National Aeronautics and
Space Administration
Langley Research Center

Scientific and Technical
Information Program Office

Scientific and Technical Aerospace Reports

STAR

Volume 46 Number 07

April 14, 2008

WHAT'S INSIDE

NASA STI Program ... in Profile

Since its founding, NASA has been dedicated to the advancement of aeronautics and space science. The NASA scientific and technical information (STI) program plays a key part in helping NASA maintain this important role.

The NASA STI program operates under the auspices of the Agency Chief Information Officer. It collects, organizes, provides for archiving, and disseminates NASA's STI. The NASA STI program provides access to the NASA Aeronautics and Space Database and its public interface, the NASA Technical Report Server, thus providing one of the largest collections of aeronautical and space science STI in the world. Results are published in both non-NASA channels and by NASA in the NASA STI Report Series, which includes the following report types:

- TECHNICAL PUBLICATION. Reports of completed research or a major significant phase of research that present the results of NASA Programs and include extensive data or theoretical analysis. Includes compilations of significant scientific and technical data and information deemed to be of continuing reference value. NASA counterpart of peer-reviewed formal professional papers but has less stringent limitations on manuscript length and extent of graphic presentations.

- TECHNICAL MEMORANDUM. Scientific and technical findings that are preliminary or of specialized interest, e.g., quick release reports, working papers, and bibliographies that contain minimal annotation. Does not contain extensive analysis.

- CONTRACTOR REPORT. Scientific and technical findings by NASA-sponsored contractors and grantees.

- CONFERENCE PUBLICATION. Collected papers from scientific and technical conferences, symposia, seminars, or other meetings sponsored or co-sponsored by NASA.

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

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

Specialized services also include creating custom thesauri, building customized databases, and organizing and publishing research results.

For more information about the NASA STI program, see the following:

- Access the NASA STI program home page at http://www.sti.nasa.gov

- E-mail your question via the Internet to help@sti.nasa.gov

- Fax your question to the NASA STI Help Desk at (301) 621-0134

- Phone the NASA STI Help Desk at (301) 621-0390

- Write to:
  NASA STI Help Desk
  NASA Center for AeroSpace Information
  7115 Standard Drive
  Hanover, MD 21076-1320

Introduction

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

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

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 world-wide STI. The results of 20th and 21st century aeronautics and aerospace research and development, a worldwide investment totaling billions of dollars, have been captured, organized, and stored in the NASA Aeronautics and Space Database. New information is continually announced and made available as it is acquired, making this a dynamic and historical collection of value to business, industry, academia, federal institutions, and the general public.

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

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

NASA STI Availability Information

NASA Center for AeroSpace Information (CASI)

Through NASA CASI, the NASA STI Program offers many information products and services to the aerospace community and to the public, including access to a selection of full text of the NASA STI. Free registration with the program is available to NASA, U.S. Government agencies and contractors. To register, contact CASI at help@sti.nasa.gov. Others should visit the program at www.sti.nasa.gov. The 'search selected databases' button provides access to the NASA Technical Reports Server (NTRS) – the publicly available contents of the NASA Aeronautics and Space Database.

Each citation in *STAR* indicates a 'Source of Availability.' When CASI is indicated, the user can order this information directly from CASI using the STI Online Order Form, e-mail to help@sti.nasa.gov, or telephone the STI Help Desk at 301-621-0390. Before ordering you may access price code tables for STI documents and videos. When information is not available from CASI, the source of the information is indicated when known.

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

National Technical Information Service (NTIS)

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

The Federal Depository Library Program (FDLP)

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/.

Table of Contents

Subject Divisions/Categories

Document citations are grouped by division and then by category, according to the *NASA Scope and Subject Category Guide.*

Aeronautics

Astronautics

Chemistry and Materials

Engineering

Geosciences

Life Sciences

Mathematical and Computer Sciences

Physics

Social and Information Sciences

Space Sciences

Indexes

Two indexes are available. You may use the find command under the tools menu while viewing the PDF file for direct match searching on any text string. You may also select either of the two indexes provided for linking to the corresponding document citation from *NASA Thesaurus* terms and personal author names.

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

A Biweekly Publication of the National Aeronautics and Space Administration

VOLUME 46, NUMBER 07 APRIL 14, 2008

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.

20080013542 National Inst. of Aerospace, Hampton, VA, USA

Final Report for The Creation of a Physics-based Ground-effect Model, Phase 2 - Inclusion of the Effects of Wind, Stratification, and Shear into the New Ground Effect Model

Sarpkaya, Turgut; October 2006; 39 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNL06AB77T; NAS1-02117; TO6-6000-HAI; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080013542

The reduction of the separation of the leading and following aircrafts is desirable to enhance the airport capacity provided that there is a physics-based operational model applicable to all regions of the flight domain (out of ground effect, OGE; near ground effect, NGE; and in ground effect, IGE) and that the quality of the quantitative input from the measurements of the prevailing atmospheric conditions and the quality of the total airport operations regarding the safety and the sound interpretation of the prevailing conditions match the quality of the analysis and numerical simulations. In the absence of an analytical solution, the physics of the flow is best expressed by a mathematical model based on numerical simulations, field and laboratory experiments, and heuristic reasoning. This report deals with the creation of a sound physics-based real-time IGE model of the aircraft wake vortices subjected to crosswind, stratification and shear.

Author

Ground Effect (Aerodynamics); Stratification; Wind Effects; Wind Shear; Physics; Real Time Operation; Aircraft Wakes; Vortices

20080014029 Government Accountability Office, Washington, DC, USA

Aviation and the Environment: FAA's and NASA's Research and Development Plans for Noise Reduction Are Aligned but the Prospects of Achieving Noise Reduction Goals Are Uncertain

February 2008; 32 pp.; In English

Report No.(s): GAO-08-384; No Copyright; Avail.: CASI: A03, Hardcopy

FAA's and NASA's R&D plans include a wide range of projects for addressing aviation noise, and these plans are aligned through partnerships and planning and coordinating mechanisms. FAA sponsors aviation noise R&D in areas such as aviation noise measurement, aviation noise effects, aviation noise and emissions interrelationships, and flight procedures and technologies to mitigate the impact of noise on communities. FAA sponsors much of this research through partnerships with universities; other federal agencies, including NASA; and industry. NASA conducts R&D that can eventually lead to new technologies for making substantially quieter aircraft provided that the technologies are further developed by industry and integrated into production-ready aircraft designs. FAA and NASA have aligned their aviation noise R&D activities by working with interagency planning and coordinating groups to establish objectives for the nation s aeronautical research and for specific research on the environmental impacts of next generation aviation technologies. Both agencies also serve on the same aviation research advisory groups, and the alignment of their aviation noise R&D activities is reflected in strategic plans for the National Airspace System that indicates how each agenc's R&D efforts will contribute to meeting goals for reducing noise and thereby help reduce community opposition to increasing aviation system capacity. FAA's and NASA's noise reduction goals are designed, together, to reduce people s exposure to aviation noise primarily by reducing such noise at its source, but the likelihood of achieving these goals is uncertain. Under FAA s targets, the number of people exposed to significant aviation noise--estimated at 500,000 nationwide--would be reduced by 4 percent a year through fiscal year 2012. NASA s targets, established for the next three generations of aircraft, would lead to the entry into service of successively quieter aircraft by

2015, 2020-2025, and 2030-2035, respectively. The likelihood of meeting these targets depends on a number of uncertainties. First, federal funding will be needed not only for NASA's research but also for later-stage R&D, which NASA expects others to perform. The administration has proposed a 10-year program to support later-stage R&D to demonstrate technologies for industry acceptance. But even if funded, the development of noise reduction technologies may be limited by concerns about global warming, since advances in these technologies could make it more difficult to also achieve reductions in aircraft emissions of greenhouse gases. Also uncertain is the extent to which manufacturers will integrate newly developed technologies into aircraft and engine designs. Finally, it is uncertain whether airlines will purchase new aircraft or retrofit existing aircraft with the new technologies in sufficient numbers to achieve targeted reductions in exposure to aviation noise. Failure to achieve FAA's and NASA's noise reduction goals could constrain efforts to expand the National Airspace System's capacity and reduce congestion.
Derived from text
Aeronautical Engineering; Noise Measurement; Noise Reduction; Aerodynamic Noise; Aircraft Noise; Aircraft Industry; Aircraft Design

20080014107 NASA Langley Research Center, Hampton, VA, USA
Incorporating Data Link Messaging into a Multi-function Display for General Aviation Aircraft
Adams, Catherine A.; Murdoch, Jennifer L.; September 03, 2006; 9 pp.; In English; ICAS 2006 - 25th Congress of the International Council of the Aeronautical Sciences, 3-8 Sep. 2006, Hamburg, Germany; Original contains color illustrations
Contract(s)/Grant(s): WBS 609866.02.07.07.01
Report No.(s): Paper No. 375; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080014107

One objective of the Small Aircraft Transportation System (SATS) Project is to increase the capacity and utilization of small non-towered, non-radar equipped airports by transferring traffic management activities to an automated system and separation responsibilities to general aviation (GA) pilots. This paper describes the development of a research multi-function display (MFD) to support the interaction between pilots and an automated Airport Management Module (AMM). Preliminary results of simulation and flight tests indicate that adding the responsibility of monitoring other traffic for self-separation does not increase pilots subjective workload levels. Pilots preferred using the enhanced MFD to execute flight procedures, reporting improved situation awareness over conventional instrument flight rules (IFR) procedures.
Author
Data Links; General Aviation Aircraft; Aeronautics; Messages; Display Devices

20080014173 NASA Langley Research Center, Hampton, VA, USA
Overview of the NASA Subsonic Rotary Wing Aeronautics Research Program in Rotorcraft Crashworthiness
Jackson, Karen E.; Fuchs, Yvonne T.; Kellas, Sotiris; March 03, 2008; 19 pp.; In English; ASCE 11th Earth and Space Conference, 3-5 Mar. 2008, Long Beach, CA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 877868.02.07.07.05.02; Copyright; Avail.: CASI: A03, Hardcopy

This paper provides an overview of rotorcraft crashworthiness research being conducted at NASA Langley Research Center under sponsorship of the Subsonic Rotary Wing (SRW) Aeronautics Program. The research is focused in two areas: development of an externally deployable energy attenuating concept and improved prediction of rotorcraft crashworthiness. The deployable energy absorber (DEA) is a composite honeycomb structure, with a unique flexible hinge design that allows the honeycomb to be packaged and remain flat until needed for deployment. The capabilities of the DEA have been demonstrated through component crush tests and vertical drop tests of a retrofitted fuselage section onto different surfaces or terrain. The research on improved prediction of rotorcraft crashworthiness is focused in several areas including simulating occupant responses and injury risk assessment, predicting multi-terrain impact, and utilizing probabilistic analysis methods. A final task is to perform a system-integrated simulation of a full-scale helicopter crash test onto a rigid surface. A brief description of each research task is provided along with a summary of recent accomplishments.
Author
Crashworthiness; Rotary Wing Aircraft; General Overviews; Subsonic Flow; Aeronautical Engineering; Research Projects

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.

20080013557 Army Aviation and Missile Command, Moffett Field, CA, USA

Aerodynamic Characteristics of Two Rotary Wing UAV Designs

Jones, Henry E.; Wong, Oliver D.; Noonan, Kevin W.; Reis, Deane G.; Malovrh, Brendon D.; January 18, 2006; 24 pp.; In English; AHS International - 4th Vertical Lift Aircraft Design Conference, 18-20 Jan. 2006, San Francisco, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): 23R72399917001; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080013557

This paper presents the results of an experimental investigation of two rotary-wing UAV designs. The primary goal of the investigation was to provide a set of interactional aerodynamic data for an emerging class of rotorcraft. The present paper provides an overview of the test and an introduction to the test articles, and instrumentation. Sample data in the form of a parametric study of fixed system lift and drag coefficient response to changes in configuration and flight condition for both rotor off and on conditions are presented. The presence of the rotor is seen to greatly affect both the character and magnitude of the response. The affect of scaled stores on body drag is observed to be dependent on body shape.

Author

Rotary Wing Aircraft; Pilotless Aircraft; Aerodynamic Coefficients; Aerodynamic Characteristics; Aerodynamic Drag

20080013574 NASA Langley Research Center, Hampton, VA, USA

Boundary-Layer-Ingesting Inlet Flow Control

Owens, Lewis R.; Allan, Brian G.; Gorton, Susan A.; [2006]; 23 pp.; In English; 44th AIAA Aerospace Sciences Meeting and Exhibit, 9-12 Jan. 2006, Reno, NV, USA; Original contains color illustrations

Report No.(s): AIAA 2006-0839; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080013574

This paper gives an overview of a research study conducted in support of the small-scale demonstration of an active flow control system for a boundary-layer-ingesting (BLI) inlet. The effectiveness of active flow control in reducing engine inlet circumferential distortion was assessed using a 2.5% scale model of a 35% boundary-layer-ingesting flush-mounted, offset, diffusing inlet. This experiment was conducted in the NASA Langley 0.3-meter Transonic Cryogenic Tunnel at flight Mach numbers with a model inlet specifically designed for this type of testing. High mass flow actuators controlled the flow through distributed control jets providing the active flow control. A vortex generator point design configuration was also tested for comparison purposes and to provide a means to examine a hybrid vortex generator and control jets configuration. Measurements were made of the onset boundary layer, the duct surface static pressures, and the mass flow through the duct and the actuators. The distortion and pressure recovery were determined by 40 total pressure measurements on 8 rake arms each separated by 45 degrees and were located at the aerodynamic interface plane. The test matrix was limited to a maximum free-stream Mach number of 0.85 with scaled mass flows through the inlet for that condition. The data show that the flow control jets alone can reduce circumferential distortion (DPCP(sub avg)) from 0.055 to about 0.015 using about 2.5% of inlet mass flow. The vortex generators also reduced the circumferential distortion from 0.055 to 0.010 near the inlet mass flow design point. Lower inlet mass flow settings with the vortex generator configuration produced higher distortion levels that were reduced to acceptable levels using a hybrid vortex generator/control jets configuration that required less than 1% of the inlet mass flow.

Author

Boundary Layers; Engine Inlets; Mass Flow; Inlet Flow; Scale Models; Pressure Measurement; Active Control; Distributed Parameter Systems; Flow Distribution

20080013583 NASA Langley Research Center, Hampton, VA, USA

Pressure Gradient Effects on Hypersonic Cavity Flow Heating

Everhart, Joel L.; Alter, Stephen J.; Merski, N. Ronald; Wood, William A.; Prabhu, Ramdas K.; [2007]; 28 pp.; In English; 44th AIAA Aerospace Sciences Meeting and Exhibit, 9-12 Jan. 2006, Reno, NV, USA; Original contains color illustrations

Report No.(s): AIAA 2006-0185; Copyright; Avail.: CASI: A03, Hardcopy

The effect of a pressure gradient on the local heating disturbance of rectangular cavities tested at hypersonic freestream

conditions has been globally assessed using the two-color phosphor thermography method. These experiments were conducted in the Langley 31-Inch Mach 10 Tunnel and were initiated in support of the Space Shuttle Return-To-Flight Program. Two blunted-nose test surface geometries were developed, including an expansion plate test surface with nearly constant negative pressure gradient and a flat plate surface with nearly zero pressure gradient. The test surface designs and flow characterizations were performed using two-dimensional laminar computational methods, while the experimental boundary layer state conditions were inferred using the measured heating distributions. Three-dimensional computational predictions of the entire model geometry were used as a check on the design process. Both open-flow and closed-flow cavities were tested on each test surface. The cavity design parameters and the test condition matrix were established using the computational predictions. Preliminary conclusions based on an analysis of only the cavity centerline data indicate that the presence of the pressure gradient did not alter the open cavity heating for laminar-entry/laminar-exit flows, but did raise the average floor heating for closed cavities. The results of these risk-reduction studies will be used to formulate a heating assessment of potential damage scenarios occurring during future Space Shuttle flights.
Author
Cavity Flow; Pressure Gradients; Temperature Effects; Boundary Layers; Hypersonic Flow; Laminar Flow; Pressure Effects; Dimensional Analysis; Damage Assessment; Thermography; Heating; Design Analysis

20080014033 NASA Langley Research Center, Hampton, VA, USA
Recent Improvements in Semi-Span Testing at the National Transonic Facility (Invited)
Gatlin, G. M.; Tomek, W. G.; Payne, F. M.; Griffiths, R. C.; [2006]; 20 pp.; In English; 44th AIAA Aerospace Sciences Meeting and Exhibit, 9-12 Jan. 2006, Reno, NV, USA; Original contains color illustrations
Contract(s)/Grant(s): 23-561581.02.08.07; Copyright; Avail.: CASI: A03, Hardcopy

Three wind tunnel investigations of a commercial transport, high-lift, semi-span configuration have recently been conducted in the National Transonic Facility at the NASA Langley Research Center. Throughout the course of these investigations multiple improvements have been developed in the facility semi-span test capability. The primary purpose of the investigations was to assess Reynolds number scale effects on a modern commercial transport configuration up to full-scale flight test conditions (Reynolds numbers on the order of 27 million). The tests included longitudinal aerodynamic studies at subsonic takeoff and landing conditions across a range of Reynolds numbers from that available in conventional wind tunnels up to flight conditions. The purpose of this paper is to discuss lessons learned and improvements incorporated into the semi-span testing process. Topics addressed include enhanced thermal stabilization and moisture reduction procedures, assessments and improvements in model sealing techniques, compensation of model reference dimensions due to test temperature, significantly improved semi-span model access capability, and assessments of data repeatability.
Author
Wind Tunnel Tests; Aerodynamic Configurations; Flight Tests; Full Scale Tests; Semispan Models; Transonic Wind Tunnels; Commercial Aircraft

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.

20080013436 NASA Langley Research Center, Hampton, VA, USA
The Effects of Projected Future Demand Including Very Light Jet Air-Taxi Operations on U.S. National Airspace System Delays as a Function of Next Generation Air Transportation System Airspace Capacity
Smith, Jerry; Viken, Jeff; Dollyhigh, Samuel; Trani, Antonio; Baik, Hojong; Hinze, Nicholas; Ashiabor, Senanu; July 13, 2007; 34 pp.; In English; 7th AIAA Aviation Technology, Integration and Operations Conference (ATIO), 18-20 Sep. 2007, Belfast, Ireland; Original contains color illustrations
Contract(s)/Grant(s): WBS 411931.02.71.07.01.04; Copyright; Avail.: CASI: A03, Hardcopy

This paper presents the results from a study which investigates the potential effects of the growth in air traffic demand including projected Very Light Jet (VLJ) air-taxi operations adding to delays experienced by commercial passenger air transportation in the year 2025. The geographic region studied is the contiguous USA (U.S.) of America, although international air traffic to and from the U.S. is included. The main focus of this paper is to determine how much air traffic growth, including

VLJ air-taxi operations will add to enroute airspace congestion and determine what additional airspace capacity will be needed to accommodate the expected demand. Terminal airspace is not modeled and increased airport capacity is assumed.
Author
Air Traffic; Air Transportation; Airports; Airspace; Airline Operations

20080013438 NASA Langley Research Center, Hampton, VA, USA
Development of Terrorist Attack Scenarios Against the Air Transportation System
Sorokach, Michael; Brown, Sherilyn; Fisher, Kenneth; Jones, Frank; Bott, Terry; Eisenhawer, Stephen; Foggia, John; Santos, Joseph; March 27, 2007; 26 pp.; In English; Risk Symposium 2007 - 2nd Annual Symposium on Risk Analysis for Homeland Security and Defense: Theory and Application, 26-28 Mar. 2007, Santa Fe, NM, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 609866.02.07.07.05; Copyright; Avail.: CASI: A03, Hardcopy

This viewgraph presentation describes the different types of terrorist attack scenarios against the Air Transportation System.
CASI
Air Transportation; Terrorism; Technology Utilization; Logistics

20080013474 NASA Langley Research Center, Hampton, VA, USA
Development of Attack Scenarios Against the Air Transportation System
Sorokach, Michael; Brown, Sherilyn; Fisher, Kenneth; Jones, Frank; Bott, Terry; Eisenhawer, Stephen; Foggia, John; Santos, Joseph; September 13, 2007; 29 pp.; In English; MODSIM World Conference and Expo 2007, 11-13 Sep. 2007, Virginia Beach, VA, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 609866.02.07.07.05; Copyright; Avail.: CASI: A03, Hardcopy

This viewgraph presentation describes the use of logic gate trees to reduce the risk of terrorism against the Air Transportation System.
CASI
Air Transportation; Terrorism; Attack; Civil Aviation; Technology Utilization

20080013487 NASA Johnson Space Center, Houston, TX, USA
Safety Review Panel (SRP) Special Topic Presentation on the Iodine Compatible Water Container (ICWC)
Thomas, Evan A.; March 12, 2008; 19 pp.; In English; Safety Review Panel, 4 Mar. 2008, Houston, TX, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 401769.06.03.03.02.06; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013487

This viewgraph presentation reviews the safety requirements for the Iodine Compatible Water Container (ICWC). The topics include: 1) ICWC Team; 2) Purpose of presentation; 3) Background/Description of ICWC System; 4) Current status of ICWC Project; 5) HTV launch NCR Processing; 6) Tox 1 containment NCR processing; and 7) ISS on-orbit failure propagation and fault tolerance NCR processing.
CASI
Iodine; Water; Bioastronautics; Space Shuttles; Aerospace Safety; Containers

20080013631 NASA Langley Research Center, Hampton, VA, USA
Airborne Precision Spacing: A Trajectory-based Approach to Improve Terminal Area Operations
Barmore, Bryan; October 15, 2006; 12 pp.; In English; 25th Digital Avionics Systems Conference, 15-19 Oct. 2006, Portland, OR, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 411931.02.07.07; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013631

Airborne Precision Spacing has been developed by the National Aeronautics and Space Administration (NASA) over the past seven years as an attempt to benefit from the capabilities of the flight deck to precisely space their aircraft relative to another aircraft. This development has leveraged decades of work on improving terminal area operations, especially the arrival phase. With APS operations, the air traffic controller instructs the participating aircraft to achieve an assigned inter-arrival spacing interval at the runway threshold, relative to another aircraft. The flight crew then uses airborne automation to manage the aircraft s speed to achieve the goal. The spacing tool is designed to keep the speed within acceptable operational limits, promote system-wide stability, and meet the assigned goal. This reallocation of tasks with the controller issuing strategic goals

and the flight crew managing the tactical achievement of those goals has been shown to be feasible through simulation and flight test. A precision of plus or minus 2-3 seconds is generally achievable. Simulations of long strings of arriving traffic show no signs of instabilities or compression waves. Subject pilots have rated the workload to be similar to current-day operations and eye-tracking data substantiate this result. This paper will present a high-level review of research results over the past seven years from a variety of tests and experiments. The results will focus on the precision and accuracy achievable, flow stability and some major sources of uncertainty. The paper also includes a summary of the flight crew s procedures and interface and a brief concept overview.
Author
Air Traffic Control; Airports; Aircraft Approach Spacing

20080014031 NASA Langley Research Center, Hampton, VA, USA
Evaluation of Risk and Possible Mitigation Schemes for Previously Unidentified Hazards
Linzey, William; McCutchan, Micah; Traskos, Michael; Gilbrech, Richard; Cherney, Robert; Slenski, George; Thomas, Walter, III; [2006]; 28 pp.; In English; 9th Joint FAA/DoD/NASA Conference on Aging Aircraft, 6-9 Mar. 2006, Atlanta, GA, USA; Original contains color illustrations
Contract(s)/Grant(s): 23-104-08-46; Copyright; Avail.: CASI: A03, Hardcopy

In April 2004, the NASA Engineering and Safety Center (NESC) was commissioned by NASA's Chief Safety and Mission Assurance (S&MA) Officer to review and render a technical opinion on the probability of a catastrophic failure related to this scenario: The Space Shuttle Program (SSP) recognized a zero-fault-tolerant design related to an inadvertent firing of the primary reaction control system (RCS) jets on the Orbiter during mated operations with the International Space Station (ISS). It was determined that an un-commanded firing of an RCS jet could cause serious damage or loss of both the SSP Orbiter and the ISS. Several scenarios were suggested in which an un-commanded firing of the RCS jet is possible. These scenarios include an arc track event in the 28-volt heater circuits that could result in a wire-to-wire short to the adjacent reaction control jet wire. In this worst-case scenario, enough current and power could be applied to activate the reaction control jet valves and fire a thruster. The following report summarizes the work that was sponsored by the NESC as part of their assessment of the Orbiter inadvertent firing of a RCS thruster while attached to the ISS.
Author
Risk; Aircraft Safety; Air Transportation; Aircraft Fuel Systems; Transport Aircraft; Aircraft Power Supplies; Civil Aviation; Aircraft Hazards

20080014225 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
The Impact of Training on General Aviation Pilots' Ability to Make Strategic Weather-related Decisions
Ball, Jerry; February 2008; 20 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): AHRR521
Report No.(s): DOT/FAA/AM-08/3; No Copyright; Avail.: CASI: A03, Hardcopy

Inadvertent flight into hazardous weather can have devastating results for general aviation pilots. In fact, weather is the leading cause of fatalities in general aviation. The purpose of this study was to determine if a graphical weather display combined with an instructional training paradigm could improve pilots' ability to maintain a safe flying distance from convective thunderstorm activity. Previous research suggested that giving pilots the ability to see accurately the weather they are flying in and around may tempt some pilots to try to fly through small breaks in the convective activity. Indeed, Beringer and Ball found that pilots using graphical weather could be classified into two types of users (tactical vs. strategic). Tactical users were those pilots who used the information to try and navigate . . - through or very close to the hazardous weather. Strategic users were those pilots who used the graphical information to plan and maintain a safe distance (20 nautical miles or greater) from the storm. An instructional slide presentation based on the Aeronautical Information Manual (AIM, 7-1-27) guidelines was developed with the intent of modifying the behavior of users classified as 'tactical.' Fifty-seven general aviation pilots were evaluated on a low-visibility visual flight rules (VFR) scenario where they encountered an encroaching thunderstorm traversing their flight plan. he pilots were separated into two groups, tactical or strategic users, according to how they responded to a simulated scenario of a VFR flight using a graphical weather display. Half of the pilots in each group then received training to see if it would decrease the incidence of tactical usage. Additionally, a control group was evaluated that flew the multifunction display without the graphical weather information. The hypothesis that training would improve the tactical pilots' ability to maintain a safe flying distance was supported. The analyses indicate that training lowered the tactical users from 100% tactical usage down to 44% tactical usage. It also significantly increased the average distance tactical users flew from the thunderstorm from 10.2 miles (SD = 4.0) to 31.3 miles (SD = 18.2); t (8.76) = -3.401, p<.008 (equal variances

not assumed). The strategic and tactical untrained user groups were not significantly different from their respective control group (no training and no graphical weather) on how close they flew to the weather or cells.
Author
Education; General Aviation Aircraft; Aviation Meteorology; Pilot Training; Meteorological Parameters

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.

20080013422 NASA Glenn Research Center, Cleveland, OH, USA
Application of the Systematic Sensor Selection Strategy for Turbofan Engine Diagnostics
Sowers, T. Shane; Kopasakis, George; Simon, Donald L.; [2008]; 9 pp.; In English; ASME Turbo Expo Conference, 9-13 Jun. 2008, Berlin, Germany; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 645846.02.07.03.03.01
Report No.(s): GT2008-50525; Copyright; Avail.: Other Sources

The data acquired from available system sensors forms the foundation upon which any health management system is based, and the available sensor suite directly impacts the overall diagnostic performance that can be achieved. While additional sensors may provide improved fault diagnostic performance there are other factors that also need to be considered such as instrumentation cost, weight, and reliability. A systematic sensor selection approach is desired to perform sensor selection from a holistic system-level perspective as opposed to performing decisions in an ad hoc or heuristic fashion. The Systematic Sensor Selection Strategy is a methodology that optimally selects a sensor suite from a pool of sensors based on the system fault diagnostic approach, with the ability of taking cost, weight and reliability into consideration. This procedure was applied to a large commercial turbofan engine simulation. In this initial study, sensor suites tailored for improved diagnostic performance are constructed from a prescribed collection of candidate sensors. The diagnostic performance of the best performing sensor suites in terms of fault detection and identification are demonstrated, with a discussion of the results and implications for future research.
Author
Diagnosis; Turbofan Engines; Data Acquisition; Sensors; Aircraft Engines; Systems Engineering

20080013493 NASA Dryden Flight Research Center, Edwards, CA, USA
IRAC Full-scale Flight Test
Bosworth, John T.; January 2008; 29 pp.; In English; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013493

This viewgraph presentation reviews Integrated Resilient Aircraft Control (IRAC) full scale flight tests.
CASI
Aircraft Control; Flight Tests; Full Scale Tests; F-18 Aircraft; C-17 Aircraft; F-15 Aircraft

20080013519 NASA Langley Research Center, Hampton, VA, USA
Summary of NACA/NASA Variable-Sweep Research and Development Leading to the F-111 (TFX)
December 22, 1966; 42 pp.; In English; Original contains black and white illustrations
Report No.(s): LWP-285; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013519

On November 24, 1962, the USA ushered in a new era of aircraft development when the Department of Defense placed an initial development contract for the world's first supersonic variable-sweep aircraft - the F-111 or so-called TFX (tactical fighter-experimental). The multimission performance potential of this concept is made possible by virtue of the variable-sweep wing - a research development of the NASA and its predecessor, the NACA. With the wing swept forward into the maximum span position, the aircraft configuration is ideal for efficient subsonic flight. This provides long-range combat and ferry mission capability, short-field landing and take-off characteristics, and compatibility with naval aircraft carrier operation. With the wing swept back to about 650 of sweep, the aircraft has optimum supersonic performance to accomplish high-altitude supersonic bombing or interceptor missions. With the wing folded still further back, the aircraft provides low drag and low

gust loads during supersonic flight ‘on the deck’ (altitudes under 1000 feet). The concept of wing variable sweep, of course, is not new. Initial studies were conducted at Langley as early as 1945, and two subsonic variable-sweep prototypes (Bell X-5 and Grumman XF-IOF) were flown as early as 1951/52. These were subsonic aircraft, however, and the great advantage of variable sweep in improving supersonic flight efficiency could not be realized. Further~ the structures of these early aircraft were complicated by the necessity for translating the ~ing fore and aft to achieve satisfactory longitUdinal stability as the wing sweep was varied. Late in 1958 a research breakthrough at Langley provided the technology for designing a variable-sweep wing having satisfactory stability through a wide sweep angle range without the necessity for fore and aft translation of the wing. In this same period there evolved within the military services an urgent requirement for a versatile fighter-bomber that could fly efficiently at subsonic and supersonic speeds at high altitude and ‘on the deck’. The application of variable sweep to this mission requirement then became obvious.
Derived from text
F-111 Aircraft; Sweep Angle; Aerodynamic Characteristics; Supersonic Aircraft; Variable Sweep Wings; Military Aircraft; Prototypes

20080013520 NASA Dryden Flight Research Center, Edwards, CA, USA
E-2C Loads Calibration in DFRC Flight Loads Lab
Schuster, Lawrence S.; February 07, 2008; 35 pp.; In English; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013520

Objectives: a) Safely and efficiently perform structural load tests on NAVAIR E-2C aircraft to calibrate strain gage instrumentation installed by NAVAIR; b) Collect load test data and derive loads equations for use in NAVAIR flight tests; and c) Assist flight test team with use of loads equations measurements at PAX River.
Derived from text
E-2 Aircraft; Load Tests; Flight Tests; Calibrating; Aerodynamic Loads

20080013521 NASA Langley Research Center, Hampton, VA, USA
Summary of NASA Support of the F-111 Development Program, Part 1, December 1962 - December 1965
October 10, 1966; 38 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 526282.01.07.04.01
Report No.(s): LWP-246; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013521

The F-111 is a biservice, multimission, tactical aircraft being developed for the Air Force and Navy by General Dynamics and Grumman. The general arrangement of the F-111 is shown in figure 1. This aircraft, through the use of the ‘variable sweep wing’ concept, offers the possibility of combining a wide range of mission capabilities into a single aircraft. The F-111 is a direct outgrowth of the Langley Research Center’s variable sweep research which began in 1947. The early research culminated in the X-5 variable sweep research airplane which demonstrated the advantage and feasibility of in-flight sweep variation~ The X-5 utilized the translating wing concept to offset the longitudinal stability variation with sweep changes. Later Langley research beginning in 1958 resulted in the ‘outboard pivot’ concept which eliminated the need for wing translation and led .to the TFX (F-111) concept. A chronology of the NACA/NASA variable sweep research effort and direct su~port of the TFX up to the awarding of the contract to General Dynamics/Grumman on November 24, 1962, is presented in refer’ence 1. Since the awarding of the contract, the Langley, Ames, Lewis, and Flight Research Centers have been actively supporting the F-111 development program. Because of the strong NASA interest in this aircraft and the large magnitude of NASA support involved, it was felt desirable to document this support. The purpose of this paper therefore is to present a brief summary of the NASA support, in chronological order, through December 1965, beginning with the awarding of the contract in November 1962.
Derived from text
F-111 Aircraft; Research Aircraft; Longitudinal Stability; Chronology

20080013589 NASA Dryden Flight Research Center, Edwards, CA, USA
Small UAS Test Area at NASA’s Dryden Flight Research Center
Bauer, Jeffrey T.; March 04, 2008; 7 pp.; In English; Original contains color illustrations; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013589

This viewgraph presentation reviews the areas that Dryden Flight Research Center has set up for testing small Unmanned

Aerial Systems (UAS). It also reviews the requirements and process to use an area for UAS test.
CASI
Unmanned Aircraft Systems; Test Facilities

20080014075 NASA Dryden Flight Research Center, Edwards, CA, USA
Limits to Open Class Performance?
Bowers, Albion H.; February 15, 2008; 35 pp.; In English; Annual Convention of the Soaring Society of America, 15 Feb, 2008, Albuquerque, NM, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080014075

This presentation discusses open or unlimited class aircraft performance limitations and design solutions. Limitations in this class of aircraft include slow climbing flight which requires low wing loading, high cruise speed which requires high wing loading, gains in induced or viscous drag alone which result in only half the gain overall and other structural problems (yaw inertia and spins, flutter and static loads integrity). Design solutions include introducing minimum induced drag for a given span (elliptical span load or winglets) and introducing minimum induced drag for a bell shaped span load. It is concluded that open class performance limits (under current rules and technologies) is very close to absolute limits, though some gains remain to be made from unexplored areas and new technologies.
Derived from text
Light Aircraft; Aircraft Performance; Aircraft Design; Aircraft Reliability; Structural Failure

20080014171 NASA Langley Research Center, Hampton, VA, USA
Study of Synthetic Vision Systems (SVS) and Velocity-vector Based Command Augmentation System (V-CAS) on Pilot Performance
Liu, Dahai; Goodrich, Ken; Peak, Bob; May 20, 2006; 6 pp.; In English; 2006 IIE Annual Conference & Exposition, 20-24 May 2006, Orlando, FL, USA; Original contains color illustrations
Contract(s)/Grant(s): 561581.02.07; Copyright; Avail.: CASI: A02, Hardcopy

This study investigated the effects of synthetic vision system (SVS) concepts and advanced flight controls on single pilot performance (SPP). Specifically, we evaluated the benefits and interactions of two levels of terrain portrayal, guidance symbology, and control-system response type on SPP in the context of lower-landing minima (LLM) approaches. Performance measures consisted of flight technical error (FTE) and pilot perceived workload. In this study, pilot rating, control type, and guidance symbology were not found to significantly affect FTE or workload. It is likely that transfer from prior experience, limited scope of the evaluation task, specific implementation limitations, and limited sample size were major factors in obtaining these results.
Author
Augmentation; Enhanced Vision; Flight Control; Pilot Performance; General Aviation Aircraft; Human Factors Engineering; Velocity Distribution; Vectors (Mathematics)

20080014214 NASA Langley Research Center, Hampton, VA, USA
Aerospace Applications of Optimization under Uncertainty
Padula, Sharon; Gumbert, Clyde; Li, Wu; Optimization and Engineering; [2006]; Volume 7, No. 3, pp. 317-328; In English; Original contains color illustrations
Contract(s)/Grant(s): 23-762-45-G6; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080014214

The Multidisciplinary Optimization (MDO) Branch at NASA Langley Research Center develops new methods and investigates opportunities for applying optimization to aerospace vehicle design. This paper describes MDO Branch experiences with three applications of optimization under uncertainty: (1) improved impact dynamics for airframes, (2) transonic airfoil optimization for low drag, and (3) coupled aerodynamic/structures optimization of a 3-D wing. For each case, a brief overview of the problem and references to previous publications are provided. The three cases are aerospace examples of the challenges and opportunities presented by optimization under uncertainty. The present paper will illustrate a variety of needs for this technology, summarize promising methods, and uncover fruitful areas for new research.
Author
Aerospace Engineering; Multidisciplinary Design Optimization; Mathematical Models; Computational Fluid Dynamics; Aerospace Vehicles; Shape Optimization; Flexible Wings

20080014215 NASA Langley Research Center, Hampton, VA, USA

Response of Damaged and Undamaged Tailored Extension-Shear-Coupled Composite Panels

Baker, Donald J.; Journal of Aircraft; [2008]; Volume 43, No. 2, pp. 517-527; In English; Original contains black and white illustrations

Contract(s)/Grant(s): 23-719-20-30; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080014215

The results of an analytical and experimental investigation of the response of composite I-stiffener panels with extension-shear coupling are presented. This tailored concept, when used in the panel cover skins of a tiltrotor aircraft wing has the potential for increasing the aeroelastic stability margins and improving the aircraft productivity. The extension-shear coupling is achieved by using unbalanced plus or minus 45 deg. plies in the skin. Experimental and STAGS analysis results are compared for eight I-stiffener panel specimens. The results indicate that the tailored concept would be feasible to use in the wing skin of a tiltrotor aircraft. Evaluation of specimens impacted at an energy level of 500 in.-lbs indicate a minimal loss in stiffness and less than 30 percent loss in strength. Evaluation of specimens with severed center stiffener and adjacent skin indicated a strength loss in excess of 60 percent.

