one of the most powerful explosions in the universe and have been detected out to distances of almost 13 billion light years. The exact origin of these energetic explosions is still unknown but the resulting huge release of energy is thought to create a highly relativistic jet of material and a power-law distribution of electrons. There are several theories describing the origin of the prompt GRB emission that currently cannot be distinguished. Measurements of the linear polarization would provide unique and important constraints on the mechanisms thought to drive these powerful explosions. We present the design of a sensitive, and extremely versatile gamma-ray burst polarimeter. The instrument is a photoelectric polarimeter based on a time-projection chamber. The photoelectric time-projection technique combines high sensitivity with broad band-pass and is potentially the most powerful method between 2 and 100 keV where the photoelectric effect is the dominant interaction process. We present measurements of polarized and unpolarized X-rays obtained with a prototype

detector and describe the two mission concepts, the Gamma-Ray Burst Polarimeter (GRBP) for the U S Naval Academy satellite MidSTAR-2, and the Low Energy Polarimeter (LEP) onboard POET, a broadband polarimetry concept for a small explorer mission.

Author

Gamma Ray Bursts; Explosions; Linear Polarization; Photoelectric Effect; Polarimeters; Electrons

20080040150 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Five Millennium Catalog of Solar Eclipses: -1999 to +3000 (2000 BCE to 3000 CE)

Espenak, Fred; Meeus, Jean; August 2008; 276 pp.; In English; Original contains color and black and white illustrations
Report No.(s): NASA/TP-2008-214170; Rept-200702402; Copyright; Avail.: CASI: [A13](#), Hardcopy

This catalog is a supplement to the 'Five Millennium Canon of Solar Eclipses.' It includes additional information for each eclipse that could not be included in the original 648-page publication because of size limits. The data tabulated for each eclipse include the catalog number, canon plate number, calendar date, Terrestrial Dynamical Time of greatest eclipse, (Delta)T, lunation number, Saros number, eclipse type, Quincena Lunar Eclipse parameter, gamma, eclipse magnitude, geographic coordinates of greatest eclipse (latitude and longitude), and the circumstances at greatest eclipse (i.e., Sun altitude and azimuth, path width, and central line duration). The Canon and the Catalog both use the same solar and lunar ephemerides as well as the same values of (Delta)T. This 1-to-1 correspondence between them will enhance the value of each. The researcher may now search, evaluate, and compare eclipses graphically (Canon) or textually (Catalog).

Author

Lunar Eclipses; Ephemerides; Sun; Catalogs (Publications); Eclipses

20080040165 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Emission-Line Galaxies from the PEARS Hubble Ultra Deep Field: A 2-D Detection Method and First Results

Gardner, J. P.; Straughn, Amber N.; Meurer, Gerhard R.; Pirzkal, Norbert; Cohen, Seth H.; Malhotra, Sangeeta; Rhoads, James; Windhorst, Rogier A.; Gardner, Jonathan P.; Hathi, Nimish P.; Xu, Chun; Gronwall, Caryl; Koekemoer, Anton M.; Walsh, Jeremy; diSeregoAlighieri, Sperello; [2007]; 37 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAS5-26555; HST-GO-10530; HST-GO-9793; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Hubble Space Telescope (HST) Advanced Camera for Surveys (ACS) grism PEARS (Probing Evolution And Reionization Spectroscopically) survey provides a large dataset of low-resolution spectra from thousands of galaxies in the GOODS North and South fields. One important subset of objects in these data are emission-line galaxies (ELGs), and we have investigated several different methods aimed at systematically selecting these galaxies. Here we present a new methodology and results of a search for these ELGs in the PEARS observations of the Hubble Ultra Deep Field (HUDF) using a 2D detection method that utilizes the observation that many emission lines originate from clumpy knots within galaxies. This 2D line-finding method proves to be useful in detecting emission lines from compact knots within galaxies that might not otherwise be detected using more traditional 1D line-finding techniques. We find in total 96 emission lines in the HUDF, originating from 81 distinct 'knots' within 63 individual galaxies. We find in general that [O III] emitters are the most common, comprising 44% of the sample, and on average have high equivalent widths (70% of [O III] emitters having rest-frame EW > 100Å). There are 12 galaxies with multiple emitting knots; several show evidence of variations in H-alpha flux in the knots, suggesting that the differing star formation properties across a single galaxy can in general be probed at redshifts approximately greater than 0.2 - 0.4. The most prevalent morphologies are large face-on spirals and clumpy interacting systems, many being unique detections owing to the 2D method described here, thus highlighting the strength of this technique.

Author

Detection; Emission Spectra; Star Formation; Starburst Galaxies; Spaceborne Astronomy

20080040171 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Carina Nebula with XMM-Newton

Hamaguchi, K.; Smith, N.; Brooks, K.; [2007]; 1 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NNH06E090A; No Copyright; Avail.: CASI: [A01](#), Hardcopy

This document is a black and white copy of an XMM-Newton picture of the Carina Nebula.

CASI

Images; Nebulae

20080040172 NASA Goddard Space Flight Center, Greenbelt, MD, USA

GCN and VOEvent - A Status Report

Barthelmy, Scott; [2006]; 2 pp.; In English; Copyright; Avail.: Other Sources

The GRB Coordinates Network (GCN) has filled an important niche in the conduct and progress of research on GRB for more than 14 years. The methods used to collect and distribute the positions, lightcurves, spectra, and images on GRB in real time (a few seconds) will be reviewed. For the research on GRBs to continue to move forward and for other fields of transient astronomy to move forward, enhancements are needed to the GCN. VOEvents is one of those changes, and that addition will be described here. The enhanced system will be called VO-GCN.

Author

Gamma Ray Bursts; Data Bases; Astronomical Coordinates

20080040178 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Magnetar-Like Emission from the Young Pulsar in Kes 75

Gavriil, F. P.; Gonzalez, M. E.; Gotthelf, E. V.; Kaspi, V. M.; Livingstone, M. A.; Woods, P. M.; Science; March 28, 2008; Volume 319, No. 5871, pp. 1802-1805; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNG06EO90A; 228738-03; NNG05GM87G; N5-RXTE05-34; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1126/Science.1153465>

We report the detection of magnetar-like x-ray bursts from the young pulsar PSR J1846-0258, at the center of the supernova remnant Kes 75. This pulsar, long thought to be exclusively rotation-powered, has an inferred surface dipolar magnetic field of 4.9×10^{13} gauss, which is higher than those of the vast majority of rotation-powered pulsars, but lower than those of the approximately 12 previously identified magnetars. The bursts were accompanied by a sudden flux increase and an unprecedented change in timing behavior. These phenomena lower the magnetic and rotational thresholds associated with magnetar-like behavior and suggest that in neutron stars there exists a continuum of magnetic activity that increases with inferred magnetic field strength.

Author

Magnetars; Continuums; Pulsars; Neutron Stars; Magnetic Flux; Magnetic Fields; Supernova Remnants

20080040205 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Entire Blow-Up Solutions of Semilinear Elliptic Equations and Systems

Peterson, Jesse D; Mar 2008; 82 pp.; In English; Original contains color illustrations

Report No.(s): AD-A482963; AFIT/GAM/ENC/08-02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We examine two problems concerning semilinear elliptic equations. We consider single equations of the form $\Delta u + q(x)u(\beta)$ for $0 < \alpha \leq \beta \leq 1$ and systems $\Delta u = p(|x|)f(v)$, $\Delta v = q(|x|)g(u)$, both in Euclidean n -space, $n \geq 3$. These types of problems arise in steady state diffusion, the electric potential of some bodies, subsonic motion of gases, and control theory. For the single equation case, we present sufficient conditions on p and q to guarantee existence of nonnegative bounded solutions on the entire space. We also give alternative conditions that ensure existence of nonnegative radial solutions blowing up at infinity. Similarly, for systems, we provide conditions on p , q , f , and g that guarantee existence of nonnegative solutions on the entire space. The main requirement for f and g will be closely related to a growth requirement known as the Keller-Osserman condition. Further, we demonstrate the existence of solutions blowing up at infinity and describe a set of initial conditions that would generate such solutions. Lastly, we examine several specific examples numerically to graphically demonstrate the results of our analysis.

DTIC

Ellipses; Elliptic Differential Equations; Equations

20080040710 NASA Goddard Space Flight Center, Greenbelt, MD, USA

From the Big Bang to the Nobel Prize and on to the James Webb Space Telescope

Mather, John C.; [2008]; 1 pp.; In English; Frontiers in Optics 2008 Laser Science XXIV, 19 - 21 Oct. 2008, Rochester, New York, USA; No Copyright; Avail.: Other Sources; Abstract Only

The history of the universe in a nutshell, from the Big Bang to now, and on to the future - John Mather will tell the story of how we got here, how the Universe began with a Big Bang, how it could have produced an Earth where sentient beings can live, and how those beings are discovering their history. Mather was Project Scientist for NASA's Cosmic Background Explorer (COBE) satellite, which measured the spectrum (the color) of the heat radiation from the Big Bang, discovered hot and cold spots in that radiation, and hunted for the first objects that formed after the great explosion. He will explain Einstein's

biggest mistake, show how Edwin Hubble discovered the expansion of the universe, how the COBE mission was built, and how the COBE data support the Big Bang theory. He will also show NASA's plans for the next great telescope in space, the James Webb Space Telescope. It will look even farther back in time than the Hubble Space Telescope, and will look inside the dusty cocoons where stars and planets are being born today. Planned for launch in 2013, it may lead to another Nobel Prize for some lucky observer.

Author

James Webb Space Telescope; Cosmic Background Explorer Satellite; Explorer Satellites; Explosions; Hubble Space Telescope

20080040713 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Wide-Field Imaging Interferometry Testbed (WIIT): Recent Progress and Results

Rinehart, Stephen A.; Frey, Bradley J.; Leisawitz, David T.; Lyon, Richard G.; Maher, Stephen F.; Martino, Anthony J.; June 23, 2008; 1 pp.; In English; SPIE Meeting, 23-28 Jun. 2008, Marseille, France

Report No.(s): Paper 7013-100; Copyright; Avail.: Other Sources; Abstract Only

Continued research with the Wide-Field Imaging Interferometry Testbed (WIIT) has achieved several important milestones. We have moved WIIT into the Advanced Interferometry and Metrology (AIM) Laboratory at Goddard, and have characterized the testbed in this well-controlled environment. The system is now completely automated and we are in the process of acquiring large data sets for analysis. In this paper, we discuss these new developments and outline our future research directions. The WIIT testbed, combined with new data analysis techniques and algorithms, provides a demonstration of the technique of wide-field interferometric imaging, a powerful tool for future space-borne interferometers.

Author

Interferometry; Imaging Techniques; Metrology; Data Processing

20080040714 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The International Heliophysical Year

Davila, Joseph M.; Gopalswamy, Nat; Thompson, Barbara; [2008]; 1 pp.; In English; IAU Symposium 257 'Universal Heliophysical Processes, 15 - 19 Sep. 2008, Ioannina, Greece; No Copyright; Avail.: Other Sources; Abstract Only

It is now widely recognized that evolution in the solar system proceeds through a set of Universal Processes, i.e. reconnection, particle acceleration, plasma wave generation and propagation, etc. By studying these Universal Processes together, in diverse environments, and in a comparative way, new scientific insights will be gained. This is perhaps best understood by citing a few examples: (1) Shocks are observed in situ in the interplanetary medium, shocks are believed to play a role in the acceleration of particles in the solar corona, and standing bow shocks and termination shocks separate the major regions in the heliosphere. Shock formation, and particle acceleration are universal processes. (2) Aurorae are observed on Earth, Saturn, and Jupiter, and Jovian auroral 'footprints' have been observed on Io, Ganymede and Europa. The formation of aurorae is observed to be the universal response of a magnetized body in the solar wind. The International Heliophysical Year (IHY) specifically highlights the cross-disciplinary study of universal physical processes in the solar system, observed in a variety of settings. The study of these processes will provide new insights that will lead to a better understanding of the universal processes in the solar system that affect the interplanetary and planetary environments, and pave the way for safe human space travel to the Moon and planets in the future, and it will serve to inspire the next generation of space physicists.

Author

Particle Acceleration; Wave Generation; Interplanetary Medium; Auroras; Planetary Environments; Heliosphere; Solar System

20080040718 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The James Webb Space Telescope

Garner, Jonathan P.; October 1, 2007; 8 pp.; In English; From Planets to Dark Energy: The Modern Radio Universe, 1-5 Oct. 2007, Manchester, UK; Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

The scientific capabilities of the James Webb Space Telescope (JWST) fall into four themes. The End of the Dark Ages: First Light and Reionization theme seeks to identify the first luminous sources to form and to determine the ionization history of the universe. The Assembly of Galaxies theme seeks to determine how galaxies and the dark matter, gas, stars, metals, morphological structures, and active nuclei within them evolved from the epoch of reionization to the present. The Birth of Stars and Protoplanetary Systems theme seeks to unravel the birth and early evolution of stars, from infall onto dust-enshrouded protostars, to the genesis of planetary systems. The Planetary Systems and the Origins of Life theme seeks

to determine the physical and chemical properties of planetary systems around nearby stars and of our own, and investigate the potential for life in those systems. To enable these four science themes, JWST will be a large (6.6m) cold (50K) telescope launched to the second Earth-Sun Lagrange point early in the next decade. It is the successor to the Hubble Space Telescope, and is a partnership of NASA, ESA and CSA. JWST will have four instruments: The Near-Infrared Camera, the Near-Infrared multi-object Spectrograph, and the Tunable Filter Imager will cover the wavelength range 0.6 to 5 microns, while the Mid-Infrared Instrument will do both imaging and spectroscopy from 5 to 28.5 microns. In this paper, the status and capabilities of the observatory and instruments in the context of the major scientific goals are reviewed.

Author (revised)

James Webb Space Telescope; Planetary Systems; Galaxies; Ionization; Stellar Evolution; Biological Evolution

20080040721 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Trails of Superluminal Jet Components in 3C 111

Kadler, M.; Ros, E.; Perucho, M.; Kovalev, Y. Y.; Homan, D. C.; Agudo, I.; Kellermann, K. I.; Aller, M. F.; Aller, H. D.; Lister, M. L.; Zensus, J. A.; [2007]; 50 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNH06CC03B; NSF AST-0406923; Copyright; Avail.: CASI: [A03](#), Hardcopy

The parsec-scale radio jet of the broad-line radio galaxy 3C 111 has been monitored since 1995 as part of the 2cm Survey and MOJAVE monitoring observations conducted with the VLBA. Here, we present results from 18 epochs of VLBA observations of 3C 111 and from 18 years of radio flux density monitoring observations conducted at the University of Michigan. A major radio flux-density outburst of 3C 111 occurred in 1996 and was followed by a particularly bright plasma ejection associated with a superluminal jet component. This major event allows us to study a variety of processes associated with outbursts of radio-loud AGN in much greater detail than possible in other cases: the primary perturbation gives rise to the formation of a forward and a backward-shock, which both evolve in characteristically different ways and allow us to draw conclusions about the workflow of jet-production events; the expansion, acceleration and recollimation of the ejected jet plasma in an environment with steep pressure and density gradients are revealed; trailing components are formed in the wake of the primary perturbation as a result of Kelvin-Helmholtz instabilities from the interaction of the jet with the external medium. The jet-medium interaction is further scrutinized by the linear-polarization signature of jet components traveling along the jet and passing a region of steep pressure/density gradients.

Author

Radio Galaxies; Active Galactic Nuclei; Radio Astronomy; Radio Emission

20080040734 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Interferometric Testbed for Nanometer Level Stabilization of Environmental Motion Over Long Timescales

Numata, Kenji; Camp, Jordan; [2008]; 25 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NMG06EO90A; Copyright; Avail.: Other Sources

We developed an interferometric testbed to stabilize environmental motions over timescales of several hours and a lengthscale of 1m. Typically, thermal and seismic motions on the ground are larger than 1 micron over these scales, affecting the precision of more sensitive measurements. To suppress such motions, we built an active stabilization system composed of interferometric sensors, a hexapod actuator, and a frequency stabilized laser. With this stabilized testbed, environmental motions were suppressed down to nm level. This system will allow us to perform sensitive measurements, such as ground testing of LISA (Laser Interferometer Space Antenna), in the presence of environmental noise.

Author

LISA (Observatory); Interferometry; Ground Tests; Precision

20080040739 NASA Goddard Space Flight Center, Greenbelt, MD, USA

From the Big Bang to the Nobel Prize and on to James Webb Space Telescope

Mather, John C.; [2008]; 27 pp.; In English; Original contains color and black and white illustrations; No Copyright;

Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040739>

The Big Bang 13.7 billion years ago started the expansion of our piece of the universe, and portions of it stopped expanding and made stars, galaxies, planets, and people. I summarize the history of the universe, and explain how humans have learned about its size, its expansion, and its constituents. The COBE (Cosmic Background Explorer) mission measured the remnant heat radiation from the Big Bang, showed that its color (spectrum) matches the predictions perfectly, and discovered hot and cold spots in the radiation that reveal the primordial density variations that enabled us to exist. My current

project, the James Webb Space Telescope (JWST), is the planned successor to the Hubble Space Telescope, and will extend its scientific discoveries to ever greater distances and ever closer to the Big Bang itself. Its infrared capabilities enable it to see inside dust clouds to study the formation of stars and planets, and it may reveal the atmospheric properties of planets around other stars. Planned for launch in 2013, it is an international project led by NASA along with the European and Canadian Space Agencies.

Author

James Webb Space Telescope; Planetary Evolution; Atmospheric Chemistry; Cosmic Background Explorer Satellite; Hubble Space Telescope; Meteorological Parameters; Infrared Radiation

20080040770 NASA Goddard Space Flight Center, Greenbelt, MD, USA

What can be Learned from X-Ray Spectroscopy Concerning Hot Gas in the Local Bubble and Charge Exchange Processes

Snowden, Steven L.; October 15, 2007; 1 pp.; In English; From the Outer Heliosphere to the Local Bubble: Comparison of New Observations with Theory, 15-19 Oct. 2007, Berm, Switzerland; No Copyright; Avail.: Other Sources; Abstract Only

Solar wind charge exchange produces diffuse X-ray emission with a variable surface brightness comparable to that of the cosmic background. While the temporal variation of the charge exchange emission allows some separation of the components, there remains a great deal of uncertainty as to the zero level of both. Because the production mechanisms of the two components are considerably different, their spectra would provide critical diagnostics to the understanding of both. However, current X-ray observatories are very limited in both spectral resolution and sensitivity in the critical soft X-ray (less than 1.0 keV) energy range. Non-dispersive high-resolution spectrometers, such as the calorimeter proposed for the Spectrum Roentgen Gamma mission, will be extremely useful in distinguishing the cascade emission of charge exchange from the spectra of thermal bremsstrahlung cosmic plasmas.

Author

Astronomical Observatories; X Ray Spectroscopy; Radiation; Charge Exchange; High Temperature Gases

20080040774 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Eta Carinae: X-ray Line Variations during the 2003 X-ray Minimum, and the Orbit Orientation

Corcoran, M. F.; Henley, D.; Hamaguchi, K.; Khibashi, K.; Pittard, J. M.; Stevens, I. R.; Gull, T. R.; July 11, 2007; 1 pp.; In English; X-ray Grating Spectroscopy Conference, 11-13 Jul. 2007, Cambridge, MA, USA; Original contains poor quality, truncated or crooked pages

Contract(s)/Grant(s): NNG06EO90A; Copyright; Avail.: CASI: [A01](#), Hardcopy

The future evolution of Eta Carinae will be as a supernova (or hypernova) and black hole. The evolution is highly contingent on mass and angular momentum changes and instabilities. The presence of a companion can serve to trigger instabilities and provide pathways for mass and angular momentum exchange loss. X-rays can be used as a key diagnostic tool: x-ray temperatures trace pre-shock wind velocities, periodic x-ray variability traces the orbit, and x-ray line variations traces the flow and orientation of shocked gas. This brief presentation highlights x-ray line variations from the HETG and presents a model of the colliding wind flow.

CASI

Giant Stars; Variable Stars; Blue Stars; X Ray Spectra; Line Spectra; Stellar Evolution

20080040779 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Blazar Gamma-Rays, Shock Acceleration, and the Extragalactic Background Light

Stecker, Floyd W.; Baring, Matthew G.; Summerlin, Errol J.; Submitted to The Astrophysical Journal.; [2007]; 5 pp.; In English; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A01](#), Hardcopy
ONLINE: <http://hdl.handle.net/2060/20080040779>

The observed spectra of blazars, their intrinsic emission, and the underlying populations of radiating particles are intimately related. The use of these sources as probes of the extragalactic infrared background, a prospect propelled by recent advances in TeV-band telescopes, soon to be augmented by observations by NASA's upcoming Gamma-Ray Large Area Space Telescope (GLAST), has been a topic of great recent interest. Here, it is demonstrated that if particles in blazar jets are accelerated at relativistic shocks, then GAMMA-ray spectra with indices less than 1.5 can be produced. This, in turn, loosens the upper limits on the near infrared extragalactic background radiation previously proposed. We also show evidence hinting

that TeV blazars with flatter spectra have higher intrinsic TeV GAMMA-ray luminosities and we indicate that there may be a correlation of flatness and luminosity with redshift.

Author

Background Radiation; Gamma Rays; Blazars; Light (Visible Radiation); Extraterrestrial Radiation; Near Infrared Radiation

20080040789 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Binary Black Holes, Gravitational Waves, and Numerical Relativity

Centrella, Joan; March 13, 2007; 34 pp.; In English; Institute for Theory and Computation Colloquium, 13 Mar. 2007, Cambridge, MA, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: **A03**, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040789>

Massive black hole (MBH) binaries are found at the centers of most galaxies. MBH mergers trace galaxy mergers and are strong sources of gravitational waves. 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 hole; in the binary could complete even a single orbit. Recently this situation has changed dramatically, with a series of amazing breakthroughs. This presentation shows how a spacetime is constructed on a computer to build a simulation laboratory for binary black hole mergers. Focus is on the recent advances that reveal these waveforms, and the potential for discoveries that arises when these sources are observed by LIGO and LISA.

Author

Black Holes (Astronomy); Gravitational Waves; Relativity; Numerical Analysis

90

ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20080039337 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Dissipation Mechanism of Magnetic Reconnection

Hesse, Michael; March 03, 2008; 1 pp.; In English; The US-Japan Workshop on Magnetic Reconnection 2008, 3 - 6 Mar. 2008, Okinawa, Japan; No Copyright; Avail.: Other Sources; Abstract Only

Magnetic reconnection is arguably the most efficient transport and energy conversion mechanism in almost ideal plasmas. Reconnection controls the overall dynamics in space and astrophysics plasmas, as well as in many laboratory plasma systems. Reconnection operates by means of a localized diffusion region, where deviations from the plasma idealness condition generate electric fields and permit plasma transport even far away from the diffusion region itself. Recent advances in analytic theory and computer modeling have begun to shed light on the internal dynamics of the diffusion region. In particular, we begin to understand the delicate nature of the force balance in the inner diffusion region, where particles can become unmagnetized and where electric field forces are important. This presentation will provide a brief introduction of the reconnection process and its applications. This introduction will be followed by a detailed analysis of the current understanding of dissipation region physics, and by an outlook toward future research.