Author

Composite Structures; Stiffness; Scale Models; Fabrication; Tilt Wing Aircraft; Aeroelastic Research Wings; Wing Panels

20080014230 NASA Langley Research Center, Hampton, VA, USA

Innovation in Aerodynamic Design Features of Soviet Missiles

Spearman, M. Leroy; November 14, 2006; 4 pp.; In English; AIAA Missile Sciences Conference, 14-16 Nov. 2006, Monterey, CA, USA

Contract(s)/Grant(s): WBS 584772; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080014230

Wind tunnel investigations of some tactical and strategic missile systems developed by the former Soviet Union have been included in the basic missile research programs of the NACA/NASA. Studies of the Soviet missiles sometimes revealed innovative design features that resulted in unusual or unexpected aerodynamic characteristics. In some cases these characteristics have been such that the measured performance of the missile exceeds what might have been predicted. In other cases some unusual design features have been found that would alleviate what might otherwise have been a serious aerodynamic problem. In some designs, what has appeared to be a lack of refinement has proven to be a matter of expediency. It is a purpose of this paper to describe some examples of unusual design features of some Soviet missiles and to illustrate the effectiveness of the design features on the aerodynamic behavior of the missile. The paper draws on the experience of the author who for over 60 years was involved in the aerodynamic wind tunnel testing of aircraft and missiles with the NACA/NASA.

Author

Missile Systems; U.S.S.R.; Wind Tunnel Tests; Military Technology; Missile Design; Aerodynamic Configurations

06
AVIONICS AND AIRCRAFT INSTRUMENTATION

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

20080014170 NASA Langley Research Center, Hampton, VA, USA

Effectively Transforming IMC Flight into VMC Flight: An SVS Case Study

Glaab, Louis J.; Hughes, Monic F.; Parrish, Russell V.; Takallu, Mohammad A.; October 15, 2006; 14 pp.; In English; 25th Digital Avionics Systems Conference, 15-19 Oct. 2006, Portland, OR, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 609866.02.07.07; Copyright; Avail.: CASI: A03, Hardcopy

A flight-test experiment was conducted using the NASA LaRC Cessna 206 aircraft. Four primary flight and navigation display concepts, including baseline and Synthetic Vision System (SVS) concepts, were evaluated in the local area of Roanoke Virginia Airport, flying visual and instrument approach procedures. A total of 19 pilots, from 3 pilot groups reflecting the diverse piloting skills of the GA population, served as evaluation pilots. Multi-variable Discriminant Analysis was applied to three carefully selected and markedly different operating conditions with conventional instrumentation to provide an extension

of traditional analysis methods as well as provide an assessment of the effectiveness of SVS displays to effectively transform IMC flight into VMC flight.
Author
Cessna Aircraft; Enhanced Vision; Flight Tests; Meteorology; Air Traffic Control; Display Devices; Aircraft Instruments

20080014216 NASA Dryden Flight Research Center, Edwards, CA, USA
High-Rate Wireless Airborne Network Demonstration (HiWAND) Flight Test Results
Franz, Russell; March 2008; 20 pp.; In English; Original contains color illustrations
Report No.(s): NASA/TM-2008-214633; H-2788; Copyright; Avail.: CASI: A03, Hardcopy

An increasing number of flight research and airborne science experiments now contain network-ready systems that could benefit from a high-rate bidirectional air-to-ground network link. A prototype system, the High-Rate Wireless Airborne Network Demonstration, was developed from commercial off-the-shelf components while leveraging the existing telemetry infrastructure on the Western Aeronautical Test Range. This approach resulted in a cost-effective, long-range, line-of-sight network link over the S and the L frequency bands using both frequency modulation and shaped-offset quadrature phase-shift keying modulation. This report discusses system configuration and the flight test results.
Author
Flight Tests; Wireless Communication; Systems Engineering; Airborne Equipment; Communication Networks; Avionics

20080014220 NASA Johnson Space Center, Houston, TX, USA
Integrated Software Systems for Crew Management During Extravehicular Activity in Planetary Terrain Exploration
Kuznetz, Lawrence; Nguen, Dan; Jones, Jeffrey; Lee, Pascal; Merrell, Ronald; Rafiq, Azhar; [2008]; 2 pp.; In English; Annual Meeting of the Aerospace Medical Association, 11-15 May 2008, Boston, MA, USA; Copyright; Avail.: CASI: A01, Hardcopy

Initial planetary explorations with the Apollo program had a veritable ground support army monitoring the safety and health of the 12 astronauts who performed lunar surface extravehicular activities (EVAs). Given the distances involved, this will not be possible on Mars. A spacesuit for Mars must be smart enough to replace that army. The next generation suits can do so using 2 software systems serving as virtual companions, LEGACI (Life support, Exploration Guidance Algorithm and Consumable Interrogator) and VIOLET (Voice Initiated Operator for Life support and Exploration Tracking). The system presented in this study integrates data inputs from a suite of sensors into the MIII suit s communications, avionics and informatics hardware for distribution to remote managers and data analysis. If successful, the system has application not only for Mars but for nearer term missions to the Moon, and the next generation suits used on ISS as well. Field tests are conducted to assess capabilities for next generation spacesuits at Johnson Space Center (JSC) as well as the Mars and Lunar analog (Devon Island, Canada). LEGACI integrates data inputs from a suite of noninvasive biosensors in the suit and the astronaut (heart rate, suit inlet/outlet lcg temperature and flowrate, suit outlet gas and dewpoint temperature, pCO2, suit O2 pressure, state vector (accelerometry) and others). In the Integrated Walkback Suit Tests held at NASA-JSC and the HMP tests at Devon Island, communication and informatics capabilities were tested (including routing by satellite from the suit at Devon Island to JSC in Houston via secure servers at VCU in Richmond, VA). Results. The input from all the sensors enable LEGACI to compute multiple independent assessments of metabolic rate, from which a ‘best’ met rate is chosen based on statistical methods. This rate can compute detailed information about the suit, crew and EVA performance using test-derived algorithms. VIOLET gives LEGACI voice activation capability, allowing the crew to query the suit, and receive feedback and alerts that will lead to corrective action. LEGACI and VIOLET can also automatically control the astronaut’s cooling and consumable use rate without crew input if desired. These findings suggest that non-invasive physiological and environmental sensors supported with data analysis can allow for more effective management of mission task performance during EVA. Integrated remote and local view of data metrics allow crewmember to receive real time feedback in synch with mission control in preventing performance shortcomings for EVA in exploration missions.
Author
Extravehicular Activity; Software Engineering; Terrain; Apollo Project; Avionics; Spacecrews; Space Exploration; Bioinstrumentation; Systems Integration

07
AIRCRAFT PROPULSION AND POWER

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

20080013391 NASA Langley Research Center, Hampton, VA, USA

Supersonic Combustion Research at NASA

Drummond, J. P.; Danehy, Paul M.; Gaffney, Richard L., Jr.; Tedder, Sarah A.; Cutler, Andrew D.; Bivolaru, Daniel; October 24, 2007; 12 pp.; In English; 2007 Fall Technical Meeting - Eastern States Section of the Combustion Institute, 21-24 Oct. 2007, Charlotesville, VA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 599489.02.07.07.03.02; Copyright; Avail.: CASI: A03, Hardcopy

This paper discusses the progress of work to model high-speed supersonic reacting flow. The purpose of the work is to improve the state of the art of CFD capabilities for predicting the flow in high-speed propulsion systems, particularly combustor flowpaths. The program has several components including the development of advanced algorithms and models for simulating engine flowpaths as well as a fundamental experimental and diagnostic development effort to support the formulation and validation of the mathematical models. The paper will provide details of current work on experiments that will provide data for the modeling efforts along with the associated nonintrusive diagnostics used to collect the data from the experimental flowfield. Simulation of a recent experiment to partially validate the accuracy of a combustion code is also described.

Author

Supersonic Combustion; Supersonic Flow; Reacting Flow; Computational Fluid Dynamics; Propulsion System Performance; Flow Distribution; Engine Design

20080014174 NASA Langley Research Center, Hampton, VA, USA

Testing of SMA-enabled Active Chevron Prototypes under Representative Flow Conditions

Turner, Travis L.; Cabell,Randolph H.; Cano, Roberto J.; Silcox, Richard J.; March 09, 2008; 11 pp.; In English; ASCE 11th Earth and Space Conference, 9-13 Mar. 2008, San Diego, cA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 561581.02.08.07.18.03

Report No.(s): Paper-6928-36; LAR-17332; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080014174

Control of jet noise continues to be an important research topic. Exhaust-nozzle chevrons have been shown to reduce jet noise, but parametric effects are not well understood. Additionally, thrust loss due to chevrons at cruise suggests significant benefit from active chevrons. The focus of this study is development of an active chevron concept for the primary purpose of parametric studies for jet noise reduction in the laboratory and secondarily for technology development to leverage for full scale systems. The active chevron concept employed in this work consists of a laminated composite structure with embedded shape memory alloy (SMA) actuators, termed a SMA hybrid composite (SMAHC). SMA actuators are embedded on one side of the neutral axis of the structure such that thermal excitation, via joule heating, generates a moment and deflects the structure. The performance of two active chevron concepts is demonstrated in the presence of representative flow conditions. One of the concepts is shown to possess significant advantages for the proposed application and is selected for further development. Fabrication and design changes are described and shown to produce a chevron prototype that meets the performance objectives.

Author

Exhaust Nozzles; Jet Aircraft Noise; Noise Reduction; Shape Memory Alloys; Prototypes; Jet Engines; Composite Structures; Hybrid Composites; Jet Flow; Flow Distribution

20080014219 NASA Glenn Research Center, Cleveland, OH, USA

On the Mixing of Single and Opposed Rows of Jets With a Confined Crossflow

Holdeman, James D.; Clisset, James R.; Moder, Jeffrey P.; Lear, William E.; October 2006; 224 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WU-22-066-10-12

Report No.(s): NASA/TM-2006-214226; E-15473; Copyright; Avail.: CASI: A10, Hardcopy

The primary objectives of this study were 1) to demonstrate that contour plots could be made using the data interface in the NASA GRC jet-in-crossflow (JIC) spreadsheet, and 2) to investigate the suitability of using superposition for the case of

opposed rows of jets with their centerlines in-line. The current report is similar to NASA/TM-2005-213137 but the 'basic' effects of a confined JIC that are shown in profile plots there are shown as contour plots in this report, and profile plots for opposed rows of aligned jets are presented here using both symmetry and superposition models. Although superposition was found to be suitable for most cases of opposed rows of jets with jet centerlines in-line, the calculation procedure in the JIC spreadsheet was not changed and it still uses the symmetry method for this case, as did all previous publications of the NASA empirical model.
Author
Gas Turbines; Correlation; Cross Flow; Fluid Jets; Jet Mixing Flow; Combustion Chambers; Dilution

08
AIRCRAFT STABILITY AND CONTROL

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

20080014213 NASA Langley Research Center, Hampton, VA, USA
Active Control of Separation From the Flap of a Supercritical Airfoil
Melton, LaTunia Pack; Yao, Chung-Sheng; Seifert, Avi; AIAA Journal; [2006]; Volume 44, No. 1, pp. 34-41; In English
Contract(s)/Grant(s): 23-719-55-MG; Copyright; Avail.: CASI: A03, Hardcopy

Zero-mass-flux periodic excitation was applied at several regions on a simplified high-lift system to delay the occurrence of flow separation. The NASA Energy Efficient Transport (EET) supercritical airfoil was equipped with a 15% chord simply hinged leading edge flap and a 25% chord simply hinged trailing edge flap. Detailed flow features were measured in an attempt to identify optimal actuator placement. The measurements included steady and unsteady model and tunnel wall pressures, wake surveys, arrays of surface hot-films, flow visualization, and particle image velocimetry (PIV). The current paper describes the application of active separation control at several locations on the deflected trailing edge flap. High frequency (F(+) approximately equal to 10) and low frequency amplitude modulation (F(+) sub AM approximately equal to 1) of the high frequency excitation were used for control. It was noted that the same performance gains were obtained with amplitude modulation and required only 30% of the momentum input required by pure sine excitation.
Author
Active Control; Supercritical Airfoils; Separated Flow; Trailing Edge Flaps; Wind Tunnel Models; Flaps (Control Surfaces)

12
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*.

20080014201 NASA Johnson Space Center, Houston, TX, USA
Best Practices for Researching and Documenting Lessons Learned
Goodman, John L.; March 2008; 20 pp.; In English
Report No.(s): NASA/CR-2008-214777; S-1028; Copyright; Avail.: CASI: A03, Hardcopy

Identification, resolution, and avoidance of technical and programmatic issues are important for ensuring safe and successful space missions. Although the importance of applying lessons learned to reduce risk is frequently stressed, there is little material available to help technical and management personnel research and document lessons learned. Collecting, researching, identifying, and documenting lessons learned that will be useful to current and future management and engineering personnel is not always a straightforward task. This white paper presents lessons learned and best practices concerning the research and documentation of technical and organizational lessons learned. It is intended to enable organizations to initiate or improve lessons learned research and documentation efforts. The content of this white paper is based on four technical lessons learned projects conducted by the United Space Alliance (USA) Flight Design and Dynamics Department, in support of the NASA/Johnson Space Center (JSC) Flight Design and Dynamics Division. Each project published a report, titled as follows: (1) GPS Lessons Learned From the ISS, Space Shuttle and X-38; (2) Lessons Learned

From Seven Space Shuttle Missions; (3) Space Shuttle Rendezvous and Proximity Operations Experience Report; and (4) Navigation Technical History with Lessons Learned
Author
Risk; Operations Research; Forecasting; Predictions; Space Shuttle Missions; Procedures; Navigation; Aerodynamics; Global Positioning System

13
ASTRODYNAMICS

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

20080013470 NASA Langley Research Center, Hampton, VA, USA
Reconstruction of the Stardust Entry
Desai, Prasun N.; Qualls, Garry D.; June 28, 2007; 17 pp.; In English; 5th International Planetary Probe Workshop, 23-29 Jun. 2007, Bordeaux, France; Original contains color illustrations
Contract(s)/Grant(s): WBS 439654.02.07.01.01; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013470

An overview of the reconstruction analyses performed for the Stardust capsule entry is described. The results indicate that the actual entry was very close to the pre-entry predictions. The capsule landed 8.1 km northwest of the desired target at Utah Test and Training Range. Frequency analysis on the infrared video data indicates that the aerodynamics generated for the Stardust capsule reasonably predicted the drag and static stability. Observations of the heatshield support the pre-entry simulation estimates of a small hypersonic angles-of-attack, since there is very little, if any, charring of the shoulder region or the aftbody. Through this investigation, an overall assertion can be made that all the data gathered from the Stardust entry is consistent with flight performance close to the nominal pre-entry prediction. Consequently, the design principles and methodologies utilized for the flight dynamics, aerodynamics, and aerothermodynamics analyses have been corroborated.
Author
Aerodynamics; Stardust Mission; Space Capsules; Atmospheric Entry; Spacecraft Landing; Spacecraft Performance; Spacecraft Design; Spacecraft Trajectories

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)*.

20080013579 NASA Langley Research Center, Hampton, VA, USA
Recent Enhancements to the National Transonic Facility (Mixed Mode Operations)
Kilgore, W. Allen; Chan, David; Balakrishna, S.; Wahls, Richard A.; [2006]; 15 pp.; In English; 44th AIAA Aerospace Sciences Meeting and Exhibit, 9-12 Jan. 2006, Reno, NV, USA; Original contains color illustrations
Report No.(s): AIAA 2006-0507; Copyright; Avail.: CASI: A03, Hardcopy

The U.S. National Transonic Facility continues to make enhancements to provide quality data in a safe, efficient and cost effective method for aerodynamic ground testing. Recent enhancements discussed in this paper include the development of a Mixed-mode of operations that combine Air-mode operations with Nitrogen-mode operations. This implementation and operational results of this new Mixed-mode expands the ambient temperature transonic region of testing beyond the Air-mode limitations at a significantly reduced cost over Nitrogen Mode operation.
Author
Aerodynamic Characteristics; Wind Tunnel Tests; Test Facilities; Ground Tests; Ambient Temperature

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*.

20080013437 NASA Langley Research Center, Hampton, VA, USA
Integrated System Test Approaches for the NASA Ares I Crew Launch Vehicle
Cockrell, Charles E., Jr.; Askins, Bruce R.; Bland, Jeffrey; Davis, Stephan; Holladay, Jon B.; Taylor, James L.; Taylor, Terry L.; Robinson, Kimberly F.; Roberts, Ryan E.; Tuma, Margaret; September 24, 2007; 9 pp.; In English; 58th International Astronautical Congress - IAC 2007, 24-28 Sep. 2007, Hyderabad, India; Original contains color illustrations
Contract(s)/Grant(s): WBS 136905.02.04.04.01.02
Report No.(s): IAC-07-D2.6.04; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013437

The Ares I Crew Launch Vehicle (CLV) is being developed by the U.S. National Aeronautics and Space Administration (NASA) to provide crew access to the International Space Station (ISS) and, together with the Ares V Cargo Launch Vehicle (CaLV), serves as one component of a future launch capability for human exploration of the Moon. During the system requirements definition process and early design cycles, NASA defined and began implementing plans for integrated ground and flight testing necessary to achieve the first human launch of Ares I. The individual Ares I flight hardware elements: the first stage five segment booster (FSB), upper stage, and J-2X upper stage engine, will undergo extensive development, qualification, and certification testing prior to flight. Key integrated system tests include the Main Propulsion Test Article (MPTA), acceptance tests of the integrated upper stage and upper stage engine assembly, a full-scale integrated vehicle dynamic test (IVDT), aerodynamic testing to characterize vehicle performance, and integrated testing of the avionics and software components. The Ares I-X development flight test will provide flight data to validate engineering models for aerodynamic performance, stage separation, structural dynamic performance, and control system functionality. The Ares I-Y flight test will validate ascent performance of the first stage, stage separation functionality, and a highaltitude actuation of the launch abort system (LAS) following separation. The Orion-1 flight test will be conducted as a full, un-crewed, operational flight test through the entire ascent flight profile prior to the first crewed launch.
Author
Ares 1 Launch Vehicle; Avionics; NASA Programs; Ares 5 Cargo Launch Vehicle; Systems Integration; Flight Tests; Computational Fluid Dynamics; Wind Tunnel Tests

20080013455 NASA Johnson Space Center, Houston, TX, USA
The Development of the Ares I-X Flight Test
Ess, Robert H.; [2008]; 2 pp.; In English; 59th International Astronautical Congress, 29 Sep. - 3 Oct. 2008, Glasgow, Scotland, UK; No Copyright; Avail.: Other Sources; Abstract Only

The National Aeronautics and Space Administration (NASA) Constellation Program (CxP) has identified a series of tests to provide insight into the design and development of the Ares I Crew Launch Vehicle (CLV) and the Orion Crew Exploration Vehicle (CEV). Ares I-X was created as the first suborbital development flight test to help meet CxP objectives. The Ares I-X flight vehicle is an early operational model of Ares, with specific emphasis on Ares I and ground operation characteristics necessary to meet Ares I-X flight test objectives. Ares I-X will encompass the design and construction of an entire system that includes the Flight Test Vehicle (FTV) and associated operations. The FTV will be a test model based on the Ares I design. Select design features will be incorporated in the FTV design to emulate the operation of the CLV in order to meet the flight test objectives. The operations infrastructure and processes will be customized for Ares I-X, while still providing data to inform the developers of the launch processing system for Ares/Orion. The FTV is comprised of multiple elements and components that will be developed at different locations. The components will be delivered to the launch/assembly site, Kennedy Space Center (KSC), for assembly of the elements and components into an integrated, flight-ready, launch vehicle. The FTV will fly a prescribed trajectory in order to obtain the necessary data to meet the objectives. Ares I-X will not be commanded or controlled from the ground during flight, but the FTV will be equipped with telemetry systems, a data recording capability and a flight termination system (FTS). The in-flight part of the test includes a trajectory to simulate maximum dynamic pressure during flight and perform a stage separation representative of the CLV. The in-flight test also includes separation of the Upper Stage Simulator (USS) from the First Stage and recovery of the First Stage. The data retrieved from the flight test will be analyzed and used in the design and development of the Ares I vehicle. This paper will discuss the challenges in developing a new launch vehicle in a very short timeframe. The duration from formal Authority to Proceed to

launch is 32 months with launch scheduled for April, 2009. The discussion will include changes to organizational structure, system engineering approaches, and early lessons learned for a fast tracked and highly visible project.
Author
Launch Vehicles; Crew Exploration Vehicle; Ares 1 Launch Vehicle; Flight Tests; Systems Engineering; Dynamic Pressure

16
SPACE TRANSPORTATION AND SAFETY

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

20080013607 NASA Langley Research Center, Hampton, VA, USA
Status of Thermal NDT of Space Shuttle Materials at NASA
Cramer, K. Elliott; Winfree, William P.; Hodges, Kenneth; Koshti, Ajay; Ryan, Daniel; Reinhardt, Walter W.; [2007]; 9 pp.; In English; 9th Joint FAA/DoD/NASA Conference on Aging Aircraft, 6-9 Mar. 2006, Atlanta, GA, USA; Original contains color illustrations
Contract(s)/Grant(s): 377816.06.03.03.05; Copyright; Avail.: CASI: A02, Hardcopy

Since the Space Shuttle Columbia accident, NASA has focused on improving advanced NDE techniques for the Reinforced Carbon-Carbon (RCC) panels that comprise the orbiter s wing leading edge and nose cap. Various nondestructive inspection techniques have been used in the examination of the RCC, but thermography has emerged as an effective inspection alternative to more traditional methods. Thermography is a non-contact inspection method as compared to ultrasonic techniques which typically require the use of a coupling medium between the transducer and material. Like radiographic techniques, thermography can inspect large areas, but has the advantage of minimal safety concerns and the ability for single-sided measurements. Details of the analysis technique that has been developed to allow insitu inspection of a majority of shuttle RCC components is discussed. Additionally, validation testing, performed to quantify the performance of the system, will be discussed. Finally, the results of applying this technology to the Space Shuttle Discovery after its return from the STS-114 mission in July 2005 are discussed.
Author
Thermography; Carbon-Carbon Composites; Composite Structures; Space Shuttles; Nondestructive Tests; Inspection; Space Shuttle Missions

20080014090 NASA Johnson Space Center, Houston, TX, USA
Material Density Distribution of Small Debris in Earth Orbit
Krisko, P. H.; Xu, Y.-l.; Opiela, J. N.; Hill, N. M.; Matney, M. J.; [2008]; 1 pp.; In English; 54th International Astronautical Congress, 29 Sep. - 3 Oct. 2008, Glasow, Scotland, UK; Copyright; Avail.: Other Sources; Abstract Only

Over 200 spacecraft and rocket body breakups in Earth orbit have populated that regime with debris fragments in the sub-micron through meter size range. Though the largest debris fragments can cause significant collisional damage to active (operational) spacecraft, these are few and trackable by radar. Fragments on the order of a millimeter to a centimeter in size are as yet untrackable. But this smaller debris can result in damage to critical spacecraft systems and, under the worst conditions, fragmenting collision events. Ongoing research at the NASA Orbital Debris Program Office on the sources of these small fragments has focused on the material components of spacecraft and rocket bodies and on breakup event morphology. This has led to fragment material density estimates, and also the beginnings of shape categorizations. To date the NASA Standard Breakup Model has not considered specific material density distinctions of small debris. The basis of small debris in that model is the fourth hypervelocity impact event of the Satellite Orbital Debris Characterization Impact Test (SOCIT) series. This test targeted a flight-ready, U.S. Transit navigation satellite with a solid aluminum sphere impactor. Results in this event yield characteristic length (size) and area-to-mass distributions of fragments smaller than 10 cm in the NASA model. Recent re-analysis of the SOCIT4 small fragment dataset highlighted the material-specific characteristics of metals and non-metals. Concurrent analysis of Space Shuttle in-situ impact data showed a high percentage of aluminum debris in shuttle orbit regions. Both analyses led to the definition of three main on-orbit debris material density categories -low density (< 2 g/cc), medium density (2 to 6 g/cc), and high density (> 6 g/cc). This report considers the above studies in an explicit extension of the NASA Standard Breakup Model where separate material densities for debris are generated and these debris fragments are propagated in Earth orbit. The near Earth environment is thus parameterized by debris density percentages within

subsections of that environment. This model version is used in the upgraded NASA Orbital Debris Engineering Model (ORDEM).
Author
Space Debris; Density Distribution; Damage; Earth Orbits; Spacecraft Breakup; Impactors; Fragmentation; Impact Tests; Spacecraft Orbits

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*.

20080013440 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Uplink Coding
Pollara, Fabrizio; Hamkins, Jon; Dolinar, Sam; Andrews, Ken; Divsalar, Dariush; June 11, 2006; 11 pp.; In English; Spring 2006 CCSDS Area and Working Group Meeting, 12 Jun. 2006, Rome, Italy; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40647

This viewgraph presentation reviews uplink coding. The purpose and goals of the briefing are (1) Show a plan for using uplink coding and describe benefits (2) Define possible solutions and their applicability to different types of uplink, including emergency uplink (3) Concur with our conclusions so we can embark on a plan to use proposed uplink system (4) Identify the need for the development of appropriate technology and infusion in the DSN (5) Gain advocacy to implement uplink coding in flight projects Action Item EMB04-1-14 -- Show a plan for using uplink coding, including showing where it is useful or not (include discussion of emergency uplink coding).
CASI
Coding; Uplinking; Communication Satellites; Space Communication

20080014095 United Space Alliance, Houston, TX, USA
Operational Use of GPS Navigation for Space Shuttle Entry
Goodman, John L.; Propst, Carolyn A.; [2008]; 39 pp.; In English; IEEE/ION PLANS Conference, 5-8 May 2008, Monterey, CA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNJ06VA01C; Copyright; Avail.: CASI: A03, Hardcopy

The STS-118 flight of the Space Shuttle Endeavour was the first shuttle mission flown with three Global Positioning System (GPS) receivers in place of the three legacy Tactical Air Navigation (TACAN) units. This marked the conclusion of a 15 year effort involving procurement, missionization, integration, and flight testing of a GPS receiver and a parallel effort to formulate and implement shuttle computer software changes to support GPS. The use of GPS data from a single receiver in parallel with TACAN during entry was successfully demonstrated by the orbiters Discovery and Atlantis during four shuttle missions in 2006 and 2007. This provided the confidence needed before flying the first all GPS, no TACAN flight with Endeavour. A significant number of lessons were learned concerning the integration of a software intensive navigation unit into a legacy avionics system. These lessons have been taken into consideration during vehicle design by other flight programs, including the vehicle that will replace the Space Shuttle, Orion.
Author
Global Positioning System; Space Shuttle Missions; Space Transportation System Flights; Endeavour (Orbiter); Navigation; Avionics; Atmospheric Entry

20080014135 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Mars Reconnaissance Orbiter: Ka Band Radio Science Experiments and the Effect of the Troposphere
Asmar, Sami W.; Morabito, David; March 26, 2006; 11 pp.; In English; Ground System Architectures Workshop (GSAW), 29 Mar. 2006, Manhattan Beach, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40682

This viewgraph presentation reviews the possibilities of utilizing the telecommunication links between spacecraft and Earth to examine changes in the phase/frequency, amplitude, and polarization of radio signals to investigate, specifically for the Mars Reconnaissance Orbiter (MRO)mission utilizes X-band coherent (uplink and downlink) carrier Doppler and range

for its gravity investigation Gravity team will also take advantage of Ka-band downlink signal Tropospheric calibration data from Advanced Water Vapor Radiometer (AWVR) will be used. The calibration of the received Ka band signal for the effect of the troposphere is discussed.
CASI
Calibrating; Extremely High Frequencies; Meteorological Parameters; Troposphere

20080014138 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Interplanetary Network Directorate
Weber, William J.; May 27, 2004; 24 pp.; In English; 7th Briefing for Industry, 27 May 2004, Pasadena, CA, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40704

This viewgraph presentation reviews the work of the Interplanetary Network Directorate at NASA's Jet Propulsion Laboratory. The attributes of the interplanetary network are reviewed, and the expansion of the current Deep Space Network for future mission support is described. Points of interest to the industry are emphasized.
CASI
Deep Space Network; Space Missions; Interplanetary Communication; Extraterrestrial Communication; Antennas; Optical Communication

18
SPACECRAFT DESIGN, TESTING AND PERFORMANCE

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

20080013397 NASA Langley Research Center, Hampton, VA, USA
Structural Design and Analysis of the Upper Pressure Shell Section of a Composite Crew Module
Sleight, David W.; Paddock, David; Jeans, Jim W.; Hudeck, John D.; March 03, 2008; 22 pp.; In English; 11th ASCE Aerospace Division International Conference (Earth and Space 2008), 3-5 Mar. 2008, Long Beach, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 510505.05.07.07.03; Copyright; Avail.: CASI: A03, Hardcopy

This paper presents the results of the structural design and analysis of the upper pressure shell section of a carbon composite demonstration structure for the Composite Crew Module (CCM) Project. The project is managed by the NASA Engineering and Safety Center with participants from eight NASA Centers, the Air Force Research Laboratory, and multiple aerospace contractors including ATK/Swales, Northrop Grumman, Lockheed Martin, Collier Research Corporation, Genesis Engineering, and Janicki Industries. The paper discusses details of the upper pressure shell section design of the CCM and presents the structural analysis results using the HyperSizer structural sizing software and the MSC Nastran finite element analysis software. The HyperSizer results showed that the controlling load case driving most of the sizing in the upper pressure shell section was the internal pressure load case. The regions around the cutouts were controlled by internal pressure and the main parachute load cases. The global finite element analysis results showed that the majority of the elements of the CCM had a positive margin of safety with the exception of a few hot spots around the cutouts. These hot spots are currently being investigated with a more detailed analysis. Local finite element models of the Low Impact Docking System (LIDS) interface ring and the forward bay gussets with greater mesh fidelity were created for local sizing and analysis. The sizing of the LIDS interface ring was driven by the drogue parachute loads, Trans-Lunar Insertion (TLI) loads, and internal pressure. The drogue parachute loads controlled the sizing of the gusset cap on the drogue gusset and TLI loads controlled the sizing of the other five gusset caps. The main parachute loads controlled the sizing of the lower ends of the gusset caps on the main parachute fittings. The results showed that the gusset web/pressure shell and gusset web/gusset cap interfaces bonded using Pi-preform joints had local hot spots in the Pi-preform termination regions. These regions require a detailed three-dimensional analysis, which is currently being performed, to accurately address the load distribution near the Pi-preform termination in the upper and lower gusset caps.
Author
Structural Analysis; Structural Design; Spacecraft Modules; Composite Materials; Spacecraft Design

20080013406 NASA Johnson Space Center, Houston, TX, USA

Effect of Space Vehicle Structure Vibration on Control Moment Gyroscope Dynamics

Dobrinskaya, Tatiana; [2008]; 1 pp.; In English; 59th International Astronautical Congress, 29 Sep. 3 Oct. 2008, Glasgow, Scotland, UK; No Copyright; Avail.: Other Sources; Abstract Only

Control Moment Gyroscopes (CMGs) are used for non-propulsive attitude control of satellites and space stations, including the International Space Station (ISS). CMGs could be essential for future long duration space missions due to the fact that they help to save propellant. CMGs were successfully tested on the ground for many years, and have been successfully used on satellites. However, operations have shown that the CMG service life on the ISS is significantly shorter than predicted. Since the dynamic environment of the ISS differs greatly from the nominal environment of satellites, it was important to analyze how operations specific to the station (dockings and undockings, huge solar array motion, crew exercising, robotic operations, etc) can affect the CMG performance. This task became even more important since the first CMG failure onboard the ISS. The CMG failure resulted in the limitation of the attitude control capabilities, more propellant consumption, and additional operational issues. Therefore, the goal of this work was to find out how the vibrations of a space vehicle structure, caused by a variety of onboard operations, can affect the CMG dynamics and performance. The equations of CMG motion were derived and analyzed for the case when the gyro foundation can vibrate in any direction. The analysis was performed for unbalanced CMG gimbals to match the CMG configuration on ISS. The analysis showed that vehicle structure vibrations can amplify and significantly change the CMG motion if the gyro gimbals are unbalanced in flight. The resonance frequencies were found. It was shown that the resonance effect depends on the magnitude of gimbal imbalance, on the direction of a structure vibration, and on gimbal bearing friction. Computer modeling results of CMG dynamics affected by the external vibration are presented. The results can explain some of the CMG vibration telemetry observed on ISS. This work shows that balancing the CMG gimbals decreases the effect of vehicle structure vibration on CMGs. Additionally, the effect of external vibrations may also be decreased by increasing the gimbal bearing friction. With the suggested modifications there may be no need to lower the gimbal rates below the nominal design requirements as it is currently done on ISS. The conclusions of this work

Author

Control Moment Gyroscopes; Attitude Control; Vibration Damping; Robotics; Propellant Consumption; Vibration Effects

20080013457 NASA Langley Research Center, Hampton, VA, USA

Reaction Control System Design Considerations for Mars Entry Vehicles

Dyakonov, Artem A.; Schoenenberger, Mark; Edquist, Karl T.; Cheatwood, F. M.; Wright, Michael J.; April 2007; 20 pp.; In English; 5th International Planetary Probe Workshop, 23-29 Jun. 2007, Bordeaux, France; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 810031.07.05; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080013457

The next generation of Mars exploration landers must precisely deliver scientific payloads to sites of interest, unlike previous Mars missions. The past missions, such as Viking and Pathfinder, performed landings to within 100s of kilometers from their targets using an unguided atmospheric entry. Guided entry of a capsule with a relatively high lift-to-drag ratio will allow landing to within 10s of kilometers from the target with a significantly more massive payload. Successful guided entry requires the use of a reaction control system (RCS) for both attitude correction and entry guidance maneuvers. Various aspects of the entry, descent and landing (EDL) system performance may be impacted by the operation of the RCS during entry. This paper illustrates the risks that arise from the gasdynamic interaction of the entry vehicle (EV) and RCS, and which require attention in the areas of aerodynamics and control, and aerothermal environments. This paper will review the methods to address the design challenges associated with integration of RCS into the atmospheric entry system. Among these challenges is the analysis of the potential for the aerodynamic interference due to both the direct jet plume impingement and more complex plume interactions with the wake flow. These interactions can result in enhanced aeroheating, requiring that a different approach to the thermal protection system (TPS) selection and sizing be used. The recent findings for Mars Science Laboratory and Mars Phoenix will be presented to help illustrate some of the phenomena. Current design solutions will be discussed.

Author

Spacecraft Design; Attitude Control; Guidance (Motion); Aerodynamics; Mars Landing; Atmospheric Entry; Descent

20080013462 NASA Johnson Space Center, Houston, TX, USA

International Space Station USOS Crew Quarters Development

Broyan, James Lee, Jr.; Borrego, Melissa Ann; Bahr, Juergen F.; [2008]; 14 pp.; In English; 38th International Confeence on Environmental Systems, 29 Jun. - 3 Jul. 2008, San Francisco, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 401769.06.05.01.02.01

Report No.(s): 08ICES-0222; Copyright; Avail.: CASI: A03, Hardcopy

The International Space Station (ISS) USA Operational Segment (USOS) currently provides a Temporary Sleep Station (TeSS) as crew quarters for one crewmember in the Laboratory Module. The Russian Segment provides permanent crew quarters (Kayutas) for two crewmembers in the Service Module. The TeSS provides limited electrical, communication, and ventilation functionality. A new permanent rack sized USOS ISS Crew Quarters (CQ) is being developed. Up to four CQs can be installed into the Node 2 element to increase the ISS crewmember size to six. The new CQs will provide private crewmember space with enhanced acoustic noise mitigation, integrated radiation reduction material, controllable airflow, communication equipment, redundant electrical systems, and redundant caution and warning systems. The rack sized CQ is a system with multiple crewmember restraints, adjustable lighting, controllable ventilation, and interfaces that allow each crewmember to personalize their CQ workspace. Providing an acoustically quiet and visually isolated environment, while ensuring crewmember safety, is critical for obtaining crewmember rest and comfort to enable long term crewmember performance. The numerous human factor, engineering, and program considerations during the concept, design, and prototyping are outlined in the paper.

Author

Sleep; Spacecrews; Human Factors Engineering; Multi-Purpose Logistics Modules; International Space Station; Spacecraft Cabins

20080013464 NASA Langley Research Center, Hampton, VA, USA

Electron Beam Freeform Fabrication in the Space Environment

Taminger, Karen M.; Hafley, Robert A.; June 28, 2007; 24 pp.; In English; AeroMat 2007 - 18th AeroMat Conference and Exposition, 25-28 Jun. 2007, Baltimore, MD, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 140765.04.01.03.04; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080013464

This viewgraph presentation describes the effect of microgravity on the fabrication of electron beam freeform (EBF) in aerospace environments. The contents include: 1) Electron Beam Freeform Fabrication (EBF3) Process Description; 2) Portable Electron Beam Freeform Fabrication System at NASA LaRC; 3) Electron Beam Freeform Fabrication in the Space Environment; 4) Effect of Gravity on Surface Tension; 5) Effect of Deposit Height on Cooling Path; 6) Microgravity Testing Aboard JSC's C-9; 7) Typical Test Flight Plates; 8) Direction and Height Trials for Process Control; 9) Effect of Wire Entry Direction into Molten Pool; 10) Microstructure of Single Layer EBF Deposits; 11) 0-g Deposit with Incorrect Standoff Distance; 12) Successful Demonstration of EBF in 0-g; and 13) Conclusion.

CASI

Aerospace Environments; Electron Beams; Fabrication; Microgravity; Systems Engineering

20080013473 NASA Langley Research Center, Hampton, VA, USA

Application of Terahertz Radiation to the Detection of Corrosion under the Shuttle's Thermal Protection System

Madaras, Eric I.; Anastasi, Robert F.; Smith, Stephen W.; Seebo, Jeffrey P.; Walker, James L.; Lomness, Janice K.; Hintze, Paul E.; Kammerer, Catherine C.; Winfree, William P.; Russell, Richard W.; [2007]; 8 pp.; In English; 34th Annual Review of Progress in Quantitative Nondestructive Evaluation (QNDE 2007), 22-27 Jul. 2007, Golden, CO, USA; Original contains color illustrations; Copyright; Avail.: CASI: A02, Hardcopy

There is currently no method for detecting corrosion under Shuttle tiles except for the expensive process of tile removal and replacement; hence NASA is investigating new NDE methods for detecting hidden corrosion. Time domain terahertz radiation has been applied to corrosion detection under tiles in samples ranging from small lab samples to a Shuttle with positive results. Terahertz imaging methods have been able to detect corrosion at thicknesses of 5 mils or greater under 1' thick Shuttle tiles and 7-12 mils or greater under 2' thick Shuttle tiles.