Author

Magnetic Field Reconnection; Diffusion; Plasmas (Physics); Force Distribution; Energy Conversion; Electric Fields; Computerized Simulation; Astrophysics

20080039341 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Finite Gyro-Radius Ion Pickup Current at Titan: Application to T9 and T5

Sittler, Edward C.; Hartle, R. E.; Lipatov, A.; October 07, 2006; 1 pp.; In English; Division of Planetary Sciences meeting, 7-13 Oct. 2006, Orlando, FL, USA; No Copyright; Avail.: Other Sources; Abstract Only

We propose a possible explanation for the second wake event observed by Cassini during the T9 encounter with Titan. As shown in Hartle and Sittler [2007a], ions will emanate from Titan's upper atmosphere as ion beams when the ion gyroradii are large compared to the neutral scale height. Furthermore, Sittler and Hartle [2007] and Hartle and Sittler [2007b] showed that when this condition is satisfied and the electric field of the external flow is not reduced significantly due to draping field lines, the heavier pickup ions will be highly localized in space and velocity, or beam-like, in Titan's wake. This can cause these

ion bunches to jump across the spacecraft trajectory and not be observed except for the lighter ions such as H⁺ and H₂⁺, which have smaller gyroradii. These heavy ions will form a large pickup current which can deflect the tail position away from Saturn. We will discuss this model for the T9 encounter, which was a wake pass, and also explore its possible application for T5.

Author

Gyroscopes; Heavy Ions; Ion Currents; Wakes; Upper Atmosphere; Ion Beams; Titan; Electric Fields

20080039344 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Journey of Interstellar Dust

Dwek, Eliahu; December 06, 2007; 1 pp.; In English; SOFIA VISION Conference, 6-7 Dec. 2007, Pasadena, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

Interstellar dust particles undergo a complex journey in space. It commences with their formation in stellar outflows or outbursts, but may end in very different ways. Their fates range from sudden 'death by destruction' promptly after their formation to maturity and inclusion in protoplanetary objects in stellar nursery homes. Throughout this journey dust grains are subjected to a host of interstellar processes in different astrophysical environments which leave their imprint on the dust and affects their surrounding environment. In this review I will summarize our current knowledge of the field, emphasizing what we still need to know to gain a full understanding of interstellar dust grains and their journey through the ISM.

Author

Interstellar Matter; Cosmic Dust; Stars; Astrophysics

20080039351 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Heavy Ion Formation in Titan's Ionosphere: Magnetospheric Introduction of Free Oxygen and Source of Titan's Aerosols?

Sittler, E. C., Jr.; Hartle, R. E.; Cooper, J. F.; Johnson, R. E.; Coates, A.; dePater, imke; Strom, Daphne; Simoes, F.; Steele, A.; Robb, F.; August 27, 2007; 1 pp.; In English; International Space Science Institute Conference, 27-31 Aug. 2007, Bern, Switzerland; No Copyright; Avail.: Other Sources; Abstract Only

With the recent discovery of heavy ions, positive and negative, by the Cassini Plasma Spectrometer (CAPS) instrument in Titan's ionosphere, it reveals new possibilities for aerosol formation at Titan and the introduction of free oxygen to the aerosol chemistry from Saturn's magnetosphere with Enceladus as the primary oxygen source. One can estimate whether the heavy ions in the ionosphere are of sufficient number to account for all the aerosols, under what conditions are favorable for heavy ion formation and how they are introduced as seed particles deeper in Titan's atmosphere where the aerosols form and eventually find themselves on Titan's surface where unknown chemical processes can take place. Finally, what are the possibilities with regard to their chemistry on the surface with some free oxygen present in their seed particles?

Author

Titan; Satellite Atmospheres; Heavy Ions; Chemical Reactions; Aerosols; Oxygen

20080039382 Leeds Univ., UK

Energy Dependent Morphology in the PWN Candidate HESSJ1825-137

Funk, S.; Hinton, J. A.; DeJager, O. C.; Jul. 01, 2007; 4 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-916980; SLAC-PUB-12833; No Copyright; Avail.: National Technical Information Service (NTIS)

Observations with H.E.S.S. revealed a new source of very high-energy (VHE) gamma-rays above 100 GeV--HESS-J1825137--extending mainly to the south of the energetic pulsar PSRB1823-13. A detailed spectral and morphological analysis of HESS J1825137 reveals for the first time in VHE gamma-ray astronomy a steepening of the energy spectrum with increasing distance from the pulsar. This behaviour can be understood by invoking radiative cooling of the IC-Compton gamma-ray emitting electrons during their propagation. In this scenario the vastly different sizes between the VHE gamma-ray emitting region and the X-ray PWN associated with PSRB182313 can be naturally explained by different cooling timescales for the radiating electron populations. If this scenario is correct, HESS J1825137 can serve as a prototype for a whole class of asymmetric PWN in which the X-rays are extended over a much smaller angular scales than the gamma-rays and can help understanding recent detections of X-ray PWN in systems such as HESS J1640465 and HESS J1813178. The future GLAST satellite will probe lower electron energies shedding further light on cooling and diffusion processes in this source.

NTIS

Astrophysics; Gamma Rays; Morphology; Pulsars

20080039439 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Spectropolarimetric Evolution of V838 Monocerotis

Wisniewski, John P.; [2006]; 8 pp.; In English; Original contains black and white illustrations; No Copyright; Avail.:

CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039439>

I review photo-polarimetric and spectropolarimetric observations of V838 Mon, which revealed that it had an asymmetrical inner circumstellar envelope following its 2nd photometric outburst. Electron scattering, modified by pre- or post-scattering H absorption, is the polarizing mechanism in V838 Mon's envelope. The simplest geometry implied by these observations is that of a spheroidal shell, flattened by at least 10% and having a projected position angle on the sky of approx. 37deg. Analysis of V838 Mon's polarized flux reveals that this electron scattering shell lies interior to the envelope region in which Ha and Ca II triplet emission originates. To date, none of the theoretical models proposed for V838 Mon have demonstrated that they can reproduce the evolution of V838 Mon's inner circumstellar environment, as probed by spectropolarimetry.

Author

Polarimetry; Mathematical Models; Atomic Energy Levels; Stellar Envelopes; Photometry; Electron Scattering

20080039464 Stanford Linear Accelerator Center, CA, USA; California Univ., Davis, CA, USA

Long-Term X-Ray Variability of NGC 4945

Miller, A.; Aug. 01, 2007; 23 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-915381; SLAC-TN-07-016; No Copyright; Avail.: Department of Energy Information Bridge

Though short-term X-ray variability has been studied for the active galaxy NGC 4945, long-term studies promise to contribute to our understanding of the processes involved in accretion onto supermassive black holes. In order to understand the relationship between black hole mass and breaks in the power spectral density (PSD), the long-term X-ray variability of NGC 4945 was studied over the energy range 8-30 keV. Observations occurred over the year 2006 using the Rossi X-ray Timing Explorer. The data was reduced using the package FTOOLS, most notably the scripts Rex and faxbary. Light curves were produced and a PSD was obtained using a Fast Fourier Transform algorithm. Preliminary studies of the light curve show greater X-ray variability at higher frequencies. This result complements previous studies of NGC 4945 by Martin Mueller. However, the PSD produced must go through further study before accurate results can be obtained. A way to account for the window function of the PSD must be found before the behavior at lower frequencies can be studied with accuracy and the relationship between black hole mass and the break in NGC 4945's PSD can be better understood.

NTIS

Astrophysics; Variability; X Ray Sources; X Rays

20080039465 Stanford Linear Accelerator Center, CA, USA; California Univ., Santa Cruz, CA, USA

Definition of a Twelve-Point Polygonal SAA Boundry for the GLAST Mission

Djomehri, S. I.; Aug. 24, 2007; 23 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-915382; SLAC-TN-07-015; No Copyright; Avail.: National Technical Information Service (NTIS)

The Gamma-Ray Large Area Space Telescope (GLAST), set to launch in early 2008, detects gamma rays within a huge energy range of 100 MeV--300 GeV. Background cosmic radiation interferes with such detection resulting in confusion over distinguishing cosmic from gamma rays encountered. This quandary is resolved by encasing GLAST's Large Area Telescope (LAT) with an Anti-Coincidence Detector (ACD), a device which identifies and vetoes charged particles. The ACD accomplishes this through plastic scintillator tiles; when cosmic rays strike, photons produced induce currents in Photomultiplier Tubes (PMTs) attached to these tiles. However, as GLAST orbits Earth at altitudes approx. 550km and latitudes between -26 degrees and 26 degrees, it will confront the South Atlantic Anomaly (SAA), a region of high particle flux caused by trapped radiation in the geomagnetic field. Since the SAA flux would degrade the sensitivity of the ACD's PMTs over time, a determined boundary enclosing this region need be attained, signaling when to lower the voltage on the PMTs as a protective measure. The operational constraints on such a boundary require a convex SAA polygon with twelve edges, whose area is minimal ensuring GLAST has maximum observation time. The AP8 and PSB97 models describing the behavior of trapped radiation were used in analyzing the SAA and defining a convex SAA boundary of twelve sides. The smallest possible boundary was found to cover 14.58% of GLAST's observation time.

NTIS

Astrophysics; Gamma Rays; Telescopes

20080039469 Stanford Linear Accelerator Center, CA, USA

Future GLAST Observations of Supernova Remnants And Pulsar Wind Nebulae

Funk, S.; Sep. 26, 2007; 4 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-916981; SLAC-PUB-12834; No Copyright; Avail.: National Technical Information Service (NTIS)

Shell-type Supernova remnants (SNRs) have long been known to harbour a population of ultra-relativistic particles, accelerated in the Supernova shock wave by the mechanism of diffusive shock acceleration. Experimental evidence for the existence of electrons up to energies of 100 TeV was first provided by the detection of hard X-ray synchrotron emission as e.g. in the shell of the young SNR SN1006. Furthermore using theoretical arguments shell-type Supernova remnants have long been considered as the main accelerator of protons - Cosmic rays - in the Galaxy; definite proof of this process is however still missing. Pulsar Wind Nebulae (PWN) - diffuse structures surrounding young pulsars - are another class of objects known to be a site of particle acceleration in the Galaxy, again through the detection of hard synchrotron X-rays such as in the Crab Nebula. Gamma-rays above 100 MeV provide a direct access to acceleration processes. The GLAST Large Area telescope (LAT) will be operating in the energy range between 30 MeV and 300 GeV and will provide excellent sensitivity, angular and energy resolution in a previously rather poorly explored energy band. We will describe prospects for the investigation of these Galactic particle accelerators with GLAST.

NTIS

Astrophysics; Gamma Rays; Nebulae; Pulsars; Supernova Remnants; Supernovae

20080039471 Stanford Linear Accelerator Center, Menlo Park, CA, USA

X-ray Observations of Unidentified H.E.S.S. gamma-ray Sources

Funk, S.; January 2006; 3 pp.; In English

Report No.(s): DE2007-917735; SLAC-PUB-12872; No Copyright; Avail.: National Technical Information Service (NTIS)

In a survey of the inner part of the Galaxy, performed with the H.E.S.S. Instrument (High energy stereoscopic system) in 2004 and 2005, a large number of new unidentified very high energy (VHE) gamma ray sources above an energy of 100 GeV was discovered. Often the gamma ray spectra in these sources reach energies of up to approximately 10 TeV. These are the highest energy particles ever attributed to single astrophysical objects. While a few of these sources can be identified at other wavebands, most of these sources remain unidentified so far. A positive identification of these new gamma ray sources with a counterpart object at other wavebands requires (a) a positional coincidence between the two sources, (b) a viable gamma ray emission mechanism and (c) a consistent multiwavelength behaviour of the two sources. X-ray observations with satellites such as XMM-Newton, Chandra or Suzaku provide one of the best channels to studying these enigmatic gamma ray sources at other wavebands, since they combine high angular resolution and sensitivity with the ability to access non-thermal electrons through their synchrotron emission. We therefore have started a dedicated programme to investigate VHE -ray sources with high-sensitivity X-ray instruments.

NTIS

Astrophysics; Gamma Rays; Supernova Remnants; X Rays

20080039472 Stanford Linear Accelerator Center, CA, USA

GLAST and Ground-Based gamma-ray Astronomy

Funk, S.; Carson, J. E.; Giebels, B.; Longo, F.; McEnery, J. E.; January 2007; 2 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-917739; SLAC-PUB-12871; No Copyright; Avail.: Department of Energy Information Bridge

The launch of the Gamma-ray Large Area Space Telescope (GLAST) in 2007 will open the possibility of combined studies of astrophysical sources with existing ground-based VHE gamma ray experiments such as H.E.S.S., VERITAS and MAGIC. Ground-based gamma ray observatories provide complementary capabilities for spectral, temporal, spatial and population studies of high-energy gamma ray sources. Joint observations cover a huge energy range, from 20 MeV to over 50 TeV. The LAT will survey the entire sky every three hours, allowing us to perform long-term monitoring of variable sources under uniform observation conditions and to detect flaring sources promptly. Imaging atmospheric Cherenkov telescopes (IACTs) will complement these observations with high-sensitivity pointed observations on regions of interest.

NTIS

Astrophysics; Gamma Ray Astronomy

20080039473 Stanford Linear Accelerator Center, CA, USA

Prospects for Observations of Microquasars with GLAST

Dubois, R.; January 2007; 2 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-917740; SLAC-PUB-12829; No Copyright; Avail.: Department of Energy Information Bridge

The Gamma-ray Large Area Space Telescope (GLAST) is a next generation high energy gamma-ray observatory due for launch in Fall 2007. The primary instrument is the Large Area Telescope (LAT), which will measure gamma-ray flux and spectra from 20 MeV to > 300 GeV and is a successor to the highly successful EGRET experiment on CGRO. The LAT will have better angular resolution, greater effective area, wider field of view and broader energy coverage than any previous experiment in this energy range. This poster will present performance estimates with particular emphasis on how these apply to studies of microquasars. The LATs scanning mode will provide unprecedented uniformity of sky coverage and permit measurements of light curves for any source. We will show results from recent detailed simulations that illustrate the potential of the LAT to observe microquasar variability and spectra, including source sensitivity and ability to detect orbital modulation.

NTIS

Astrophysics; Quasars

20080039575 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Chandra X-ray Spectroscopy of the Focused Wind In the Cygnus X-1 System I. The Non-Dip Spectrum in the Low/Hard State

Hanke, Manfred; Wilms, Jorn; Nowak, Michael A.; Pottschmidt, Katja; Schultz, Norbert S.; Lee, Julia C.; [2008]; 16 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): 50OR0701; NNG06EO90A; GO-34050B; SV3-73016; Copyright; Avail.: CASI: [A03](#), Hardcopy

We present analyses of a 50 ks observation of the supergiant X-ray binary system CygnusX-1/HDE226868 taken with the Chandra High Energy Transmission Grating Spectrometer (HETGS). CygX-1 was in its spectrally hard state and the observation was performed during superior conjunction of the black hole, allowing for the spectroscopic analysis of the accreted stellar wind along the line of sight. A significant part of the observation covers X-ray dips as commonly observed for CygX-1 at this orbital phase, however, here we only analyze the high count rate non-dip spectrum. The full 0.5-10 keV continuum can be described by a single model consisting of a disk, a narrow and a relativistically broadened Fe K line, and a power law component, which is consistent with simultaneous RXTE broad band data. We detect absorption edges from overabundant neutral O, Ne and Fe, and absorption line series from highly ionized ions and infer column densities and Doppler shifts. With emission lines of He-like Mg XI, we detect two plasma components with velocities and densities consistent with the base of the spherical wind and a focused wind. A simple simulation of the photoionization zone suggests that large parts of the spherical wind outside of the focused stream are completely ionized, which is consistent with the low velocities (<200 km/s) observed in the absorption lines, as the position of absorbers in a spherical wind at low projected velocity is well constrained. Our observations provide input for models that couple the wind activity of HDE 226868 to the properties of the accretion flow onto the black hole.

Author

Supergiant Stars; Black Holes (Astronomy); Energy Transfer; X Ray Timing Explorer; Stellar Winds; Spectroscopic Analysis; Photoionization; Plasmas (Physics); Emission Spectra; Broadband

20080039750 Max-Planck-Inst. fuer Radioastronomie, Bonn, Germany

Interacting Coronae of Two T Tauri Stars: First Observational Evidence for Solar-Like Helmet Streamers

Massi, M; Ros, E; Menten, K M; Bernado, M K.; Torricelli-Ciamponi, G; Neidhoefer, J; Boden, A; Boboltz, D; Sargent, A; Torres, G; Jan 2008; 7 pp.; In English

Report No.(s): AD-A482891; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482891>

The young binary system V773 Tau A exhibits a persistent radio flaring activity that gradually increases from a level of a few mJy at apoastron to more than 100 mJy at periastron. Interbinary collisions between very large (>15 R) magnetic structures anchored on the two rotating stars of the system have been proposed to be the origin of these periodic radio flares. Magnetic structures extended over tens of stellar radii, that can also account for the observed fast decay of the radio flares, seem to correspond to the typical solar semi-open quite extended magnetic configurations called helmet streamers. We aim to find direct observational evidence for the postulated, solar-like, coronal topologies. Two distinctive structures appear in the radio images here presented. They happen to be associated with the primary and secondary stars of the V773 Tau A system. In one image (Fig. 2B) the two features are extended up to 18 R each and are nearly parallel revealing the presence of two

interacting helmet streamers. One image (Fig. 2E) taken a few hours after a flare monitored by the 100-m Effelsberg telescope shows one elongated fading structure substantially rotated with respect to those seen in the B run. The same decay scenario is seen in Fig. 2G for the helmet streamer associated with the other star. Conclusions. This is the very first direct evidence revealing that even if the flare origin is magnetic reconnection due to interbinary collision, both stars independently emit in the radio range with structures of their own. These structures are helmet streamers, observed for the first time in stars other than the Sun. The complete extent of each helmet streamer above the stellar surface is about 24 R which implies that they can practically interact throughout the whole orbit, even rather close to apoastron where the stellar separation is 52 R . However, the radio flares become stronger when the stars approach.

DTIC

Binary Stars; Coronas; Helmets; T Tauri Stars

20080039754 Defence Science and Technology Organisation, Salisbury, Australia

A Laboratory Facility for Measuring Solar Reflections from Model Aircraft

Oermann, R J; Jun 1986; 27 pp.; In English

Report No.(s): AD-A482899; ERL-0385-TM; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA482899>

A laboratory facility has been developed to simulate solar reflections from military aircraft. Scale models are placed in a mount which enables orientation in any chosen attitude. A fixed infrared source is collimated to simulate the sun and a mobile detector accepts reflected radiation in the 1.8 micrometers waveband. A computer program generates the relevant parameters necessary to describe the aircraft's attitude in the frame of reference which includes both the observer and the sun. A group of such parameters enables an entire overhead pass of an aircraft to be simulated. The resultant relative reflectance plot gives an indication of the radiance from an aircraft primarily due to solar reflection.

DTIC

Aircraft Models; Infrared Radiation; Research Facilities; Scale Models; Solar Radiation

20080040109 Air Force Research Lab., Hanscom AFB, MA USA

Space Particle Hazard Specification, Forecasting, and Mitigation

Metcalf, James; Brautigam, Donald; Cooke, David; Dichter, Bronek; Ginet, Gregory; Hilmer, Robert; Kadinsky-Cade, Katharine; Ray, Kevin; Starks, Michael; Wheelock, Adrian; Nov 30, 2007; 48 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-5021

Report No.(s): AD-A483066; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes R&D to measure and model the near-Earth space environment and its effects on spacecraft in orbit. A Compact Environmental Anomaly Sensor (CEASE) was developed, and two versions of the instrument were flown in two different orbital domains. Other space environment instruments are being developed for flight on the Demonstration and Science Experiment (DSX) satellite. Data from CEASE and other sensors were used to develop new models of the space environment, which have been incorporated into AF-GEOSpace, a software program that includes many space environment models, applications, and data visualization products. Spacecraft charging technology includes development of the NASA-Air Force Spacecraft Charging Analyzer Program (NASCAP-2K) to model interactions between spacecraft surfaces and plasma environments and a Satellite Charge/Discharge Product (Char/D) to create tailored system-impact decision aids related to both surface and deep charging of satellites. NASCAP-2K has been used in the design of spacecraft components and in the analysis of on-orbit anomalies. We developed a second-generation Charge Control System (CCS-II), which is designed to emit xenon plasma to neutralize electrostatic charge on a spacecraft, and explored alternative charge mitigation techniques.

DTIC

Aerospace Environments; Anomalies; Artificial Satellites; Forecasting; Hazards; Spacecraft Charging

20080040110 Air Force Research Lab., Hanscom AFB, MA USA

Solar Environmental Disturbances

Altrock, Richard C; Radick, Richard R; Nov 2, 2007; 47 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-2311

Report No.(s): AD-A483067; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Solar activity refers to a variety of non-thermal phenomena seated in the Sun's outer layers. Many aspects of solar activity exhibit pronounced, and sometimes explosive, temporal variability. The aim of this task has been to explore the basic physics

of the sun that leads to the ultimate production of activity. We have investigated processes occurring below the visible surface of the sun, those seen at the visible surface (the photosphere) the variation of processes with height in the photosphere, processes seen in the middle atmosphere (chromosphere), the variation up to and into the upper atmosphere (the corona) and effects on the interplanetary medium that lead to terrestrial and near-terrestrial effects (space weather). We have sought explanations for how these physical processes affect the production of solar activity, both on short and long time scales.

DTIC

Aerospace Environments; Chromosphere; Photosphere; Solar Activity

20080040166 NASA Goddard Space Flight Center, Greenbelt, MD, USA

SPACE: The SPectroscopic, All-sky Cosmic Explorer

Cimatti, A.; Robberto, M.; Baugh, C.; Beckwith, S. W. V.; Content, R.; Daddi, E.; deLucia, G.; Garilli, B.; Guzzo, L.; Kauffmann, G.; Lehnert, M.; Maccagni, D.; Martinez-Sansigre, A.; Pasian, F.; Reid, I. N.; Rosati, P.; Salvaterra, R.; Stiavelli, M.; Wang, Y.; ZapateroOsorio, M.; Balcells, M.; Bersanelli, M.; Bertoldi, F.; Blaizot, J.; Bottini, D., et al.; [2007]; 26 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

We describe the scientific motivations, the mission concept and the instrumentation of SPACE, a class-M mission proposed for concept study at the first call of the ESA Cosmic-Vision 2015-2025 planning cycle. SPACE aims at producing the largest three-dimensional evolutionary map of the Universe over the past 10 billion years by taking near-IR spectra and measuring redshifts of more than half a billion galaxies at $0 < z < 2$ down to AB approximately 23 over 37π sr of the sky. In addition, SPACE will also target a smaller sky field, performing a deep spectroscopic survey of millions of galaxies to AB approximately 26 and at $2 < z < 10+$. Owing to the depth, redshift range, volume coverage and quality of its spectra, SPACE will reveal with unique sensitivity most of the fundamental cosmological signatures, including the power spectrum of density fluctuations and its turnover, the baryonic acoustic oscillations imprinted when matter and radiation decoupled, the distance-luminosity relation of cosmological supernovae, the evolution of the cosmic expansion rate, the growth rate of cosmic large-scale structure, the large scale distribution of galaxies. The datasets from the SPACE mission will represent a long lasting legacy that will be data mined for many years to come.