Author

Thermal Protection; Space Shuttles; Nondestructive Tests; Tiles; Corrosion

20080013501 Boeing Co., Houston, TX, USA

Induced Contamination Predictions for JAXA's MPAC&SEED Devices

Steagall, Courtney; Smith, Kendall; Huang, Alvin; Soares, Carlos; Mikatarian, Ron; March 11, 2008; 24 pp.; In English; International Symposium on Sm/MPAC&SEED, 10-11 Mar. 2008, Tsukuba, Japan; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

Externally mounted ISS payloads are exposed to the induced ISS environment, including material outgassing and thruster plume contamination. The Boeing Space Environments Team developed analytical and semiempirical models to predict material outgassing and thruster plume induced contamination. JAXA s SM/MPAC&SEED experiment provides an unique opportunity to compare induced contamination predications with measurements. Analysis results are qualitatively consistent with XPS measurements. Calculated depth of contamination within a factor of 2-3 of measured contamination. Represents extremely good agreement, especially considering long duration of experiment and number of outgassing sources. Despite XPS limitations in quantifying plume contamination, the measured and predicted results are of similar scale for the wake-facing surfaces. JAXA s JEM/MPAC&SEED experiment will also be exposed to induced contamination due to JEM and ISS hardware. Predicted material outgassing induced contamination to JEM/MPAC&SEED ranges from 44 to 262 (depending on surface temperature) for a 3 year exposure duration.

Derived from text

Photoelectron Spectroscopy; Aerospace Environments; Outgassing; Surface Temperature; Spacecraft Modules; X Ray Spectroscopy; Contamination; Exhaust Gases; Mathematical Models

20080013505 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA; Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Evolution of the Phoenix EDL System Architecture

Grover, Myron R.; Desai, Prasun N.; June 26, 2007; 13 pp.; In English; 5th International Planetary Probe Workshop, 23-29 Jun. 2007, Boudeaux, France; Original contains color illustrations

Contract(s)/Grant(s): WBS 439654.02.07.01.01; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080013505

This viewgraph presentation gives a general overview of the Phoenix spacecraft evolution, entry, descent, landing and system architecture.

CASI

General Overviews; Spacecraft Landing; Spacecraft Design; Space Missions; Spacecraft Reentry; Descent

20080013516 NASA Langley Research Center, Hampton, VA, USA

Descent Assisted Split Habitat Lunar Lander Concept

Mazanek, Daniel D.; Goodliff, Kandyce; Cornelius, David M.; February 21, 2008; 16 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

The Descent Assisted Split Habitat (DASH) lunar lander concept utilizes a disposable braking stage for descent and a minimally sized pressurized volume for crew transport to and from the lunar surface. The lander can also be configured to perform autonomous cargo missions. Although a braking-stage approach represents a significantly different operational concept compared with a traditional two-stage lander, the DASH lander offers many important benefits. These benefits include improved crew egress/ingress and large-cargo unloading; excellent surface visibility during landing; elimination of the need for deep-throttling descent engines; potentially reduced plume-surface interactions and lower vertical touchdown velocity; and reduced lander gross mass through efficient mass staging and volume segmentation. This paper documents the conceptual study on various aspects of the design, including development of sortie and outpost lander configurations and a mission concept of operations; the initial descent trajectory design; the initial spacecraft sizing estimates and subsystem design; and the identification of technology needs

Author

Descent Trajectories; Lunar Surface; Surface Reactions; Throttling; Touchdown; Spacecraft Landing

20080013518 NASA Langley Research Center, Hampton, VA, USA

Airbag Landing Impact Performance Optimization for the Orion Crew Module

Lee, Timothy J.; McKinney, John; Corliss, James M.; March 03, 2008; 12 pp.; In English; Earth and Space Conference 2008, 3-5 Mar. 2008, Long Beach, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 644423.04.31.04.10; Copyright; Avail.: CASI: A03, Hardcopy

This report will discuss the use of advanced simulation techniques to optimize the performance of the proposed Orion

Crew Module airbag landing system design. The Boeing Company and the National Aeronautic and Space Administration s Langley Research Center collaborated in the analysis of the proposed airbag landing system for the next generation space shuttle replacement, the Orion spacecraft. Using LS-DYNA to simulate the Crew Module landing impacts, two main objectives were established and achieved: the investigation of potential methods of optimizing the airbag performance in order to reduce rebound on the anti-bottoming bags, lower overall landing loads, and increase overall Crew Module stability; and the determination of the Crew Module stability and load boundaries using the optimized airbag design, based on the potential Crew Module landing pitch angles and ground slopes in both the center of gravity forward and aft configurations. This paper describes the optimization and stability and load boundary studies and presents a summary of the results obtained and key lessons learned from this analysis.
Author
Air Bag Restraint Devices; Landing Aids; Optimization; Simulation; Crew Exploration Vehicle; Systems Engineering

20080013546 NASA Marshall Space Flight Center, Huntsville, AL, USA
Marshall Space Flight Center's Impact Testing Facility Capabilities
Evans, Steve; Finchum, Andy; Hubbs, Whitney; January 28, 2008; 1 pp.; In English; 32nd Annual Conference on Composites, Materials, and Structures, 28-31 Jan. 2008, Daytona Beach, FL, USA; No Copyright; Avail.: Other Sources; Abstract Only

Marshall Space Flight Center's (MSFC) Impact Testing Facility (ITF) serves as an important installation for space and missile related materials science research. The ITF was established and began its research in spacecraft debris shielding in the early 1960% then played a major role in the International Space Station debris shield development. As NASA became more interested in launch debris and in-flight impact concerns, the ITF grew to include research in a variety of impact genres. Collaborative partnerships with the DoD led to a wider range of impact capabilities being relocated to MSFC as a result of the closure of Particle Impact Facilities in Santa Barbara, California. The Particle Impact Facility had a 30 year history in providing evaluations of aerospace materials and components during flights through rain, ice, and solid particle environments at subsonic through hypersonic velocities. The facility's unique capabilities were deemed a 'National Asset' by the DoD. The ITF now has capabilities including environmental, ballistic, and hypervelocity impact testing utilizing an array of air, powder, and two-stage light gas guns to accommodate a variety of projectile and target types and sizes. Relocated test equipment was dated and in need of upgrade. Numerous upgrades including new instrumentation, triggering circuitry, high speed photography, and optimized sabot designs have been implemented. Other recent research has included rain drop demise characterization tests to obtain data for inclusion in on-going model development. Future ITF improvements will be focused on continued instrumentation and performance enhancements. These enhancements will allow further, more in-depth, characterization of rain drop demise characterization and evaluation of ice crystal impact. Performance enhancements also include increasing the upper velocity limit of the current environmental guns to allow direct environmental simulation for missile components. The current and proposed ITF capabilities range from rain to micrometeoroids allowing the widest test parameter range possible for materials investigations in support of space, atmospheric, and ground environments. These test capabilities including hydrometeor, single/multi-particle, ballistic gas grins, exploding wire gun, and light gas guns combined with Smooth Particle Hydrodynamics Code (SPHC) simulations represent the widest range of impact test capabilities in the country.
Author
Impact Tests; Drop Tests; Spacecraft Construction Materials; Test Facilities; Spacecraft Shielding; Hypervelocity Impact; Projectiles; Terminal Ballistics; Spacecraft Design; Atmospheric Composition

20080013569 NASA Marshall Space Flight Center, Huntsville, AL, USA
Effects of Low Temperature on Charging of Spacecraft Dielectrics
Ferguson, Dale C.; Schneider, Todd A.; Vaughn, Jason A.; January 07, 2008; 1 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; No Copyright; Avail.: Other Sources; Abstract Only

Spacecraft dielectric charging, sometimes called deep-dielectric-charging or bulk-charging, occurs when high energy electrons imbed themselves in dielectric materials, and the charge density builds up, sometimes to breakdown levels. Charges usually bleed off slowly due to material conductivity. At very low (cryogenic) temperatures, the dielectric conductivity decreases until charges may remain and build up over weeks, months, or years. In those cases, the guidelines given in NASA and industry documents for when dielectric charging may become important are misleading. Arcing tests of spacecraft cables at liquid nitrogen temperatures and very low flux levels have been done at NASA MSFC for the JWST Project. In this paper,

we describe the results of those tests and analyze their important implications for cryogenic spacecraft cable design and construction.
Author
Dielectrics; Electric Charge; High Energy Electrons; Spacecraft Charging; Temperature Effects; Low Temperature; Cryogenic Temperature

20080013578 NASA Langley Research Center, Hampton, VA, USA
Mach 10 Stage Separation Analysis for the X43-A
Tartabini, Paul V.; Bose, David M.; Thornblom, Mark N.; Lien, J. P.; Martin, John G.; [2007]; 13 pp.; In English; 44th AIAA Aerospace Sciences Meeting and Exhibit, 9-12 Jan. 2006, Reno, NV, USA; Original contains color illustrations
Contract(s)/Grant(s): 584772.07.01
Report No.(s): AIAA 2006-1038; Copyright; Avail.: CASI: A03, Hardcopy

This paper describes the pre-flight stage separation analysis that was conducted in support of the final flight of the X-43A. In that flight, which occurred less than eight months after the successful Mach 7 flight, the X-43A Research Vehicle attained a peak speed of Mach 9.6. Details are provided on how the lessons learned from the Mach 7 flight affected separation modeling and how adjustments were made to account for the increased flight Mach number. Also, the procedure for defining the feedback loop closure and feed-forward parameters employed in the separation control logic are described, and their effect on separation performance is explained. In addition, the range and nominal values of these parameters, which were included in the Mission Data Load, are presented. Once updates were made, the nominal pre-flight trajectory and Monte Carlo statistical results were determined and stress tests were performed to ensure system robustness. During flight the vehicle performed within the uncertainty bounds predicted in the pre-flight analysis and ultimately set the world record for airbreathing powered flight.
Author
X-43 Vehicle; Stage Separation; Mach Number; Research Vehicles; Hypersonic Speed; Sequential Control; Monte Carlo Method; Control Systems Design

20080013593 bd Systems, Inc., Huntsville, AL, USA
Embedded Relative Navigation Sensor Fusion Algorithms for Autonomous Rendezvous and Docking Missions
DeKock, Brandon K.; Betts, Kevin M.; McDuffie, James H.; Dreas, Christine B.; January 28, 2008; 12 pp.; In English; Institute of Navigation National Technical Meeting 2008: Innovating together Exploring the Future Uses of Navigation of Technology, 28-30 Jan. 2008, San Diego, CA, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NNM06AB28C; Copyright; Avail.: CASI: A03, Hardcopy

bd Systems (a subsidiary of SAIC) has developed a suite of embedded relative navigation sensor fusion algorithms to enable NASA autonomous rendezvous and docking (AR&D) missions. Translational and rotational Extended Kalman Filters (EKFs) were developed for integrating measurements based on the vehicles' orbital mechanics and high-fidelity sensor error models and provide a solution with increased accuracy and robustness relative to any single relative navigation sensor. The filters were tested tinough stand-alone covariance analysis, closed-loop testing with a high-fidelity multi-body orbital simulation, and hardware-in-the-loop (HWIL) testing in the Marshall Space Flight Center (MSFC) Flight Robotics Laboratory (FRL).
Author
Algorithms; Autonomous Docking; Navigation Instruments; Orbital Rendezvous; Spacecraft Docking

20080014079 ATK Launch Systems Group, Clearfield, UT, USA
Automated Eddy Current Inspection on Space Shuttle Hardware
Hartmann, John; Felker, Jeremy; November 12, 2007; 25 pp.; In English; 2007 ASNT Fall Conference, 12-16 Nov. 2007, Las Vegas, NV, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NAS8-97238; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080014079

Over the life time of the Space Shuttle program, metal parts used for the Reusable Solid Rocket Motors (RSRMs) have been nondestructively inspected for cracks and surface breaking discontinuities using magnetic particle (steel) and penetrant methods. Although these inspections adequately screened for critical sized cracks in most regions of the hardware, it became apparent after detection of several sub-critical flaws that the processes were very dependent on operator attentiveness and training. Throughout the 1990's, eddy current inspections were added to areas that had either limited visual access or were

more fracture critical. In the late 1990's. a project was initiated to upgrade NDE inspections with the overall objective of improving inspection reliability and control. An automated eddy current inspection system was installed in 2001. A figure shows one of the inspection bays with the robotic axis of the system highlighted. The system was programmed to inspect the various case, nozzle, and igniter metal components that make up an RSRM. both steel and aluminum. For the past few years, the automated inspection system has been a part of the baseline inspection process for steel components. Although the majority of the RSRM metal part inventory ts free of detectable surface flaws, a few small, sub-critical manufacturing defects have been detected with the automated system. This paper will summarize the benefits that have been realized with the current automated eddy current system, as well as the flaws that have been detected.
Derived from text
Cracks; Eddy Currents; Nondestructive Tests; Reusable Rocket Engines; Space Shuttles

20080014082 NASA Marshall Space Flight Center, Huntsville, AL, USA
The 2006 Cape Canaveral Air Force Station Range Reference Atmosphere Model Validation Study and Sensitivity Analysis to the National Aeronautics and Space Administration's Space Shuttle
Decker, Ryan; Burns, Lee; Merry, Carl; Harrington, Brian; January 20, 2008; 6 pp.; In English; 13th Conference on Aviation, Range and Aerospace Meteorology/American Meteorological Society, 20-24 Jan. 2008, New Orleans, LA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A02, Hardcopy

NASA's Space Shuttle utilizes atmospheric thermodynamic properties to evaluate structural dynamics and vehicle flight performance impacts by the atmosphere during ascent. Statistical characteristics of atmospheric thermodynamic properties at Kennedy Space Center (KSC) used in Space. Shuttle Vehicle assessments are contained in the Cape Canaveral Air Force Station (CCAFS) Range Reference Atmosphere (RRA) Database. Database contains tabulations for monthly and annual means (mu), standard deviations (sigma) and skewness of wind and thermodynamic variables. Wind, Thermodynamic, Humidity and Hydrostatic parameters 1 km resolution interval from 0-30 km 2 km resolution interval 30-70 km Multiple revisions of the CCAFS RRA database have been developed since initial RRA published in 1963. 1971, 1983, 2006 Space Shuttle program utilized 1983 version for use in deriving 'hot' and 'cold' atmospheres, atmospheric density dispersions for use in vehicle certification analyses and selection of atmospheric thermodynamic profiles for use in vehicle ascent design and certification analyses. During STS-114 launch preparations in July 2005 atmospheric density observations between 50-80 kft exceeded density limits used for aerodynamic ascent heating constraints in vehicle certification analyses. Mission specific analyses were conducted and concluded that the density bias resulted in small changes to heating rates and integrated heat loading on the vehicle. In 2001, the Air Force Combat Climatology Center began developing an updated RRA for CCAFS.
Author
Atmospheric Models; Reference Atmospheres; Thermodynamic Properties; Space Shuttles; NASA Programs; Sensitivity Analysis; Dynamic Structural Analysis; Atmospheric Entry; Ascent

20080014096 NASA Ames Research Center, Moffett Field, CA, USA
Caution and Warning Alarm Design and Evaluation for NASA CEV Auditory Displays: SHFE Information Presentation Directed Research Project (DRPP) report 12.07
Begault, Durand R.; Godfroy, Martine; Sandor, Aniko; Holden, Kritina; [2008]; 13 pp.; In English; 124th Audio Engineering Society Convention 2008, 17-20 May 2008, Amsterdam, Netherlands; Original contains color illustrations; Copyright;
Avail.: CASI: A03, Hardcopy

The design of caution-warning signals for NASA s Crew Exploration Vehicle (CEV) and other future spacecraft will be based on both best practices based on current research and evaluation of current alarms. A design approach is presented based upon cross-disciplinary examination of psychoacoustic research, human factors experience, aerospace practices, and acoustical engineering requirements. A listening test with thirteen participants was performed involving ranking and grading of current and newly developed caution-warning stimuli under three conditions: (1) alarm levels adjusted for compliance with ISO 7731, 'Danger signals for work places - Auditory Danger Signals', (2) alarm levels adjusted to an overall 15 dBA s/n ratio and (3) simulated codec low-pass filtering. Questionnaire data yielded useful insights regarding cognitive associations with the sounds.
Author
Warning Systems; Aerospace Engineering; Decoders; Hazards; Human Factors Engineering

20080014105 NASA Langley Research Center, Hampton, VA, USA

Trajectory and Aeroheating Environment Development and Sensitivity Analysis for Capsule-shaped Vehicles

Robinson, Jeffrey S.; Wurster, Kathryn E.; November 06, 2006; 13 pp.; In English; 14th AIAA/AHI International Space Planes and Hypersonics Systems and Technologies Conference, 6-9 Nov. 2006, Canberra, Australia; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 599489.02.07.07.01

Report No.(s): AIAA Paper-2006-7949; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080014105

Recently, NASA's Exploration Systems Research and Technology Project funded several tasks that endeavored to develop and evaluate various thermal protection systems and high temperature material concepts for potential use on the crew exploration vehicle. In support of these tasks, NASA Langley's Vehicle Analysis Branch generated trajectory information and associated aeroheating environments for more than 60 unique entry cases. Using the Apollo Command Module as the baseline entry system because of its relevance to the favored crew exploration vehicle design, trajectories for a range of lunar and Mars return, direct and aerocapture Earth-entry scenarios were developed. For direct entry, a matrix of cases was created that reflects reasonably expected minimum and maximum values of vehicle ballistic coefficient, inertial velocity at entry interface, and inertial flight path angle at entry interface. For aerocapture, trajectories were generated for a range of values of initial velocity and ballistic coefficient that, when combined with proper initial flight path angles, resulted in achieving a low Earth orbit either by employing a full lift vector up or full lift vector down attitude. For each trajectory generated, aeroheating environments were generated which were intended to bound the thermal protection system requirements for likely crew exploration vehicle concepts. The trades examined clearly pointed to a range of missions / concepts that will require ablative systems as well as a range for which reusable systems may be feasible. In addition, the results clearly indicated those entry conditions and modes suitable for manned flight, considering vehicle deceleration levels experienced during entry. This paper presents an overview of the analysis performed, including the assumptions, methods, and general approach used, as well as a summary of the trajectory and aerothermal environment information that was generated.

Author

Aerodynamic Heating; Atmospheric Entry; Sensitivity Analysis; Space Capsules; Aerocapture; Refractory Materials; Trajectory Analysis

20080014194 NASA Johnson Space Center, Houston, TX, USA

Post-Landing Orion Crew Survival in Warm Ocean Areas: A Case Study in Iterative Environmental Design

Rains, George E.; Bue, Grant C.; Pantermuehl, Jerry; [2008]; 9 pp.; In English; 38th International Conference on Environmental Systems, 29 Jun. - 2 ul. 2008, San Francisco, CA, USA

Contract(s)/Grant(s): 644423.02.36.12.10; Copyright; Avail.: CASI: A02, Hardcopy

The Orion crew module (CM) is being designed to perform survivable land and water landings. There are many issues associated with post-landing crew survival. In general, the most challenging of the realistic Orion landing scenarios from an environmental control standpoint is the off-nominal water landing. Available power and other consumables will be very limited after landing, and it may not be possible to provide full environmental control within the crew cabin for very long after splashdown. Given the bulk and thermal insulation characteristics of the crew-worn pressure suits, landing in a warm tropical ocean area would pose a risk to crew survival from elevated core body temperatures, if for some reason the crewmembers were not able to remove their suits and/or exit the vehicle. This paper summarizes the analyses performed and conclusions reached regarding post-landing crew survival following a water landing, from the standpoint of the crew s core body temperatures.

Author

Spacecraft Modules; Water Landing; Environmental Control; Spacecrews; Survival; Consumables (Spacecraft); Thermal Insulation; Pressure Suits; Body Temperature

20080014198 NASA Glenn Research Center, Cleveland, OH, USA

Evaluation of a Seat Attenuation System for the Orion Crew Module

Lawrence, Charles; McMichael, James H.; Littell, Justin; March 2008; 25 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 843515.02.01.03.05.08.04

Report No.(s): NASA/TM-2008-215053; E-16269; Copyright; Avail.: CASI: A03, Hardcopy

The function of the crew seat attenuation system for the Orion Crew Module (CM) is to provide the crew with a low injury-risk landing environment under a range of crew configurations and landing conditions. The current design for the seat attenuation system provides the crew with a low risk of injury environment based on the Brinkley criteria for most of the landing conditions considered. Furthermore, the stroking of the seat attenuation system is within limits, and the clearance

between the seat support platform and vehicle is not exceeded. For the limited number of landing conditions where a low injury risk is exceeded, the risk is never beyond a moderate level. The results presented in this study are based on a CM structural model that is rigid except for the pallet struts, which attenuate landing loads and reduce the accelerations transferred to the astronauts. The CM simulations include a soft soil landing. Several different crew configurations are evaluated in this study. It is expected that situations where the risk is above low can be eliminated in future design iterations.
Author
Seats; Spacecraft Modules; Crew Exploration Vehicle; Spacecraft Design; Attenuation; Landing Loads; Spacecraft Landing

20080014232 NASA Langley Research Center, Hampton, VA, USA
Test-Analysis Correlation for Space Shuttle External Tank Foam Impacting RCC Wing Leading Edge Component Panels
Lyle, Karen H.; March 08, 2008; 23 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 644423.04.31.04.40.43.20
Report No.(s): NASA/TM-2008-215115; L-19437; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080014232

The Space Shuttle Columbia Accident Investigation Board recommended that NASA develop, validate, and maintain a modeling tool capable of predicting the damage threshold for debris impacts on the Space Shuttle Reinforced Carbon-Carbon (RCC) wing leading edge and nosecap assembly. The results presented in this paper are one part of a multi-level approach that supported the development of the predictive tool used to recertify the shuttle for flight following the Columbia Accident. The assessment of predictive capability was largely based on test analysis comparisons for simpler component structures. This paper provides comparisons of finite element simulations with test data for external tank foam debris impacts onto 6-in. square RCC flat panels. Both quantitative displacement and qualitative damage assessment correlations are provided. The comparisons show good agreement and provided the Space Shuttle Program with confidence in the predictive tool.
Author
Accident Investigation; Carbon-Carbon Composites; Correlation; External Tanks; Foams; Leading Edges; Wing Panels; Columbia (Orbiter)

19
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*.

20080013390 NASA Langley Research Center, Hampton, VA, USA
Space Qualification Issues in Acousto-optic and Electro-optic Devices
Prasad, Narasimha S.; Taylor, Edward W.; Trivedi, Sudhir; Kutcher, Sue; Soos, Jolanta; [2007]; 10 pp.; In English; SPIE Optics and Photonics 2007, 26-30 Aug. 2007, San Diego, CA, USA
Contract(s)/Grant(s): WBS 478643.02.02.02.15; Copyright; Avail.: CASI: A02, Hardcopy

Satellite and space-based applications of photonic devices and systems require operational reliability in the harsh environment of space for extended periods of time. This in turn requires every component of the systems and their packaging to meet space qualifications. Acousto- and electro-optical devices form the major components of many current space based optical systems, which is the focus of this paper. The major space qualification issues are related to: mechanical stability, thermal effects and operation of the devices in the naturally occurring space radiation environment. This paper will discuss acousto- and electro-optic materials and devices with respect to their stability against mechanical vibrations, thermal cycling in operating and non-operating conditions and device responses to space ionizing and displacement radiation effects. Selection of suitable materials and packaging to meet space qualification criteria will also be discussed. Finally, a general roadmap for production and testing of acousto- and electro-optic devices will be discussed.
Author
Spacecraft Instruments; Space Missions; Optoelectronic Devices; Acousto-Optics; Photonics; Aerospace Environments; Suitability; Satellite-Borne Instruments

20080013510 NASA Langley Research Center, Hampton, VA, USA

Overview of the MEDLI Project

Gazarik, Michael J.; Little, Alan; Cheatwood, F. Neil; Wright, Michael J.; Herath, Jeff A.; Martinez, Edward R.; Munk, Michelle; Novak, Frank J.; Wright, Henry S.; March 2008; 10 pp.; In English; 2008 IEEE Aerospace Conference, 1-8 Mar. 2008, Big Sky, MT, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 599489.02.07.07.04.33.01; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080013510

The Mars Science Laboratory Entry, Descent, and Landing Instrumentation (MEDLI) Project s objectives are to measure aerothermal environments, sub-surface heatshield material response, vehicle orientation, and atmospheric density for the atmospheric entry and descent phases of the Mars Science Laboratory (MSL) entry vehicle. The flight science objectives of MEDLI directly address the largest uncertainties in the ability to design and validate a robust Mars entry system, including aerothermal, aerodynamic and atmosphere models, and thermal protection system (TPS) design. The instrumentation suite will be installed in the heatshield of the MSL entry vehicle. The acquired data will support future Mars entry and aerocapture missions by providing measured atmospheric data to validate Mars atmosphere models and clarify the design margins for future Mars missions. MEDLI thermocouple and recession sensor data will significantly improve the understanding of aeroheating and TPS performance uncertainties for future missions. MEDLI pressure data will permit more accurate trajectory reconstruction, as well as separation of aerodynamic and atmospheric uncertainties in the hypersonic and supersonic regimes. This paper provides an overview of the project including the instrumentation design, system architecture, and expected measurement response.

Author

Space Laboratories; Atmospheric Entry; Descent; Mars Landing; Spacecraft Instruments; Aerocapture; Spacecraft Design

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*.

20080013447 NASA Marshall Space Flight Center, Huntsville, AL, USA

Lander Propulsion Overview and Technology Requirements Discussion

Brown, Thomas M.; November 14, 2007; 11 pp.; In English; Constellation Technology Conference, 14-15 Nov. 2007, Galveston, TX, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080013447

This viewgraph presentation reviews the lunar lander propulsion requirements. It includes discussion on: Lander Project Overview, Project Evolution/Design Cycles, Lunar Architecture & Lander Reference Missions, Lander Concept Configurations, Descent and Ascent propulsion reviews, and a review of the technology requirements.

CASI

Propulsion; Lunar Landing Modules; Lunar Landing

20080013489 NASA Stennis Space Center, Stennis Space Center, MS, USA

Developments in Test Facility and Data Networking for the Altitude Test Stand at the John C. Stennis Space Center: A General Overview

Hebert, Phillip W.; March 02, 2008; 60 pp.; In English; Mississippi Engineering Society (MES) Conference, 2-4 Mar. 2008, Jackson, MS, USA; Original contains color and black and white illustrations

Report No.(s): SSTI-8080-0020; No Copyright; Avail.: CASI: A04, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080013489

NASA/SSC's Mission in Rocket Propulsion Testing Is to Acquire Test Performance Data for Verification, Validation and Qualification of Propulsion Systems Hardware: Accurate, Reliable, Comprehensive, and Timely. Data Acquisition in a Rocket Propulsion Test Environment Is Challenging: a) Severe Temporal Transient Dynamic Environments; b) Large Thermal Gradients; c) Vacuum to high pressure regimes. A-3 Test Stand Development is equally challenging with respect to accommodating vacuum environment, operation of a CSG system, and a large quantity of data system and control channels to determine proper engine performance as well as Test Stand operation. SSC is currently in the process of providing

modernized DAS, Control Systems, Video, and network systems for the A-3 Test Stand to overcome these challenges.
Derived from text
Propulsion System Configurations; Test Stands; Temperature Gradients; Data Systems; Data Acquisition; Propulsion System Performance; High Pressure; Vacuum

20080013515 NASA Langley Research Center, Hampton, VA, USA
A Survey of Supersonic Retropropulsion Technology for Mars Entry, Descent, and Landing
Korzun, Ashley M.; Cruz, Juan R.; Braun, Robert D.; October 25, 2007; 15 pp.; In English; 2008 IEEE Aerospace Conference, 1-8 Mar. 2008, Big Sky, MT, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 599489.02.07.07.08.33.01; Copyright; Avail.: Other Sources

This paper presents a literature survey on supersonic retropropulsion technology as it applies to Mars entry, descent, and landing (EDL). The relevance of this technology to the feasibility of Mars EDL is shown to increase with ballistic coefficient to the point that it is likely required for human Mars exploration. The use of retropropulsion to decelerate an entry vehicle from hypersonic or supersonic conditions to a subsonic velocity is the primary focus of this review. Discussed are systems-level studies, general flowfield characteristics, static aerodynamics, vehicle and flowfield stability considerations, and aerothermodynamics. The experimental and computational approaches used to develop retropropulsion technology are also reviewed. Finally, the applicability and limitations of the existing literature and current state-of-the-art computational tools to future missions are discussed in the context of human and robotic Mars exploration.
Author
Mars Landing; Descent; Mars Exploration; Supersonic Flight; Hypersonics; Aerothermodynamics; Aerodynamic Stability

20080013527 NASA Johnson Space Center, Houston, TX, USA
Computational Plume Modeling of COnceptual ARES Vehicle Stage Tests
Allgood, Daniel C.; Ahuja, Vineet; July 08, 2007; 19 pp.; In English; American Institute of Aeronautics and Astronautics Conference, 8-11 Jul. 2007, Cincinnati, OH, USA; Original contains color illustrations
Contract(s)/Grant(s): NNS04AB67T
Report No.(s): SSTI-2180-0001; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013527

The plume-induced environment of a conceptual ARES V vehicle stage test at the NASA Stennis Space Center (NASA-SSC) was modeled using computational fluid dynamics (CFD). A full-scale multi-element grid was generated for the NASA-SSC B-2 test stand with the ARES V stage being located in a proposed off-center forward position. The plume produced by the ARES V main power plant (cluster of five RS-68 LOX/LH2 engines) was simulated using a multi-element flow solver - CRUNCH. The primary objective of this work was to obtain a fundamental understanding of the ARES V plume and its impingement characteristics on the B-2 flame-deflector. The location, size and shape of the impingement region were quantified along with the un-cooled deflector wall pressures, temperatures and incident heating rates. Issues with the proposed tests were identified and several of these addressed using the CFD methodology. The final results of this modeling effort will provide useful data and boundary conditions in upcoming engineering studies that are directed towards determining the required facility modifications for ensuring safe and reliable stage testing in support of the Constellation Program.
Author
Ares 5 Cargo Launch Vehicle; Plumes; Computational Fluid Dynamics; Test Stands; Hydrogen Oxygen Engines; Wall Pressure; Flame Deflectors

20080013568 NASA Marshall Space Flight Center, Huntsville, AL, USA
Up the Technology Readiness Level (TRL) Scale to Demonstrate a Robust, Long Life, Liquid Rocket Engine Combustion Chamber, or...Up the Downstairs
Holmes, Richard; Elam, Sandra; McKechnie, Timothy; Power, Christopher; January 27, 2008; 1 pp.; In English; 32nd International Conference and Exposition on Advanced Ceramics and Composites, 27 Jan.-1 Feb. 2008, Daytona, FL, USA; Copyright; Avail.: Other Sources; Abstract Only

Advanced vacuum plasma spray (VPS) technology, utilized to successfully apply thermal barrier coatings to space shuttle main engine turbine blades, was further refined as a functional gradient material (FGM) process for space furnace cartridge experiments at 1600 C and for robust, long life combustion chambers for liquid rocket engines. A VPS/FGM 5K (5,000 lb. thrust) thruster has undergone 220 hot firing tests, in pristine condition, showing no wear, blanching or cooling channel cracks.

Most recently, this technology has been applied to a 40K thruster, with scale up planned for a 194K Ares I, J-2X engine.
Author
Liquid Propellant Rocket Engines; Plasmas (Physics); Thermal Control Coatings; Space Shuttle Main Engine; Turbine Blades; Functionally Gradient Materials; Combustion Chambers

20080014042 West Virginia High Technology Consortium Foundation, Fairmont, WV, USA
Scaling and Systems Considerations in Pulsed Inductive Plasma Thrusters
Polzin, Kurt A.; [2007]; 9 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NNM06AA17G; No Copyright; Avail.: Other Sources

Performance scaling in pulsed inductive thrusters is discussed in the context of previous experimental studies and modeling results. Two processes, propellant ionization and acceleration, are interconnected where overall thruster performance and operation are concerned, but they are separated here to gain physical insight into each process and arrive at quantitative criteria that should be met to address or mitigate inherent inductive thruster difficulties. The use of preionization to lower the discharge energy relative to the case where no preionization is employed, and to influence the location of the initial current sheet, are described. The relevant performance scaling parameters for the acceleration stage are reviewed, emphasizing their physical importance and the numerical values required for efficient acceleration. The scaling parameters are then related to the design of the acceleration coil and the pulsed power train that provides current to the acceleration stage. An accurate numerical technique that allows computation of the inductance of a planar acceleration coil using an axisymmetric magnetostatic solver is described and validated against measured coil inductance values. Requirements for the pulsed power train are reviewed. Several power train and circuit topologies are described, highlighting the impact each can have on inductive thruster performance and on systems issues associated with high-current switching, lifetime, and power consumption.
Author
Propellants; Ionization; Pulsed Inductive Thrusters; Plasma Engines; Magnetostatics; Current Sheets

20080014089 Engineering Research and Consulting, Inc., Houston, TX, USA
The Solid Rocket Motor Slag Population: Results of a Radar-based Regressive Statistical Evaluation
Horstman, Matthew F.; Xu, Yu-Lin; [2008]; 1 pp.; In English; COSPAR 2008, 13-20 Jul. 2008, Ontario, Canada; No Copyright; Avail.: Other Sources; Abstract Only

Solid rocket motor (SRM) slag has been identified as a significant source of man-made orbital debris. The propensity of SRMs to generate particles of 100 m and larger has caused concern regarding their contribution to the debris environment. Radar observation, rather than in-situ gathered evidence, is currently the only measurable source for the NASA/ODPO model of the on-orbit slag population. This simulated model includes the time evolution of the resultant orbital populations using a historical database of SRM launches, propellant masses, and estimated locations and times of tail-off. However, due to the small amount of observational evidence, there can be no direct comparison to check the validity of this model. Rather than using the assumed population developed from purely historical and physical assumptions, a regressional approach was used which utilized the populations observed by the Haystack radar from 1996 to present. The estimated trajectories from the historical model of slag sources, and the corresponding plausible detections by the Haystack radar, were identified. Comparisons with observational data from the ensuing years were made, and the SRM model was altered with respect to size and mass production of slag particles to reflect the historical data obtained. The result is a model SRM population that fits within the bounds of the observed environment.
Author
Solid Propellant Rocket Engines; Space Debris; Radar Tracking; Statistical Analysis; Trajectories; Slags

20080014139 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Advanced Radioisotope Power System Enabled Titan Rover Concept with Inflatable Wheels
Balint, Tibor S.; Schriener, Timothy M.; Shirley, James H.; February 12, 2006; 9 pp.; In English; Space Technology and Applications International Forum (STAIF), 12-16 Feb. 2006, Albuquerque, NM, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40667

This viewgraph presentation reviews study into exploration of Titan. Including a possible Titan Rover that would use the advanced radioisotope power system (RPS). The goal of the study is to demonstrate a simple, credible and affordable rover mission concept for Titan in-situ exploration, enabled by an Advanced RPS. The presentation reviews the possible launch

vehicle, and trajectory options; desired instrumentation that would be aboard the rover; and considerations for the design of the rover.
CASI
Mission Planning; Titan; Roving Vehicles; Radioisotope Batteries

20080014140 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
The Potential Benefits of Nuclear Power on the Surface of Mars: The Robotic Exploration Perspective
Hayati, Samad A.; Balint, Tibor S.; February 14, 2006; 10 pp.; In English; Space Technology and Applications International Forum (STAIF), 14 Feb. 2006, Albuquerque, NM, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40675

This viewgraph presentation reviews the future planning for further exploration of the Martian Surface by robotic vehicles. Particular emphasis is given to the use of nuclear power in the planning process. Advantages of Radioisotope Power Systems and Radioisotope Heating units are reviewed.
CASI
Mars Exploration; Mission Planning; Spacecraft Power Supplies; Mars Missions

20080014169 NASA Langley Research Center, Hampton, VA, USA
Testing of Flexible Ballutes in Hypersonic Wind Tunnels for Planetary Aerocapture
Buck, Gregory M.; [2007]; 10 pp.; In English; 44th AIAA Aerospace Sciences Meeting and Exhibit, 9-12 Jan. 2006, Reno, NV, USA; Original contains color illustrations
Contract(s)/Grant(s): 346620.04.04.01.07.03
Report No.(s): AIAA Paper-2006-1319; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080014169

Studies were conducted for the In-Space Propulsion (ISP) Ultralightweight Ballute Technology Development Program to increase the technical readiness level of inflatable decelerator systems for planetary aerocapture. The present experimental study was conducted to develop the capability for testing lightweight, flexible materials in hypersonic facilities. The primary objectives were to evaluate advanced polymer film materials in a high-temperature, high-speed flow environment and provide experimental data for comparisons with fluid-structure interaction modeling tools. Experimental testing was conducted in the Langley Aerothermodynamics Laboratory 20-Inch Hypersonic CF4 and 31-Inch Mach 10 Air blowdown wind tunnels. Quantitative flexure measurements were made for 60 degree half angle afterbody-attached ballutes, in which polyimide films (1-mil and 3- mil thick) were clamped between a 1/2-inch diameter disk and a base ring (4-inch and 6-inch diameters). Deflection measurements were made using a parallel light silhouette of the film surface through an existing schlieren optical system. The purpose of this paper is to discuss these results as well as free-flying testing techniques being developed for both an afterbody-attached and trailing toroidal ballute configuration to determine dynamic fluid-structural stability. Methods for measuring polymer film temperature were also explored using both temperature sensitive paints (for up to 370 C) and laser-etched thin-film gages.
Author
Aerocapture; Ballutes; Hypersonic Wind Tunnels; Wind Tunnel Models; Flexible Bodies; Aerothermodynamics; Spacecraft Propulsion; Technology Utilization

20080014199 NASA Glenn Research Center, Cleveland, OH, USA
Advanced Chemical Propulsion for Science Missions
Liou, Larry; March 2008; 16 pp.; In English; 2008 IEEE Aerodpace Conference, 1-8 Mar. 2008, Big Sky, MT, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 346620.01.03.01
Report No.(s): NASA/TM-2008-215069; E-16298; AIAA Paper 1482; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080014199

The advanced chemical propulsion technology area of NASA's In-Space Technology Project is investing in systems and components for increased performance and reduced cost of chemical propulsion technologies applicable to near-term science missions. Presently the primary investment in the advanced chemical propulsion technology area is in the AMBR high temperature storable bipropellant rocket engine. Scheduled to be available for flight development starting in year 2008, AMBR engine shows a 60 kg payload gain in an analysis for the Titan-Enceladus orbiter mission and a 33 percent manufacturing cost

reduction over its baseline, state-of-the-art counterpart. Other technologies invested include the reliable lightweight tanks for propellant and the precision propellant management and mixture ratio control. Both technologies show significant mission benefit, can be applied to any liquid propulsion system, and upon completion of the efforts described in this paper, are at least in parts ready for flight infusion. Details of the technologies are discussed.
Author
Chemical Propulsion; Technology Utilization; Space Missions; Aerospace Sciences; Fabrication

20080014200 NASA Glenn Research Center, Cleveland, OH, USA
Volume Dynamics Propulsion System Modeling for Supersonics Vehicle Research
Kopasakis, George; Connolly, Joseph W.; Paxson, Daniel E.; Ma, Peter; [2008]; 10 pp.; In English; ASME Turbo Expo Conference, 9-13 Jun. 2008, Berlin, Germany
Contract(s)/Grant(s): WBS 984754.02.07.03.20.02
Report No.(s): GT2008-50524; Copyright; Avail.: Other Sources