Author

Cosmology; Spectroscopy; Surveys; Universe; Dark Energy; Astrophysics

20080040167 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Discovery of a New Dusty B[E] Star in the Small Magellanic Cloud

Wisniewski, John P.; Bjorkman, Karen S.; Bjorkman, Jon E.; Clampin, Mark; [2007]; 12 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNH06CC03B; NGT5-50469; NAG5-8054; NSF AST-0307686; Copyright; Avail.: CASI: [A03](#), Hardcopy

We present new optical spectroscopic and Spitzer IRAC photometric observations of a B-type star in the SMC cluster NGC 346, NGC 346:KWBB 200. We detect numerous Fe II, [O I], [Fe II], as well as strong P-Cygni profile H I emission lines in its optical spectrum. The star's near-IR color and optical to IR SED clearly indicate the presence of an infrared excess, consistent with the presence of gas and warm, T ~ 800 K, circumstellar dust. Based on a crude estimate of the star's luminosity and the observed spectroscopic line profile morphologies, we find that the star is likely to be a B-type supergiant. We suggest that NGC 346:KWBB 200 is a newly discovered B[e] supergiant star, and represents the fifth such object to be identified in the SMC.

Author

B Stars; Emission Spectra; Magellanic Clouds; Spectroscopy; Stellar Envelopes; Supergiant Stars; Interstellar Matter; H Lines; Infrared Astronomy

20080040681 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Atmospheric Dynamics of alpha Tau (K5 III) - Clues to Understanding the Magnetic Dynamo in Late-Type Giant Stars

Carpenter, Kenneth G.; Airapetian, Vladimir; [2008]; 4 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): HST GO/AR 9967; HST GO/AR 10956; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040681>

Using HST/GHRS, HST/STIS and FUSE archival data for alpha Tau and the CHIANTI spectroscopic code, we have derived line shifts, volumetric emission measures, and plasma density estimates, and calculated filling factors for a number

of UV lines forming between 10,000 K and 300,000 K in the outer atmosphere of this red giant star. The data suggest the presence of low-temperature extended regions and high-temperature compact regions, associated with magnetically open and closed structures in the stellar atmosphere, respectively. The signatures of UV lines from alpha Tau can be consistently understood via a model of upward-traveling Alfvén waves in a gravitationally stratified atmosphere. These waves cause non-thermal broadening in UV lines due to unresolved wave motions and downward plasma motions in compact magnetic loops heated by resonant Alfvén wave heating.

Author

Magnetohydrodynamic Waves; Giant Stars; Atmospheric Physics; Late Stars; Plasma Waves; Solar Magnetic Field; Plasma Density

20080040725 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Gas in Protoplanetary and Debris Disks: Insights from UV Spectroscopy

Roberge, Aki; [2008]; 1 pp.; In English; FUSE Workshop, 20-22 Oct. 2008, Annapolis, MD, USA; No Copyright; Avail.: Other Sources; Abstract Only

Over the last two decades, observations of protoplanetary and debris disks have played an important role in the new field of extrasolar planetary studies. Many are familiar with the extensive work on the cold circumstellar dust present in these disks done using infrared and sub-millimeter photometry and spectroscopy. However, UV spectroscopy has made some unique contributions by probing the elusive but vital gas component in protoplanetary and debris disks. In this talk, I will outline our picture of the evolution of protoplanetary disks and discuss the importance of the gas component. New insights obtained from UV spectroscopy will be highlighted, as well as some new puzzles. Finally, I will touch on upcoming studies of gas in protoplanetary and debris disks, some at UV wavelengths, some at far-IR and sub-mm wavelengths.

Author

Ultraviolet Spectroscopy; Far Infrared Radiation; Protoplanetary Disks; Infrared Photometry; Stellar Envelopes; Debris; Dust

20080040732 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Spitzer IRS Spectra of Basaltic Asteroids: Preliminary Results

Lim, Lucy F.; Emery, Joshua P.; Moskovitz, Nick; Stewart, Heather; Marchis, Frank; October 10, 2008; 1 pp.; In English; DPS Meeting, 10-15 Oct. 2008, Ithaca, NY, USA

Contract(s)/Grant(s): GO-50259; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040732>

We present preliminary results of a Spitzer program to observe the 5.2--38 micron spectra of small basaltic asteroids using the Spitzer IRS (Infrared Spectrograph). Our targets include members of the dynamical family of the unique large differentiated asteroid 4 Vesta ('Vestoids'), four outer-main-belt basaltic asteroids whose orbits exclude them from originating on 4 Vesta, and the basaltic near-Earth asteroid (NEA) 4055 Magellan. We will compare the compositions and thermophysical properties of the non-Vestoid objects with those of the dynamical vestoids to provide insight on the extent of metal-silicate differentiation on planetsimals during the epoch of planet formation in the early Solar System. As of this writing, spectra of asteroids 10537 (1991 RY16) and 2763 Jeans have been returned. Analysis of these data are ongoing. Observations of 956 Elisa, 2653 Principia, 4215 Kamo, 7472 Kumakiri, and 1459 Magnya have been scheduled and are expected to be available by the time of the DPS meeting. NIR spectra and lightcurves of the target asteroids are also being observed in support of this program.

Author

Asteroids; Basalt; Spectrographs; Thermophysical Properties; Planetary Evolution; Infrared Radiation; Silicates

20080040733 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Black Hole Mergers as Probes of Structure Formation

Alicea-Munoz, E.; Miller, M. Coleman; [2008]; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NNX08AH29G; Copyright; Avail.: CASI: [A03](#), Hardcopy

Intense structure formation and reionization occur at high redshift, yet there is currently little observational information about this very important epoch. Observations of gravitational waves from massive black hole (MBH) mergers can provide us with important clues about the formation of structures in the early universe. Past efforts have been limited to calculating merger rates using different models in which many assumptions are made about the specific values of physical parameters of the mergers, resulting in merger rate estimates that span a very wide range (0.1 - 104 mergers/year). Here we develop a

semi-analytical, phenomenological model of MBH mergers that includes plausible combinations of several physical parameters, which we then turn around to determine how well observations with the Laser Interferometer Space Antenna (LISA) will be able to enhance our understanding of the universe during the critical $z \sim 5 - 30$ structure formation era. We do this by generating synthetic LISA observable data (total BH mass, BH mass ratio, redshift, merger rates), which are then analyzed using a Markov Chain Monte Carlo method. This allows us to constrain the physical parameters of the mergers. We find that our methodology works well at estimating merger parameters, consistently giving results within 1- of the input parameter values. We also discover that the number of merger events is a key discriminant among models. This helps our method be robust against observational uncertainties. Our approach, which at this stage constitutes a proof of principle, can be readily extended to physical models and to more general problems in cosmology and gravitational wave astrophysics.

Author

Black Holes (Astronomy); Gravitational Waves; Monte Carlo Method; Astrophysics; Mass Ratios; Markov Chains

20080040736 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The First Detection of [O IV] from an Ultraluminous X-ray Source with Spitzer: Evidence of High Unbeamed Luminosity in Holmberg II ULX

Berghea, C. T.; Dudik, R. P.; Weaver, K. A.; Kallman, T. R.; [2008]; 36 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

We present the first Spitzer Infrared Spectrograph (IRS) observations of the [O IV] 25.89 micron emission line detected from the ultraluminous X-ray source (ULX) in Holmberg II. This line is a well established signature of high excitation, usually associated with AGN. Its detection suggests that the ULX has a strong impact on the surrounding gas. A Spitzer high resolution spectral map shows that the [O IV] is coincident with the X-ray position of the Holmberg II ULX. We find that the luminosity and the morphology of the line emission is consistent with photoionization by the soft X-ray and far ultraviolet (FUV) radiation from the accretion disk of the binary system and inconsistent with narrow beaming. We show that the emission nebula is radiation bounded both in the line of sight direction and to the west, and probably matter bounded to the east. Evidence for a massive black hole (BH) in this ULX is mounting. Detailed photoionization models favor an intermediate mass black hole of at least 85 Solar Mass as the ionization source for the [OIV] emission. We find that the spectral type of the companion star strongly affects the expected strength of the [O IV] emission. This finding could explain the origin of [O IV] in some starburst galaxies containing black hole binaries.

Author

Far Ultraviolet Radiation; Infrared Astronomy; Luminosity; Photoionization; X Ray Sources; Accretion Disks; Background Radiation; Companion Stars; Spectrographs

20080040740 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Benign, Low Z Electron Capture Agent for Negative Ion TPCs

Martoff, C. J.; Dion, M. P.; Hosack, M.; Barton, D.; Black, J. K.; [2008]; 11 pp.; In English
Contract(s)/Grant(s): NNG07EJ03C; Copyright; Avail.: CASI: [A03](#), Hardcopy

We have identified nitromethane (CH_3NO_2) as an effective electron capture agent for negative ion TPCs (NITPCs). We present drift velocity and longitudinal diffusion measurements for negative ion gas mixtures using nitromethane as the capture agent. Not only is nitromethane substantially more benign than the only other identified capture agent, CS_2 , but its low atomic number will enable the use of the NITPC as a photoelectric X-ray polarimeter in the 1-10 keV band.

Author

Negative Ions; Dark Matter; Diffusion; Nitromethane; Electron Capture; Velocity Measurement

20080040741 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Suzaku Observations of Thermal and Non-Thermal X-Ray Emission from the Middle-Aged Supernova Remnant G156.2+5.7

Katsuda, Satoru; Petre, Robert; Hwang, Una; Yamaguchi, Hiroya; Mori, Koji; Tsunemi, Hiroshi; [2008]; 19 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNG06EL90A; MOE-16002004; Copyright; Avail.: CASI: [A03](#), Hardcopy

We present results from X-ray analysis of a Galactic middle-aged supernova remnant (SNR) G156.2+5.7 which is bright and largely extended in X-ray wavelengths, showing a clear circular shape (radius approx. $50'$). Using the Suzaku satellite, we observed this SNR in three pointings; partially covering the northwestern (NW) rim, the eastern (E) rim, and the central portion of this SNR. In the NW rim and the central portion, we confirm that the X-ray spectra consist of soft and hard-tail

emission, while in the E rim we find no significant hard-tail emission. The soft emission is well fitted by either a one-component or two-component non-equilibrium ionization (NEI) model. In the NW and E rims, a one-component (the swept-up interstellar medium) NEI model well represents the soft emission. On the other hand, in the central portion, a two-component (the interstellar medium and the metal-rich ejecta) NEI model fits the soft emission better than the one-component NEI model from a statistical point of view. The relative abundances in the ejecta component suggest that G156.2+5.7 is a remnant from a core-collapse SN explosion whose progenitor mass is less than 15 Solar Mass. The origin of the hard-tail emission detected in the NW rim and the central portion of the SNR is highly likely non-thermal synchrotron emission from relativistic electrons. In the NW rim, the relativistic electrons seems to be accelerated by a forward shock with a slow velocity of APPROX.500 km/sec.

Author

Supernova Remnants; High Energy Electrons; Interstellar Matter; Relativistic Particles; Stellar Mass; X Ray Analysis; Thermal Emission

20080040788 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Binary Black Holes, Gravitational Waves, and Numerical Relativity

Centrella, Joan; March 13, 2007; 34 pp.; In English; Massachusetts Institute of Technology, 15 Mar. 2007, Cambridge, MA, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: **A03**, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040788>

This viewgraph presentation reviews the massive black hole (MBH) binaries that are found at the center of most galaxies, 'astronomical messenger', gravitational waves (GW), and the use of numerical relativity understand the features of these phenomena. 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.. This talk will take you on this quest for the holy grail of numerical relativity, showing how a spacetime is constructed on a computer to build a simulation laboratory for binary black hole mergers. We will focus on the recent advances that are revealing these waveforms, and the dramatic new potential for discoveries that arises when these sources will be observed by LIGO and LISA.

CASI

Black Holes (Astronomy); Computerized Simulation; Gravitational Waves; Relativity; Space-Time Functions; Computational Astrophysics; Binary Stars; Relativistic Effects

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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*.

20080039236 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Titan Orbiter Aerover Mission with Enceladus Science (TOAMES)

Sittler, Edward C.; Cooper, J.; Mahaffy, P.; Fairbrother D.; dePater, I.; Schultze-Makuch, D.; Pitman, J.; August 20, 2007; 2 pp.; In English; European Planetary (Europlanet) Science Congress 2007, 20-24 Aug. 2007, Potsdam, Germany

Report No.(s): EPSC2007-A-00429; Copyright; Avail.: Other Sources; Abstract Only

Cassini and Huygens have made exciting discoveries at Titan and Enceladus, and at the same time made us aware of how little we understand about these bodies. For example, the source, and/or recycling mechanism, of methane in Titan's atmosphere is still puzzling. Indeed, river beds (mostly dry) and lakes have been spotted, and occasional clouds have been seen, but the physics to explain the observations is still mostly lacking, since our 'image' of Titan is still sketchy and quite incomplete. Enceladus, only -500 km in extent, is even more puzzling, with its fiery plumes of vapor, dust and ice emanating from its south polar region, 'feeding' Saturn's E ring. Long term variability of magnetospheric plasma, neutral gas, E-ring ice grain density, radio emissions, and corotation of Saturn's planetary magnetic field in response to Enceladus plume activity are of great interest for Saturn system science. Both Titan and Enceladus are bodies of considerable astrobiological interest in view of high organic abundances at Titan and potential subsurface liquid water at Enceladus. We propose to develop a new mission to Titan and Enceladus, the Titan Orbiter Aerover Mission with Enceladus Science (TOAMES), to address these questions using novel new technologies. TOAMES is a multi-faceted mission that starts with orbit insertion around Saturn using

aerobraking with Titan's extended atmosphere. We then have an orbital tour around Saturn (for 1-2 years) and close encounters with Enceladus, before it goes into orbit around Titan (via aerocapture). During the early reconnaissance phase around Titan, perhaps 6 months long, the orbiter will use altimetry, radio science and remote sensing instruments to measure Titan's global topography, subsurface structure and atmospheric winds. This information will be used to determine where and when to release the Aerover, so that it can navigate safely around Titan and identify prime sites for surface sampling and analysis. In situ instruments will sample the upper atmosphere which may provide the seed population for the complex organic chemistry on the surface. The Aerover will probably use a 'hot air' Montgolfier balloon concept using the waste heat from the MMRTG 1-2 kwatts. New technologies will need to be developed and miniaturization will be required to maintain functionality while controlling mass, power and cost. Duty cycling will be used. The Aerover will have all the instruments needed to sample Titan's atmosphere and surface with possible methane lakes-rivers. It will e.g., use multi-spectral imagers and for last 6 months of mission, balloon payload will land on surface at predetermined site to take core samples of the surface and use seismometers to help probe the interior. All remote (and active) sensors on the orbiter will share a - 1 meter telescope, called MIDAS (Multiple Instrument Distributed Aperture Sensor). MIDAS observations in stable orbit at Titan can provide full global maps of Titan's surface and could additionally provide long term observations of the Saturn system including Enceladus for extended mission phases over many years, potentially for decades. Experience from the Hubble Space Telescope has shown strong public interest and commitment to exciting generational missions.

Author

Enceladus; Titan; Planetary Magnetic Fields; Satellite Atmospheres; Saturn Rings; Remote Sensing; Gas Density; Atmospheric Circulation; Aerocapture; Core Sampling

20080039320 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Planetary Entry Probes and Mass Spectroscopy: Tools and Science Results from In Situ Studies of Planetary Atmospheres and Surfaces

Niemann, Hasso B.; June 25, 2007; 1 pp.; In English; 5th International Planetary Probe Workshop, 25-29 Jun. 2007, Bordeaux, France; No Copyright; Avail.: Other Sources; Abstract Only

Probing the atmospheres and surfaces of the planets and their moons with fast moving entry probes has been a very useful and essential technique to obtain in situ or quasi in situ scientific data (ground truth) which could not otherwise be obtained from fly by or orbiter only missions and where balloon, aircraft or lander missions are too complex and costly. Planetary entry probe missions have been conducted successfully on Venus, Mars, Jupiter and Titan after having been first demonstrated in the Earth's atmosphere. Future missions will hopefully also include more entry probe missions back to Venus and to the outer planets. The success of and science returns from past missions, the need for more and better data, and a continuously advancing technology generate confidence that future missions will be even more successful with respect to science return and technical performance. The pioneering and tireless work of Al Seiff and his collaborators at the NASA Ames Research Center had provided convincing evidence of the value of entry probe science and how to practically implement flight missions. Even in the most recent missions involving entry probes i.e. Galileo and Cassini/Huygens Al contributed uniquely to the science results on atmospheric structure, turbulence and temperature on Jupiter and Titan.

Author

Planetary Atmospheres; Atmospheric Turbulence; Atmospheric Entry; Earth Atmosphere; Ground Truth; In Situ Measurement; Planetary Surfaces

20080039323 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Development and Execution of End-of-Mission Operations Case Study of the UARS and ERBS End-of-Mission Plans

Hughes, John; Marius, Julio L.; Montoro, Manuel; Patel, Mehul; Bludworth, David; June 19, 2006; 38 pp.; In English; SpaceOps 2006, 19-23 Jun. 2006, Rome, Italy; Original contains black and white illustrations; Copyright; Avail.: CASI:

A03, Hardcopy

This Paper is a case study of the development and execution of the End-of-Mission plans for the Earth Radiation Budget Satellite (ERBS) and the Upper Atmosphere Research Satellite (UARS). The goals of the End-of-Mission Plans are to minimize the time the spacecraft remains on orbit and to minimize the risk of creating orbital debris. Both of these Missions predate the NASA Management Instructions (NMI) that directs missions to provide for safe mission termination. Each spacecraft had their own unique challenges, which required assessing End-of-Mission requirements versus spacecraft limitations. Ultimately the End-of-Mission operations were about risk mitigation. This paper will describe the operational challenges and the lessons learned executing these End-of-Mission Plans

Author

Mission Planning; Upper Atmosphere Research Satellite (UARS); Earth Radiation Budget; Lessons Learned; Space Debris

20080039325 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Fourier-Kelvin Stellar Interferometer a Low Complexity, Low Cost Space Mission for High-Resolution Astronomy and Direct Exoplanet Detection

Barry, R. K.; Danchi, W. C.; Deming, L. D.; Richardson, L. J.; Kuchner, M. J.; Seager, S.; Frey, B. J.; Martino, A. J.; Lee, K. A.; Zuray, M.; Rajagopal, J.; Hyde, T. T.; Millan-Gabet, R.; Monnier, J. D.; Allen, R. J.; Traub, W. A.; May 24, 2006; 11 pp.; In English; Astronomical Telescopes and Instrumentation 2006, 24-31 May 2006, Orlando, FL, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Fourier-Kelvin Stellar Interferometer (FKSI) is a mission concept for a spacecraft-borne nulling interferometer for high-resolution astronomy and the direct detection of exoplanets and assay of their environments and atmospheres. FKSI is a high angular resolution system operating in the near to midinfrared spectral region and is a scientific and technological pathfinder to the Darwin and Terrestrial Planet Finder (TPF) missions. The instrument is configured with an optical system consisting, depending on configuration, of two 0.5 - 1.0 m telescopes on a 12.5 - 20 m boom feeding a symmetric, dual Mach-Zehnder beam combiner. We report on progress on our nulling testbed including the design of an optical pathlength null-tracking control system and development of a testing regime for hollow-core fiber waveguides proposed for use in wavefront cleanup. We also report results of integrated simulation studies of the planet detection performance of FKSI and results from an in-depth control system and residual optical pathlength jitter analysis.

Author

Extrasolar Planets; Planet Detection; Systems Engineering; Spectral Bands; Interferometers; Angular Resolution; High Resolution; Waveguides; Infrared Radiation

20080039381 Stanford Linear Accelerator Center, CA, USA; Rochester Inst. of Tech., NY, USA; California Univ., Davis, CA, USA

First Use of a HyViSi H4RG for Astronomical Observations

Simms, L. M.; Figer, D. F.; Hanold, B. J.; Kerr, D. J.; Gilmore, D. K.; Sep. 01, 2007; 33 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-916978; SLAC-PUB-12819; No Copyright; Avail.: National Technical Information Service (NTIS)

We present the first astronomical results from a 4K2 Hybrid Visible Silicon PIN array detector (HyViSi) read out with the Teledyne Scientific and Imaging SIDECAR ASIC. These results include observations of astronomical standards and photometric measurements using the 2.1m KPNO telescope. We also report results from a test program in the Rochester Imaging Detector Laboratory (RIDL), including: read noise, dark current, linearity, gain, well depth, quantum efficiency, and substrate voltage effects. Lastly, we highlight results from operation of the detector in window read out mode and discuss its potential role for focusing, image correction, and use as a telescope guide camera.

NTIS

Astronomy; Infrared Detectors

20080039474 Stanford Linear Accelerator Center, CA, USA

Future GLAST Observations of SNRs and PWNe

Funk, S.; January 2007; 2 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-917741; No Copyright; Avail.: Department of Energy Information Bridge

Shell-type Supernova remnants (SNRs) have long been known to harbour a population of ultra-relativistic particles, accelerated in the Supernova shock wave by the mechanism of Diffusive shock acceleration. Pulsar Wind Nebulae (PWNe) - diffuse structures surrounding young pulsars - are also known to be a site of particle acceleration in the Galaxy. Gamma rays above 100 MeV provide a direct access to acceleration processes through the following channels: ultra-relativistic electrons emit gamma radiation through Inverse Compton scattering in ubiquitous photon fields (such as CMBR), protons emit gamma radiation through the decay of pi0s, generated in hadronic interactions with Interstellar material such as gas clouds. The upcoming GLAST Large Area Telescope (LAT) will be operating in the energy range between 30 MeV and 300 GeV and will provide excellent sensitivity, angular and energy resolution in a so-far rather poorly investigated energy band to address important questions in our understanding of both shell-type SNRs and PWNe.

NTIS

Astrophysics; Supernova Remnants

20080039645 Planetary Science Inst., Tucson, AZ, USA

A Photographic Atlas of Rock Breakdown Features in Geomorphic Environments

Bourke, Mary C., Editor; Brearley, J. Alexander; Haas, Randall; Viles, Heather A.; 2007; 87 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNG05GJ91G; Copyright; Avail.: Other Sources

ONLINE: <http://www.psi.edu/staff/bourkepubs/atlas/>

A primary goal of geomorphological enquiry is to make genetic associations between process and form. In rock breakdown studies, the links between process, inheritance and lithology are not well constrained. In particular, there is a need to establish an understanding of feature persistence. That is, to determine the extent to which in situ rock breakdown (e.g., aeolian abrasion or salt weathering) masks signatures of earlier geomorphic transport processes (e.g., fluvial transport or crater ejecta). Equally important is the extent to which breakdown during geomorphic transport masks the imprint of past weathering. The use of rock features in this way raises the important question: Can features on the surface of a rock reliably indicate its geomorphic history? This has not been determined for rock surfaces on Earth or other planets. A first step towards constraining the links between process, inheritance, and morphology is to identify pristine features produced by different process regimes. The purpose of this atlas is to provide a comprehensive image collection of breakdown features commonly observed on boulders in different geomorphic environments. The atlas is intended as a tool for planetary geoscientists and their students to assist in identifying features found on rocks on planetary surfaces. In compiling this atlas, we have attempted to include features that have formed 'recently' and where the potential for modification by another geomorphic process is low. However, we acknowledge that this is, in fact, difficult to achieve when selecting rocks in their natural environment. We group breakdown features according to their formative environment and process. In selecting images for inclusion in the atlas we were mindful to cover a wide range of climatic zones. For example, in the weathering chapter, clast features are shown from locations such as the hyper-arid polar desert of Antarctica and the semi-arid canyons of central Australia. This is important as some features (e.g., alveoli) occur across climate regimes. We have drawn on the published geomorphological literature and our own field experience. We use, where possible, images of extrusive igneous rocks as the data returned from Mars, Venus and the Moon indicates that this is the predominant rock type. One of the purposes of this atlas is to expand the range of surface features that are known to indicate a particular geomorphic environment or process history. The surface features on boulders in some environments such as aeolian and weathering are well understood. In contrast, those in fluvial or ejecta environments are not. Therefore we have presented a comprehensive assemblage of features that are likely to be produced in each of the geomorphic environments. We hope that this atlas will trigger more research on diagnostic features, particularly their morphometry and detailed morphology, their persistence and rates of formation. In this first edition of the atlas we detail the features found on clasts in three geomorphic environments: aeolian, fluvial and weathering. Future editions of the atlas will include chapters on ejecta, micro-impacts, coastal, colluvial, glacial and structural features.