Under the NASA Fundamental Aeronautics Program the Supersonics Project is working to overcome the obstacles to supersonic commercial flight. The proposed vehicles are long slim body aircraft with pronounced aero-servo-elastic modes. These modes can potentially couple with propulsion system dynamics; leading to performance challenges such as aircraft ride quality and stability. Other disturbances upstream of the engine generated from atmospheric wind gusts, angle of attack, and yaw can have similar effects. In addition, for optimal propulsion system performance, normal inlet-engine operations are required to be closer to compressor stall and inlet unstart. To study these phenomena an integrated model is needed that includes both airframe structural dynamics as well as the propulsion system dynamics. This paper covers the propulsion system component volume dynamics modeling of a turbojet engine that will be used for an integrated vehicle Aero-Propulso-Servo-Elastic model and for propulsion efficiency studies.
Author
Supersonic Flight; Gas Dynamics; Rotor Dynamics; Dynamic Models; Aerospace Systems; Gas Turbine Engines; Computerized Simulation; Propulsion System Performance

23
CHEMISTRY AND MATERIALS (GENERAL)

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

20080013427 NASA Marshall Space Flight Center, Huntsville, AL, USA
Simulation of Unique Pressure Changing Steps and Situations in Psa Processes
Ebner, Armin D.; Mehrotra, Amal; Knox, James C.; LeVan, Douglas; Ritter, James A.; November 06, 2007; 27 pp.; In English; AIChE 2007, 6-10 Nov. 2007, Salt Lake City, UT, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

A more rigorous cyclic adsorption process simulator is being developed for use in the development and understanding of new and existing PSA processes. Unique features of this new version of the simulator that Ritter and co-workers have been developing for the past decade or so include: multiple absorbent layers in each bed, pressure drop in the column, valves for entering and exiting flows and predicting real-time pressurization and depressurization rates, ability to account for choked flow conditions, ability to pressurize and depressurize simultaneously from both ends of the columns, ability to equalize between multiple pairs of columns, ability to equalize simultaneously from both ends of pairs of columns, and ability to handle very large pressure ratios and hence velocities associated with deep vacuum systems. These changes to the simulator now provide for unique opportunities to study the effects of novel pressure changing steps and extreme process conditions on the performance of virtually any commercial or developmental PSA process. This presentation will provide an overview of the cyclic adsorption process simulator equations and algorithms used in the new adaptation. It will focus primarily on the novel pressure changing steps and their effects on the performance of a PSA system that epitomizes the extremes of PSA process design and operation. This PSA process is a sorbent-based atmosphere revitalization (SBAR) system that NASA is developing for new manned exploration vehicles. This SBAR system consists of a 2-bed 3-step 3-layer system that operates between atmospheric pressure and the vacuum of space, evacuates from both ends of the column simultaneously, experiences choked flow conditions during pressure changing steps, and experiences a continuously changing feed composition, as it removes metabolic CO2 and H20 from a closed and fixed volume, i.e., the spacecraft cabin. Important process performance indicators

of this SBAR system are size, and the corresponding CO2 and H20 removal efficiencies, and N2 and O2 loss rates. Results of the fundamental behavior of this PSA process during extreme operating conditions will be presented and discussed.
Author
Absorbers (Materials); Carbon Dioxide Removal; Atmospheric Pressure; Carbon Dioxide; Pressure Effects; Vacuum Systems; Simulators; Real Time Operation; Pressure Ratio; Oxygen

20080014172 NASA Langley Research Center, Hampton, VA, USA
Ultrasonication of Bismuth Telluride Nanocrystals Fabricated by Solvothermal Method
Chu, Sang-Hyon; Choi, Sang H.; Kim, Jae-Woo; King, Glen C.; Elliott, James R.; February 26, 2006; 8 pp.; In English; SPIE 13th Annual International Symposium Smart Structures and Materials, 26 Feb. - 2 Mar. 2006, San Diego, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): 561581.02.08; Copyright; Avail.: CASI: A02, Hardcopy

The objective of this study is to evaluate the effect of ultrasonication on bismuth telluride nanocrystals prepared by solvothermal method. In this study, a low dimensional nanocrystal of bismuth telluride (Bi2Te3) was synthesized by a solvothermal process in an autoclave at 180 C and 200 psi. During the solvothermal reaction, organic surfactants effectively prevented unwanted aggregation of nanocrystals in a selected solvent while controlling the shape of the nanocrystal. The atomic ratio of bismuth and tellurium was determined by energy dispersive spectroscopy (EDS). The cavitational energy created by the ultrasonic probe was varied by the ultrasonication process time, while power amplitude remained constant. The nanocrystal size and its size distribution were measured by field emission scanning electron microscopy (FESEM) and a dynamic light scattering system. When the ultrasonication time increased, the average size of bismuth telluride nanocrystal gradually increased due to the direct collision of nanocrystals. The polydispersity of the nanocrystals showed a minimum when the ultrasonication was applied for 5 min. Keywords: bismuth telluride, nanocrystal, low-dimensional, ultrasonication, solvothermal
Author
Bismuth Tellurides; Nanocrystals; Field Emission; Surfactants; Size Distribution; Solvents; Scanning Electron Microscopy

24
COMPOSITE MATERIALS

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

20080013434 NASA Langley Research Center, Hampton, VA, USA
Ground-Based Testing of TiB2 and Al2O3/TiB2 Response to Space Environment
Jefferies, Sharon A.; Logan, Kathryn V.; [2007]; 20 pp.; In English; 2007 National Space and Missile Materials Symposium, 25-29 Jun. 2007, Keystone, CO, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 604746.04.02.04; Copyright; Avail.: CASI: A03, Hardcopy

Two materials, titanium diboride and an alumina/titanium diboride composite, exhibit characteristics favorable for use in multiple space applications. These characteristics include low mass (4.52 gm/cc), high strain rate impact resistance, high temperature use (3000oC M.P.), thermal and electrical conductivity, thermal shock resistance, and high visible-range reflectivity. Additionally, the presence of boron in these materials gives them the potential to shield against neutron radiation as well as charged radiation. These materials are flying on MISSE 6 to assess material changes resulting from exposure to the space environment. This study provides a preliminary, ground-based examination of these materials' interactions with individual components of the space environment, in particular atomic oxygen (AO) and neutron radiation, in order to better predict and understand post-flight results. Individual specimens are exposed to ground state AO and surface oxidation is measured. Equivalent exposures of up to 13 months show no rapid oxidation, however evidence indicates some surface oxidation occurring. Other samples are placed near a polyethylene moderated, one Ci Am/Be neutron source to determine their shielding capability. Comparisons between exposed and shielded indium foil, which is activated by transmitted neutrons, measure each material's ability to shield neutrons. Preliminary results indicate a significant shielding benefit provided by both materials.
Author
Ground Tests; Titanium Borides; Aluminum Oxides; Titanium; Aerospace Environments; Radiation Effects; Durability; Mechanical Properties; Composite Materials

20080013456 NASA Glenn Research Center, Cleveland, OH, USA

FAA Development of Reliable Modeling Methodologies for Fan Blade Out Containment Analysis, Part 2, Ballistic Impact Testing

Revilock, Duane M.; Pereira, J. Michael; March 03, 2008; 39 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.16.05; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013456

This report summarizes the ballistic impact testing that was conducted to provide validation data for the development of numerical models of blade out events in fabric containment systems. The ballistic impact response of two different fiber materials - Kevlar 49 (E.I. DuPont Nemours and Company) and Zylon AS (Toyobo Co., Ltd.) was studied by firing metal projectiles into dry woven fabric specimens using a gas gun. The shape, mass, orientation and velocity of the projectile were varied and recorded. In most cases the tests were designed such that the projectile would perforate the specimen, allowing measurement of the energy absorbed by the fabric. The results for both Zylon and Kevlar presented here represent a useful set of data for the purposes of establishing and validating numerical models for predicting the response of fabrics under conditions simulating those of a jet engine blade release situations. In addition some useful empirical observations were made regarding the effects of projectile orientation and the relative performance of the different materials.
Author

Containment; Fan Blades; Impact Tests; Mathematical Models; Terminal Ballistics; Reliability Analysis; Air Transportation

20080013506 National Inst. of Aerospace Associates, Hampton, VA, USA

A Selection of Composites Simulation Practices at NASA Langley Research Center

Ratcliffe, James G.; May 04, 2007; 44 pp.; In English; MSC Software Composites Consortium Meeting, 3-4 May 2007, Santa Ana, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 732759.07.09; Copyright; Avail.: CASI: A03, Hardcopy

One of the major areas of study at NASA Langley Research Center is the development of technologies that support the use of advanced composite materials in aerospace applications. Amongst the supporting technologies are analysis tools used to simulate the behavior of these materials. This presentation will discuss a number of examples of analysis tools and simulation practices conducted at NASA Langley. The presentation will include examples of damage tolerance analyses for both interlaminar and intralaminar failure modes. Tools for modeling interlaminar failure modes include fracture mechanics and cohesive methods, whilst tools for modeling intralaminar failure involve the development of various progressive failure analyses. Other examples of analyses developed at NASA Langley include a thermo-mechanical model of an orthotropic material and the simulation of delamination growth in z-pin reinforced laminates.
Author

Aerospace Engineering; Composite Materials; Structural Analysis; Failure Analysis; Simulation; Dimensional Analysis; Finite Element Method; Fatigue (Materials)

20080013514 NASA Langley Research Center, Hampton, VA, USA

NASA NDE Program

Generazio, Edward R.; May 17, 2007; 6 pp.; In English; NDE Communications Group Meeting, 16-17 May 2007, Arlington, VA, USA

Contract(s)/Grant(s): WBS 939904.05.07; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013514

This viewgraph presentation describes the NASA Nondestructive Evaluation (NDE) Program. The contents include: 1) NASA NDE Program; 2) Nondestructive Evaluation Requirements for Fracture Critical Components; 3) Directed Design of Experiments for Probability of Detection (DOEPOD) A8002L data from NTIAC Capabilities Data Book, 1997; 4) Directed Design of Experiments for Probability of Detection (DOEPOD) Remove 94 samples from A8002L data; and 5) A8002L data from NTIAC Capabilities Data Book, 1997
CASI

Nondestructive Tests; NASA Programs; Experiment Design; Data Processing

20080013535 NASA Langley Research Center, Hampton, VA, USA

An Approximate Ablative Thermal Protection System Sizing Tool for Entry System Design

Dec, John A.; Braun, Robert D.; January 09, 2006; 15 pp.; In English; 44th AIAA Aerospace Sciences Meeting and Exhibit, 9-12 Jan. 2006, Reno, NV, USA; Original contains color and black and white illustrations

Report No.(s): AIAA Paper 2006-0780; Copyright; Avail.: CASI: A03, Hardcopy

A computer tool to perform entry vehicle ablative thermal protection systems sizing has been developed. Two options for calculating the thermal response are incorporated into the tool. One, an industry-standard, high-fidelity ablation and thermal response program was integrated into the tool, making use of simulated trajectory data to calculate its boundary conditions at the ablating surface. Second, an approximate method that uses heat of ablation data to estimate heat shield recession during entry has been coupled to a one-dimensional finite-difference calculation that calculates the in-depth thermal response. The in-depth solution accounts for material decomposition, but does not account for pyrolysis gas energy absorption through the material. Engineering correlations are used to estimate stagnation point convective and radiative heating as a function of time. The sizing tool calculates recovery enthalpy, wall enthalpy, surface pressure, and heat transfer coefficient. Verification of this tool is performed by comparison to past thermal protection system sizings for the Mars Pathfinder and Stardust entry systems and calculations are performed for an Apollo capsule entering the atmosphere at lunar and Mars return speeds.

Author

Approximation; Systems Engineering; Thermal Protection; Atmospheric Entry; Ablative Materials; Sizing (Shaping)

20080013548 National Inst. of Aerospace, Hampton, VA, USA

Panel-Stiffener Debonding and Analysis Using a Shell/3D Modeling Technique

Krueger, Ronald; Ratcliffe, James G.; Minguet, Pierre J.; May 04, 2007; 10 pp.; In English; 16th International Conference on Composite Materials (ICCM-16), 8-13 Jul. 2007, Kyoto, Japan; Original contains color illustrations

Contract(s)/Grant(s): WBS 732759.07.09; Copyright; Avail.: CASI: A02, Hardcopy

A shear loaded, stringer reinforced composite panel is analyzed to evaluate the fidelity of computational fracture mechanics analyses of complex structures. Shear loading causes the panel to buckle. The resulting out-of-plane deformations initiate skin/stringer separation at the location of an embedded defect. The panel and surrounding load fixture were modeled with shell elements. A small section of the stringer foot, web and noodle as well as the panel skin near the delamination front were modeled with a local 3D solid model. Across the width of the stringer foot, the mixed-mode strain energy release rates were calculated using the virtual crack closure technique. A failure index was calculated by correlating the results with a mixed-mode failure criterion of the graphite/epoxy material. The objective was to study the effect of the fidelity of the local 3D finite element model on the computed mixed-mode strain energy release rates and the failure index.

Author

Fracture Mechanics; Delaminating; Finite Element Method; Composite Structures; Debonding (Materials)

20080013553 NASA Marshall Space Flight Center, Huntsville, AL, USA

Heat Treated Carbon Fiber Material Selection Database

Effinger, M.; Patel, B.; Koenig, J.; January 28, 2008; 1 pp.; In English; 32nd Annual Conference on Composites, Materials, and Structures, 28-31 Jan. 2008, Daytona Beach, Fl, USA; Copyright; Avail.: Other Sources; Abstract Only

Carbon fibers are used in a variety high temperature applications and materials. However, one limiting factor in their transition into additional applications is an understanding of their functional properties during component processing and function. The requirements on the fibers are governed by the nature of the materials and the environments in which they will be used. The current carbon fiber vendor literature is geared toward the polymeric composite industry and not the ceramic composite industry. Thus, selection of carbon fibers is difficult, since their properties change as a function of heat treatment, processing or component operational temperature, which ever is greatest. To enable proper decisions to be made, a program was established wherein multiple fibers were selected and heat treated at different temperatures. The fibers were then examined for their physical and mechanical properties which are reported herein.

Author

Carbon Fibers; Heat Treatment; Fiber Composites; Mechanical Properties; Refractory Materials; Ceramics

20080013558 NASA Langley Research Center, Hampton, VA, USA

Quantifiable Assessment of SWNT Dispersion in Polymer Composites

Park, Cheol; Kim, Jae-Woo; Wise, Kristopher E.; Working, Dennis; Siochi, Mia; Harrison, Joycelyn; Gibbons, Luke; Siochi, Emilie J.; Lillehei, Peter T.; Cantrell, Sean; Cantrell, John; [2007]; 57 pp.; In English; Third NASA-NIST Workshop on Nanotube Measurements, 26-28 Sep. 2007, Gaithersburg, MD, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 561581.02.08.07.15.02; Copyright; Avail.: CASI: A04, Hardcopy

NASA LaRC has established a new protocol for visualizing the nanomaterials in structural polymer matrix resins. Using this new technique and reconstructing the 3D distribution of the nanomaterials allows us to compare this distribution against a theoretically perfect distribution. Additional tertiary structural information can now be obtained and quantified with the electron tomography studies. These tools will be necessary to establish the structural-functional relationships between the nano and the bulk. This will also help define the critical length scales needed for functional properties. Field ready tool development and calibration can begin by using these same samples and comparing the response. i.e. gold standards of good and bad dispersion.

Derived from text

Resin Matrix Composites; Matrix Materials; Nanostructure (Characteristics); Calibrating; Tomography

20080013571 NASA Langley Research Center, Hampton, VA, USA

Optimal Composite Material for Low Cost Fabrication of Large Composite Aerospace Structures using NASA Resins or POSS Nanoparticle Modifications

Lamontia, Mark A.; Gruber, Mark B.; Jensen, Brian J.; [2006]; 6 pp.; In English; SAMPE Europe - 27th International Conference and Forums, 27-29 Mar. 2006, Paris, France; Original contains color illustrations

Contract(s)/Grant(s): 984754.02.07.07; Copyright; Avail.: CASI: A02, Hardcopy

Thermoplastic laminates in situ consolidated via tape or tow placement require full mechanical properties. Realizing full properties requires resin crystallinity to be controlled - partial crystallinity leads to unacceptably low laminate compression properties. There are two approaches: utilize an amorphous matrix resin; or place material made from a semi-crystalline resin featuring kinetics faster than the process. In this paper, a matrix resin evaluation and trade study was completed with commercial and NASA amorphous polyimides on the one hand, and with PEKK mixed with POSS nanoparticles for accelerated crystallinity growth on the other. A new thermoplastic impregnated material, 6 mm wide (0.25-in) AS-4 carbon/LaRC(TradeMark)8515 dry polyimide tow, was fabricated. Since LaRC(TradeMark)8515 is fully amorphous, it attains full properties following in situ consolidation, with no post processing required to build crystallinity. The tow in situ processing was demonstrated via in situ thermoplastic filament winding it into rings.

Author

Aircraft Structures; Composite Materials; Resins; Nanoparticles; Composite Structures; Laminates

20080013603 NASA Langley Research Center, Hampton, VA, USA

Thermal Conductivity of Polyimide/Carbon Nanofiller Blends

Ghose, S.; Watson, K. A.; Delozier, D. M.; Working, D. C.; Connell, J. W.; Smith, J. G.; Sun, Y. P.; Lin, Y.; [2007]; 4 pp.; In English; 5th Asian-Australasian Conference on Composite Materials, 27-30 Nov. 2006, Kowloon, Hong Kong; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.07; Copyright; Avail.: CASI: A01, Hardcopy

In efforts to improve the thermal conductivity (TC) of Ultem(TM) 1000, it was compounded with three carbon based nano-fillers. Multiwalled carbon nanotubes (MWCNT), vapor grown carbon nanofibers (CNF) and expanded graphite (EG) were investigated. Ribbons were extruded to form samples in which the nano-fillers were aligned. Samples were also fabricated by compression molding in which the nano-fillers were randomly oriented. The thermal properties were evaluated by DSC and TGA, and the mechanical properties of the aligned samples were determined by tensile testing. The degree of dispersion and alignment of the nanoparticles were investigated with high-resolution scanning electron microscopy. The thermal conductivity of the samples was measured in both the direction of alignment as well as perpendicular to that direction using the Nanoflash technique. The results of this study will be presented.

Author

Fillers; Mechanical Properties; Nanoparticles; Polyimides; Thermal Conductivity; Nanotechnology; Carbon Nanotubes; Polymer Blends

20080013632 National Inst. of Aerospace, Hampton, VA, USA

Multiscale Modeling of Intergranular Fracture in Aluminum: Constitutive Relation For Interface Debonding

Yamakov, V.; Saether, E.; Glaessgen, E. H.; March 09, 2008; 20 pp.; In English; 2008 TMS Annual Meeting and Exhibition, 9-13 Mar. 2008, New Orleans, LA, USA

Contract(s)/Grant(s): NCC1-02043; WBS 698259.02.07.07.03.01; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080013632

Intergranular fracture is a dominant mode of failure in ultrafine grained materials. In the present study, the atomistic mechanisms of grain-boundary debonding during intergranular fracture in aluminum are modeled using a coupled molecular dynamics finite element simulation. Using a statistical mechanics approach, a cohesive-zone law in the form of a traction-displacement constitutive relationship, characterizing the load transfer across the plane of a growing edge crack, is extracted from atomistic simulations and then recast in a form suitable for inclusion within a continuum finite element model. The cohesive-zone law derived by the presented technique is free of finite size effects and is statistically representative for describing the interfacial debonding of a grain boundary (GB) interface examined at atomic length scales. By incorporating the cohesive-zone law in cohesive-zone finite elements, the debonding of a GB interface can be simulated in a coupled continuum-atomistic model, in which a crack starts in the continuum environment, smoothly penetrates the continuum-atomistic interface, and continues its propagation in the atomistic environment. This study is a step towards relating atomistically derived decohesion laws to macroscopic predictions of fracture and constructing multiscale models for nanocrystalline and ultrafine grained materials.

Author

Aluminum; Fracturing; Mathematical Models; Multiscale Models; Molecular Dynamics; Statistical Mechanics; Debonding (Materials); Grain Boundaries

20080014030 NASA Marshall Space Flight Center, Huntsville, AL, USA

Low-Cost, Large C-SiC Blisk Fabrication

Kowbel, W.; Effinger, M.; January 28, 2008; 1 pp.; In English; 32nd Annual Conference on Composites, Materials, and Structures, 28-31 Jan. 2008, Daytona Beach, FL, USA

Contract(s)/Grant(s): NAS8-02038; No Copyright; Avail.: Other Sources; Abstract Only

C-SiC composites offer unique properties for propulsion applications. However, fabrication of low-cost, thick, large scale C-SiC disk for integrally bladed disk (blisk) applications has not been established yet. MER has demonstrated a new process to address this issue. Polymer-based processing was employed for interfacial coatings, consolidation and densification. Up to 40' O.C., 2' thick C-SiC composite processing was established, yielding in excess of 1.8 g/cu cm density. Computer tomography (CT) scans on the 40' O.D., 2' thick C-SiC disk showed no visible delamination, and good density uniformity. Stress-rupture testing in air was conducted at 2200 F, 2400 F and 2550 F.

Author

Carbon-Silicon Carbide Composites; Fabrication; Low Cost; Coatings; Propulsion; Densification; Delaminating

20080014032 National Inst. of Aerospace, Hampton, VA, USA

Nonlinear Spring Finite Elements for Predicting Mode I-Dominated Delamination Growth in Laminated Structure with Through-Thickness reinforcement

Ratcliffe, James G.; Krueger, Ronald; September 20, 2006; 3 pp.; In English; American Society for Composites 21st Annual Technical Conference, 17-20 Sep. 2006, Dearborn, MI, USA

Contract(s)/Grant(s): WBS 732759.07.09; Copyright; Avail.: CASI: A01, Hardcopy

One particular concern of polymer matrix composite laminates is the relatively low resistance to delamination cracking, in particular when the dominant type of failure is mode I opening. One method proposed for alleviating this problem involves the insertion pultruded carbon pins through the laminate thickness. The pins, known as z-pins, are inserted into the prepreg laminate using an ultrasonic hammer prior to the curing process, resulting in a field of pins embedded normal to the laminate plane as illustrated in Figure. 1. Pin diameters range between 0.28-mm to 0.5-mm and standard areal densities range from 0.5% to 4%. The z-pins are provided by the manufacturer, Aztex(Registered TradeMark) , in a low-density foam preform, which acts to stabilize orientation of the pins during the insertion process [1-3]. Typical pin materials include boron and carbon fibers embedded in a polymer matrix. A number of methods have been developed for predicting delamination growth in laminates reinforced with z-pins. During a study on the effect of z-pin reinforcement on mode I delamination resistance, finite element analyses of z-pin reinforced double cantilever beam (DCB) specimens were performed by Cartie and Partridge [4]. The z-pin bridging stresses were modeled by applying equivalent forces at the pin locations. Single z-pin pull-out tests were performed to characterize the traction law of the pins under mode I loading conditions. Analytical solutions for delamination

growth in z-pin reinforced DCB specimens were independently derived by Robinson and Das [5] and Ratcliffe and O'Brien [6]. In the former case, pin bridging stresses were modeled using a distributed load and in the latter example the bridging stresses were discretely modeled by way of grounded springs. Additionally, Robinson and Das developed a data reduction strategy for calculating mode I fracture toughness, G(sub Ic), from a z-pin reinforced DCB specimen test [5]. In both cases a traction law similar to that adopted by Cartie and Partridge was used to represent z-pin failure under mode I loading conditions. In the current work spring elements available in most commercial finite element codes were used to model z-pins. The traction law used in previous analyses [4-6] was employed to represent z-pin damage. This method is intended for and is limited to simulating z-pins in composite laminate structure containing mode I-dominated delamination cracking. The current technique differs from previous analyses in that spring finite elements (available in commercial codes) are employed for simulating zpins, reducing the complexity of the analysis construction process. Furthermore, the analysis method can be applied to general structure that experiences mode I-dominated delamination cracking, in contrast to existing analytical solutions that are only applicable to coupon DCB specimens.
Author
Carbon Fibers; Composite Structures; Polymer Matrix Composites; Laminates; Delaminating; Embedding; Adhesion Tests; Fracture Strength; Failure Modes; Finite Element Method

20080014103 National Inst. of Aerospace Associates, Hampton, VA, USA
Fracture Mechanics for Composites: State of the Art and Challenges
Krueger, Ronald; Krueger, Ronald; May 31, 2006; 15 pp.; In English; NAFEMS Nordic Seminar, 31 May - 1 Jun. 2006, Copenhagen, Denmark; Original contains color and black and white illustrations
Contract(s)/Grant(s): DAAH10-02-2-0001; WBS 732759.07.11; Copyright; Avail.: CASI: A03, Hardcopy

Interlaminar fracture mechanics has proven useful for characterizing the onset of delaminations in composites and has been used with limited success primarily to investigate onset in fracture toughness specimens and laboratory size coupon type specimens. Future acceptance of the methodology by industry and certification authorities however, requires the successful demonstration of the methodology on the structural level. In this paper, the state-of-the-art in fracture toughness characterization, and interlaminar fracture mechanics analysis tools are described. To demonstrate the application on the structural level, a panel was selected which is reinforced with stringers. Full implementation of interlaminar fracture mechanics in design however remains a challenge and requires a continuing development effort of codes to calculate energy release rates and advancements in delamination onset and growth criteria under mixed mode conditions.
Author
Fracture Mechanics; Delaminating; Composite Materials; Mechanical Properties

20080014177 NASA Langley Research Center, Hampton, VA, USA
Investigation of Fiber Waviness in a Thick Glass Composite Beam Using THz NDE
Anastasi, Robert F.; March 09, 2008; 8 pp.; In English; SPIE Smart Structures and Materials and Nondestructive Evaluation and Health Monitoring, 9-13 Mar. 2008, San Diego, CA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 377816.06.02.03.02; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080014177

Fiber waviness in laminated composite material is introduced during manufacture because of uneven curing, resin shrinkage, or ply buckling caused by bending the composite lay-up into its final shape prior to curing. The resulting waviness has a detrimental effect on mechanical properties, therefore this condition is important to detect and characterize. Ultrasonic characterization methods are difficult to interpret because elastic wave propagation is highly dependent on ply orientation and material stresses. By comparison, the pulsed terahertz response of the composite is shown to provide clear indications of the fiber waviness. Pulsed Terahertz NDE is an electromagnetic inspection method that operates in the frequency range between 300 GHz and 3 THz. Its propagation is influenced by refractive index variations and interfaces. This work applies pulsed Terahertz NDE to the inspection of a thick composite beam with fiber waviness. The sample is a laminated glass composite material approximately 15mm thick with a 90-degree bend. Terahertz response from the planar section, away from the bend, is indicative of a homogeneous material with no major reflections from internal plies, while the multiple reflections at the bend area correspond to the fiber waviness. Results of these measurements are presented for the planar and bend areas.
Author
Laminates; Nondestructive Tests; Composite Materials; Elastic Waves; Fiber Composites; Glass; Buckling

20080014186 NASA Langley Research Center, Hampton, VA, USA

Thermal Conductivity of Polymer/Nano-filler Blends

Ghose, Sayata; Watson, Kent A.; Delozier, Donovan M.; Working, Dennis C.; Connell, John W.; Smith, Joseph G.; Sun, Y. P.; Lin, Y.; November 06, 2006; 17 pp.; In English; SAMPE '06 Fall Technical Conference, 6-9 Nov. 2006, Dallas, TX, USA; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.07

Report No.(s): Paper ID No. D83; Copyright; Avail.: CASI: A03, Hardcopy

To improve the thermal conductivity of an ethylene vinyl acetate copolymer, Elvax 260 was compounded with three carbon based nano-fillers. Multiwalled carbon nanotubes (MWCNT), vapor grown carbon nanofibers (CNF) and expanded graphite (EG) were investigated. In an attempt to improve compatibility between the Elvax and nanofillers, MWCNTs and EGs were modified through non covalent and covalent attachment of alkyl groups. Ribbons were extruded to form samples in which the nanofillers were aligned, and samples were also fabricated by compression molding in which the nano-fillers were randomly oriented. The thermal properties were evaluated by DSC and TGA, and mechanical properties of the aligned samples were determined by tensile testing. The degree of dispersion and alignment of the nanoparticles were investigated using high-resolution scanning electron microscopy. Thermal conductivity measurements were performed using a Nanoflash technique. The thermal conductivity of the samples was measured in both the direction of alignment as well as perpendicular to that direction. The results of this study will be presented.

Author

Fabrication; Fillers; Mechanical Properties; Nanoparticles; Polymer Blends; Thermal Conductivity

26
METALS AND METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.

20080013388 NASA Langley Research Center, Hampton, VA, USA

Distortion and Residual Stress Control in Integrally Stiffened Structure Produced by Direct Metal Deposition

Lin, Shih-Yung; Hoffman, Eric K.; Domack, Marcia S.; June 27, 2007; 35 pp.; In English; AeroMat 2007 - 18th AeroMat Conference and Exposition, 25-28 Jun. 2007, Baltimore, MD, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.07.15.03; Copyright; Avail.: CASI: A03, Hardcopy

2-D thermo-mechanical model developed to characterize distortion and residual stresses in integral structure produced by DMD. Demonstrated as a tool to guide experimental development of DMD fabrication process for aero structures. Distortion and residual stresses are local to deposit. Most distortion develops during deposition of the first few layers; Little change in distortion or residual stresses after fifth deposit layer Most of distortion is localized just beneath the build. Thicker build plates and the use of build lands results in greatest decrease in levels of distortion. Pre-straining shown to reduce distortion. Difficult to implement, particularly for complex stiffener arrays. Clamp position has complex effect on distortion and stresses. Overall distortion reduced with decreasing clamp clearance. Larger clamp clearances induce bending. Use of pre-heat and active cooling show minor influence on panel distortion. Generate changes in thermal gradients in the build plate.

Author

Residual Stress; Distortion; Control Systems Design; Metallizing; Two Dimensional Models; Temperature Gradients

20080013503 NASA Langley Research Center, Hampton, VA, USA

Effect of Electron Beam Freeform Fabrication (EBF3) Processing Parameters on Composition of Ti-6-4

Lach, Cynthia L.; Taminger, Karen; Schuszler, A. Bud, II; Sankaran, Sankara; Ehlers, Helen; Nasserrafi, Rahbar; Woods, Bryan; June 27, 2007; 19 pp.; In English; 18th AeroMat Conference and Exposition (AeroMAT 2007), 25-28 Jun. 2007, Baltimore, MD, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 561581.02.08.07.15.03; Copyright; Avail.: CASI: A03, Hardcopy

The Electron Beam Freeform Fabrication (EBF3) process developed at NASA Langley Research Center was evaluated using a design of experiments approach to determine the effect of processing parameters on the composition and geometry of Ti-6-4 deposits. The effects of three processing parameters: beam power, translation speed, and wire feed rate, were investigated by varying one while keeping the remaining parameters constant. A three-factorial, three-level, fully balanced mutually orthogonal array (L27) design of experiments approach was used to examine the effects of low, medium, and high settings for the processing parameters on the chemistry, geometry, and quality of the resulting deposits. Single bead high deposits were fabricated and evaluated for 27 experimental conditions. Loss of aluminum in Ti-6-4 was observed in EBF3

processing due to selective vaporization of the aluminum from the sustained molten pool in the vacuum environment; therefore, the chemistries of the deposits were measured and compared with the composition of the initial wire and base plate to determine if the loss of aluminum could be minimized through careful selection of processing parameters. The influence of processing parameters and coupling between these parameters on bulk composition, measured by Direct Current Plasma (DCP), local microchemistries determined by Wavelength Dispersive Spectrometry (WDS), and deposit geometry will also be discussed.
Author
Electron Beams; Fabrication; Titanium Alloys; Chemical Composition; Deposition; Microanalysis

20080013538 NASA Langley Research Center, Hampton, VA, USA
Electron Beam Freeform Fabrication for Cost Effective Near-Net Shape Manufacturing
Taminger, Karen M.; Hafley, Robert A.; May 15, 2006; 19 pp.; In English; NATO/RTO AVT-139 Specialists' Meeting on Cost Effective Manufacture via Net Shape Processing, 15-17 May 2006, Amsterdam, Netherlands; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013538

Manufacturing of structural metal parts directly from computer aided design (CAD) data has been investigated by numerous researchers over the past decade. Researchers at NASA Langley Research Center are developing a new solid freeform fabrication process, electron beam freeform fabrication (EBF3), as a rapid metal deposition process that works efficiently with a variety of weldable alloys. EBF3 deposits of 2219 aluminium and Ti-6Al-4V have exhibited a range of grain morphologies depending upon the deposition parameters. These materials have exhibited excellent tensile properties comparable to typical handbook data for wrought plate product after post-processing heat treatments. The EBF3 process is capable of bulk metal deposition at deposition rates in excess of 2500 cm3/hr (150 in3/hr) or finer detail at lower deposition rates, depending upon the desired application. This process offers the potential for rapidly adding structural details to simpler cast or forged structures rather than the conventional approach of machining large volumes of chips to produce a monolithic metallic structure. Selective addition of metal onto simpler blanks of material can have a significant effect on lead time reduction and lower material and machining costs.
Author
Electron Beams; Fabrication; Manufacturing; Cost Effectiveness; Forming Techniques; Metallizing

20080013591 NASA Langley Research Center, Hampton, VA, USA
Evolution and Control of 2219 Aluminum Microstructural Features through Electron Beam Freeform Fabrication
Taminger, Karen M.; Hafley, Robert A.; Domack, Marcia S.; July 09, 2006; 6 pp.; In English; 10th International Conference on Aluminum Alloys - ICAA-10, 9-13 Jul. 2006, Vancouver, Canada; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013591

Electron beam freeform fabrication (EBF3) is a new layer-additive process that has been developed for near-net shape fabrication of complex structures. EBF3 uses an electron beam to create a molten pool on the surface of a substrate. Wire is fed into the molten pool and the part translated with respect to the beam to build up a 3-dimensional structure one layer at a time. Unlike many other freeform fabrication processes, the energy coupling of the electron beam is extremely well suited to processing of aluminum alloys. The layer-additive nature of the EBF3 process results in a tortuous thermal path producing complex microstructures including: small homogeneous equiaxed grains; dendritic growth contained within larger grains; and/or pervasive dendritic formation in the interpass regions of the deposits. Several process control variables contribute to the formation of these different microstructures, including translation speed, wire feed rate, beam current and accelerating voltage. In electron beam processing, higher accelerating voltages embed the energy deeper below the surface of the substrate. Two EBF3 systems have been established at NASA Langley, one with a low-voltage (10-30kV) and the other a high-voltage (30-60 kV) electron beam gun. Aluminum alloy 2219 was processed over a range of different variables to explore the design space and correlate the resultant microstructures with the processing parameters. This report is specifically exploring the impact of accelerating voltage. Of particular interest is correlating energy to the resultant material characteristics to determine the potential of achieving microstructural control through precise management of the heat flux and cooling rates during deposition.
Author
Aluminum Alloys; Electron Beams; Fabrication; Manufacturing; Electric Potential

20080014081 NASA Langley Research Center, Hampton, VA, USA

Metallurgical Mechanisms Controlling Mechanical Properties of Aluminum Alloy 2219 Produced By Electron Beam Freeform Fabrication

Domack, Marcia S.; Taminger, Karen M. B.; Begley, Matthew; July 09, 2006; 6 pp.; In English; 10th International Conference on Aluminum Alloys - ICAA-10, 9-13 Jul. 2006, Vancouver, Canada; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 23-064-50-10; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080014081

The electron beam freeform fabrication (EBF3) layer-additive manufacturing process has been developed to directly fabricate complex geometry components. EBF3 introduces metal wire into a molten pool created on the surface of a substrate by a focused electron beam. Part geometry is achieved by translating the substrate with respect to the beam to build the part one layer at a time. Tensile properties have been demonstrated for electron beam deposited aluminum and titanium alloys that are comparable to wrought products, although the microstructures of the deposits exhibit features more typical of cast material. Understanding the metallurgical mechanisms controlling mechanical properties is essential to maximizing application of the EBF3 process. In the current study, mechanical properties and resulting microstructures were examined for aluminum alloy 2219 fabricated over a range of EBF3 process variables. Material performance was evaluated based on tensile properties and results were compared with properties of Al 2219 wrought products. Unique microstructures were observed within the deposited layers and at interlayer boundaries, which varied within the deposit height due to microstructural evolution associated with the complex thermal history experienced during subsequent layer deposition. Microstructures exhibited irregularly shaped grains, typically with interior dendritic structures, which were described based on overall grain size, morphology, distribution, and dendrite spacing, and were correlated with deposition parameters. Fracture features were compared with microstructural elements to define fracture paths and aid in definition of basic processing-microstructure-property correlations.

Author

Electron Beams; Metallurgy; Aluminum Alloys; Fabrication; Mechanical Properties; Control Theory; Titanium Alloys

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*.

20080014197 NASA Glenn Research Center, Cleveland, OH, USA

NASA Glenn High Pressure Low NOx Emissions Research

Tacina, Kathleen M.; Wey, Changlie; February 2008; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.19.04

Report No.(s): NASA/TM-2008-214974; E-16137; Copyright; Avail.: CASI: A03, Hardcopy

In collaboration with U.S. aircraft engine companies, NASA Glenn Research Center has contributed to the advancement of low emissions combustion systems. For the High Speed Research Program (HSR), a 90% reduction in nitrogen oxides (NOx) emissions (relative to the then-current state of the art) has been demonstrated in sector rig testing at General Electric Aircraft Engines (GEAE). For the Advanced Subsonic Technology Program (AST), a 50% reduction in NOx emissions relative to the 1996 International Civil Aviation Organization (ICAO) standards has been demonstrated in sector rigs at both GEAE and Pratt & Whitney (P&W). During the Ultra Efficient Engine Technology Program (UEET), a 70% reduction in NOx emissions, relative to the 1996 ICAO standards, was achieved in sector rig testing at Glenn in the world class Advanced Subsonic Combustion Rig (ASCR) and at contractor facilities. Low NOx combustor development continues under the Fundamental Aeronautics Program. To achieve these reductions, experimental and analytical research has been conducted to advance the understanding of emissions formation in combustion processes. Lean direct injection (LDI) concept development uses advanced laser-based non-intrusive diagnostics and analytical work to complement the emissions measurements and to provide guidance for concept improvement. This paper describes emissions results from flametube tests of a 9-injection-point LDI fuel/air mixer tested at inlet pressures up to 5500 kPa. Sample results from CFD and laser diagnostics are also discussed.