Derived from text

Geomorphology; Lithology; Planetary Surfaces; Rocks; Wind Erosion; Geological Surveys; Planetary Geology; Weathering

20080040197 NASA Langley Research Center, Hampton, VA, USA

Micro-Logistics Analysis for Human Space Exploration

Cirillo, William; Stromgren, Chel; Galan, Ricardo; September 09, 2008; 8 pp.; In English; AIAA Space 2008 Conference and Exposition, 9-11 Sep. 2008, San Diego, CA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 329231.01.12.04.01; Copyright; Avail.: CASI: A02, Hardcopy

Traditionally, logistics analysis for space missions has focused on the delivery of elements and goods to a destination. This type of logistics analysis can be referred to as 'macro-logistics'. While the delivery of goods is a critical component of mission analysis, it captures only a portion of the constraints that logistics planning may impose on a mission scenario. The other component of logistics analysis concerns the local handling of goods at the destination, including storage, usage, and disposal. This type of logistics analysis, referred to as 'micro-logistics', may also be a primary driver in the viability of a human lunar exploration scenario. With the rigorous constraints that will be placed upon a human lunar outpost, it is necessary to accurately evaluate micro-logistics operations in order to develop exploration scenarios that will result in an acceptable level of system performance.

Author

Space Exploration; Space Logistics; Lunar Bases; Space Missions; Lunar Exploration

20080040692 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A GPS Receiver for Lunar Missions

Bamford, William A.; Heckler, Gregory W.; Holt, Greg N.; Moreau, Michael C.; January 28, 2008; 9 pp.; In English; ION

NTM 2008 Conference, 28-30 Jan. 2008, San Diego, CA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A02, Hardcopy

Beginning with the launch of the Lunar Reconnaissance Orbiter (LRO) in October of 2008, NASA will once again begin its quest to land humans on the Moon. This effort will require the development of new spacecraft which will safely transport people from the Earth to the Moon and back again, as well as robotic probes tagged with science, re-supply, and communication duties. In addition to the next-generation spacecraft currently under construction, including the Orion capsule, NASA is also investigating and developing cutting edge navigation sensors which will allow for autonomous state estimation in low Earth orbit (LEO) and cislunar space. Such instruments could provide an extra layer of redundancy in avionics systems and reduce the reliance on support and on the Deep Space Network (DSN). One such sensor is the weak-signal Global Positioning System (GPS) receiver 'Navigator' being developed at NASA's Goddard Space Flight Center (GSFC). At the heart of the Navigator is a Field Programmable Gate Array (FPGA) based acquisition engine. This engine allows for the rapid acquisition/reacquisition of strong GPS signals, enabling the receiver to quickly recover from outages due to blocked satellites or atmospheric entry. Additionally, the acquisition algorithm provides significantly lower sensitivities than a conventional space-based GPS receiver, permitting it to acquire satellites well above the GPS constellation. This paper assesses the performance of the Navigator receiver based upon three of the major flight regimes of a manned lunar mission: Earth ascent, cislunar navigation, and entry. Representative trajectories for each of these segments were provided by NASA. The Navigator receiver was connected to a Spirent GPS signal generator, to allow for the collection of real-time, hardware-in-the-loop results for each phase of the flight. For each of the flight segments, the Navigator was tested on its ability to acquire and track GPS satellites under the dynamical environment unique to that trajectory.

Author

Navigation Instruments; Global Positioning System; Lunar Orbiter; Reconnaissance; Atmospheric Entry; State Estimation; Autonomy; Low Earth Orbits

20080040729 NASA Goddard Space Flight Center, Greenbelt, MD, USA

New Worlds Observer Formation Control Design Based on the Dynamics of Relative Motion

Luquette, Richard J.; August 18, 2008; 10 pp.; In English; AIAA Guidance, Navigation and Control Conference and Exhibit, 18-21 Aug. 2008, Honolulu, HI, USA; Original contains color and black and white illustrations; No Copyright; Avail.:

CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040729>

The New Worlds Observer (NWO) mission is designed for the direct detection and characterization of extrasolar planets. The NWO mission concept employs a two spacecraft leader-follower formation on a trajectory around the Earth/Moon-Sun L(sub 2) Libration Point. The leader spacecraft is baselined as a 4 meter optical telescope. The follower, Starshade spacecraft, is designed to suppress light from a central body star permitting direct detection of a surrounding exoplanetary system. The current design requires a nominal leader-follower separation range of 72 Megameters. NWO poses many challenges including formation control. NWO cycles between three principal control modes during the nominal mission timeline: science (fine pointing), realignment and transition. This paper examines formation control strategies in the context of dynamics of relative motion for two spacecraft operating in the vicinity of the Earth/Moon-Sun L(sub 2)libration point. The paper presents an overview of the equations of relative motion followed by a discussion of each of the control modes. Discussion and analysis characterize control strategies for each of the mission control modes, including requirements, implementation challenges and project fuel budgets.

Author

Equations of Motion; Mission Planning; Extrasolar Planets; Libration; Detection; Trajectories

92

SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see 93 *Space Radiation*.

20080039251 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Variability of Solar Irradiances Using Wavelet Analysis

Pesnell, William D.; December 09, 2007; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

We have used wavelets to analyze the sunspot number, F10.7 (the solar irradiance at a wavelength of approx.10.7 cm), and Ap (a geomagnetic activity index). Three different wavelets are compared, showing how each selects either temporal or scale resolution. Our goal is an envelope of solar activity that better bounds the large amplitude fluctuations from solar

minimum to maximum. We show how the 11-year cycle does not disappear at solar minimum, that minimum is only the other part of the solar cycle. Power in the fluctuations of solar-activity-related indices may peak during solar maximum but the solar cycle itself is always present. The Ap index has a peak after solar maximum that appears to be better correlated with the current solar cycle than with the following cycle.

Author

Solar Activity Effects; Geomagnetism; Light (Visible Radiation); Wavelet Analysis; Solar Radiation

20080039335 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Four Point Measurements of the Foreshock

Sibeck, D. G.; Omidi, N.; Angelopoulos, V.; March 11, 2008; 1 pp.; In English; 15th Cluster Workshop, 11-15 Mar. 2008, Santa Cruz de Tenerife, Spain; Original contains poor quality, truncated or crooked pages; Copyright; Avail.: Other Sources; Abstract Only

Hybrid code numerical simulations accurately predict the properties of the Earth's foreshock, a region populated by solar wind particles heated and reflected by their interaction with the bow shock. The thermal pressures associated with the reflected population suffice to substantially modify the oncoming solar wind, substantially reducing densities, velocities, and magnetic field strengths, but enhance temperatures. Enhanced thermal pressures cause the foreshock to expand at the expense of the ambient solar wind, creating a boundary that extends approx.10 RE upstream which is marked by enhanced densities and magnetic field strengths, and flows deflected away from the foreshock. We present a case study of Cluster plasma and magnetic field observations of this boundary.

Author

Shock Waves; Magnetic Fields; Solar Wind; Bow Waves; Magnetic Flux; Plasmas (Physics)

20080039345 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Developing the Next Generation of Active Region Evolution Models

MacNeice, P. J.; November 04, 2007; 1 pp.; In English; 4th CCMC Community Workshop, Arecibo, Puerto Rico; No Copyright; Avail.: Other Sources; Abstract Only

We recently began development work on an integrated suite of models for slowly evolving solar active regions. In this presentation I will describe the design of this suite, highlight the challenges which this presents and discuss the implications of this design for the CCMC, to which a functional beta test version is to be delivered in three years.

Author

Models; Solar Activity Effects; Solar System Evolution

20080039348 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Cusp: Open Questions

Sibeck, D. G.; Omidi, N.; Korotova, G.; Angelopoulos, V.; December 09, 2007; 1 pp.; In English; 2007 AGU Fall meeting, 9-14 Dec. 2007, San Francisco, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

The northern and southern cusps play an important role in the overall solar wind-magnetosphere-ionosphere interaction. Optical, radar, and ground magnetometer observations of transient events in the dayside auroral oval provide strong evidence for bursty reconnection on the dayside magnetopause occurring along extended reconnection lines during periods of southward and/or ecliptic IMF orientation. During periods of northward IMF orientation, the same ground-based observations provide evidence for reconnection on the magnetopause poleward of the cusps. Cluster observations in the cusp have confirmed the transition in reconnection locations from the dayside to the high-latitude magnetopause as a function of IMF orientation, while in situ observations of the dayside magnetopause indicate that bursty reconnection frequently generates transient events marked by symmetric bipolar magnetic field signatures normal to the nominal magnetopause and magnetic field strength enhancements. In this talk we review recent and invoke new results from analytical, two-dimensional hybrid, and three-dimensional MHD codes to describe the motion and fate of the newly-reconnected magnetic field lines within FTEs, with a view to predicting (1) the locations where events form, (2) the mechanism(s) by which they are generated, (3) their signatures on the dayside and flank magnetopause, (4) their antisunward motion, (5) their interaction with the cusps, and (6) their signatures in the dayside auroral oval, including their occurrence patterns as a function of season. We compare these predictions with observations, in particular the results of a statistical study of Interball-1 FTEs and new multipoint THEMIS observations of FTEs.

Author

Solar Wind; Cusps (Landforms); Magnetopause; Magnetic Field Reconnection; Magnetohydrodynamics; Polar Regions; Auroras

20080039352 NASA Goddard Space Flight Center, Greenbelt, MD, USA

CMEs and Low Density Events in the Solar Wind

Ogilvie, K. W.; Steven, M. L.; Usmanov, A. V.; December 10, 2007; 2 pp.; In English; 2007 American Geophysical Union (AGU) Fall Meeting, 10-15 Dec. 2007, San Francisco, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

From time to time the density of the Solar Wind falls below unity for a day or so. Despite studies of these events, their cause has not been established. In the solar wind there are frequent rarefactions but these are much shallower than the ones we are discussing here. In particular any role that CMEs might play in forming more extreme rarefactions is not clear. We discuss 9 cases of extreme events, leading to sub-alfvenic flow and well observed by Wind, which occurred between 1999 and 2002, and look for corresponding CME events in the LASCO catalog. The catalog gives a fitted speed, good out to 20 Rs, as well as a speed lower down in the corona, and this is used to distinguish between a CME and an ICME. We find one of the events, which was simulated by Usmanov et al., cannot be associated with an ICME. The other eight events can plausibly be associated with fast ICMEs, identified by the presence of bi-streaming electrons also seen by Wind SWE, and by other phenomena. The implications of these observations are discussed but do not seem to be conclusive as to the cause of the extreme rarefactions.