Author

Civil Aviation; Computational Fluid Dynamics; High Pressure; Nitrogen Oxides; Exhaust Emission; Gas Turbine Engines; Combustion Physics

29
SPACE PROCESSING

Includes space-based development of materials, compounds, and processes for research or commercial application. Also includes the development of materials and compounds in simulated reduced-gravity environments. For legal aspects of space commercialization see *84 Law, Political Science and Space Policy*.

20080013596 NASA Glenn Research Center, Cleveland, OH, USA
Pyrolysis and Combustion of Large Black Liquor Droplets
Bartkus, Tadas P.; Dietrich, Daniel L.; T'ien, James S.; Wessel, Richard A.; January 2006; 26 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NGT5-50369; WBS 567524.04.02.03; Copyright; Avail.: Other Sources

This work studied the pyrolysis, ignition, and combustion of single, large black liquor droplets, in reduced gravity. The experiments took place in the NASA KC-135 reduced gravity aircraft, where the reduced gravity environment enabled observations of droplets with initial diameters (Do) ranging from 0.5 mm to 9 mm. The primary independent variables were the initial droplet diameter, the black liquor solids content, and the ambient oxygen mole fraction. Video records of the experiments provided the particle swelling, the time duration at each stage, and the particle sphericity. The results show that the particle diameter at the end of drying (DDRY) increases linearly with the initial particle diameter (Do). The results further show that the ratio of the maximum swollen diameter (DMAX) to Do decreases with increasing Do for droplets with Do less than 4 mm. This ratio was independent of Do for droplets with Do greater than 4 mm. The particle is the most spherical at the end of drying, and the least spherical at the maximum swollen size, regardless of initial sphericity and droplet size.
Author
Combustion; Pyrolysis; Drops (Liquids); C-135 Aircraft; Microgravity

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*.

20080014086 NASA Marshall Space Flight Center, Huntsville, AL, USA
Technical Excellence: A Requirement for Good Engineering
Gill, Paul S.; Vaughan, William W.; January 07, 2008; 8 pp.; In English; AIAA, 7-10 Jan. 2008, Reno, N, USA
Report No.(s): AIAA Paper-2008-1120; Copyright; Avail.: CASI: A02, Hardcopy

Technical excellence is a requirement for good engineering. Technical excellence has many different ways of expressing itself within engineering. NASA has initiatives that address the enhancement of the Agency's technical excellence and thrust to maintain the associated high level of performance by the Agency on current programs/projects and as it moves into the Constellation Program and the return to the Moon with plans to visit Mars. This paper addresses some of the key initiatives associated with NASA's technical excellence thrust. Examples are provided to illustrate some results being achieved and plans to enhance these initiatives.
Author
Constellation Program; Positive Feedback; Education; Engineers; NASA Programs; Organizations

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*.

20080013393 NASA Langley Research Center, Hampton, VA, USA
Design, Qualification, and On Orbit Performance of the CALIPSO Aerosol Lidar Transmitter
Hovis, Floyd E.; Witt, Greg; Sullivan, Edward T.; Le, Khoa; Weimer, Carl; Applegate, Jeff; Luck, William S., Jr.; Verhapen, Ron; Cisewski, Michael S.; September 17, 2007; 21 pp.; In English; Optical Society of America Laser Science XIII, 17-21 Sep. 2007, San Jose, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 305311.01.07.73; Copyright; Avail.: CASI: A03, Hardcopy

The laser transmitter for the CALIPSO aerosol lidar mission has been operating on orbit as planned since June 2006. This

document discusses the optical and laser system design and qualification process that led to this success. Space-qualifiable laser design guidelines included the use of mature laser technologies, the use of alignment sensitive resonator designs, the development and practice of stringent contamination control procedures, the operation of all optical components at appropriately derated levels, and the proper budgeting for the space-qualification of the electronics and software.
CASI
Aerosols; Lasers; Transmitters; CALIPSO (Pathfinder Satellite); Optical Radar; Structural Design

20080013511 NASA Langley Research Center, Hampton, VA, USA
Development of Laser, Detector, and Receiver Systems for an Atmospheric CO2 Lidar Profiling System
Ismail, Syed; Koch, Grady; Abedin, Nurul; Refaat, Tamer; Rubio, Manuel; Singh, Upendra; March 2008; 7 pp.; In English; 2008 IEEE Aerospace Conference, 1-8 Mar. 2008, Big Sky, MT, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 478643.02.05.04.07; Copyright; Avail.: CASI: A02, Hardcopy

A ground-based Differential Absorption Lidar (DIAL) is being developed with the capability to measure range-resolved and column amounts of atmospheric CO2. This system is also capable of providing high-resolution aerosol profiles and cloud distributions. It is being developed as part of the NASA Earth Science Technology Office s Instrument Incubator Program. This three year program involves the design, development, evaluation, and fielding of a ground-based CO2 profiling system. At the end of a three-year development this instrument is expected to be capable of making measurements in the lower troposphere and boundary layer where the sources and sinks of CO2 are located. It will be a valuable tool in the validation of NASA Orbiting Carbon Observatory (OCO) measurements of column CO2 and suitable for deployment in the North American Carbon Program (NACP) regional intensive field campaigns. The system can also be used as a test-bed for the evaluation of lidar technologies for space-application. This DIAL system leverages 2-micron laser technology developed under a number of NASA programs to develop new solid-state laser technology that provides high pulse energy, tunable, wavelength-stabilized, and double-pulsed lasers that are operable over pre-selected temperature insensitive strong CO2 absorption lines suitable for profiling of lower tropospheric CO2. It also incorporates new high quantum efficiency, high gain, and relatively low noise phototransistors, and a new receiver/signal processor system to achieve high precision DIAL measurements.
Author
Atmospheric Composition; Carbon Dioxide Concentration; Solid State Lasers; Differential Absorption Lidar; Infrared Radar; Line Spectra

20080014132 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Protograph LDPC Codes for the Erasure Channel
Pollara, Fabrizio; Dolinar, Samuel J.; Divsalar, Dariush; June 12, 2006; 17 pp.; In English; Consultative Committee for Space Data Systems (CCSDS) Area and Working Group Meeting, 12-16 Jun. 2006, Rome, Italy; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40696

This viewgraph presentation reviews the use of protograph Low Density Parity Check (LDPC) codes for erasure channels. A protograph is a Tanner graph with a relatively small number of nodes. A ‘copy-and-permute’ operation can be applied to the protograph to obtain larger derived graphs of various sizes. For very high code rates and short block sizes, a low asymptotic threshold criterion is not the best approach to designing LDPC codes. Simple protographs with much regularity and low maximum node degrees appear to be the best choices Quantized-rateless protograph LDPC codes can be built by careful design of the protograph such that multiple puncturing patterns will still permit message passing decoding to proceed
Derived from text
Parity; Error Detection Codes; Information Theory; Communication Theory; Coding

20080014134 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
All about Eve: Secret Sharing using Quantum Effects
Jackson, Deborah J.; April 2, 2005; 55 pp.; In English; National Science Teacher’s Association Annual Meeting, Shell Lecture, 30 Mar. - 2 Apr. 2005, Dallas, TX, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40642

This document discusses the nature of light (including classical light and photons), encryption, quantum key distribution (QKD), light polarization and beamsplitters and their application to information communication. A quantum of light represents

the smallest possible subdivision of radiant energy (light) and is called a photon. The QKD key generation sequence is outlined including the receiver broadcasting the initial signal indicating reception availability, timing pulses from the sender to provide reference for gated detection of photons, the sender generating photons through random polarization while the receiver detects photons with random polarization and communicating via data link to mutually establish random keys. The QKD network vision includes inter-SATCOM, point-to-point Gnd Fiber and SATCOM-fiber nodes. QKD offers an unconditionally secure method of exchanging encryption keys. Ongoing research will focus on how to increase the key generation rate.
Derived from text
Light (Visible Radiation); Cryptography; Optical Communication; Lasers; Quantum Communication

20080014187 NASA Langley Research Center, Hampton, VA, USA
IIP Update: A Packaged Coherent Doppler Wind Lidar Transceiver. Doppler Aerosol WiNd Lidar (DAWN)
Kavaya, Michael J.; Koch, Grady J.; Yu, Jirong; Trieu, Bo C.; Amzajerdian, Farzin; Singh, Upendra N.; Petros, Mulugeta; June 27, 2006; 40 pp.; In English; Working Group on Space-Based Lidar Winds, 27-30 Jun. 2006, Welches, OR; Original contains color illustrations
Contract(s)/Grant(s): WBS 478643.02.05.04.05; Copyright; Avail.: CASI: A03, Hardcopy

The state-of-the-art 2-micron coherent Doppler wind lidar breadboard at NASA/LaRC will be engineered and compactly packaged consistent with future aircraft flights. The packaged transceiver will be integrated into a coherent Doppler wind lidar system test bed at LaRC. Atmospheric wind measurements will be made to validate the packaged technology. This will greatly advance the coherent part of the hybrid Doppler wind lidar solution to the need for global tropospheric wind measurements. Author
Aerosols; Doppler Radar; Optical Radar; Transmitter Receivers; Wind (Meteorology); Wind Measurement; Lasers

20080014191 NASA Langley Research Center, Hampton, VA, USA
A Ground-Based 2-Micron DIAL System to Profile Tropospheric CO2 and Aerosol Distributions for Atmospheric Studies
Ismail, Syed; Koch, Grady; Abedin, Nurul; Refaat, Tamer; Rubio, Manuel; Davis, Kenneth; Miller, Charles; Singh, Upendra; November 13, 2006; 31 pp.; In English; SPIE 5th International Symposium on Asia-Pacific Remote Sensing Conference 2006, 13-17 Nov. 2006, Goa, India; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 478643.02.05.04.07; Copyright; Avail.: CASI: A03, Hardcopy

System will operate at a temperature insensitive CO2 line (2050.967 nm) with side-line tuning and off-set locking. Demonstrated an order of magnitude improvement in laser line locking needed for high precision measurements, side-line operation, and simultaneously double pulsing and line locking. Detector testing of phototransistor has demonstrated sensitivity to aerosol features over long distances in the atmosphere and resolve features approx. 100m. Optical systems that collect light onto small area detectors work well. Receiver optical designs are being optimized and data acquisition systems developed. CO2 line parameter characterization in progress In situ sensor calibration in progress for validation of DIAL CO2 system. Derived from text
Carbon Dioxide; Aerosols; Calibrating; Optical Scanners; Precision; Phototransistors

33
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*.

20080013608 NASA Marshall Space Flight Center, Huntsville, AL, USA
Effects of Low Temperature on Charging of Spacecraft Dielectrics
Ferguson, Dale C.; Schneider, Todd A.; Vaughn, Jason A.; January 22, 2008; 1 pp.; In English; 4th Space Environment Symposium, 22-23 Jan. 2008, Tokyo, Japan; No Copyright; Avail.: Other Sources; Abstract Only

Spacecraft dielectric charging, sometimes called deep-dielectric-charging or bulk-charging, occurs when high energy electrons imbed themselves in dielectric materials, and the charge density builds up, sometimes to breakdown levels. Charges usually bleed off slowly due to material conductivity. At very low (cryogenic) temperatures, the dielectric conductivity decreases until charges may remain and build up over weeks, months, or years. In those cases, the guidelines given in NASA and industry documents for when dielectric charging may become important are misleading. Arcing tests of spacecraft cables

at liquid nitrogen temperatures and very low flux levels have been done at NASA MSFC for the JWST Project. In this paper, we describe the results of those tests and analyze their important implications for cryogenic spacecraft cable design and construction.
Author
Dielectrics; Spacecraft Charging; Low Temperature; Temperature Effects; Electric Charge; High Energy Electrons; Cryogenic Temperature

20080013630 National Inst. of Aerospace, Hampton, VA, USA
The Load Capability of Piezoelectric Single Crystal Actuators
Xu, Tian-Bing; Su, Ji; Jiang, Xiaoning; Rehrig, Paul W.; Hackenberger, Wesley S.; [2007]; 6 pp.; In English; 2006 MRS Spring Meeting, 17-21 Apr. 2006, San Francisco, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): 23-064-10-41; Copyright; Avail.: CASI: A02, Hardcopy

Piezoelectric lead magnesium niobate-lead titanate (PMN-PT) single crystal is one of the most promising materials for electromechanical device applications due to its high electrical field induced strain and high electromechanical coupling factor. PMN-PT single crystal-based multilayer stack actuators and multilayer stack-based flextensional actuators have exhibited high stroke and high displacement-voltage ratios. The actuation capabilities of these two actuators were evaluated using a newly developed method based upon a laser vibrometer system under various loading conditions. The measured displacements as a function of mechanical loads at different driving voltages indicate that the displacement response of the actuators is approximately constant under broad ranges of mechanical load. The load capabilities of these PMN-PT single crystal-based actuators and the advantages of the capability for applications will be discussed.
Derived from text
Actuators; Loads (Forces); Piezoelectric Crystals; Piezoelectricity; Single Crystals

20080014133 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Design and Varactors: Operational Considerations. A Reliability Study for Robust Planar GaAs
Maiwald, Frank; Schlecht, Erich; Ward, John; Lin, Robert; Leon, Rosa; Pearson, John; Mehdi, Imran; April 22, 2003; 16 pp.; In English; 14th International Symposium on Space Terahertz Technology, 22-24 Apr. 2003, Tucson, AZ, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40697

Preliminary conclusions include: Limits for reverse currents cannot be set. Based on current data we want to avoid any reverse bias current. We know 1 micro-A is too high. Leakage current gets suppressed when operated at 120K. Migration and verification: a) Reverse Bias Voltage will be limited; b) Health check with I/V curve: 1) Minimal reverse voltage shall be x0.75 of the calculated voltage breakdown Vbr; 2) Degradation of the Reverse Bias voltage at given current will be used as indication of ESD incidents or other Damages (high RF power, heat); 3) Calculation of diodes parameter to verify initial health check result in forward direction. RF output power starts to degrade when diode I/V curve is very strongly degraded only. Experienced on 400GHz doubler and 200GHz doubler
Derived from text
Gallium Arsenides; Bias; Radio Frequencies; Reliability; Electric Potential; Diodes; Electrical Faults

20080014176 NASA Langley Research Center, Hampton, VA, USA
Design and Build a Compact Raman Sensor for Identification of Chemical Composition
Garcia, Christopher S.; Abedin, M. Nurul; Ismail, Syed; Sharma, Shiv K.; Misra, Anupam K.; Sandford, Stephen P.; Elsayed-Ali, Hani; March 16, 2008; 7 pp.; In English; SPIE Defense and Security Symposium 2008, 16-20 Mar. 2008, Orlando, FL, USA; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 698671.02.07.05; Copyright; Avail.: CASI: A02, Hardcopy

A compact remote Raman sensor system was developed at NASA Langley Research Center. This sensor is an improvement over the previously reported system, which consisted of a 532 nm pulsed laser, a 4-inch telescope, a spectrograph, and an intensified charge-coupled devices (CCD) camera. One of the attractive features of the previous system was its portability, thereby making it suitable for applications such as planetary surface explorations, homeland security and defense applications where a compact portable instrument is important. The new system was made more compact by replacing bulky components with smaller and lighter components. The new compact system uses a smaller spectrograph measuring 9 x 4 x 4 in. and a smaller intensified CCD camera measuring 5 in. long and 2 in. in diameter. The previous system was used to obtain the Raman spectra of several materials that are important to defense and security applications. Furthermore, the new

compact Raman sensor system is used to obtain the Raman spectra of a diverse set of materials to demonstrate the sensor system's potential use in the identification of unknown materials.
Author (revised)
Raman Spectra; Remote Sensors; Spectroscopic Analysis; Chemical Composition

34
FLUID MECHANICS AND THERMODYNAMICS

Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also *02 Aerodynamics*.

20080013387 NASA Langley Research Center, Hampton, VA, USA
A Parametric Geometry Computational Fluid Dynamics (CFD) Study Utilizing Design of Experiments (DOE)
Rhew, Ray D.; Parker, Peter A.; February 14, 2007; 22 pp.; In English; INFORMS International: AIAA U.S. air Force T&E Days, 8-11 Jul. 2007, Rio Grande, Puerto Rico; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 698671.02.07.02.01
Report No.(s): AIAA Paper-2007-1615; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013387

Design of Experiments (DOE) was applied to the LAS geometric parameter study to efficiently identify and rank primary contributors to integrated drag over the vehicles ascent trajectory in an order of magnitude fewer CFD configurations thereby reducing computational resources and solution time. SME s were able to gain a better understanding on the underlying flowphysics of different geometric parameter configurations through the identification of interaction effects. An interaction effect, which describes how the effect of one factor changes with respect to the levels of other factors, is often the key to product optimization. A DOE approach emphasizes a sequential approach to learning through successive experimentation to continuously build on previous knowledge. These studies represent a starting point for expanded experimental activities that will eventually cover the entire design space of the vehicle and flight trajectory.
Author
Experiment Design; Computational Fluid Dynamics; Flight Paths; Ascent Trajectories; Drag

20080013450 NASA Johnson Space Center, Houston, TX, USA
Sensitivity of Hollow Fiber Spacesuit Water Membrane Evaporator Systems to Potable Water Constituents, Contaminants and Air Bubbles
Bue, Grant C.; Trevino, Luis A.; Fritts, Sharon; Tsioulos, Gus; [2008]; 11 pp.; In English; 38th International Conference on Environmental Systems, 29 Jun. - 2 Jul. 2008, San Francisco, CA, USA; Original contains black and white illustrations
Report No.(s): 08ICES-0296; Copyright; Avail.: CASI: A03, Hardcopy

The Spacesuit Water Membrane Evaporator (SWME) is the baseline heat rejection technology selected for development for the Constellation lunar suit. The first SWME prototype, designed, built, and tested at Johnson Space Center in 1999 used a Teflon hydrophobic porous membrane sheet shaped into an annulus to provide cooling to the coolant loop through water evaporation to the vacuum of space. This present study describes the test methodology and planning and compares the test performance of three commercially available hollow fiber materials as alternatives to the sheet membrane prototype for SWME, in particular, a porous hydrophobic polypropylene, and two variants that employ ion exchange through non-porous hydrophilic modified Nafion. Contamination tests will be performed to probe for sensitivities of the candidate SWME elements to ordinary constituents that are expected to be found in the potable water provided by the vehicle, the target feedwater source. Some of the impurities in potable water are volatile, such as the organics, while others, such as the metals and inorganic ions are nonvolatile. The non-volatile constituents will concentrate in the SWME as evaporated water from the loop is replaced by the feedwater. At some point in the SWME mission lifecycle as the concentrations of the non-volatiles increase, the solubility limits of one or more of the constituents may be reached. The resulting presence of precipitate in the coolant water may begin to plug pores and tube channels and affect the SWME performance. Sensitivity to macroparticles, lunar dust simulant, and air bubbles will also be investigated.
Author
Space Suits; Potable Water; Evaporators; Membranes; Bubbles; Hydrophobicity; Ion Exchanging; Liquid Cooling; Contaminants

20080013458 NASA Langley Research Center, Hampton, VA, USA

Modeling Combustion in Supersonic Flows

Drummond, J. Philip; Danehy, Paul M.; Bivolaru, Daniel; Gaffney, Richard L.; Tedder, Sarah A.; Cutler, Andrew D.; June 25, 2007; 14 pp.; In English; 3rd International Symposium on Non-Equilibrium Processes, Plasma, Combustion, and Atmospheric Phenomena (NEPCAP 2007), 25-29 Jun. 2007, Sochi, Russia; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 599489.02.07.07.03.02; Copyright; Avail.: CASI: A03, Hardcopy

This paper discusses the progress of work to model high-speed supersonic reacting flow. The purpose of the work is to improve the state of the art of CFD capabilities for predicting the flow in high-speed propulsion systems, particularly combustor flow-paths. The program has several components including the development of advanced algorithms and models for simulating engine flowpaths as well as a fundamental experimental and diagnostic development effort to support the formulation and validation of the mathematical models. The paper will provide details of current work on experiments that will provide data for the modeling efforts along with with the associated nonintrusive diagnostics used to collect the data from the experimental flowfield. Simulation of a recent experiment to partially validate the accuracy of a combustion code is also described.

Author

Computational Fluid Dynamics; Flow Distribution; Propulsion System Performance; Reacting Flow; Supersonic Flow; Combustible Flow; Internal Combustion Engines

20080013560 NASA Langley Research Center, Hampton, VA, USA

Heat Transfer in High Temperature Multilayer Insulation

Daryabeigi, Kamran; Miller, Steve D.; Cunnington, George R.; [2007]; 9 pp.; In English; 5th European Workshop on Thermal Protection Systems and Hot Structures, 17-19 May 2006, Noordwijk, Netherlands

Contract(s)/Grant(s): 23-617-43-01-01; Copyright; Avail.: CASI: A02, Hardcopy

High temperature multilayer insulations have been investigated as an effective component of thermal-protection systems for atmospheric re-entry of reusable launch vehicles. Heat transfer in multilayer insulations consisting of thin, gold-coated, ceramic reflective foils and Saffil(TradeMark) fibrous insulation spacers was studied both numerically and experimentally. A finite volume numerical thermal model using combined conduction (gaseous and solid) and radiation in porous media was developed. A two-flux model with anisotropic scattering was used for radiation heat transfer in the fibrous insulation spacers between the reflective foils. The thermal model was validated by comparison with effective thermal conductivity measurements in an apparatus based on ASTM standard C201. Measurements were performed at environmental pressures in the range from 1x10(exp -4) to 760 torr over the temperature range from 300 to 1300 K. Four multilayer samples with nominal densities of 48 kg/cu m were tested. The first sample was 13.3 mm thick and had four evenly spaced reflective foils. The other three samples were 26.6 mm thick and utilized either one, two, or four reflective foils, located near the hot boundary with nominal foil spacing of 1.7 mm. The validated thermal model was then used to study relevant design parameters, such as reflective foil spacing and location in the stack-up and coating of one or both sides of foils.

Author

Heat Transfer; High Temperature; Radiative Heat Transfer; Thermal Conductivity; Thermal Protection; Reentry Vehicles; Multilayer Insulation

20080013561 NASA Langley Research Center, Hampton, VA, USA

Viking Afterbody Heating Computations and Comparisons to Flight Data

Edquist, Karl T.; Wright, Michael J.; Allen, Gary A., Jr.; [2006]; 42 pp.; In English; 44th AIAA Aerospace Sciences Meeting and Exhibit, 9-12 Jan. 2006, Reno, NV, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 23-979-20-10

Report No.(s): AIAA 2006-0386; Copyright; Avail.: CASI: A03, Hardcopy

Computational fluid dynamics predictions of Viking Lander 1 entry vehicle afterbody heating are compared to flight data. The analysis includes a derivation of heat flux from temperature data at two base cover locations, as well as a discussion of available reconstructed entry trajectories. Based on the raw temperature-time history data, convective heat flux is derived to be 0.63-1.10 W/cm2 for the aluminum base cover at the time of thermocouple failure. Peak heat flux at the fiberglass base cover thermocouple is estimated to be 0.54-0.76 W/cm2, occurring 16 seconds after peak stagnation point heat flux. Navier-Stokes computational solutions are obtained with two separate codes using an 8- species Mars gas model in chemical and thermal non-equilibrium. Flowfield solutions using local time-stepping did not result in converged heating at either thermocouple location. A global time-stepping approach improved the computational stability, but steady state heat flux was

not reached for either base cover location. Both thermocouple locations lie within a separated flow region of the base cover that is likely unsteady. Heat flux computations averaged over the solution history are generally below the flight data and do not vary smoothly over time for both base cover locations. Possible reasons for the mismatch between flight data and flowfield solutions include underestimated conduction effects and limitations of the computational methods.
Author
Viking Lander 1; Afterbodies; Heating; Spacecraft Reentry; Computational Fluid Dynamics; Data Acquisition

20080013573 NASA Langley Research Center, Hampton, VA, USA
Optimal Design of Passive Flow Control for a Boundary-Layer-Ingesting Offset Inlet Using Design-of-Experiments
Allan, Brian G.; Owens, Lewis R., Jr.; Lin, John C.; [2006]; 14 pp.; In English; 44th AIAA Aerospace Sciences Meeting and Exhibit, 9-12 Jan. 2006, Reno, NV, USA; Original contains color illustrations
Contract(s)/Grant(s): 599489.02.07.07; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013573

This research will investigate the use of Design-of-Experiments (DOE) in the development of an optimal passive flow control vane design for a boundary-layer-ingesting (BLI) offset inlet in transonic flow. This inlet flow control is designed to minimize the engine fan face distortion levels and first five Fourier harmonic half amplitudes while maximizing the inlet pressure recovery. Numerical simulations of the BLI inlet are computed using the Reynolds-averaged Navier-Stokes (RANS) flow solver, OVERFLOW, developed at NASA. These simulations are used to generate the numerical experiments for the DOE response surface model. In this investigation, two DOE optimizations were performed using a D-Optimal Response Surface model. The first DOE optimization was performed using four design factors which were vane height and angles-of-attack for two groups of vanes. One group of vanes was placed at the bottom of the inlet and a second group symmetrically on the sides. The DOE design was performed for a BLI inlet with a free-stream Mach number of 0.85 and a Reynolds number of 2 million, based on the length of the fan face diameter, matching an experimental wind tunnel BLI inlet test. The first DOE optimization required a fifth order model having 173 numerical simulation experiments and was able to reduce the DC60 baseline distortion from 64% down to 4.4%, while holding the pressure recovery constant. A second DOE optimization was performed holding the vanes heights at a constant value from the first DOE optimization with the two vane angles-of-attack as design factors. This DOE only required a second order model fit with 15 numerical simulation experiments and reduced DC60 to 3.5% with small decreases in the fourth and fifth harmonic amplitudes. The second optimal vane design was tested at the NASA Langley 0.3-Meter Transonic Cryogenic Tunnel in a BLI inlet experiment. The experimental results showed a 80% reduction of DPCPavg, the circumferential distortion level at the engine fan face.
Author
Design Optimization; Flow Regulators; Inlet Flow; Boundary Layers; Experiment Design; Vanes; Transonic Flow; Computational Fluid Dynamics; Engine Inlets; Aircraft Engines; Flow Distortion; Fans

20080013580 NASA Langley Research Center, Hampton, VA, USA
Numerical Modeling of Flow Control in a Boundary-Layer-Ingesting Offset Inlet Diffuser at Transonic Mach Numbers
Allan Brian G.; Owens, Lewis, R.; [2006]; 25 pp.; In English; 44th AIAA Aerospace Sciences Meeting and Exhibit, 9-12 Jan. 2006, Reno, NV, USA; Original contains color illustrations
Report No.(s): AIAA 2006-0845; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013580

This paper will investigate the validation of a NASA developed, Reynolds-averaged Navier-Stokes (RANS) flow solver, OVERFLOW, for a boundary-layer-ingesting (BLI) offset (S-shaped) inlet in transonic flow with passive and active flow control devices as well as the baseline case. Numerical simulations are compared to wind tunnel results of a BLI inlet conducted at the NASA Langley 0.3-Meter Transonic Cryogenic Tunnel. Comparisons of inlet flow distortion, pressure recovery, and inlet wall pressures are performed. The numerical simulations are compared to the BLI inlet data at a freestream Mach number of 0.85 and a Reynolds number of approximately 2 million based on the length of the fan-face diameter. The numerical simulations with and without wind tunnel walls are performed, quantifying effects of the tunnel walls on the BLI inlet flow measurements. The wind tunnel test evaluated several different combinations of jet locations and mass flow rates as well as a vortex generator (VG) vane case. The numerical simulations will be performed on a single jet configuration for varying actuator mass flow rates at a fix inlet mass flow condition. Validation of the numerical simulations for the VG vane case will also be performed for varying inlet mass flow rates. Overall, the numerical simulations were able to predict the baseline circumferential flow distortion, DPCPavg, very well for comparisons made within the designed operating range of the BLI inlet. However the CFD simulations did predict a total pressure recovery that was 0.01 lower than the experiment. Numerical simulations of the baseline inlet flow also showed good agreement with the experimental inlet centerline surface

pressures. The vane case showed that the CFD predicted the correct trends in the circumferential distortion for varying inlet mass flow but had a distortion level that was nearly twice as large as the experiment. Comparison to circumferential distortion measurements for a 15 deg clocked 40 probe rake indicated that the circumferential distortion levels are very sensitive to the symmetry of the flow and that a miss alignment of the vanes in the experiment could have resulted in this difference. The numerical simulations of the BLI inlet with jets showed good agreement with the circumferential inlet distortion levels for a range of jet actuator mass flow ratios at a fixed inlet mass flow rate. The CFD simulations for the jet case also predicted an average total pressure recovery that was 0.01 lower than the experiment as was seen in the baseline. Comparison of the flow features the jet case revealed that the CFD predicted a much larger vortex at the engine fan-face when compare to the experiment.
Author
Navier-Stokes Equation; Reynolds Averaging; Computational Fluid Dynamics; Boundary Layers; Inlet Flow; Flow Regulators; Transonic Flow; Transonic Wind Tunnels; Mathematical Models; Mach Number; Mass Flow

20080013581 NASA Langley Research Center, Hampton, VA, USA
Toward a High-Frequency Pulsed-Detonation Actuator
Cutler, Andrew D.; Drummond, J. Philip; [2006]; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): 599489.02.07.07
Report No.(s): AIAA 2006-0555; LAR-16967-1; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013581

This paper describes the continued development of an actuator, energized by pulsed detonations, that provides a pulsed jet suitable for flow control in high-speed applications. A high-speed valve, capable of delivering a pulsed stream of reactants a mixture of H2 and air at rates of up to 1500 pulses per second, has been constructed. The reactants burn in a resonant tube and the products exit the tube as a pulsed jet. High frequency pressure transducers have been used to monitor the pressure fluctuations in the device at various reactant injection frequencies, including both resonant and off-resonant conditions. Pulsed detonations have been demonstrated in the lambda/4 mode of an 8 inch long tube at approx. 600 Hz. The pulsed jet at the exit of the device has been observed using shadowgraph and an infrared camera.
Author
Actuators; Air Flow; High Frequencies; Pulse Detonation Engines; Mechanical Engineering; Combustion; Flow Regulators

20080013582 NASA Langley Research Center, Hampton, VA, USA
Implementation of Flow Tripping Capability in the USM3D Unstructured Flow Solver
Pandya, Mohagna J.; Abdol-Hamid, Khaled S.; Campbell, Richard L.; Frink, Neal T.; [2006]; 21 pp.; In English; 44th AIAA Aerospace Sciences Meeting and Exhibit, 9-12 Jan. 2006, Reno, NV, USA; Original contains color illustrations
Contract(s)/Grant(s): 23-561-581-02.08.07
Report No.(s): AIAA 2006-0919; Copyright; Avail.: CASI: A03, Hardcopy

A flow tripping capability is added to an established NASA tetrahedral unstructured parallel Navier-Stokes flow solver, USM3D. The capability is based on prescribing an appropriate profile of turbulence model variables to energize the boundary layer in a plane normal to a specified trip region on the body surface. We demonstrate this approach using the k-epsilon two-equation turbulence model of USM3D. Modification to the solution procedure primarily consists of developing a data structure to identify all unstructured tetrahedral grid cells located in the plane normal to a specified surface trip region and computing a function based on the mean flow solution to specify the modified profile of the turbulence model variables. We leverage this data structure and also show an adjunct approach that is based on enforcing a laminar flow condition on the otherwise fully turbulent flow solution in user-specified region. The latter approach is applied for the solutions obtained using other one-and two-equation turbulence models of USM3D. A key ingredient of the present capability is the use of a graphical user-interface tool PREDISC to define a trip region on the body surface in an existing grid. Verification of the present modifications is demonstrated on three cases, namely, a flat plate, the RAE2822 airfoil, and the DLR F6 wing-fuselage configuration.
Author
Unstructured Grids (Mathematics); Turbulent Flow; Computational Fluid Dynamics; Aerodynamic Configurations; Aircraft Structures

20080014144 NASA Langley Research Center, Hampton, VA, USA

Solver and Turbulence Model Upgrades to OVERFLOW 2 for Unsteady and High-Speed Applications

Nichols, Robert H.; Tramel, Robert W.; Rahman, Zia-Ur; June 05, 2006; 34 pp.; In English; 24th AIAA Applied Aerodynamics Conference, 5-8 Jun. 2006, San Francisco, CA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 23-069256.03.09.02.01

Report No.(s): AIAA Paper 2006-2824; Copyright; Avail.: CASI: A03, Hardcopy

An implicit unfactored SSOR algorithm has been added to the overset Navier-Stokes CFD code OVERFLOW 2 for unsteady and moving body applications. The HLLEM and HLLC third-order spatial upwind convective flux models have been added for high-speed flow applications. A generalized upwind transport equation has been added for solution of the two-equation turbulence models and the species equations. The generalized transport equation is solved using an unfactored SSOR implicit algorithm. Three hybrid RANS/DES turbulence models have been added for unsteady flow applications. Wall function boundary conditions that include compressibility and heat transfer effects have been also been added to OVERFLOW 2.

Author

Algorithms; Computational Fluid Dynamics; High Speed; Mathematical Models; Turbulence Models; Unsteady Flow

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*.

20080013396 NASA Langley Research Center, Hampton, VA, USA

Promoting Robust Design of Diode Lasers for Space: A National Initiative

Tratt, David M.; Amzajerdian, Farzin; Kashem, Nasir B.; Shapiro, Andrew A.; Mense, Allan T.; September 04, 2007; 10 pp.; In English; 2008 IEEE Aerospace Conference, 1-8 Mar. 2008, Big Sky, MT, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 478643.02.02.02.12; Copyright; Avail.: Other Sources

The Diode-laser Array Working Group (DAWG) is a national-level consumer/provider forum for discussion of engineering and manufacturing issues which influence the reliability and survivability of high-power broad-area laser diode devices in space, with an emphasis on laser diode arrays (LDAs) for optical pumping of solid-state laser media. The goals of the group are to formulate and validate standardized test and qualification protocols, operational control recommendations, and consensus manufacturing and certification standards. The group is using reliability and lifetime data collected by laser diode manufacturers and the user community to develop a set of standardized guidelines for specifying and qualifying laser diodes for long-duration operation in space, the ultimate goal being to promote an informed U.S. Government investment and procurement strategy for assuring the availability and durability of space-qualified LDAs. The group is also working to establish effective implementation of statistical design techniques at the supplier design, development, and manufacturing levels to help reduce product performance variability and improve product reliability for diodes employed in space applications

Author

Laser Arrays; Optical Pumping; Semiconductor Lasers; Solid State Lasers; Aerospace Environments

20080013499 NASA Langley Research Center, Hampton, VA, USA

Highly Efficient Operation of Tm:fiber Laser Pumped Ho:YLF Laser

Bai, Yingxin; Petros, M.; Yu, Jirong; Petzar, Paul; Trieu, Bo; Chen, Sam; Lee, Hyung; Singh, U.; January 29, 2006; 3 pp.; In English; Advanced Solid-State Photonics Topical Meeting and Tabletop Exhibit, 29 Jan. - 1 Feb. 2006, Incline Village, NV, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): 23-258-80-TT; Copyright; Avail.: Other Sources

A 19 W, TEM(sub 00) mode, Ho:YLF laser pumped by continuous wave Tm:fiber laser has been demonstrated at the room temperature. The slope efficiency and optical-to-optical efficiency are 65% and 55%, respectively.

Author

YLF Lasers; Holmium; Laser Pumping; Thulium

20080013540 NASA Langley Research Center, Hampton, VA, USA

An Injection-seeded Narrow Linewidth Singly Resonant ZGP OPO

Yu, Jirong; Barnes, Norman P.; Lee, Hyung R.; Bai, Yingxin; January 29, 2006; 3 pp.; In English; Advanced Solid-State Photonics Topical Meeting and Tabletop Exhibit, 29 Jan. - 1 Feb. 2006, Incline Village, NV, USA; Original contains black and white illustrations

Contract(s)/Grant(s): 23-258-80-TT; Copyright; Avail.: Other Sources

Injection seeding of a singly resonant ZnGeP2 (ZGP) mid-infrared optical parametric oscillator (OPO) using a continuous wave 3.39 micrometers laser and a tunable near-infrared laser has been demonstrated. This ZGP OPO utilizes a bow-tie shape cavity with a partially reflective mirror for injection seeding at the signal wavelength. It produces high energy pulses in the mid-IR range from 4-10 micrometers. The injection seeded OPO provides a narrow idler wavelength linewidth of approximately 1 nm, limited by the measurement resolution of the monochromator.

Author

Tunable Lasers; Oscillators; Spectroscopy; Parametric Amplifiers; Injection Lasers; Spectral Line Width; Infrared Lasers; Continuous Wave Lasers; Optics

20080014104 NASA Langley Research Center, Hampton, VA, USA

Reliability of High Power Laser Diode Arrays Operating in Long Pulse Mode

Amzajerdian, Farzin; Meadows, Byron L.; Barnes, Bruce W.; Lockard, George E.; Singh, Upendra N.; Kavaya, Michael J.; Baker, Nathaniel R.; May 21, 2006; 1 pp.; In English; 2006 CLEO/QELS - Conference on Lasers and Electro-Optics/ Quantum Electronics and Laser Science Conference, 21-26 May 2006, Long Beach, CA, USA

Contract(s)/Grant(s): 478643.02.02.02.05; Copyright; Avail.: CASI: A01, Hardcopy

Reliability and lifetime of quasi-CW laser diode arrays are greatly influenced by their thermal characteristics. This paper examines the thermal properties of laser diode arrays operating in long pulse duration regime.

Author

High Power Lasers; Reliability; Semiconductor Lasers; Continuous Radiation; Laser Arrays

20080014141 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Development of Efficient Mid-IR Interband Cascade Lasers for Chemical Sensing

Yang, Rui Q.; Hill, Cory J.; Yang, Baohua; Qiu, Yueming; Jan, Darrell; February 8, 2006; 25 pp.; In English; Habitation, 5-8 Feb. 2006, Orlando, FL, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40671

Significant progress has been made: Above room temperature (up to 350K) pulsed operation has been demonstrated. CW operation temperature has been raised up to 237 K. DFB IC lasers have been applied for the detection of trace gases such as CH4, HCl, and H2CO. Devices have been operated continuously over several hundred hours without degradation. Main challenge remains for many potential applications of ICLs. CW operation at room temperature and above with significant output powers. There is still significant room for improvement: Laser design and material quality - many parameters have not been optimized. Device fabrication and thermal management (passivation, better mounting, etc.). Significantly higher output power can be achieved with laser arrays.

Derived from text

Laser Arrays; Infrared Radiation; Temperature Control; Distributed Feedback Lasers; Detection; Continuous Radiation; Room Temperature

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*.

20080013394 NASA Langley Research Center, Hampton, VA, USA

Wire Crimp Connectors Verification using Ultrasonic Inspection

Cramer, K. Elliott; Perey, Daniel F.; Yost, William T.; [2007]; 11 pp.; In English; IV Pan American Conference for Non Destructive Testing, 22-27 Oct. 2007, Buenos Aires, Argentina; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 698259.02.07.07.02; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080013394

The development of a new ultrasonic measurement technique to quantitatively assess wire crimp connections is discussed.

The amplitude change of a compressional ultrasonic wave propagating through the junction of a crimp connector and wire is shown to correlate with the results of a destructive pull test, which previously has been used to assess crimp wire junction quality. Various crimp junction pathologies (missing wire strands, incorrect wire gauge, incomplete wire insertion in connector) are ultrasonically tested, and their results are correlated with pull tests. Results show that the ultrasonic measurement technique consistently (as evidenced with pull-testing data) predicts good crimps when ultrasonic transmission is above a certain threshold amplitude level. A physics-based model, solved by finite element analysis, describes the compressional ultrasonic wave propagation through the junction during the crimping process. This model is in agreement within 6% of the ultrasonic measurements. A prototype instrument for applying the technique while wire crimps are installed is also presented.
Author
Measuring Instruments; Wire; Connectors; Adhesion Tests; Ultrasonic Radiation; Inspection

20080014236 NASA Johnson Space Center, Houston, TX, USA
Laser and Shot Peening Effects on Fatigue Crack Growth in Friction Stir Welded 7075 Under Different Load Ratios
Hatamleh, Omar; Forth, Scott; Reynolds, Anthony; [2008]; 22 pp.; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

The effect of peening on the fatigue crack growth performance of friction stir welded 7075 aluminum alloy was investigated. The fatigue crack growth rates were assessed for laser and shot peening conditions at stress ratios (R) of 0.1, and 0.7. The surface and through thickness residual stress distributions were characterized for the different regions in the weld. The results indicate a significant reduction in fatigue crack growth rates using laser peening compared to shot peening and the as welded condition. The effect of the compressive stresses obtained through laser peening was deemed responsible for increasing the resistance to fatigue crack growth of the welds.
Author
Friction Stir Welding; Lasers; Shot Peening; Fatigue (Materials); Crack Propagation; Welded Joints; Residual Stress; Compressibility; Aluminum Alloys

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*.

20080013435 NASA Langley Research Center, Hampton, VA, USA
Recent Advances in Near-Net-Shape Fabrication of Al-Li Alloy 2195 for Launch Vehicles
Wagner, John; Domack, Marcia; Hoffman, Eric; June 26, 2007; 18 pp.; In English; 2007 National Space and Missile Materials Symposium, 25-29 Jun. 2007, Keystone, CO, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 136905.08.05.04.01.04; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013435

Recent applications in launch vehicles use 2195 processed to Super Lightweight Tank specifications. Potential benefits exist by tailoring heat treatment and other processing parameters to the application. Assess the potential benefits and advocate application of Al-Li near-net-shape technologies for other launch vehicle structural components. Work with manufacturing and material producers to optimize Al-Li ingot shape and size for enhanced near-net-shape processing. Examine time dependent properties of 2195 critical for reusable applications.
Author
Aluminum Alloys; Lithium Alloys; Structural Design; Launch Vehicles; Heat Treatment; Fabrication

20080013459 NASA Langley Research Center, Hampton, VA, USA

Nondestructive Testing of Fracture and Failure Critical Components

Generazio, Edward R.; August 27, 2007; 61 pp.; In English; 50th Annual Air Transportation Association (ATA) Non-Destructive Testing (NDT) Forum, 27-30 Aug. 2007, Orlando, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 939904.05.07; No Copyright; Avail.: CASI: A04, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080013459

This viewgraph presentation discusses the Columbia mishap and non-destructive evaluation of the thermal protection system for added mission safety and assurance.

CASI

Fracturing; Nondestructive Tests; Systems Engineering; Columbia (Orbiter); Fracture Mechanics; Spacecraft Components; Structural Failure

20080013461 National Inst. of Aerospace, Hampton, VA, USA

An Approach for Assessing Delamination Propagation Capabilities in Commercial Finite Element Codes

Krueger, Ronald; October 10, 2007; 24 pp.; In English; NASA Aviation Safety Technical Conference, 10-12 Oct. 2007, Saint Louis, MO, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 698259.02.07.07.03; Copyright; Avail.: CASI: A03, Hardcopy

An approach for assessing the delamination propagation capabilities in commercial finite element codes is presented and demonstrated for one code. For this investigation, the Double Cantilever Beam (DCB) specimen and the Single Leg Bending (SLB) specimen were chosen for full three-dimensional finite element simulations. First, benchmark results were created for both specimens. Second, starting from an initially straight front, the delamination was allowed to propagate. Good agreement between the load-displacement relationship obtained from the propagation analysis results and the benchmark results could be achieved by selecting the appropriate input parameters. Selecting the appropriate input parameters, however, was not straightforward and often required an iterative procedure. Qualitatively, the delamination front computed for the DCB specimen did not take the shape of a curved front as expected. However, the analysis of the SLB specimen yielded a curved front as may be expected from the distribution of the energy release rate and the failure index across the width of the specimen. Overall, the results are encouraging but further assessment on a structural level is required.

Author

Delaminating; Crack Propagation; Finite Element Method; Rotary Wing Aircraft; Rotor Blades; Crack Closure; Fracture Mechanics; Fatigue (Materials)

20080013504 NASA Langley Research Center, Hampton, VA, USA

Replica-based Crack Inspection

Newman, John A.; Smith, Stephen W.; Piascik, R. S.; Willard, Scott A.; Dawicke, David S.; [2007]; 24 pp.; In English; 18th AeroMat Conference and Exposition (AeroMat 2007), 25-28 Jun. 2007, Baltimore, MD, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 732759.07.09; Copyright; Avail.: CASI: A03, Hardcopy

A surface replica-based crack inspection method has recently been developed for use in Space Shuttle main engine (SSME) hydrogen feedline flowliners. These flowliners exist to ensure favorable flow of liquid hydrogen over gimble joint bellows, and consist of two rings each containing 38 elongated slots. In the summer of 2002, multiple cracks ranging from 0.1 inches to 0.6 inches long were discovered; each orbiter contained at least one cracked flowliner. These long cracks were repaired and eddy current inspections ensured that no cracks longer than 0.075 inches were present. However, subsequent fracture-mechanics review of flight rationale required detection of smaller cracks, and was the driving force for development of higher-resolution inspection method. Acetate tape surface replicas have been used for decades to detect and monitor small cracks. However, acetate tape replicas have primarily been limited to laboratory specimens because complexities involved in making these replicas - requiring acetate tape to be dissolved with acetone - are not well suited for a crack inspection tool. More recently developed silicon-based replicas are better suited for use as a crack detection tool. A commercially available silicon-based replica product has been determined to be acceptable for use in SSME hydrogen feedlines. A method has been developed using this product and a scanning electron microscope for analysis, which can find cracks as small as 0.005 inches and other features (e.g., pits, scratches, tool marks, etc.) as small as 0.001 inches. The resolution of this method has been validated with dozens of cracks generated in a laboratory setting and this method has been used to locate 55 cracks (ranging

in size from 0.040 inches to 0.004 inches) on space flight hardware. These cracks were removed by polishing away the cracked material and a second round of replicas confirmed the repair.
Author
Silicones; Replicas; Cracks; Crack Propagation; Crack Closure; Space Shuttle Main Engine; Inspection; Fracture Mechanics

20080013534 NASA Langley Research Center, Hampton, VA, USA
Static and Dynamic Model Update of an Inflatable/Rigidizable Torus Structure
Horta, Lucas G.; Reaves, mercedes C.; January 30, 2006; 26 pp.; In English; IMAC-XXIV Conference and Exposition on Structural Dynamics, 30 Jan. - 2 Feb. 2006, Saint Louis, MO, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): 23-064-20-12; Copyright; Avail.: CASI: A03, Hardcopy

The present work addresses the development of an experimental and computational procedure for validating finite element models. A torus structure, part of an inflatable/rigidizable Hexapod, is used to demonstrate the approach. Because of fabrication, materials, and geometric uncertainties, a statistical approach combined with optimization is used to modify key model parameters. Static test results are used to update stiffness parameters and dynamic test results are used to update the mass distribution. Updated parameters are computed using gradient and non-gradient based optimization algorithms. Results show significant improvements in model predictions after parameters are updated. Lessons learned in the areas of test procedures, modeling approaches, and uncertainties quantification are presented.
Author
Computational Fluid Dynamics; Finite Element Method; Toruses; Inflatable Structures; Rigid Structures; Static Models; Dynamic Models; Structural Analysis

20080013536 NASA Langley Research Center, Hampton, VA, USA
Testing of a 10-meter Quadrant Solar Sail
Gaspar, James L.; Mann, Troy; Behun, Vaughn; Macy, Brian; Barker, Peter; Murphy, David; January 30, 2006; 16 pp.; In English; IMAC-XXIV Conference and Exposition on Structural Dynamics, 30 Jan. - 2 Feb. 2006, Saint Louis, MO, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 23-800-92-68; Copyright; Avail.: CASI: A03, Hardcopy

The purpose of this paper is to address the technical challenges and requirements of modal testing a solar sail system (Fig. 1). Specific objectives of this work are to investigate the effectiveness (i.e. accuracy, precision, repeatability, etc.) of laser vibrometer measurements obtained on solar sail components (i.e. sail membrane quadrant and masts) actuated with various excitation methods in vacuum conditions. Results from this work will be used to determine the appropriate test technique for testing large scale full quadrant flight-like solar sail system hardware in vacuum conditions. This paper will focus on the dynamic tests conducted in-vacuum on a 10-meter solar sail quadrant development by AEC-ABLE as part of a ground demonstrator system development program funded by NASA's In-Space Propulsion program. One triangular shaped quadrant of a solar sail membrane (Fig. 2) was modal tested in a 1 Torr vacuum environment using various excitation techniques including, shaker excitation through the masts, magnetic excitation (Ref. 3), and surface-bonded piezoelectric patch actuators (Ref. 4 & 5). The excitation methods are evaluated for their applicability to in-vacuum ground testing and their traceability to the development of on-orbit flight test techniques. The solar sail masts (Fig. 3) were also tested in ambient atmospheric conditions and vacuum using various excitation techniques and these methods will also be assessed for their ground test capabilities and traceability to on-orbit flight testing.
Author
Ground Tests; Solar Sails; Vibration Meters; Piezoelectric Actuators; Vacuum; Excitation; Structural Reliability; Dynamic Structural Analysis; Quadrants

20080013570 Pratt and Whitney Rocketdyne, Canoga Park, CA, USA
Optimized Non-Obstructive Particle Damping (NOPD) Treatment for Composite Honeycomb Structures
Panossian, H.; [2008]; 10 pp.; In English; 47th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 1-4 May 2006, Newport, RI, USA
Contract(s)/Grant(s): 23-781-10-13; Copyright; Avail.: CASI: A02, Hardcopy

Non-Obstructive Particle Damping (NOPD) technology is a passive vibration damping approach whereby metallic or non-metallic particles in spherical or irregular shapes, of heavy or light consistency, and even liquid particles are placed inside

cavities or attached to structures by an appropriate means at strategic locations, to absorb vibration energy. The objective of the work described herein is the development of a design optimization procedure and discussion of test results for such a NOPD treatment on honeycomb (HC) composite structures, based on finite element modeling (FEM) analyses, optimization and tests. Modeling and predictions were performed and tests were carried out to correlate the test data with the FEM. The optimization procedure consisted of defining a global objective function, using finite difference methods, to determine the optimal values of the design variables through quadratic linear programming. The optimization process was carried out by targeting the highest dynamic displacements of several vibration modes of the structure and finding an optimal treatment configuration that will minimize them. An optimal design was thus derived and laboratory tests were conducted to evaluate its performance under different vibration environments. Three honeycomb composite beams, with Nomex core and aluminum face sheets, empty (untreated), uniformly treated with NOPD, and optimally treated with NOPD, according to the analytically predicted optimal design configuration, were tested in the laboratory. It is shown that the beam with optimal treatment has the lowest response amplitude. Described below are results of modal vibration tests and FEM analyses from predictions of the modal characteristics of honeycomb beams under zero, 50% uniform treatment and an optimal NOPD treatment design configuration and verification with test data.
Author
Composite Structures; Design Optimization; Honeycomb Structures; Vibration Damping; Structural Vibration; Sound Waves

20080014088 NASA Langley Research Center, Hampton, VA, USA
Bounds on Flexural Properties and Buckling Response for Symmetrically Laminated Plates
Weaver, Paul M.; Nemeth, Michael P.; [2007]; 61 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 732759.07.11; Copyright; Avail.: CASI: A04, Hardcopy

Nondimensional parameters and equations governing the buckling behavior of rectangular symmetrically laminated plates are presented that can be used to represent the buckling resistance, for plates made of all known structural materials, in a very general, insightful, and encompassing manner. In addition, these parameters can be used to assess the degree of plate orthotropy, to assess the importance of anisotropy that couples bending and twisting deformations, and to characterize quasi-isotropic laminates quantitatively. Bounds for these nondimensional parameters are also presented that are based on thermodynamics and practical laminate construction considerations. These bounds provides insight into potential gains in buckling resistance through laminate tailoring and composite-material development. As an illustration of this point, upper bounds on the buckling resistance of long rectangular orthotropic plates with simply supported or clamped edges and subjected to uniform axial compression, uniform shear, or pure inplane bending loads are presented. The results indicate that the maximum gain in buckling resistance for tailored orthotropic laminates, with respect to the corresponding isotropic plate, is in the range of 26-36% for plates with simply supported edges, irrespective of the loading conditions. For the plates with clamped edges, the corresponding gains in buckling resistance are in the range of 9-12% for plates subjected to compression or pure inplane bending loads and potentially up to 30% for plates subjected to shear loads.
Author
Buckling; Composite Materials; Laminates; Loads (Forces); Plates (Structural Members); Dynamic Structural Analysis

20080014148 NASA Johnson Space Center, Houston, TX, USA
Hypervelocity Impact Evaluation of Metal Foam Core Sandwich Structures
Yasensky, John; Christiansen, Eric L.; Prior, Tom; March 2008; 116 pp.; In English; Original contains color illustrations
Report No.(s): NASA/TP-2008-214776; S-1027; Copyright; Avail.: CASI: A06, Hardcopy

A series of hypervelocity impact (HVI) tests were conducted by the NASA Johnson Space Center (JSC) Hypervelocity Impact Technology Facility (HITF), building 267 (Houston, Texas) between January 2003 and December 2005 to test the HVI performance of metal foams, as compared to the metal honeycomb panels currently in service. The HITF testing was conducted at the NASA JSC White Sands Test Facility in Las Cruces, New Mexico. Eric L. Christiansen, Ph.D., and NASA Lead for micrometeoroid orbital debris (MMOD) protection requested these HVI tests as part of shielding research conducted for the JSC Center Director Discretionary Fund project. The structure tested is a metal foam sandwich structure; a metal foam core between two metal facesheets. Aluminum and titanium metals were tested for foam sandwich and honeycomb sandwich structures. Aluminum honeycomb core material is currently used in orbiter vehicle radiator panels and in other places in space structures. It has many desirable characteristics and performs well by many measures, especially when normalized by density. Aluminum honeycomb does not perform well in HVI testing. This is a concern, as honeycomb panels are often exposed to

space environments and take on the role of MMOD shielding. Therefore, information on possible replacement core materials that perform adequately in all necessary functions of the material would be useful. In this report, HVI data are gathered for these two core materials in certain configurations and compared to gain an understanding of the metal foam HVI performance.
Author
Hypervelocity Impact; Impact Tests; Metal Foams; Spacecraft Structures; Sandwich Structures; Honeycomb Structures; Aerospace Engineering; Shielding

20080014175 NASA Langley Research Center, Hampton, VA, USA
Multi-Terrain Earth Landing Systems Applicable for Manned Space Capsules
Fasanella, Edwin L.; March 03, 2008; 26 pp.; In English; ASCE 11th Earth and Space Conference, 3-5 Mar. 2008, Long Beach, CA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 644423.04.31.04.40.43.20; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080014175

A key element of the President's Vision for Space Exploration is the development of a new space transportation system to replace the Shuttle that will enable manned exploration of the moon, Mars, and beyond. NASA has tasked the Constellation Program with the development of this architecture, which includes the Ares launch vehicle and Orion manned spacecraft. The Orion spacecraft must carry six astronauts and its primary structure should be reusable, if practical. These requirements led the Constellation Program to consider a baseline land landing on return to earth. To assess the landing system options for Orion, a review of current operational parachute landing systems such as those used for the F-111 escape module and the Soyuz is performed. In particular, landing systems with airbags and retrorockets that would enable reusability of the Orion capsule are investigated. In addition, Apollo tests and analyses conducted in the 1960's for both water and land landings are reviewed. Finally, tests and dynamic finite element simulations to understand land landings for the Orion spacecraft are also presented.
Author
Manned Spacecraft; Space Capsules; Space Exploration; Return to Earth Space Flight; Spacecraft Landing; Spacecraft Design; Structural Design

20080014241 NASA Langley Research Center, Hampton, VA, USA
A Summary of DOD-Sponsored Research Performed at NASA Langley's Impact Dynamics Research Facility
Jackson, Karen E.; Boitnott, Richard L.; Fasanella, Edwin L.; Jones, Lisa E.; Lyle, Karen H.; Journal of the American Helicopter Society; June 07, 2004; Volume 51, No. 1, pp. 59-69; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): 23-376-70-30-07; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080014241

The Impact Dynamics Research Facility (IDRF) is a 240-ft.-high gantry structure located at NASA Langley Research Center in Hampton, Virginia. The IDRF was originally built in the early 1960's for use as a Lunar Landing Research Facility. As such, the facility was configured to simulate the reduced gravitational environment of the Moon, allowing the Apollo astronauts to practice lunar landings under realistic conditions. In 1985, the IDRF was designated a National Historic Landmark based on its significant contributions to the Apollo Moon Landing Program. In the early 1970's the facility was converted into its current configuration as a full-scale crash test facility for light aircraft and rotorcraft. Since that time, the IDRF has been used to perform a wide variety of impact tests on full-scale aircraft, airframe components, and space vehicles in support of the General Aviation (GA) aircraft industry, the U.S. Department of Defense (DOD), the rotorcraft industry, and the NASA Space program. The objectives of this paper are twofold: to describe the IDRF facility and its unique capabilities for conducting structural impact testing, and to summarize the impact tests performed at the IDRF in support of the DOD. These tests cover a time period of roughly 2 1/2 decades, beginning in 1975 with the full-scale crash test of a CH-47 Chinook helicopter, and ending in 1999 with the external fuel system qualification test of a UH-60 Black Hawk helicopter. NASA officially closed the IDRF in September 2003; consequently, it is important to document the past contributions made in improved human survivability and impact tolerance through DOD-sponsored research performed at the IDRF.
Author
Impact Tests; Research Facilities; Defense Industry; Defense Program; CH-47 Helicopter; Crashworthiness; Rotary Wing Aircraft; Test Facilities; Performance Tests

42
GEOSCIENCES (GENERAL)

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see *categories 42 through 48*.

20080013401 NASA Johnson Space Center, Houston, TX, USA
Expert System Classification of Urban Land Use/Cover for Delhi, India
Wentz, Elizabeth A.; Nelson, David; Rahman, Atiqur; Stefanov, William L.; Roy, Shourasaseni Sen; August 16, 2007; 43 pp.; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

This study presents the results of classifying land use/land cover for Delhi, India using an expert system approach. For this study Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) data of September 22, 2003 were used. The research goals of this project are two-fold. In one respect, the research goal is to report on the extent covered by urbanization using the classified image. Thirteen different land cover categories were identified with an 85.55% overall classification accuracy based on 256 random points for validation and 50 on the ground observations. Secondly, we report on our efforts to duplicate an expert system model previously developed for Phoenix Arizona as a generalized approach for urban land use classification. Results suggest that while some of the methodology could be duplicated; there are local factors (e.g. data availability and specific land features) that required us to modify the approach.
Author
Land Use; Expert Systems; Accuracy; Classifications; Radiometers

20080013409 NASA Johnson Space Center, Houston, TX, USA
Comparing Wild 2 Particles to Chondrites and IDPS
Zolensky, Michael; Nakamura-Messenger, Keiko; Rietmeijer, Frans; Leroux, Hugues; Mikouchi, Takashi; Ohsumi, Kazumasa; Simon, Steven; Grossman, Lawrence; Stephan, Thomas; Weisberg, Michael; Velbel, Michael; Zega, Thomas; Stroud, Rhonda; Tomeoka, Kazushige; Ohnishi, Ichiro; Tomioka, Naotaka; Nakamura, Tomoki; Matrajt, Graciela; Joswiak, David; Brownlee, Don; Langenhorst, Falko; Krot, Alexander; Kearsley, Anton; Ishii, Hope; Graham, Giles; [2008]; 24 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

We compare the observed composition ranges of olivine, pyroxene and Fe-Ni sulfides in Wild 2 grains, comparing these with chondritic IDPs and chondrite classes to explore whether these data suggest affinities to known hydrous materials in particular. Wild 2 olivine has an extremely wide composition range, from Fo4-100 with a pronounced frequency peak at Fo99. The composition range displayed by the low-calcium pyroxene is also very extensive, from En52 to En100, with a significant frequency peak centered at En95. These ranges are as broad or broader than those reported for any other extraterrestrial material. Wild 2 Fe-Ni sulfides mainly have compositions close to that of FeS, with less than 2 atom % Ni - to date, only two pentlandite grains have been found among the Wild-grains suggesting that this mineral is not abundant. The complete lack of compositions between FeS and pentlandite (with intermediate solid solution compositions) suggests (but does not require) that FeS and pentlandite condensed as crystalline species, i.e. did not form as amorphous phases, which later became annealed. While we have not yet observed any direct evidence of water-bearing minerals, the presence of Ni-bearing sulfides, and magnesium-dominated olivine and low-Ca pyroxene does not rule out their presence at low abundance. We do conclude that modern major and minor element compositions of chondrite matrix and IDPs are needed.
Author
Chondrites; Wild 2 Comet; Interplanetary Dust; Particles; Mineralogy

20080013412 NASA Johnson Space Center, Houston, TX, USA
Rapid Contamination During Storage of Carbonaceous Chondrites Prepared for Micro FTIR Measurements
Kebukawa, Yoko; Nakashima, Satoru; Otsuka, Takahiro; Nakamura-Messenger, Keiko; Zolensky, ichael E.; [2008]; 43 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

The carbonaceous chondrites Tagish Lake and Murchison, which contain abundant hydrous minerals, when pressed on aluminum plates and analyzed by micro FTIR, were found to have been contaminated during brief (24 hours) storage. This contamination occurred when the samples were stored within containers which included silicone rubber, silicone grease or adhesive tape. Long-path gas cell FTIR measurements for silicone rubber revealed the presence of contaminant volatile molecules having 2970 cm(sup -1) (CH3) and 1265 cm(sup -1) (Si-CH3) peaks. These organic contaminants are found to be desorbed by in-situ heating infrared measurements from room temperature to 200-300 C. Careful preparation and storage are

therefore needed for precious astronomical samples such as meteorites, IDPs and mission returned samples from comets, asteroids and Mars, if useful for FTIR measurements are to be made.
Author
Carbonaceous Chondrites; Contamination; Murchison Meteorite; Mineralogy; Fast Fourier Transformations; Infrared Spectra

20080013428 NASA Johnson Space Center, Houston, TX, USA
NanoSIMS Sheds Light on the Origin and Significance of Early Archean Organic Microstructures from the Pilbara of Australia
Oehler, Dorothy Z.; Robert, Francois; Meibom, Anders; Mostefaoui, Smail; Selo, Madeleine; Walter, Malcolm, R.; Sugitani, Kenichiro; Allwood, Abigail; Gibson, Everett K.; [2008]; 2 pp.; In English; Astrobiology Science Conference, 15-17 Apr. 2008, Santa Clara, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

NanoSIMS was used to characterize sub-micron scale morphology and elemental composition (C, N, S, Si, O) of organic microstructures in Early Archean (3 - 3.4 Ga) charts from the Pilbara of Western Australia. Three categories of structures were analyzed: small spheroids in clusters; spindle-shaped remains; and large spheroids. All are relatively poorly preserved and occur within the chert matrix of the samples. Carbonaceous material in a secondary hydrothermal vein also was analyzed, as an example of non-indigenous organic matter. Comparisons were made of NanoSIMS characteristics of the Archean samples and those from well-preserved, biogenic microfossils in the 0.8 Ga Bitter Springs Formation. The comparisons show that the Pilbara microstructures are generally distinct from material in the hydrothermal vein but similar in morphology and elemental composition to the Bitter Springs microfossils. In addition, the Pilbara structures exhibit a spatial relationship to silicon and oxygen that seemingly reflects silica nucleation on organic surfaces; this argues that the organic frameworks of the Archean structures were present in the sediment during crystallization of the silica matrix. The structures are thus interpreted as being indigenous to the enclosing sediment. While these results are suggestive of Early Archean biogenicity and are consistent with a growing body of data suggesting that life on Earth was well established by 3 to 3.4 Ga, work is continuing to determine the N/C and 13C ratios of individual forms, and this should provide additional insight into the derivation and significance of these ancient organic remains.
Author
Carbonaceous Materials; Microorganisms; Morphology; Precambrian Period; Organic Materials; Chemical Composition; Fossils; Life Sciences; Sediments

43
EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis of remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photography. For related instrumentation see *35 Instrumentation and Photography*.

20080013403 NASA Johnson Space Center, Houston, TX, USA
Characterization and Monitoring of Urban/Peri-Urban Ecological Function and Landscape Structure using Satellite Data
Stefanov, William L.; Netzband M.; [2007]; 29 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

This chapter examines the relationships between ecological variables and landscape structure for the Phoenix, Arizona region using ASTER and MODIS data; expert system land cover classification; and grid-based landscape metric analysis. Urbanization is a significant, and perhaps the most visible, anthropogenic force on earth--affecting its surface, atmosphere, and seas; its biodiversity and its people. Reliable baseline data on the state of many urban area s ecosystems and biodiversity is lacking, and our progress in obtaining these data is moving slower than our ability to alter the environment. Characterization and monitoring of urban center land cover/land use change is only of limited use in understanding the development pathways of cities and their resilience to outside stressors. Geological, ecological, climatic and social/political data are also necessary to describe the developmental history of a given urban center and to understand its ecological functioning. The data available from the NASA Earth Observing System (EOS) satellite-based instruments presents an opportunity to collect this information relevant to urban (areas of high population concentration with high building density and infrastructure) and peri-urban (adjacent agricultural and undisturbed regions with low population concentration) environments at a variety of spatial, temporal and spectral scales. EOS sensors offer two advantages essential for characterization and monitoring of

urban/peri-urban regions: 1) they can supply a large volume of surficial multispectral data at relatively low cost, and 2) data for the same region can be repeatedly acquired over relatively short periods (days to weeks)
Author
Cities; Ecosystems; Land Use; Urban Development; Suburban Areas; Urban Research; Remote Sensing

20080013424 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
The AIRSAR Campaign to Central and South America
Chapman, Bruce; September 20, 2004; 16 pp.; In English; IEEE Geoscience and Remote Sensing Society (IGARSS), 20 Sep. 2004, Anchorage, AK, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40716

This viewgraph presentation reviews the status of AIRSAR in March of 2004. The topics include: 1) What is AIRSAR in 2004? 2) AIRSAR Status; 3) New AIRSAR Products for 2004; 4) March 2004 deployment; 5) Objectives; 6) Results; 7) AIRSAR Topographic Interferogram of North Antarctic Peninsula; and 8) AIRSAR Quicklook Polarimetric Imagery of Antarctic Sea Ice.
CASI
Central America; South America; Synthetic Aperture Radar; Airborne Radar; Topography; Remote Sensing

20080013448 NASA Marshall Space Flight Center, Huntsville, AL, USA
Global Simulation of Electromagnetic Ion Cyclotron Waves
Khazanov, George V.; Gallagher, D. L.; Kozyra, J. U.; December 10, 2007; 18 pp.; In English; Fall AGU 2007 Meeting, 10-14 Dec. 2007, San Francisco, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

It is very well known that the effects of electromagnetic ion cyclotron (EMIC) waves on ring current (RC) ion and radiation belt (RB) electron dynamics strongly depend on such particle/wave characteristics as the phase-space distribution function, frequency, wave-normal angle, wave energy, and the form of wave spectral energy density. The consequence is that accurate modeling of EMIC waves and RC particles requires robust inclusion of the interdependent dynamics of wave growth/damping, wave propagation, and particles. Such a self-consistent model is being progressively developed by Khazanov et al. This model is based on a system of coupled kinetic equations for the RC and EMIC wave power spectral density along with the ray tracing equations. We will discuss the recent progress in understanding EMIC waves formation mechanisms in the inner magnetosphere. This problem remains unsettled in spite of many years of experimental and theoretical studies. Modern satellite observations by CRRES, Polar and Cluster still do not reveal the whole picture experimentally since they do not stay long enough in the generation region to give a full account of all the spatio-temporal structure of EMIC waves. The complete self-consistent theory taking into account all factors significant for EMIC waves generation remains to be developed. Several mechanisms are discussed with respect to formation of EMIC waves, among them are nonlinear modification of the ionospheric reflection by precipitating energetic protons, modulation of ion-cyclotron instability by long-period (Pc3/4) pulsations, reflection of waves from layers of heavy-ion gyroresonances, and nonlinearities of wave generation process. We show that each of these mechanisms have their attractive features and explains certain part experimental data but any of them, if taken alone, meets some difficulties when compared to observations. We conclude that development of a refined nonlinear theory and further correlated analysis of modern satellite and ground-based data is needed to solve this very intriguing problem.
Author
Electromagnetic Radiation; Ion Cyclotron Radiation; Ionospheric Propagation; Ring Currents; Magnetohydrodynamic Simulation; Atmospheric Models; Mathematical Models

20080013478 Colorado Univ., Boulder, CO, USA
The Impact of Soil Reflectance on the Quantification of the Green Vegetation Fraction from NDVI
Montandon, L. M.; Small, E. E.; Remote Sensing of Environment: Remote Sensing Data Assimilation Special Issue; April 15, 2008; Volume 112, Issue 4, pp. 1835-1845; In English; Copyright; Avail.: Other Sources; Abstract Only
ONLINE: http://dx.doi.org/10.1016/j.rse.2007.09.007

The green vegetation fraction (Fg) is an important climate and hydrologic model parameter. A common method to calculate Fg is to create a simple linear mixing rnodeP between two NDVI endmembers: bare soil NDVI (NDVI(sub o)) and full vegetation NDVI (NDVI(sub infinity)). Usually it is assumed that NDVI(sub o), is close to zero (NDVI(sub o) approx.-0.05) and is generally chosen from the lowest observed NDVI values. However, the mean soil NDVI computed from

2906 samples is much larger (NDVI=0.2) and is highly variable (standard deviation=O. 1). We show that the underestimation of NDVI(sub o) yields overestimations of Fg. The largest errors occur in grassland and shrubland areas. Using parameters for NDVI(sub o) and NDVI(sub infinity) derived from global scenes yields overestimations of Fg ((Delta) Fg*) that are larger than 0.2 for the majority of U.S. land cover types when pixel NDVI values are 0.2<NDVI(sub pixel)<0.4. Figure 1 shows how the Fg overestimation varies for the most common land cover types in the conterminous U.S. for typical seasonal NDVI values. When using conterminous U.S. scenes to derive NDV(sub o) and NDVI(sub infinity), the overestimation is less (0.10-0.17 for 0.2<NDVI(sub pixel)<0.4). As a result, parts of the conterminous U.S. are affected at different times of the year depending on the local seasonal NDVI cycle. We propose using global databases of NDVI(sub o) along with information on historical NDVI(sub pixel) values to compute a statistically most-likely estimate of Fg (Fg*). Using in situ measurements made at the Sevilleta LTER, we show that this approach yields better estimates of Fg than using global invariant NDVI(sub o) values estimated from whole scenes (Figure 2). At the two studied sites, the Fg estimate was adjusted by 52% at the grassland and 86% at the shrubland. More significant advances will require information on spatial distribution of soil reflectance.
Author
Soils; Vegetation; Climate Models; Hydrology Models; Normalized Difference Vegetation Index; Estimates; In Situ Measurement

20080013490 Texas Univ., Austin, TX, USA
Earth System Science Research Using Datra and Products from Terra, Aqua, and ACRIM Satellites
Hutchison, Keith D.; December 21, 2007; 168 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNL04AA70G; WBS 921266.04.07.01; NRA Proj. 03-OES-02; No Copyright; Avail.: CASI: A08, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013490

The report describes the research conducted at CSR to extend MODIS data and products to the applications required by users in the State of Texas. This research presented in this report was completed during the timeframe of August 2004 - December 31, 2007. However, since annual reports were filed in December 2005 and 2006, results obtained during calendar year 2007 are emphasized in the report. The stated goals of the project were to complete the fundamental research needed to create two types of new, Level 3 products for the air quality community in Texas from data collected by NASA s EOS Terra and Aqua missions.
Derived from text
Air Quality; Earth Observations (From Space); Pollution Monitoring; Earth Atmosphere

20080013497 NASA Langley Research Center, Hampton, VA, USA
The Calibration of AVHRR/3 Visible Dual Gain Using Meteosat-8 as a MODIS Calibration Transfer Medium
Avey, Lance; Garber, Donald; Nguyen, Louis; Minnis, Patrick; September 13, 2007; 19 pp.; In English; 2007 CALCON Technical Conference, 10-13 Sep. 2007, Logan, UT, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 281945.02.04.01.30; Copyright; Avail.: CASI: A03, Hardcopy

This viewgraph presentation reviews the NOAA-17 AVHRR visible channels calibrated against MET-8/MODIS using dual gain regression methods. The topics include: 1) Motivation; 2) Methodology; 3) Dual Gain Regression Methods; 4) Examples of Regression methods; 5) AVHRR/3 Regression Strategy; 6) Cross-Calibration Method; 7) Spectral Response Functions; 8) MET8/NOAA-17; 9) Example of gain ratio adjustment; 10) Effect of mixed low/high count FOV; 11) Monitor dual gains over time; and 12) Conclusions
CASI
Advanced Very High Resolution Radiometer; Calibrating; Imaging Spectrometers; Meteosat Satellite; MODIS (Radiometry); Amplification

20080013509 NASA Langley Research Center, Hampton, VA, USA
Numerical Studies of Scattering Properties of Leaves and Leaf Moisture Influences on the Scattering at Microwave Wavelengths
Lin, Bing; Hu, Yongxiang; Sun, Wenbo; Min, Qilong; [2008]; 17 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 281945.02.13.01.08; Copyright; Avail.: CASI: A03, Hardcopy

This study uses 3-dimensional finite difference time domain method to accurately calculate single-scattering properties of randomly orientated leaves and evaluate the influences of vegetation water content (VWC) on these properties at 19 and 37

GHz frequencies. The studied leaves are assumed to be thin elliptic disks with two different sizes and have various VWC values. Although the leaf moisture produces considerable absorption during scattering processes, the effective efficiencies of extinction and scattering of leaves still near-linearly increase with VWC. Calculated asymmetry factors and phase functions indicate that there are significant amounts of scattering at large scattering angles in microwave wavelengths, which provides good opportunities for off-nadir microwave remote sensing of forests. This study lays a basic foundation in future quantifications of the relations between satellite measurements and physical properties of vegetation canopies.
Author
Finite Difference Time Domain Method; Leaves; Atmospheric Scattering; Vegetation; Moisture Content; Microwave Frequencies; Remote Sensing; Satellite Observation

20080014151 NASA Langley Research Center, Hampton, VA, USA
Committee on Earth Observation Satellites (CEOS) Systems Engineering Office (SEO). Ocean Surface Topography (OST) Workshop, Ruedesheim an Rhein, Germany. [CEOS SEO Status Report]
Killough, Brian D., Jr.; January 29, 2008; 11 pp.; In English; CEOS OST Constellation Workshop, 29-31 Jan. 2008, Ruedesheim An Rhein, Germany; Original contains color illustrations
Contract(s)/Grant(s): WBS 625978.01.03; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080014151

The CEOS Systems Engineering Office will present a 2007 status report of the CEOS constellation process, present a new systems engineering framework, and analysis results from the GEO Societal Benefit Area (SBA) assessment and the OST constellation requirements assessment.
Author
Earth Observations (From Space); Systems Engineering; NASA Programs; Aerospace Systems; Politics

20080014189 NASA Langley Research Center, Hampton, VA, USA
Non Radiation Hardened Microprocessors in Spaced Based Remote Sensing Systems
Decoursey, Robert J.; Estes, Robert F.; Melton, Ryan; September 11, 2006; 10 pp.; In English; SPIE Europe Remote Sensing 2006, 11-14 Sep. 2006, Stockholm, Sweden; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 653967.02.01.01; Copyright; Avail.: CASI: A02, Hardcopy

The CALIPSO (Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations) mission is a comprehensive suite of active and passive sensors including a 20Hz 230mj Nd:YAG lidar, a visible wavelength Earth-looking camera and an imaging infrared radiometer. CALIPSO flies in formation with the Earth Observing System Post-Meridian (EOS PM) train, provides continuous, near-simultaneous measurements and is a planned 3 year mission. CALIPSO was launched into a 98 degree sun synchronous Earth orbit in April of 2006 to study clouds and aerosols and acquires over 5 gigabytes of data every 24 hours. The ground track of one CALIPSO orbit as well as high and low intensity South Atlantic Anomaly outlines is shown. CALIPSO passes through the SAA several times each day. Spaced based remote sensing systems that include multiple instruments and/or instruments such as lidar generate large volumes of data and require robust real-time hardware and software mechanisms and high throughput processors. Due to onboard storage restrictions and telemetry downlink limitations these systems must pre-process and reduce the data before sending it to the ground. This onboard processing and realtime requirement load may mean that newer more powerful processors are needed even though acceptable radiation-hardened versions have not yet been released. CALIPSO's single board computer payload controller processor is actually a set of four (4) voting non-radiation hardened COTS Power PC 603r's built on a single width VME card by General Dynamics Advanced Information Systems (GDAIS). Significant radiation concerns for CALIPSO and other Low Earth Orbit (LEO) satellites include the South Atlantic Anomaly (SAA), the north and south poles and strong solar events. Over much of South America and extending into the South Atlantic Ocean the Van Allen radiation belts dip to just 200-800km and spacecraft entering this area are subjected to high energy protons and experience higher than normal Single Event Upset (SEU) and Single Event Latch-up (SEL) rates. Although less significant, spacecraft flying in the area around the poles experience similar upsets. Finally, powerful solar proton events in the range of 10MeV/10pfu to 100MeV/1pfu as are forecasted and tracked by NOAA's Space Environment Center in Colorado can result in Single Event Upset (SEU), Single Event Latch-up (SEL) and permanent failures such as Single Event Gate Rupture (SEGR) in some technologies. (Galactic Cosmic Rays (GCRs) are another source, especially for gate rupture) CALIPSO mitigates common radiation concerns in its data handling through the use of redundant processors, radiation-hardened Application Specific Integrated Circuits (ASIC), hardware-based Error Detection and Correction (EDAC), processor and memory scrubbing, redundant boot code and mirrored files. After presenting a system

overview this paper will expand on each of these strategies. Where applicable, related on-orbit data collected since the CALIPSO initial boot on May 4, 2006 will be noted.
Author
Microprocessors; Remote Sensing; Avionics; Spacecraft Instruments; Onboard Equipment