Author

Solar Wind; Electrons; Coronas

20080039553 NASA Goddard Space Flight Center, Greenbelt, MD, USA

MESSENGER and Venus Express Observations of the Solar Wind Interaction with Venus: A Dual Spacecraft Study

Slavin, James A.; Acuna, M. H.; Anderson, B. J.; Barabash, S.; Benna, M.; Boardsen, S. A.; Fraenz, M.; Gloeckler, G.; Gold, R. E.; Ho, G. C.; Korth, H.; Krimigis, S. M.; McNutt, R. L., Jr.; Raines, J. M.; Sarantos, M.; Solomon, S. C.; Zhang, T.; Zurbuchen, T. H.; December 10, 2007; 1 pp.; In English; 2007 Fall AGU meeting, 10-14 Dec. 2007, San Francisco, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

At 23:08 UT on 5 June 2007 the MESSENGER spacecraft reached its closest approach altitude (338 km) during its second flyby of Venus en route to its 201 1 orbit insertion at Mercury. Whereas no measurements were collected during MESSENGER'S first Venus flyby in October 2006, the Magnetometer (MAG) and the Energetic Particle and Plasma Spectrometer (EPPS) operated successfully throughout this second encounter. Venus provides the solar system's best example to date of a solar wind - ionosphere planetary interaction. Pioneer Venus Orbiter measurements have shown that this interaction affects the upper atmosphere and ionosphere down to altitudes of ~ 150 km. Here we present an initial overview of the MESSENGER observations during the ~ 4 hrs that the spacecraft spent within 10 planet radii of Venus and, together with Venus Express measurements, examine the influence of solar wind plasma and interplanetary magnetic field conditions on the solar wind interaction at solar minimum.

Author

Messenger (Spacecraft); Flyby Missions; Venus (Planet); Energetic Particles; Magnetometers; Wind Effects; Upper Atmosphere; Solar Wind; Solar Activity Effects; Plasma Interactions

20080039626 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Turbulence Evolution and Shock Acceleration of Solar Energetic Particles

Chee, Ng K.; [2007]; 6 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NASA LWS04-0000-0076; NASA SHP04-0016-002; NCC5-640; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080039626>

We model the effects of self-excitation/damping and shock transmission of Alfvén waves on solar-energetic-particle (SEP) acceleration at a coronal-mass-ejection (CME) driven parallel shock. SEP-excited outward upstream waves speedily bootstrap acceleration. Shock transmission further raises the SEP-excited wave intensities at high wavenumbers but lowers them at low wavenumbers through wavenumber shift. Downstream, SEP excitation of inward waves and damping of outward waves tend to slow acceleration. Nevertheless, > 2000 km/s parallel shocks at approx. 3.5 solar radii can accelerate SEPs to 100 MeV in < 5 minutes.

Author

Energetic Particles; Solar Physics; Coronal Mass Ejection; Acceleration (Physics); Turbulence; Wave Excitation; Shock Waves

20080040722 Maryland Univ., College Park, MD, USA

RHESSI and Radio Imaging Observations of Microflares E2.3-0011-04

Kundu, M. R.; Trotter, G.; Garaimov, V. I.; Grigis, P.; Schmahl, E. J.; *Advances in Space Research*; June 24, 2005; ISBN 0273-1177; Volume 35, Issue 10, pp. 1778-1784; In English; COSPAR Meeting, July 2004, Paris, France

Contract(s)/Grant(s): NNG04GG33G; NAG5-10180; NSF ATM-0233907; No Copyright; Avail.: Other Sources; Abstract Only

ONLINE: <http://dx.doi.org/10.1016/j.asr.2005.04.052>

We present the analysis of five microflares, three observed simultaneously by RHESSI in hard X-rays and Nobeyama RadioHeliograph (NoRH) in microwaves (17 GHz) and two observed by RHESSI and Nancay RadioHeliograph (NRH) at metric wavelengths (150-450 MHz). Since we have no radio imaging telescopes simultaneously operating at microwave and meter wavelengths in the same time zone, we are obliged to use a different set of microevents for comparison with metric wavelength counterparts in contrast to that used for comparison with metric wavelength counterparts in contrast to that used for comparison with microwave events. This is because we are interested in using the locations and other imaging characteristics of the events from both RHESSI and Nancay instead of just temporal correlation. Here we describe the properties of five events -- three in microwaves and two at metric wavelengths.

Author

Imaging Techniques; Radio Observation; Solar Flares

20080040730 Colorado Univ., Boulder, CO, USA

The Flare Irradiance Spectral Model (FISM) and its Contributions to Space Weather Research, the Flare Energy Budget, and Instrument Design

Chamberlin, Phillip; September 12, 2008; 1 pp.; In English; Heliophysics Science Div. Meeting, 12 Sep. 2008, Greenbelt, MD, USA; No Copyright; Avail.: Other Sources; Abstract Only

The Flare Irradiance Spectral Model (FISM) is an empirical model of the solar irradiance spectrum from 0.1 to 190 nm at 1 nm spectral resolution and on a 1-minute time cadence. The goal of FISM is to provide accurate solar spectral irradiances over the vacuum ultraviolet (VUV: 0-200 nm) range as input for ionospheric and thermospheric models. The seminar will begin with a brief overview of the FISM model, and also how the Solar Dynamics Observatory (SDO) EUV Variability Experiment (EVE) will contribute to improving FISM. Some current studies will then be presented that use FISM estimations of the solar VUV irradiance to quantify the contributions of the increased irradiance from flares to Earth's increased thermospheric and ionospheric densities. Initial results will also be presented from a study looking at the electron density increases in the Martian atmosphere during a solar flare. Results will also be shown quantifying the VUV contributions to the total flare energy budget for both the impulsive and gradual phases of solar flares. Lastly, an example of how FISM can be used to simplify the design of future solar VUV irradiance instruments will be discussed, using the future NOAA GOES-R Extreme Ultraviolet and X-Ray Sensors (EXIS) space weather instrument.

Author

Solar Flares; Space Weather; Atmospheric Models; Irradiance; Spectral Resolution; Electron Density (Concentration); Extreme Ultraviolet Radiation

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*.

20080039329 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Sheaths: A Comparison of Magnetospheric, ICME, and Heliospheric Sheaths

Sibeck, D. G.; Richardson, J. D.; Liu, W.; May 21, 2007; 1 pp.; In English; American Geophysical Union (AGU) meeting, 21-26 May 2007, Acapulco, Mexico; Copyright; Avail.: Other Sources; Abstract Only

When a supersonic flow encounters an obstacle, shocks form to divert the flow around the obstacle. The region between the shock and the obstacle is the sheath, where the supersonic flow is compressed, heated, decelerated, and deflected. Supersonic flows, obstacles, and thus sheaths are observed on many scales throughout the Universe. We compare three examples seen in the heliosphere, illustrating the interaction of the solar wind with obstacles of three very different scales lengths. Magnetosheaths form behind planetary bow shocks on scales ranging from tens to 100 planetary radii. ICME sheath form behind shocks driven by solar disturbances on scale lengths of a few to tens of AU. The heliosheath forms behind the

termination shock due to the obstacle presented by the interstellar medium on scale lengths of tens to a hundred AU. Despite this range in scales some common features have been observed. Magnetic holes, possibly due to mirror mode waves, have been observed in all three of these sheaths. Plasma depletion layers are observed in planetary and ICME sheaths. Other features observed in some sheaths are wave activity (ion cyclotron, plasma), energetic particles, transmission of Alfvén waves/shocks, tangential discontinuities turbulence behind quasi-parallel shocks, standing slow mode waves, and reconnection on the obstacle boundary. We compare these sheath regions, discussing similarities and differences and how these may relate to the scale lengths of these regions.

Author

Interstellar Matter; Sheaths; Magnetohydrodynamic Waves; Energetic Particles; Heliosphere; Supersonic Flow; Standing Waves; Solar Wind; Ion Cyclotron Radiation; Plasma Layers

20080039420 Commissariat à l'Énergie Atomique, France

RADECS Short Course Session I: The Space Radiation Environment

Xapsos, Michael; Bourdarie, Sebastien; September 10, 2007; 77 pp.; In English; 9th European Conference Radiation and Its Effects on Components and Systems, 10 - 14 Sep. 2007, Deauville, France; Original contains poor quality, truncated or crooked pages; Copyright; Avail.: CASI: [A05](#), Hardcopy

The presented slides and accompanying paper focus on radiation in the space environment. Since space exploration has begun it has become evident that the space environment is a highly aggressive medium. Beyond the natural protection provided by the Earth's atmosphere, various types of radiation can be encountered. Their characteristics (energy and nature), origins and distributions in space are extremely variable. This environment degrades electronic systems and on-board equipment in particular and creates radiobiological hazards during manned space flights. Based on several years of space exploration, a detailed analysis of the problems on satellites shows that the part due to the space environment is not negligible. It appears that the malfunctions are due to problems linked to the space environment, electronic problems, design problems, quality problems, other issues, and unexplained reasons. The space environment is largely responsible for about 20% of the anomalies occurring on satellites and a better knowledge of that environment could only increase the average lifetime of space vehicles. This naturally leads to a detailed study of the space environment and of the effects that it induces on space vehicles and astronauts. Sources of radiation in the space environment are discussed here and include the solar activity cycle, galactic cosmic rays, solar particle events, and Earth radiation belts. Future challenges for space radiation environment models are briefly addressed.

CASI

Extraterrestrial Radiation; Aerospace Environments; Space Exploration; Spacecraft Electronic Equipment; Spacecraft Design; Radiation Shielding

20080039559 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Radiation Performance of 1 Gbit DDR SDRAMs Fabricated in the 90 nm CMOS Technology Node

Ladbury, Raymond L.; Gorelick, Jerry L.; Berg, M. D.; Kim, H.; LaBel, K.; Friendlich, M.; Koga, R.; George, J.; Crain, S.; Yu, P.; Reed, R. A.; July 17, 2006; 4 pp.; In English; 2006 IEEE Nuclear and Space Radiation Effects Conference (NSREC), 17-21 Jul. 2006, Ponte Vedra, FL, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

We present Single Event Effect (SEE) and Total Ionizing Dose (TID) data for 1 Gbit DDR SDRAMs (90 nm CMOS technology) as well as comparing this data with earlier technology nodes from the same manufacturer.

Author

Dosage; CMOS; Traveling Ionospheric Disturbances; Radiation Effects; Reliability; Probability Theory

20080039622 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Space Radiation Environment

Bourdarie, Sebastien; Xapsos, Michael A.; [2008]; 25 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The effects of the space radiation environment on spacecraft systems and instruments are significant design considerations for space missions. Astronaut exposure is a serious concern for manned missions. In order to meet these challenges and have reliable, cost-effective designs, the radiation environment must be understood and accurately modeled. The nature of the environment varies greatly between low earth orbits, higher earth orbits and interplanetary space. There are both short-term and long-term variations with the phase of the solar cycle. In this paper we concentrate mainly on charged particle radiations.

Descriptions of the radiation belts and particles of solar and cosmic origin are reviewed. An overview of the traditional models is presented accompanied by their application areas and limitations. This is followed by discussion of some recent model developments.

Author

Radiation Effects; Manned Space Flight; Spacecraft Instruments; Extraterrestrial Radiation

20080040134 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Effectiveness of Internal vs. External SEU Scrubbing Mitigation Strategies in a Xilinx FPGA: Design, Test, and Analysis

Berg, Melanie; Poivey C.; Petrick, D.; Espinosa, D.; Lesea, Austin; LaBel, K. A.; Friendlich, M; Kim, H; Phan, A.; [2008]; 7 pp.; In English; Original contains black and white illustrations; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080040134>

We compare two scrubbing mitigation schemes for Xilinx FPGA devices. The design of the scrubbers is briefly discussed along with an examination of mitigation limitations. Proton and Heavy Ion data are then presented and analyzed.

Author

Field-Programmable Gate Arrays; Spacecraft Electronic Equipment; Random Access Memory

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