20080014203 NASA Langley Research Center, Hampton, VA, USA
MicroMAPS CO Measurements over North America and Europe during Summer-Fall 2004
Connors, Vickie S.; Hopkins, Patrick E.; Reichle, Henry G., Jr.; Morrow, William H.; McMillan, Wallace; Sandy, Mary L.; [2006]; 1 pp.; In English; 2006 AGU Fall Meeting, 11-15 Dec. 2006, San Francisco, CA, USA
Contract(s)/Grant(s): WBS 509496.02.04.01.04
Report No.(s): Paper No. 424; Copyright; Avail.: CASI: A01, Hardcopy

The MicroMAPS instrument is a nadir-viewing, gas filter-correlated radiometer which operating in the 4.67 micrometer fundamental band of carbon monoxide. Originally designed and built for a space mission, this CO remote sensor is being flown in support of satellite validation and science instrument demonstrations for potential UAV applications. The MicroMAPS instrument system, as flown on Proteus, was designed by a senior student design project in the Aerospace Engineering Department, Virginia Tech, in Blacksburg, VA. and then revised by Systems Engineers at NASA Langley. The final instrument system was integrated and tested at NASA LaRC, in partnership with Scaled Composites and Virginia Space Grant Consortium (VSGC). VSGC supervised the fabrication of the nacelle that houses the instrument system on the right rear tail boom of Proteus. Full system integration and flight testing was performed at Scaled Composites, in Mojave, in June 2004. Its successful performance enabled participation in four international science missions on Proteus: in 2004, INTEX -NA over eastern North America in July, ADRIEX over the Mediterranean region and EAQUATE over the UK region in September,and TWP-ICE over Darwin, Australia and the surrounding oceans in Jan-Feb 2006. These flights resulted in nearly 300 hours of data. In parallel with the engineering developments, theoretical radiative transfer models were developed specifically for the MicroMAPS instrument system at the University of Virginia, Mechanical Engineering Department by a combined undergraduate and graduate student team. With technical support from Resonance Ltd. in June 2005, the MicroMAPS instrument was calibrated for the conditions under which the Summer-Fall 2004 flights occurred. The analyses of the calibration data, combined with the theoretical radiative transfer models, provide the first data reduction for the science flights reported here. These early results and comparisons with profile data from the NASA DC-8, the coincident AIRS CO retrievals, and selected CO measurements from the MOZAIC program will be presented.
Author
Carbon Monoxide; Europe; Fabrication; North America; Radiometers; Remote Sensors; Satellite Instruments; Flight Tests; Systems Integration

20080014234 NASA Langley Research Center, Hampton, VA, USA
Validation of CALIPSO Lidar Observations Using Data From the NASA Langley Airborne High Spectral Resolution Lidar
Hostetler, Chris; Hair, Johnathan; Liu, Zhaoyan; Ferrare, Rich; Harper, David; Cook, Anthony; Vaughan, Mark; Trepte, Chip; Winker, David; [2006]; 1 pp.; In English; 2006 AGU Fall Meeting, 11-15 Dec. 2006, San Francisco, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 653967.04.01.01; Copyright; Avail.: CASI: A01, Hardcopy

This poster focuses on preliminary comparisons of data from the Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP) instrument on the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) spacecraft with data acquired by the NASA Langley Airborne High Spectral Resolution Lidar (HSRL). A series of 20 aircraft validation flights was conducted from 14 June through 27 September 2006, under both day and night lighting conditions and a variety of aerosol and cloud conditions. This poster presents comparisons of CALIOP measurements of attenuated backscatter at 532 and 1064 nm and depolarization at 532 nm with near coincident measurements from the Airborne HSRL as a preliminary assessment of CALIOP calibration accuracy. Note that the CALIOP data presented here are the pre-release version. These data have known artifacts in calibration which have been corrected in the December 8 CALIPSO data release which was not available at the time the comparisons were conducted for this poster. The HSRL data are also preliminary. No artifacts are known to exist; however, refinements in calibration and algorithms are likely to be implemented before validation comparisons are made final.
Derived from text
Aerosols; Airborne Equipment; CALIPSO (Pathfinder Satellite); High Resolution; Optical Radar; Satellite Observation; Spectral Resolution

45
ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

20080013524 NASA Johnson Space Center, Houston, TX, USA
CCD Debris Telescope Observations of the Geosynchronous Orbital Debris Environment Observing Year: 2000
Jarvis, K. S.; Parr-Thumm, T. L.; Abercromby, K. J.; Barker, E. S.; Africano, J. L.; Sydney, P. F.; Africano, B. M.; Matney, M. J.; Stansbery, E. G.; Mulrooney, M. K.; February 2008; 72 pp.; In English; Original contains color and black and white illustrations
Report No.(s): NASA/TM-2008-714772; S-1023; No Copyright; Avail.: CASI: A04, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013524

Orbital debris is a concern to all nations that use satellites or launch space vehicles. The debris field scattered near Earth s geosynchronous orbit (GEO) poses a threat to anything residing in or passing through it. To mitigate risk and minimize this environment s expansion, the threat must be understood. NASA has been using the Charged-Coupled Device Debris Telescope (CDT), a transportable 32-cm Schmidt telescope located near Cloudcroft, New Mexico, to help characterize the debris environment in GEO. Using the CDT, researchers conducted systematic searches of the GEO environment as part of an international measurement campaign under the auspices of the Inter-Agency Space Debris Coordination Committee (IADC). The objectives for this survey are to determine the extent and character of debris in GEO, specifically by obtaining distributions for the brightness, inclination, right ascension of ascending node (RAAN), and mean motion for the debris. Tests using the CDT for this campaign took place in late 1997 and data collection began in January 1998. This report describes the data taken and all of the data reduction details to make it a standalone report on the Calendar Year (CY) 2000 activities. Author
Space Debris; Geosynchronous Orbits; Earth Orbits; Launch Vehicles

20080013525 NASA Johnson Space Center, Houston, TX, USA
CCD Debris Telescope Observations of the Geosynchronous Orbital Debris Environment Observing Year: 2001
Jarvis, K. S.; Parr-Thumm, T. L.; Abercromby, K. J.; Barker, E.; Africano, J. L.; Sydney, P. F.; Africano, B. M.; Matney, M. J.; Stansbery, E. G.; Mulrooneye, M. K.; February 2008; 78 pp.; In English; Original contains color and black and white illustrations
Report No.(s): NASA/TM-2008-214773; S-1024; No Copyright; Avail.: CASI: A05, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013525

Orbital debris is a concern to all nations that use satellites or launch space vehicles. The debris field scattered near Earth s geosynchronous orbit (GEO) poses a threat to anything residing in or passing through it. To mitigate risk and minimize this environment s expansion, the threat must be understood. NASA has been using the Charged-Coupled Device Debris Telescope (CDT), a transportable 32-cm Schmidt telescope located near Cloudcroft, New Mexico, to help characterize the debris environment in GEO. Using the CDT, researchers conducted systematic searches of the GEO environment as part of an international measurement campaign under the auspices of the Inter-Agency Space Debris Coordination Committee (IADC). The objectives for this survey are to determine the extent and character of debris in GEO, specifically by obtaining distributions for the brightness, inclination, right ascension of ascending node (RAAN), and mean motion for the debris. Tests using the CDT for this campaign took place in late 1997 and data collection began in January 1998. This report describes the data taken and all of the data-reduction details to make it a stand-alone report on the Calendar Year (CY) 2001 activities. Author
Geosynchronous Orbits; Space Debris; Earth Orbits; Risk; Launch Vehicles

20080013526 NASA Johnson Space Center, Houston, TX, USA
The Geosynchronous Earth Orbit Environment as Determined by the CCD Debris Telescope Observations Between 1998 and 2002
Abercromby, K. J.; Barker, E. S.; Jarvis, K. S.; Parr-Thumm, T. L.; Africano, J. L.; Matney, M. J.; Rodriqueze, H. M.; February 2008; 54 pp.; In English; Original contains color and black and white illustrations
Report No.(s): NASA/TP-2008-214774; S-1025; No Copyright; Avail.: CASI: A04, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013526

Understanding the evolving debris environment is essential if the human race continues to venture into space. Of particular importance is the geosynchronous environment in which satellites have been placed since the 1960s. Debris in

geosynchronous Earth orbit (GEO) has an enhanced potential for collision with operational satellites due to the extremely long lifetimes of the debris. The Charged Coupled Device (CCD) Debris Telescope (CDT) conducted systematic searches of the GEO environment to help characterize and determine the extent of the debris found in this volume of near-Earth space. The observations provided distributions in brightness, mean motion, inclination, range, and Right Ascension of Ascending Node (RAAN) of detected debris. Yearly reports (NASA/Johnson Space Center (JSC) publications) described details of the observing program and observed distributions (Jarvis et al., 2001, 2002, 2007a, 2007b). In this final report, a summary and comparison of the observations is conducted. All observed magnitudes have been corrected for standard solar distance, a Lambertian phase function at phase angle 0 , and an observed range, when possible. Orbital elements were derived from two or more astrometric positions based on the assumption of a circular orbit (eccentricity = 0). We define the dimensions of a GEO environment to be between 34,000 km and 40,000 km and between 0 and 17 inclination based on the assumed circular orbit (ACO) elements of the observations. The scope of the paper is limited to the population distributions of objects found in this defined GEO environment.

Author

Charge Coupled Devices; Telescopes; Earth Orbits; Geosynchronous Orbits; Space Debris; Astrometry; Orbital Elements

20080014146 NASA Langley Research Center, Hampton, VA, USA

Using Satellite Measurements to Investigate Regional-scale Chemistry: The Case for Geostationary Observations

Fishman, Jack; Wozniak, Amy; Creilson, Jack; August 26, 2007; 1 pp.; In English; Gordon Research Conference on Atmospheric Chemistry, 26-31 Aug. 2007, Big Sky, MT, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 479717.02.01; Copyright; Avail.: CASI: A01, Hardcopy

One of the recommendations of the Decadal Survey that was recently released by the National Academy of Science was that of a geostationary platform from which to obtain trace gas measurements. The use of such a platform is particularly advantageous when applied to understanding the formation of regional air pollution. This study demonstrates the challenges of trying to utilize information from instruments on satellites in low-earth orbit (LEO). We also demonstrate the advantage gained through a simulation that would provide hourly observations. In this case study, we take advantage of the high resolution Level-2 orbital data available from the Ozone Monitoring Instrument (OMI), in conjunction with assimilated stratospheric column ozone fields, to evaluate if meaningful tropospheric ozone information can be obtained on a regional scale. We focus on a period on late June 2005 when a widespread pollution episode enveloped the Houston metropolitan area as well as a large region in southeast Texas.

Derived from text

Atmospheric Composition; Geosynchronous Orbits; Satellite Observation; Atmospheric Chemistry; Trace Contaminants; Troposphere; Ozone

20080014150 Georgia Inst. of Tech., Atlanta, GA, USA

Influence of Ohio River Valley Emissions on Fine Particle Sulfate Measured from Aircraft over Large Regions of the Eastern USA and Canada during INTEX-NA

Hennigan, Christopher J.; Sandholm, Scott; Kim, Saewung; Stickel, Robert E.; Huey, L. Gregory; Weber, Rodney J.; Journal of Geophysical Research; November 21, 2006; Volume 111; 7 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNG04GB42G; NNG06GA78G; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/ 10.1029/2006JD007282

Aircraft measurements of fine inorganic aerosol composition were made with a particle-into-liquid sampler coupled to dual ion chromatographs (PILS-IC) as part of the NASA INTEX-NA study. The sampling campaign, which lasted from 1 July to 14 August 2004, centered over the eastern USA and Canada and showed that sulfate was the dominant inorganic species measured. The highest sulfate concentrations were observed at altitudes below 2 km, and back trajectory analyses showed a distinct difference between air masses that had or had not intercepted the Ohio River valley (ORV) region. Air masses encountered below 2 km with a history over the ORV had sulfate concentrations that were higher by a factor of 3.2 and total sulfur (S) concentrations higher by 2.5. The study's highest sulfate concentrations were found in these air masses. The sulfur of the ORV air masses was also more processed with a mean sulfate to total sulfur molar ratio of 0.5 compared to 0.3 in non-ORV measurements. Results from a second, independent trajectory model agreed well with those from the primary analysis. These ORV-influenced air masses were encountered on multiple days and were widely spread across the eastern USA and western Atlantic region.

Author

Aerosols; Sulfates; Sulfur; United States; Air Pollution; Atmospheric Composition; Pollution Transport

20080014185 Georgia Inst. of Tech., Atlanta, GA, USA

Fine Aerosol Bulk Composition Measured on WP-3D Research Aircraft in Vicinity of the Northeastern USA - Results from NEAQS

Peltier, R. E.; Sullivan, A. P.; Weber, R. J.; Brock, C. A.; Wollny, A. G.; Holloway, J. S.; deGouw, J. A.; Warneke, C.; Atmospheric Chemistry and Physics; June 25, 2007; Volume 7, pp. 3231-3247; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNG04GB42G; Copyright; Avail.: Other Sources

During the New England Air Quality Study (NEAQS) in the summer of 2004, airborne measurements were made of the major inorganic ions and the water-soluble organic carbon (WSOC) of the submicron (PM(sub 1.0)) aerosol. These and ancillary data are used to describe the overall aerosol chemical characteristics encountered during the study. Fine particle mass was estimated from particle volume and a calculated density based on measured particle composition. Fine particle organic matter (OM) was estimated from WSOC and a mass balance analysis. The aerosol over the northeastern USA (U.S.) and Canada was predominantly sulfate and associated ammonium, and organic components, although in unique plumes additional ionic components were also periodically above detection limits. In power generation regions, and especially in the Ohio River Valley region, the aerosol tended to be predominantly sulfate (approximately 60% micro gram /micro gram) and apparently acidic, based on an excess of measured anions compared to cations. In all other regions where sulfate concentrations were lower and a smaller fraction of overall mass, the cations and anions were balanced suggesting a more neutral aerosol. In contrast, the WSOC and estimated OM were more spatially uniform and the fraction of OM relative to PM mass was largely influenced by sources of sulfate. The study median OM mass fraction was 40%. Throughout the study region, sulfate and organic aerosol mass were highest near the surface and decreased rapidly with increasing altitude. The relative fraction of organic mass to sulfate was similar throughout all altitudes within the boundary layer (altitude less than 2.5 km), but was significantly higher at altitude layers in the free troposphere (above 2.5 km). A number of distinct biomass burning plumes from fires in Alaska and the Yukon were periodically intercepted, mostly at altitudes between 3 and 4 km. These plumes were associated with highest aerosol concentrations of the study and were largely comprised of organic aerosol components (approximtely 60%).

Author

Aerosols; Ammonium Compounds; New England (US); Sulfates; Air Pollution; Atmospheric Chemistry; Atmospheric Composition

20080014231 NASA Langley Research Center, Hampton, VA, USA

Workshop on the Impacts of Aviation on Climate Change

Wuebbles, Don; Gupta, Mohan; Ko, Malcolm; December 12, 2006; 11 pp.; In English; 2006 AGU Fall Meeting, 11-15 Dec. 2006, San Francisco, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 305311.01.07.53; Copyright; Avail.: CASI: A03, Hardcopy

Projections indicate that demand for aviation transportation will increase by more than two fold over the next few decades. Timely action is needed to understand and quantify the potential climate impacts of aviation emissions particularly given the sustained lapse over the last several years in U.S. research activities in this area. In response to the stated needs, a group of international experts participated in the Workshop on the Impacts of Aviation on Climate Change during June 7-9, 2006 in Boston, MA. The workshop focus was on the impacts of subsonic aircraft emissions in the UT/LS region and on the potential response of the climate system. The goals of the workshop were to assess and document the present state of scientific knowledge, to identify the key underlying uncertainties and gaps, to identify ongoing and further research needed, to explore the development of climate impact metrics, and to help focus the scientific community on the aviation-climate change research needs. The workshop concluded that the major ways that aviation can affect climate, in agreement with the 1999 assessment by the Intergovernmental Panel on Climate Change (IPCC), are the direct climate effects from CO2 and water vapor emissions, the indirect forcing on climate resulting from changes in the distributions and concentrations of ozone and methane as a primary consequence of aircraft nitrogen oxide (NOx) emissions, the direct effects (and indirect effects on clouds) from emitted aerosols and aerosol precursors, and the climate effects associated with contrails and cirrus cloud formation. The workshop was organized in three subgroups: (1) Effects of aircraft emissions on the UT/LS chemical composition, (2) Effects of water and particle emissions on contrails and on cirrus clouds, and (3) Impacts on climate from aircraft emissions and identification of suitable metrics to measure these impacts. The workshop participants acknowledged the need for focused research specifically to address the uncertainties and gaps in our understanding of current and projected impacts of aviation on climate and to develop metrics to better characterize these impacts. This may entail coordination and/or expansion of

existing and planned climate research programs, or new activities. Such efforts should include strong and continuing interactions among the science and aviation communities as well as policymakers to develop well-informed decisions.
Author
Climate Change; Exhaust Emission; Civil Aviation; Air Transportation; Air Pollution

46
GEOPHYSICS

Includes Earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see *47 Meteorology and Climatology*; and *93 Space Radiation*.

20080013389 NASA Langley Research Center, Hampton, VA, USA
Empirical Storm-Time Correction to the International Reference Ionosphere Model E-Region Electron and Ion Density Parameterizations Using Observations from TIMED/SABER
Mertens, Christoper J.; Winick, Jeremy R.; Russell, James M., III; Mlynczak, Martin G.; Evans, David S.; Bilitza, Dieter; Xu, Xiaojing; September 17, 2007; 12 pp.; In English; SPIE Europe Remote Sensing 2007, 17-20 Sep. 2007, Florence, Italy; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNH06DA001N; WBS 936723.02.01.03.81
Report No.(s): Paper 6745-41; Copyright; Avail.: CASI: A03, Hardcopy

The response of the ionospheric E-region to solar-geomagnetic storms can be characterized using observations of infrared 4.3 micrometers emission. In particular, we utilize nighttime TIMED/SABER measurements of broadband 4.3 micrometers limb emission and derive a new data product, the NO+(v) volume emission rate, which is our primary observation-based quantity for developing an empirical storm-time correction the IRI E-region electron density. In this paper we describe our E-region proxy and outline our strategy for developing the empirical storm model. In our initial studies, we analyzed a six day storm period during the Halloween 2003 event. The results of this analysis are promising and suggest that the ap-index is a viable candidate to use as a magnetic driver for our model.
Author
E Region; Ion Density (Concentration); Electron Density (Concentration); Radiation Measuring Instruments; Solar Storms; Magnetic Storms; Ionospheres

20080013469 NASA Langley Research Center, Hampton, VA, USA
Dust Modeling with GEOS-Chem: Evidence for Acidic Uptake on Dust Surfaces during INTEX-B
Fairlie, T. Duncan; April 11, 2007; 20 pp.; In English; 3rd GEOS-Chem Users' Group Meeting, 11-13 Apr. 2007, Cambridge, MA, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 281.02.39.01.04; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013469

We use measurements of aerosol ion composition and size made from the DC8 aircraft during the 2006 INTEX-B airborne campaign to identify mineral dust signatures, and look for evidence for interaction of dust with acidic components. Coating of dust with sulfate or nitrate favors the role of dust particles as cloud condensation nucleii, can promote further uptake of SO2 and N2O5, can impact NOx/HNO3 partitioning, and can shift sulfate or nitrate towards larger sizes, affecting atmospheric lifetimes for both aerosol and gas components. Mineral dust had a pervasive presence on flights made during the Northern Pacific deployment of the INTEX-B mission. We use scatter plots of ion mixing ratios with Na+ and Ca(2+) to distinguish sea salt and mineral components of the aerosol distribution, respectively. Positive correlations of non-sea-salt sulfate and nitrate with calcium indicate that the dusty air stream is associated with polluted air masses. Sulfate-ammonium scatter plots indicate sulfate to be primarily in the form of (NH4)2SO4. A positive correlation between Ca(2+) and NO-, but little evidence of NH4NO3, suggests that NO3- may be associated with mineral dust surfaces. 3-d model simulations conducted with the GEOS-Chem chemical transport model indicate that transpacific transport from East Asia was principally responsible for the dust observed from the aircraft over the Pacific. We compare the aerosol component relationships in the model with those observed. Uptake of sulfate and nitrate on the dust is not yet represented in the model.
Author
Aerosols; Dust; Atmospheric Chemistry; Pollution Transport; Chemical Composition; Acids

20080013483 NASA Johnson Space Center, Houston, TX, USA

Basaltic Clasts in Y-86032 Feldspathic Lunar Meteorite: Ancient Volcanism far from the Procellarum Kreep Terrane

Yamaguchi, A.; Takeda, H.; Nyquist, L. E.; Bogard, D.; Karouji, Y.; Ebihara, M.; March 10, 2008; 2 pp.; In English; 39th Lunar and Planetary Science Conference, 10-14 Mar. 2008, League City, TX, USA; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Lunar meteorite, Y-86032 is a fragmental or regolith breccia enriched in Al2O3 (28-31 wt%) and having very low concentrations of REEs and Th, U [e.g., 1]. Nyquist et al. [2] suggested that Y- 86032 contains a variety of lithologies not represented by the Apollo samples. They found clasts with old Ar-Ar ages and an ancient Sm-Nd age, and negative Nd indicating a direct link to the primordial magma ocean. Importantly, the final lithification of the Y-86032 breccia was likely >3.8-4.1 Ga ago. Therefore, any lithic components in the breccia formed prior to 3.8 Ga, and lithic components in breccia clasts in the parent breccia formed even earlier. Here we report textures and mineralogy of basaltic and gabbroic clasts in Y-86032 to better understand the nature of ancient lunar volcanism far from the Procellarum KREEP Terrain (PKT) [3] and the central nearside.

Author

Basalt; Metamorphism (Geology); Aluminum Oxides; Lithology; Volcanology; Regolith; Meteorites; Mineralogy; Breccia

20080013498 NASA Langley Research Center, Hampton, VA, USA

Intercomparisons of Aura MLS, ACE, and HALOE Observations of Long-Lived Trace Species Using the Langley Lagrangian Chemistry and Transport Model

Considine, David B.; Natarajan, Murali; Fairlie, T. D.; Lingenfelser, Gretchen S.; Bernath, Peter; [2007]; 1 pp.; In English; Aura Fall Science Team Meeting, 1-5 Oct. 2007, Pasadena, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 281945.02.34.01.07; Copyright; Avail.: CASI: A01, Hardcopy

We use the LaRC Lagrangian Chemistry and Transport Model (LCTM) [Considine et al., 2007; Pierce et al., 2003] to intercompare ACE, Aura, and HALOE observations of long-lived trace species. The LCTM calculates the transport, mixing, and photochemical evolution of an ensemble of parcels that have been initialized from ACE-FTS measurements. Here we focus on late November, 2004 comparisons, due to the previous 3-week period of continuous HALOE observations and MLS v2.2 data on November 29, 2004.

Derived from text

Halogen Occultation Experiment; Lagrangian Function; Trace Elements; Advanced Composition Explorer; Geophysics; Transport Theory

20080013513 NASA Langley Research Center, Hampton, VA, USA

Performance of a Borehole X-ray Fluorescence Spectrometer for Planetary Exploration

Kelliher, Warren C.; Carlberg, Ingrid A.; Elam, W. T.; Willard-Schmoe, Ella; March 2008; 9 pp.; In English; 2008 IEEE Aerospace Conference, 1-8 Mar. 2008, Big Sky, MT, USA; Original contains color illustrations

Contract(s)/Grant(s): NNL05AA49C; WBS 627795.04.09.02; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080013513

We have designed and constructed a borehole X-ray Fluorescence Spectrometer (XRFS) as part of the Mars Subsurface Access program [1]. It can be used to determine the composition of the Mars regolith at various depths by insertion into a pre-drilled borehole. The primary requirements and performance metrics for the instrument are to obtain parts-per-million (ppm) lower limits of detection over a wide range of elements in the periodic table (Magnesium to Lead). Power consumption during data collection was also measured. The prototype instrument is complete and preliminary testing has been performed. Terrestrial soil Standard Reference Materials were used as the test samples. Detection limits were about 10 weight ppm for most elements, with light elements being higher, up to 1.4 weight percent for magnesium. Power consumption (excluding ground support components) was 12 watts.

Author

X Ray Fluorescence; Boreholes; Space Exploration; Mars Surface; Spectrometers; Regolith; Planetary Geology

20080013566 NASA Marshall Space Flight Center, Huntsville, AL, USA

A Semi-Empirical Model for Forecasting Relativistic Electrons at Geostationary Orbit

Lyatsky, Wladislaw; Khazanov, George V.; January 20, 2008; 7 pp.; In English; Fifth Space Weather Symposium, 20-23 Jan. 2008, New Orleans, LA, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080013566

We developed a new prediction model for forecasting relativistic (>2MeV) electrons, which provides a VERY HIGH

correlation between predicted and actually measured electron fluxes at geostationary orbit. This model implies the multi-step particle acceleration and is based on numerical integrating two linked continuity equations for primarily accelerated particles and relativistic electrons. The model includes a source and losses, and used solar wind data as only input parameters. We used the coupling function which is a best-fit combination of solar wind/Interplanetary Magnetic Field parameters, responsible for the generation of geomagnetic activity, as a source. The loss function was derived from experimental data. We tested the model for four year period 2004-2007. The correlation coefficient between predicted and actual values of the electron fluxes for whole four year period as well as for each of these years is about 0.9. The high and stable correlation between the computed and actual electron fluxes shows that the reliable forecasting these electrons at geostationary orbit is possible. The correlation coefficient between predicted and actual electron fluxes is stable and incredibly high.
Author
Relativistic Particles; High Energy Electrons; Geosynchronous Orbits; Particle Acceleration; Solar Wind; Interplanetary Magnetic Fields; Geomagnetism; Forecasting

20080013567 NASA Marshall Space Flight Center, Huntsville, AL, USA
3D RMHD Simulations of Magnetized Spine-Sheath Relativistic Jets
Mizuno, Yosuke; Hardee, Philip; Nishikawa, Ken-Ichi; January 08, 2008; 1 pp.; In English; Accretion and Outflow in Astrophysics 2008, 8-11 Jan. 2008, Kyoto, Japan; Copyright; Avail.: Other Sources; Abstract Only

We have performed numerical simulations of weakly and strongly magnetized relativistic jets embedded in a weakly and strongly magnetized stationary or mildly relativistic (0.5c) sheath flow using the RAISHIN code. In the numerical simulations a jet with Lorentz factor gamma=2.5 is processed to break the initial equilibrium configuration. Results of the numerical simulations are compared to theoretical predictions from a normal mode analysis of the linearized RMHD equations describing a uniform axially magnetized cylindrical relativistic jet embedded in a uniform axially magnetized sheath flow. The prediction of increased stability of a weakly-magnetized system with mildly relativistic sheath flow to Kelvin-Helmholtz instabilities and the stabilization of a strongly magnetized system with mildly relativistic sheath flow is confirmed by the numerical simulations.
Author
Uniform Flow; Relativistic Particles; Magnetohydrodynamic Flow; Sheaths; Kelvin-Helmholtz Instability; Cylindrical Bodies

20080014083 NASA Marshall Space Flight Center, Huntsville, AL, USA
Discovering the Ancient Maya from Space
Sever, T. L.; January 05, 2008; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

The Pet6n region of northern Guatemala contains some of the most significant Mayan archeological sites in Latin America. It was in this region that the Maya civilization began, flourished, and abruptly disappeared. Remote sensing technology is helping to locate and map ancient Maya sites that are threatened today by accelerating deforestation and looting. Thematic Mapper, IKONOS, and QuickBird satellite, and airborne STAR-3i and AIRSAR radar data, combined with Global Positioning System (GPS) technology, are successfully detecting ancient Maya features such as sites, roadways, canals, and water reservoirs. Satellite imagery is also being used to map the bajos, which are seasonally flooded swamps that cover over 40% of the land surface. Through the use of various airborne and satellite sensor systems we have been able to detect and map ancient causeways, temples, reservoirs, and land forms, and locate these features on the ground through GPS technology. Recently, we have discovered that there is a strong relationship between a tropical forest vegetation signature in satellite imagery and the location of archeological sites. We believe that the use of limestone and lime plasters in ancient Maya construction affects the moisture, nutrition, and plant species of the surface vegetation. We have mapped these vegetation signatures in the imagery and verified through field survey that they are indicative of archeological sites. Through the use of remote sensing and GIS technology it is possible to identify unrecorded archeological features in a dense tropical forest environment and monitor these cultural features for their protection.
Author
Remote Sensing; Thematic Mappers (Landsat); Satellite Imagery; Global Positioning System; Archaeology

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20080013441 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Year of Coordinated Observations, Modeling and Forecasting: Addressing the Challenge of Organized Tropical Convection
Waliser, Duane E.; October 23, 2006; 14 pp.; In English; WCRP Working Group on Numerical Experimentation (WGNE) Meeting, and ANGEWEX Workshop, Boulder, Colorado, October 23 - 27, 2006 and October 9, 2006, 23-27 Oct. 2006, Boulder, CO, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40723

The multi-scale organization of tropical convection and scale interaction are grand challenges in the prediction of weather and climate. As part of a international effort UN Year of Planet Earth, this proposed effort to observe, model and forecast the effects of organized tropical convection is reviewed. This viewgraph presentation reviews the proposal.
CASI
Climate; Convection; Climatology; Tropical Meteorology; Atmospheric General Circulation Models

20080013452 Meteorological Satellite Center, Tokyo, Japan
Monthly Report of the Meteorological Satellite Center: October 2007
October 2007; In English; Copyright; Avail.: Other Sources

This CD-ROM concerning the August 2007 Monthly Report of the Meteorological Satellite Center (MSC) contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the Polar Orbital Meteorological Satellites operated by NOAA. The CD-ROM contains the following observation data: Full Disk Earth's Cloud Image; Cloud Image of Japan and its vicinity; Cloud Amount; Sea Surface Temperature; Cloud Motion Wind; Water Vapor Motion Wind; Equivalent Blackbody Temperature; OLR (Out-going Longwave Radiation), Solar Radiation; Snow and Ice Index; Orbit Data; Attitude Data; VISSR Image Data Catalog (Cartridge Magnetic Tape (CMT), Micro Film); TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water; and TOVS Total Ozone Amount
CASI
Atmospheric Sounding; Japan; Satellite Observation; Satellite Sounding; Meteorological Parameters

20080013472 NASA Langley Research Center, Hampton, VA, USA
Geosynchronous Imaging Fourier Transform Spectrometer (GIFTS): Imaging and Tracking Capability
Zhou, D. K.; Larar, A. M.; Liu, Xu; Reisse, R. A.; Smith, W. L.; Revercomb, H. E.; Bingham, G. E.; Zollinger, L. J.; Tansock, J. J.; Huppi, Ronald J.; [2007]; 3 pp.; In English; IGARSS 2007- 27th IEEE International Geoscience and Remote Sensing Symposium, 23-27 Jul. 2007, Barcelona, Spain; Original contains color illustrations
Contract(s)/Grant(s): WBS 5341730207943802; Copyright; Avail.: CASI: A01, Hardcopy

The geosynchronous-imaging Fourier transform spectrometer (GIFTS) engineering demonstration unit (EDU) is an imaging infrared spectrometer designed for atmospheric soundings. It measures the infrared spectrum in two spectral bands (14.6 to 8.8 microns, 6.0 to 4.4 microns) using two 128 128 detector arrays with a spectral resolution of 0.57/cm with a scan duration of approx. 11 seconds. From a geosynchronous orbit, the instrument will have the capability of taking successive measurements of such data to scan desired regions of the globe, from which atmospheric status, cloud parameters, wind field profiles, and other derived products can be retrieved. The GIFTS EDU provides a flexible and accurate testbed for the new challenges of the emerging hyperspectral era. The EDU ground-based measurement experiment, held in Logan, Utah during September 2006, demonstrated its extensive capabilities and potential for geosynchronous and other applications (e.g., Earth observing environmental measurements). This paper addresses the experiment objectives and overall performance of the sensor system with a focus on the GIFTS EDU imaging capability and proof of the GIFTS measurement concept.
Author
Atmospheric Sounding; Geosynchronous Orbits; Fourier Transformation; Remote Sensing; Spectral Resolution; Imaging Spectrometers

20080013549 NASA Marshall Space Flight Center, Huntsville, AL, USA
Determination of a Limited Scope Network's Lightning Detection Efficiency
Rompala, John T.; Blakeslee, R.; January 20, 2008; 1 pp.; In English; AMS 88th Annual Meeting, 20-24 Jan. 2008, New Orleans, LA, USA; No Copyright; Avail.: Other Sources; Abstract Only

This paper outlines a modeling technique to map lightning detection efficiency variations over a region surveyed by a

sparse array of ground based detectors. A reliable flash peak current distribution (PCD) for the region serves as the technique's base. This distribution is recast as an event probability distribution function. The technique then uses the PCD together with information regarding: site signal detection thresholds, type of solution algorithm used, and range attenuation; to formulate the probability that a flash at a specified location will yield a solution. Applying this technique to the full region produces detection efficiency contour maps specific to the parameters employed. These contours facilitate a comparative analysis of each parameter's effect on the network's detection efficiency. In an alternate application, this modeling technique gives an estimate of the number, strength, and distribution of events going undetected. This approach leads to a variety of event density contour maps. This application is also illustrated. The technique's base PCD can be empirical or analytical. A process for formulating an empirical PCD specific to the region and network being studied is presented. A new method for producing an analytical representation of the empirical PCD is also introduced.
Author
Lightning; Signal Detection; Current Distribution; Probability Theory; Relief Maps; Distribution Functions

20080013550 NASA Marshall Space Flight Center, Huntsville, AL, USA
Geostationary Lightning Mapper for GOES-R and Beyond
Goodman, Steven J.; Blakeslee, R. J.; Koshak, W.; January 20, 2008; 2 pp.; In English; AMS 88th Annual Meeting, 20-24 Jan. 2008, New Orleans, LA, USA; No Copyright; Avail.: Other Sources; Abstract Only

The Geostationary Lightning Mapper (GLM) is a single channel, near-IR imager/optical transient event detector, used to detect, locate and measure total lightning activity over the full-disk as part of a 3-axis stabilized, geostationary weather satellite system. The next generation NOAA Geostationary Operational Environmental Satellite (GOES-R) series with a planned launch readiness in December 2014 will carry a GLM that will provide continuous day and night observations of lightning from the west coast of Africa (GOES-E) to New Zealand (GOES-W) when the constellation is fUlly operational. The mission objectives for the GLM are to 1) provide continuous, full-disk lightning measurements for storm warning and nowcasting, 2) provide early warning of tornadic activity, and 3) accumulate a long-term database to track decadal changes of lightning. The GLM owes its heritage to the NASA Lightning Imaging Sensor (1997-Present) and the Optical Transient Detector (1995-2000), which were developed for the Earth Observing System and have produced a combined 13 year data record of global lightning activity. Instrument formulation studies were completed in March 2007 and the implementation phase to develop a prototype model and up to four flight models will be underway in the latter part of 2007. In parallel with the instrument development, a GOES-R Risk Reduction Team and Algorithm Working Group Lightning Applications Team have begun to develop the Level 2 algorithms and applications. Proxy total lightning data from the NASA Lightning Imaging Sensor on the Tropical Rainfall Measuring Mission (TRMM) satellite and regional test beds (e.g., Lightning Mapping Arrays in North Alabama and the Washington DC Metropolitan area) are being used to develop the pre-launch algorithms and applications, and also improve our knowledge of thunderstorm initiation and evolution. Real time lightning mapping data are being provided in an experimental mode to selected National Weather Service (NWS) forecast offices in Southern and Eastern Region. This effort is designed to help improve our understanding of the application of these data in operational settings.
Author
Earth Observing System (EOS); Geosynchronous Orbits; GOES Satellites; Early Warning Systems; Lightning; Tornadoes; TRMM Satellite; Thunderstorms

20080013554 NASA Marshall Space Flight Center, Huntsville, AL, USA
Sea State and Weather Capability for NASA's Constellation Program
Barbre, R. E.; Keller, V. W.; January 20, 2008; 13 pp.; In English; AMS 88th Annual Meeting: 13th Conference on Aviation, Range, and Aerospace Meteorology, 20-24 Jan. 2008, New Orleans, LA, USA; Original contains color illustrations
Contract(s)/Grant(s): NNM05AB50C; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013554

Marine weather and related parameters such as wind, ocean wave height and period, air temperature, sea surface temperature, visibility, and potential for icing are critical to the design, operation, and safety of crewed space vehicles. The National Aeronautics and Space Administration's (NASA's) Constellation Program requires detailed assessment of marine weather related parameters that may be encountered during launch, abort, landing, and crew rescue operations for the crewed Axes/Orion space vehicles. This information is required for both space vehicle design and operational purposes. The space vehicles must be designed such that they cam withstand the environment they are likely to encounter. The crewed Axes/Orion space vehicles will launch from NASA's Kennedy Space Center (KSC), Florida for both International Space Station (ISS) missions with 51.6deg inclination orbits and lunar missions with approximately 280 inclination orbits. Since both missions will fly ever the Atlantic Ocean on ascent to orbit and will fly over the Pacific Ocean on descent from orbit, an unlikely but

possible emergency abort could require parachuting the Orion capsule and crew into the ocean. This situation could potentially put the crew in an isolated and hazardous environment for severn hours while they await rescue. Therefore, abort, landing, and crew rescue elements of the Constellation Program must address weather related parameters on a global scale. This paper describes buoy measurement data, sea surface temperature satellite data, and sea state computer model data that are being utilized by the Constellation Program to address these design and operational issues.
Author
Sea States; Marine Meteorology; Air Water Interactions; Ocean Surface; Sea Surface Temperature; Ice Formation; Spacecraft Models; Rescue Operations; Ascent; Launching; Constellation Program

20080013555 Raytheon Co., Huntsville, AL, USA; NASA Marshall Space Flight Center, Huntsville, AL, USA
Development of a New Data Tool for Computing Launch and Landing Availability with Respect to Surface Weather
Burns, K. Lee; Altino, Karen; January 18, 2008; 20 pp.; In English; 12th Aviation, Range, and Aerospace Meteorology Conference, 18-23 Jan. 2008, New Orleans, LA, USA; Original contains color illustrations
Contract(s)/Grant(s): NNM05AB50C; Copyright; Avail.: CASI: A03, Hardcopy

The Marshall Space Flight Center Natural Environments Branch has a long history of expertise in the modeling and computation of statistical launch availabilities with respect to weather conditions. Their existing data analysis product, the Atmospheric Parametric Risk Assessment (APRA) tool, computes launch availability given an input set of vehicle hardware and/or operational weather constraints by calculating the climatological probability of exceeding the specified constraint limits, APRA has been used extensively to provide the Space Shuttle program the ability to estimate impacts that various proposed design modifications would have to overall launch availability. The model accounts for both seasonal and diurnal variability at a single geographic location and provides output probabilities for a single arbitrary launch attempt. Recently, the Shuttle program has shown interest in having additional capabilities added to the APRA model, including analysis of humidity parameters, inclusion of landing site weather to produce landing availability, and concurrent analysis of multiple sites, to assist in operational landing site selection. In addition, the Constellation program has also expressed interest in the APRA tool, and has requested several additional capabilities to address some Constellation-specific issues, both in the specification and verification of design requirements and in the development of operations concepts. The combined scope of the requested capability enhancements suggests an evolution of the model beyond a simple revision process. Development has begun for a new data analysis tool that will satisfy the requests of both programs. This new tool, Probabilities of Atmospheric Conditions and Environmental Risk (PACER), will provide greater flexibility and significantly enhanced functionality compared to the currently existing tool.
Author
Risk; Landing Aids; Launching; Meteorology; Diurnal Variations; Probability Theory; Climatology; Assessments; Annual Variations

20080013556 National Oceanic and Atmospheric Administration, USA; NASA Marshall Space Flight Center, Huntsville, AL, USA
Pre-Launch Algorithms and Risk Reduction in Support of the Geostationary Lightning Mapper for GOES-R and Beyond
Goodman, Steven; Blakeslee, Richard; Koshak, William; January 20, 2008; 2 pp.; In English; 88th AMS Annual Meeting, 20-24 Jan. 2008, New Orleans, LA, USA; Copyright; Avail.: Other Sources; Abstract Only

The Geostationary Lightning Mapper (GLM) is a single channel, near-IR optical transient event detector, used to detect, locate and measure total lightning activity over the full-disk as part of a 3-axis stabilized, geostationary weather satellite system. The next generation NOAA Geostationary Operational Environmental Satellite (GOES-R) series with a planned launch in 2014 will carry a GLM that will provide continuous day and night observations of lightning from the west coast of Africa (GOES-E) to New Zealand (GOES-W) when the constellation is fully operational. The mission objectives for the GLM are to 1) provide continuous,full-disk lightning measurements for storm warning and Nowcasting, 2) provide early warning of tornado activity, and 3) accumulate a long-term database to track decadal changes of lightning. The GLM owes its heritage to the NASA Lightning Imaging Sensor (1997-Present) and the Optical Transient Detector (1995-2000), which were developed for the Earth Observing System and have produced a combined 13 year data record of global lightning activity. Instrument formulation studies were completed in March 2007 and the implementation phase to develop a prototype model and up to four flight units is expected to begin in latter part of the year. In parallel with the instrument development, a GOES-R Risk Reduction Team and Algorithm Working Group Lightning Applications Team have begun to develop the Level 2B algorithms and applications. Proxy total lightning data from the NASA Lightning Imaging Sensor on the Tropical Rainfall Measuring Mission (TRMM) satellite and regional test beds (e.g., Lightning Mapping Arrays in North Alabama and the

Washington DC Metropolitan area) are being used to develop the pre-launch algorithms and applications, and also improve our knowledge of thunderstorm initiation and evolution. Real time lightning mapping data provided to selected National Weather Service forecast offices in Southern and Eastern Region are also improving our understanding of the application of these data in the severe storm warning process and help to accelerate the development of the pre-launch algorithms and Nowcasting applications.
Author
GOES Satellites; Algorithms; Lightning

20080013565 NASA Marshall Space Flight Center, Huntsville, AL, USA
Simulation of the Impact of New Aircraft and Satellite-Based Ocean Surface Wind Measurements on H*Wind Analyses
Miller, TImothy L.; Atlas, R. M.; Black, P. G.; Case, J. L.; Chen, S. S.; Hood, R. E.; Johnson, J. W.; Jones, L.; Ruf, C. S.; Uhlborn, E. W.; January 20, 2008; 8 pp.; In English; 12th Conference on IOAS-AOLS as part of the 2008 AMS 88th Annual Meeting, 20-24 Jan. 2008, New Orleans, LA, USA; Original contains black and white illustrations; Copyright; Avail.:
CASI: A02, Hardcopy

Accurate observations of surface ocean vector winds (OVW) with high spatial and temporal resolution are required for understanding and predicting tropical cyclones. As NASA's QuikSCAT and Navy's WindSat operate beyond their design life, many members of the weather and climate science communities recognize the importance of developing new observational technologies and strategies to meet the essential need for OVW information to improve hurricane intensity and location forecasts. The Hurricane Imaging Radiometer (HIRAD) is an innovative technology development which offers new and unique remotely sensed satellite observations of both extreme oceanic wind events and strong precipitation. It is based on the airborne Stepped Frequency Microwave Radiometer (SFMR), which is the only proven remote sensing technique for observing tropical cyclone (TC) ocean surface wind speeds and rain rates. The proposed HIRAD instrument advances beyond the current nadir viewing SFMR to an equivalent wide-swath SFMR imager using passive microwave synthetic thinned aperture radiometer (STAR) technology. This sensor will operate over 4-7 GHz (C-band frequencies) where the required TC remote sensing physics has been validated by both SFMR and WindSat radiometers. The instrument is described in more detail in a paper by Jones et al. presented to the Tropical Meteorology Special Symposium at this AMS Annual Meeting. Simulated HIRAD passes through a simulation of hurricane Frances are being developed to demonstrate HIRAD estimation of surface wind speed over a wide swath in the presence of heavy rain. These are currently being used in 'quick' OSSEs (Observing System Simulation Experiments) with H'Wind analyses as the discriminating tool. The H'Wind analysis, a product of the Hurricane Research Division of NOAA's Atlantic , Oceanographic and Meteorological Laboratory, brings together wind measurements from a variety of observation platforms into an objective analysis of the distribution of wind speeds in a tropical cyclone. This product is designed to improve understanding of the extent and strength of the wind field, and to improve the assessment of hurricane intensity. See http://www.aoml.noaa._ov/hrd/data sub/wind.html. Observations have been simulated from both aircraft altitudes and space. The simulated flight patterns for the aircraft platform cases have been designed to duplicate the timing and flight patterns used in routine NOAA and USAF hurricane surveillance flights, and the spaceborne case simulates a TRMM orbit and altitude.
Author
Ocean Surface; Velocity Distribution; Wind Measurement; Temporal Resolution; Spatial Resolution; Tropical Storms; Cyclones; Wind Velocity; Precipitation (Meteorology)

20080013576 Stanley Associates, Inc., Arlington, VA, USA
Simulation of Ground Winds Time Series
Adelfant, S. I.; January 20, 2008; 4 pp.; In English; 88th American Meteorological Society Annual Meeting, 20-24 Jan. 2008, New Orleans, LA, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NNM04AA02C; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013576

A simulation process has been developed for generation of the longitudinal and lateral components of ground wind atmospheric turbulence as a function of mean wind speed, elevation, temporal frequency range and distance between locations. The distance between locations influences the spectral coherence between the simulated series at adjacent locations. Short distances reduce correlation only at high frequencies; as distances increase correlation is reduced over a wider range of frequencies. The choice of values for the constants d1 and d3 in the PSD model is the subject of work in progress. An improved knowledge of the values for zO as a function of wind direction at the ARES-1 launch pads is necessary for definition of d1. Results of other studies at other locations may be helpful as summarized in Fichtl's recent correspondence. Ideally, further research is needed based on measurements of ground wind turbulence with high resolution anemometers at a number of

altitudes at a new KSC tower located closer to the ARES-1 launch pad .The proposed research would be based on turbulence measurements that may be influenced by surface terrain roughness that may be significantly different from roughness prior to 1970 in Fichtl's measurements. Significant improvements in instrumentation, data storage end processing will greatly enhance the capability to model ground wind profiles and ground wind turbulence.
Author
Wind Profiles; Turbulent Flow; Simulation; Wind Velocity; Ares 1 Launch Vehicle; Flow Measurement; Ground Wind

20080013597 NASA Marshall Space Flight Center, Huntsville, AL, USA
Earth Global Reference Atmospheric Model 2007 (Earth-GRAM07) Applications for the NASA Constellation Program
Leslie, Fred W.; Justus, C. G.; January 20, 2008; 15 pp.; In English; 13th Conference on Aviation, Range and Aerospace Meteorology/American Meteorological Society, 20-24 Jan. 2008, New Orleans, LA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

Engineering models of the atmosphere are used extensively by the aerospace community for design issues related to vehicle ascent and descent. The Earth Global Reference Atmosphere Model version 2007 (Earth-GRAM07) is the latest in this series and includes a number of new features. Like previous versions, Earth-GRAM07 provides both mean values and perturbations for density, temperature, pressure, and winds, as well as monthly- and geographically-varying trace constituent concentrations. From 0 km to 27 km, thermodynamics and winds are based on the National Oceanic and Atmospheric Administration Global Upper Air Climatic Atlas (GUACA) climatology. For altitudes between 20 km and 120 km, the model uses data from the Middle Atmosphere Program (MAP). Above 120 km, EarthGRAM07 now provides users with a choice of three thermosphere models: the Marshall Engineering Thermosphere (MET-2007) model; the Jacchia-Bowman 2006 thermosphere model (JB2006); and the Naval Research Labs Mass Spectrometer, Incoherent Scatter Radar Extended Model (NRL MSIS E-OO) with the associated Harmonic Wind Model (HWM-93). In place of these datasets, Earth-GRAM07 has the option of using the new 2006 revised Range Reference Atmosphere (RRA) data, the earlier (1983) RRA data, or the user may also provide their own data as an auxiliary profile. Refinements of the perturbation model are also discussed which include wind shears more similar to those observed at the Kennedy Space Center than the previous version Earth-GRAM99.
Author
Atmospheric Models; Climatology; Constellation Program; Earth Atmosphere; Reference Atmospheres; Perturbation; Thermosphere; Thermodynamics

20080013598 NASA Marshall Space Flight Center, Huntsville, AL, USA
Sea State and Weather Assessment Capability for NASA's Constellation Program
Barbre, B. J.; Keller, V. W.; January 20, 2008; 1 pp.; In English; 88th Annual American Meteorological Society Meeting, 20-24 Jan. 2008, New Orleans, LA, USA
Contract(s)/Grant(s): NNM05AB50C; No Copyright; Avail.: Other Sources; Abstract Only

Marine weather and related parameters such as wind, ocean wave height and period, air temperature, sea surface temperature, visibility, and potential for icing are critical to the design, operation, and safety of crewed space vehicles. The National Aeronautics and Space Administration's (NASA's) Constellation Program requires detailed assessment of marine weather related parameters that may be encountered during launch, abort, landing, and crew rescue operations for the crewed Ares/Orion space vehicles. This information is required for both space vehicle design and operational purposes. The space vehicles must be designed such that they can withstand the environment they are likely to encounter. The crewed Ares/Orion space vehicles will launch from NASA's Kennedy Space Center (KSC), Florida for both International Space Station (ISS) missions with 51.6 o inclination orbits and lunar missions with approximately 28 inclination orbits. Since both missions will fly over the Atlantic Ocean on ascent to orbit and will fly over the Pacific Ocean on descent from orbit, an unlikely but possible emergency abort could require parachuting the Orion capsule and crew into the ocean. This situation could potentially put the crew in an isolated and hazardous environment for several hours while they await rescue. Therefore, abort, landing, and crew rescue elements of the Constellation Program must address weather related parameters on a global scale. This paper describes buoy measurement data, sea surface temperature satellite data, and sea state computer model data that are being utilized by the Constellation Program to address these design and operational issues.
Author
Constellation Program; Sea Surface Temperature; Marine Meteorology; Ice Formation; Launching; Water Waves; Emergencies; Sea States

20080013600 NASA Langley Research Center, Hampton, VA, USA

Tropospheric Airborne Meteorological Data Reporting (TAMDAR) Overview

Daniels, Taumi S.; Moninger, William R.; Mamrosh, Richard D.; [2008]; 9 pp.; In English; 86th AMS Annual Meeting, 29 Jan. - 2 Feb. 2006, Atlanta, GA, USA; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080013600

This paper is an overview of the Tropospheric Airborne Meteorological Data Reporting (TAMDAR) project, giving some history on the project, various applications of the atmospheric data, and future ideas and plans. As part of NASA's Aviation Safety and Security Program, the TAMDAR project developed a small low-cost sensor that collects useful meteorological data and makes them available in near real time to improve weather forecasts. This activity has been a joint effort with FAA, NOAA, universities, and industry. A tri-agency team collaborated by developing a concept of operations, determining the sensor specifications, and evaluating sensor performance as reported by Moosakhanian et. al. (2006). Under contract with Georgia Tech Research Institute, NASA worked with AirDat of Raleigh, NC to develop the sensor. The sensor is capable of measuring temperature, relative humidity, pressure, and icing. It can compute pressure altitude, indicated and true air speed, ice accretion rate, wind speed and direction, peak and average turbulence, and eddy dissipation rate. The overall development process, sensor capabilities, and performance based on ground and flight tests is reported by Daniels (2002), Daniels et. al. (2004) and by Tsoucalas et. al. (2006). An in-service evaluation of the sensor was performed called the Great Lakes Fleet Experiment (GLFE), first reported by Moninger et. al. (2004) and Mamrosh et. al. (2005). In this experiment, a Mesaba Airlines fleet was equipped to collect meteorological data over the Great Lakes region during normal revenue-producing flights.

Derived from text

Meteorological Parameters; Troposphere; Airborne Radar; Civil Aviation; General Overviews; Data Acquisition

20080013602 NASA Langley Research Center, Hampton, VA, USA

A Multi-Year Data Set of Cloud Properties Derived for CERES from Aqua, Terra, and TRMM

Minnis, Patrick; Sunny Sun-Mack; Trepte, Quinz Z.; Yan Chen; Brown, Richard R.; Gibson, Sharon C.; Heck, Michael L.; Dong, Xiquan; Xi, Baike; [2007]; 6 pp.; In English; IGARSS 2006-2006 IEEE International Geoscience and Remote Sensing Symposium, 31 Jul. - 4 Aug. 2006, Denver, CO, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 23r622439t0101; Copyright; Avail.: Other Sources

The Clouds and Earth's Radiant Energy System (CERES) Project is producing a suite of cloud properties from high-resolution imagers on several satellites and matching them precisely with broadband radiance data to study the influence of clouds and radiation on climate. The cloud properties generally compare well with independent validation sources. Distinct differences are found between the CERES cloud properties and those derived with other algorithms from the same imager data. CERES products will be updated beginning in late 2006.

Author

Algorithms; Cloud Physics; TRMM Satellite; MODIS (Radiometry); Terra Spacecraft; Terrestrial Radiation

20080013606 Alabama Univ., Huntsville, AL, USA; NASA Marshall Space Flight Center, Huntsville, AL, USA

Application of the NASA A-Train to Evaluate Clouds Simulated by the Weather Research and Forecast Model

Molthan, Andrew L.; Jedlovec, Gary J.; Lapenta, William M.; January 20, 2008; 1 pp.; In English; 88th American Meteorological Society Annual Meeting, Symposium on Recent Developments in Atmospheric Applications of Radar and Lidar, 20-24 Jan. 2008, New Orleans, LA, USA; Copyright; Avail.: Other Sources; Abstract Only

The CloudSat Mission, part of the NASA A-Train, is providing the first global survey of cloud profiles and cloud physical properties, observing seasonal and geographical variations that are pertinent to evaluating the way clouds are parameterized in weather and climate forecast models. CloudSat measures the vertical structure of clouds and precipitation from space through the Cloud Profiling Radar (CPR), a 94 GHz nadir-looking radar measuring the power backscattered by clouds as a function of distance from the radar. One of the goals of the CloudSat mission is to evaluate the representation of clouds in forecast models, thereby contributing to improved predictions of weather, climate and the cloud-climate feedback problem. This paper highlights potential limitations in cloud microphysical schemes currently employed in the Weather Research and Forecast (WRF) modeling system. The horizontal and vertical structure of explicitly simulated cloud fields produced by the WRF model at 4-km resolution are being evaluated using CloudSat observations in concert with products derived from MODIS and AIRS. A radiative transfer model is used to produce simulated profiles of radar reflectivity given WRF input profiles of hydrometeor mixing ratios and ambient atmospheric conditions. The preliminary results presented in the paper will

compare simulated and observed reflectivity fields corresponding to horizontal and vertical cloud structures associated with midlatitude cyclone events.
Author
CloudSat; Artificial Clouds; Weather Forecasting; Meteorology; Models

20080013626 Universities Space Research Association, Huntsville, AL, USA
Use of High-Resolution WRF Simulations to Forecast Lightning Threat
McCaul, E. W., Jr.; LaCasse, K.; Goodman, S. J.; Cecil, D. J.; January 20, 2008; 2 pp.; In English; 88th American Meteorological Society Annual Meeting, 3rd Conference on Meteorological Applications of Lightning Data, 20-24 Jan. 2008, New Orleans, LA, USA; Copyright; Avail.: Other Sources; Abstract Only

Recent observational studies have confirmed the existence of a robust statistical relationship between lightning flash rates and the amount of large precipitating ice hydrometeors aloft in storms. This relationship is exploited, in conjunction with the capabilities of cloud-resolving forecast models such as WRF, to forecast explicitly the threat of lightning from convective storms using selected output fields from the model forecasts. The simulated vertical flux of graupel at -15C and the shape of the simulated reflectivity profile are tested in this study as proxies for charge separation processes and their associated lightning risk. Our lightning forecast method differs from others in that it is entirely based on high-resolution simulation output, without reliance on any climatological data. short [6-8 h) simulations are conducted for a number of case studies for which three-dmmensional lightning validation data from the North Alabama Lightning Mapping Array are available. Experiments indicate that initialization of the WRF model on a 2 km grid using Eta boundary conditions, Doppler radar radial velocity fields, and METAR and ACARS data y&eld satisfactory simulations. __nalyses of the lightning threat fields suggests that both the graupel flux and reflectivity profile approaches, when properly calibrated, can yield reasonable lightning threat forecasts, although an ensemble approach is probably desirable in order to reduce the tendency for misplacement of modeled storms to hurt the accuracy of the forecasts. Our lightning threat forecasts are also compared to other more traditional means of forecasting thunderstorms, such as those based on inspection of the convective available potential energy field.
Author
Lightning; Forecasting; Doppler Radar; Thunderstorms; High Resolution; Hydrometeors; Polarization (Charge Separation); Climatology; Statistical Correlation

20080013627 Universities Space Research Association, Huntsville, AL, USA
A Comparison of Lightning Flashes as Observed by the Lightning Imaging Sensor and the North Alabama Lightning Mapping Array
Bateman, M. G.; Mach, D. M.; McCaul, M. G.; Bailey, J. C.; Christian, H. J.; January 20, 2008; 1 pp.; In English; 88th American Meteorological Society Annual Meeting, 20-24 Jan. 2008, New Orleans, LA; Copyright; Avail.: Other Sources; Abstract Only

The Lightning Imaging Sensor (LIS) aboard the TRMM satellite has been collecting optical lightning data since November 1997. A Lightning Mapping Array (LMA) that senses VHF impulses from lightning was installed in North Alabama in the Fall of 2001. A dataset has been compiled to compare data from both instruments for all times when the LIS was passing over the domain of our LMA. We have algorithms for both instruments to group pixels or point sources into lightning flashes. This study presents the comparison statistics of the flash data output (flash duration, size, and amplitude) from both algorithms. We will present the results of this comparison study and show ‘point-level’ data to explain the differences. AS we head closer to realizing a Global Lightning Mapper (GLM) on GOES-R, better understanding and ground truth of each of these instruments and their respective flash algorithms is needed.
Author
Lightning; Imaging Techniques; Point Sources; Ground Truth; Sensory Perception; Very High Frequencies; Data Acquisition

20080013628 National Oceanic and Atmospheric Administration, Silver Spring, MD, USA; NASA Marshall Space Flight Center, Huntsville, AL, USA
Pre-Launch Algorithms and Risk Reduction in Support of the Geostationary Lightning Mapper for GOES-R and Beyond
Goodman, Steven; Blakeslee, Richard; Koshak, William; Petersen, Walt; Buechler, Dennis; Krehbiel, Paul; Gatlin, Patrick; Zubrick, Steven; January 20, 2008; 2 pp.; In English; 88th American Meteorological Society Annual Meeting, 3rd Conference on Meteorological Applications of Lightning Data, 20-24 Jan. 2008, New Orleans, LA, USA; Copyright; Avail.: Other Sources; Abstract Only

The Geostationary Lightning Mapper (GLM) is a single channel, near-IR optical transient event detector, used to detect,

locate and measure total lightning activity over the full-disk as part of a 3-axis stabilized, geostationary weather satellite system. The next generation NOAA Geostationary Operational Environmental Satellite (GOES-R) series with a planned launch in 2014 will carry a GLM that will provide continuous day and night observations of lightning from the west coast of Africa (GOES-E) to New Zealand (GOES-W) when the constellation is fully operational.The mission objectives for the GLM are to 1) provide continuous,full-disk lightning measurements for storm warning and Nowcasting, 2) provide early warning of tornadic activity, and 3) accumulate a long-term database to track decadal changes of lightning. The GLM owes its heritage to the NASA Lightning Imaging Sensor (1997-Present) and the Optical Transient Detector (1995-2000), which were developed for the Earth Observing System and have produced a combined 13 year data record of global lightning activity. Instrument formulation studies were completed in March 2007 and the implementation phase to develop a prototype model and up to four flight units is expected to begin in latter part of the year. In parallel with the instrument development, a GOES-R Risk Reduction Team and Algorithm Working Group Lightning Applications Team have begun to develop the Level 2B algorithms and applications. Proxy total lightning data from the NASA Lightning Imaging Sensor on the Tropical Rainfall Measuring Mission (TRMM) sate]lite and regional test beds (e.g., Lightning Mapping Arrays in North Alabama and the Washington DC Metropolitan area) are being used to develop the pre-launch algorithms and applications, and also improve our knowledge of thunderstorm initiation and evolution. Real time lightning mapping data provided to selected National Weather Service forecast offices in Southern and Eastern Region are also improving our understanding of the application of these data in the severe storm warning process and help to accelerate the development of the pre-launch algorithms and Nowcasting applications. Abstract for the 3 rd Conference on Meteorological

Author

Algorithms; Launching; Geosynchronous Orbits; TRMM Satellite; Real Time Operation; Thunderstorms; Near Infrared Radiation; Early Warning Systems; GOES Satellites

20080014108 NASA Langley Research Center, Hampton, VA, USA

Compact, Engineered 2-Micron Coherent Doppler Wind Lidar Prototype for Field and Airborne Evaluation

Kavaya, Michael J.; Amzajerdian, Farzin; Koch, Grady J.; June 27, 2006; 43 pp.; In English; 6th Annual NASA Earth Science Technology Conference - ESTC 2006, 27-29 Jun. 2006, College Park, MD, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 478643.02.05.04.05

Report No.(s): IIP-04-0072; Paper No. B1P5; Copyright; Avail.: CASI: A03, Hardcopy

The state-of-the-art 2-micron coherent Doppler wind lidar breadboard at NASA/LaRC will be engineered and compactly packaged consistent with future aircraft flights. The packaged transceiver will be integrated into a coherent Doppler wind lidar system test bed at LaRC. Atmospheric wind measurements will be made to validate the packaged technology. This will greatly advance the coherent part of the hybrid Doppler wind lidar solution to the need for global tropospheric wind measurements. Author

Doppler Radar; Optical Radar; Prototypes; Wind (Meteorology); Airborne Radar; Coherent Radar

20080014136 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Using Microwave Limb Sounder Data to Validate Model Ice Fields

Waliser, Duane E.; Li, Jui-Lin; Jiang, Jonathan H.; Tompkins, Adrian; Chern, J.-D.; Tao, W.-K.; Khairoutdinov, M.; November 13, 2006; 25 pp.; In English; ECMWF Cloud Workshop, 13-15 Nov. 2006, Reading, UK; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40724

MLS IWC overall tends to be higher relative to ECMWF after considering MLS track sampling and sensitivity (cutoff application). Disagreement tends to be accentuated over Indian and Western Pacific Oceans and over tropical landmasses. Large disagreement occur at upper level at 147 hPa but small at lower levels at 215 and 316 hPa suggesting the need to investigate the strength of model large-scale circulation and physics associated with the IWC formation. Future work includes: Present MMF/ECMWF Comparisons at AGU/Baltimore Session on MMF/Cloud Resolving Modeling, GMAO/GSFC & at the WPac/Bejing/AGU in Tao's Cloud-Radiation Session. Write-up Results on ECMWF/MLS Comparisons for GRL. Continue with MLS vs ECMWF Water Vapor & Temperature comparisons - will seek more interaction with other MLS colleagues. Investigate the Development of Biases in ECMWF Forecasts - i.e. in the actual model. Work with GMAO-5 development team regarding their cloud microphysics performance. Integrate CloudSat into IWC Analyses.

Derived from text

Microwave Landing Systems; Microwave Sounding; Weather Forecasting; Ice; Cloud Physics; CloudSat; Water Vapor

20080014145 NASA Langley Research Center, Hampton, VA, USA

Integrated Cloud-Aerosol-Radiation Product using CERES, MODIS, CALIPSO and CloudSat Data

Sun-Mack, Sunny; Minnis, Patrick; Chen, Yan; Gibson, Sharon; Yi, Yuhong; Trepte, Qing; Wielicki, Bruce; Kato, Seiji; Winker, Dave; September 17, 2007; 11 pp.; In English; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

This paper documents the development of the first integrated data set of global vertical profiles of clouds, aerosols, and radiation using the combined NASA A-Train data from the Aqua Clouds and Earth's Radiant Energy System (CERES) and Moderate Resolution Imaging Spectroradiometer (MODIS), Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO), and CloudSat. As part of this effort, cloud data from the CALIPSO lidar and the CloudSat radar are merged with the integrated column cloud properties from the CERES-MODIS analyses. The active and passive datasets are compared to determine commonalities and differences in order to facilitate the development of a 3- dimensional cloud and aerosol dataset that will then be integrated into the CERES broadband radiance footprint. Preliminary results from the comparisons for April 2007 reveal that the CERES-MODIS global cloud amounts are, on average, 0.14 less and 0.15 greater than those from CALIPSO and CloudSat, respectively. These new data will provide unprecedented ability to test and improve global cloud and aerosol models, to investigate aerosol direct and indirect radiative forcing, and to validate the accuracy of global aerosol, cloud, and radiation data sets especially in polar regions and for multi-layered cloud conditions.

Author

MODIS (Radiometry); CERES (Experiment); CALIPSO (Pathfinder Satellite); Cloud Physics; Satellite Observation; Optical Radar; Atmospheric Models; Infrared Astronomy

20080014164 NASA Marshall Space Flight Center, Huntsville, AL, USA

Dissemination and Use of NPOESS Data in AWIPS II

Jedlovec, Gary; Burks, Jason; January 20, 2008; 1 pp.; In English; 88th AMS Annual Meeting, 20-24 Jan. 2008, New Orleans, LA, USA; No Copyright; Avail.: Other Sources; Abstract Only

Real-time satellite information provides one of many data sources used by NWS forecast offices to diagnose current weather conditions and to assist in short-term forecast preparation. While GOES satellite data provides relatively coarse spatial resolution coverage of the continental U.S. on a 10-15 minute repeat cycle, polar orbiting data has the potential to provide snapshots of weather conditions at high-resolution in many spectral channels. The multispectral polar orbiting satellite capabilities allow for the derivation of image and sounding products not available from geostationary orbit. The utility of these polar orbiting measurements to forecasters has been demonstrated with NASA EOS observations as part of the Short-term Prediction and Research Transition (SPORT) program at Marshall Space Flight Center. SPORT scientists have been providing real-time MODIS data to NWS forecasters on an experimental basis to address a variety of short-term weather forecasting problems since 2003. The launch of the NPOESS Preparatory Project (NPP) satellite in 2009 will extend the continuity of high-resolution data provided by the NASA EOS satellites into future operational weather systems. The NPP data will be available in a timeframe consistent with the early installation of the next generation Advanced Weather Information Processing System (AWIPS) under development by Raytheon for the NWS. The AWIPS II system will be a JAVA-based decision support system which preserves the functionality of the existing systems and offers unique development opportunities for new data sources and applications in the Service Orientated Architecture (SOA) environment. The poster will highlight some of the advanced observing and display- capabilities of these new systems such as plug-ins for NASA and NPP datasets, and the development of local applications which are not well handled in the current AWIPS (e.g., 3D displays of LMA data, generation and display of 3-channel color composites, etc.).

Author

GOES Satellites; Real Time Operation; Spatial Resolution; Weather Forecasting; Geosynchronous Orbits; Decision Support Systems; Systems Engineering; MODIS (Radiometry)

20080014165 NASA Marshall Space Flight Center, Huntsville, AL, USA

Effect of GOES-R Image Navigation and Registration Errors on Atmospheric Motion Vectors

Jedlovec, Gary; January 20, 2008; 1 pp.; In English; 88th AMS Annual Meeting, 20-24 Jan. 2008, New Orleans, LA, USA; No Copyright; Avail.: Other Sources; Abstract Only

High temporal frequency imagery from geostationary satellites allows for the continuous monitoring of rapidly changing atmospheric constituents such as smoke, dust, water vapor and clouds. The image sequences are often used to quantify the displacement of image features such as water vapor and clouds to produce atmospheric motion vectors (AMVs) which are used as diagnostic tools and also assimilated into numerical weather forecast models. The basic principle behind the determination of AMVs is the calculation of the physical displacement of features from one image (time) to the next. This process assumes

that the features being tracked do not change as a function of time, usually requiring the use of short time interval imagery to minimize substantial change in size and shape of the features being tracked. High spatial resolution imagery also is required for reliable feature identification. While these image resolution and temporal sampling requirements often provide major drivers for space-based instrument design requirements, accurate image navigation and registration, INn (between a sequence of images), is also critical to the derivation of useful AMVs. In this paper and poster to be presented at the conference, the image navigation and registration (INR) accuracy expected for the Advanced Baseline Imager (ABI) on the GOES-R series of satellites will be discussed in light of its impact on AMV accuracy. Significant satellite platform and modeling enhancements are planned which should significantly improve INn performance of the GOES-R instruments. Some of these improvements have been demonstrated for the GOES-13 satellite which was launched in summer of 2006. An analysis of GOES-13 INR data, from the special satellite check out period, will be used in the assessment.
Author
Atmospheric Circulation; Errors; Image Resolution; Navigation; Vectors (Mathematics); Numerical Weather Forecasting

20080014166 NASA Marshall Space Flight Center, Huntsville, AL, USA
Simulation of the Impact of New Air-Based Ocean Surface Wind Measurements on H*Wind Analyses
Miller, Timothy; Atlas, Robert; Black, Peter; Case, Jonathan; Chen, Shuyi; Hood, Robbie; Jones, Linwood; Ruff, Chris; Uhlhorn, Eric; January 20, 2008; 1 pp.; In English; AMS 88th Annual Meeting - 12th Conference on Integrated Observing and AsstmiIation Systems for Atmosphere, Oceans, and Land Surface (IOAS-AOLS), 20-24 Jan. 2008, New Orleans,LA, USA; No Copyright; Avail.: Other Sources; Abstract Only

The H'Wind analysis, a product of the Hurricane Research Division of NOAA's Atlantic Oceanographic and Meteorological Laboratory, brings together wind measurements from a variety of observation platforms into an objective analysis of the distribution of wind speeds in a tropical cyclone. This product is designed to improve understanding of the extent and strength of the wind field, and to improve the assessment of hurricane intensity. See http://www.aoml.noaa.gov/hrd/data sub/wind.html. The Hurricane Imaging Radiometer (HIRad) is a new airborne microwave remote sensor for hurricane observations that is currently under development by NASA Marshall Space Flight Center, NOAA Hurricane Research Division, the University of Central Florida and the University of Michigan. HIRad is being designed to enhance the real-time airborne ocean surface winds observation capabilities of NOAA and USAF Weather Squadron hurricane hunter aircraft using the operational airborne Stepped Frequency Microwave Radiometer (SFMR). Unlike SFMR, which measures wind speed and rain rate along the ground track directly beneath the aircraft, HIRad will provide images of the surface wind and rain field over a wide swath (approx. 3 x the aircraft altitude). The instrument is described in a paper presented to the Hurricanes and Tropical Meteorology Symposium. The present paper describes a set of Observing System Simulation Experiments (OSSEs) in which measurements from the new instrument as well as those from existing instruments (air, surface, and space-based) are simulated from the output of a numerical model from the University of Miami and those results are used to construct H*Wind analyses. Evaluations will be presented on the impact of the HIRad instrument on H'Wind analyses, both in terms of adding it to the full suite of current measurements, as well as using it to replace instrument(s) that may not be functioning at the future tame the HIRad instrument is implemented.
Author
Oceanography; Wind Measurement; Ground Wind; Hurricanes; Tropical Meteorology; Real Time Operation; Ocean Surface; Airborne Equipment

20080014167 NASA Marshall Space Flight Center, Huntsville, AL, USA
Simulation of Ground Winds Time Series for the NASA Crew Launch Vehicle (CLV)
Adelfang, Stanley I.; January 20, 2008; 1 pp.; In English; 12th Conference on Aviation, Range and Aerospace Meteorology Affects of the Atmosphere on the Performance, Design and Operation of Aerospace Systems, 20-24 Jan. 2008, New Orleans, LA, USA
Contract(s)/Grant(s): NNM04AA02C; No Copyright; Avail.: Other Sources; Abstract Only

Simulation of wind time series based on power spectrum density (PSD) and spectral coherence models for ground wind turbulence is described. The wind models, originally developed for the Shuttle program, are based on wind measurements at the NASA 150-m meteorological tower at Cape Canaveral, FL. The current application is for the design and/or protection of the CLV from wind effects during on-pad exposure during periods from as long as days prior to launch, to seconds or minutes just prior to launch and seconds after launch. The evaluation of vehicle response to wind will influence the design and operation of constraint systems for support of the on-pad vehicle. Longitudinal and lateral wind component time series are simulated at critical vehicle locations. The PSD model for wind turbulence is a function of mean wind speed, elevation and temporal frequency. Integration of the PSD equation over a selected frequency range yields the variance of the time series to

be simulated. The square root of the PSD defines a low-pass filter that is applied to adjust the components of the Fast Fourier Transform (FFT) of Gaussian white noise. The first simulated time series near the top of the launch vehicle is the inverse transform of the adjusted FFT. Simulation of the wind component time series at the nearest adjacent location (and all other succeeding next nearest locations) is based on a model for the coherence between winds at two locations as a function of frequency and separation distance, where the adjacent locations are separated vertically and/or horizontally. The coherence function is used to calculate a coherence weighted FFT of the wind at the next nearest location, given the FFT of the simulated time series at the previous location and the essentially incoherent FFT of the wind at the selected location derived a priori from the PSD model. The simulated time series at each adjacent location is the inverse Fourier transform of the coherence weighted FFT. For a selected design case, the equations, the process and the simulated time series at multiple vehicle stations are presented.
Author
Ground Wind; Simulation; Time Series Analysis; Wind Effects; Wind Measurement; Wind Velocity; Power Spectra; Fast Fourier Transformations; Meteorological Instruments

20080014168 NASA Marshall Space Flight Center, Huntsville, AL, USA
The 2006 Cape Canaveral Air Force Station Range Reference Atmosphere Model Validation Study and Sensitivity Analysis to the National Aeronautics and Space Administration's Space Shuttle
Burns, Lee; Merry, Carl; Decker, Ryan; Harrington, Brian; January 20, 2008; 1 pp.; In English; 13th Conference on Aviation, Range and Aerospace Meteorology, 20-24 Jan. 2008, New Orleans, LA, USA; Copyright; Avail.: Other Sources; Abstract Only

The 2006 Cape Canaveral Air Force Station (CCAFS) Range Reference Atmosphere (RRA) is a statistical model summarizing the wind and thermodynamic atmospheric variability from surface to 70 kin. Launches of the National Aeronautics and Space Administration's (NASA) Space Shuttle from Kennedy Space Center utilize CCAFS RRA data to evaluate environmental constraints on various aspects of the vehicle during ascent. An update to the CCAFS RRA was recently completed. As part of the update, a validation study on the 2006 version was conducted as well as a comparison analysis of the 2006 version to the existing CCAFS RRA database version 1983. Assessments to the Space Shuttle vehicle ascent profile characteristics were performed to determine impacts of the updated model to the vehicle performance. Details on the model updates and the vehicle sensitivity analyses with the update model are presented.
Author
Thermodynamics; Atmospheric Models; Sensitivity Analysis; NASA Programs; Variability; Space Shuttles; Reference Atmospheres; Ascent

20080014179 Desert Research Inst., Reno, NV, USA
TRMM Common Microphysics Products: A Tool for Evaluating Spaceborne Precipitation Retrieval Algorithms
Kingsmill, David E.; Yuter, Sandra E.; Hobbs, Peter V.; Rangno, Arthur L.; Heymsfield, Andrew J.; Stith, Jeffrey L.; Bansemer, Aaron; Haggerty, Julie A.; Korolev, Alexei V.; Journal of Applied Meteorology; November 2004; Volume 43, Issue 11, pp. 1598-1618; In English
Contract(s)/Grant(s): NNG04GJ15G; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1175/JAM2151.1

A customized product for analysis of microphysics data collected from aircraft during field campaigns in support of the TRMM program is described. These Common Microphysics Products (CMP's) are designed to aid in evaluation of TRMM spaceborne precipitation retrieval algorithms. Information needed for this purpose (e.g., particle size spectra and habit, liquid and ice water content) was derived using a common processing strategy on the wide variety of microphysical instruments and raw native data formats employed in the field campaigns. The CMP's are organized into an ASCII structure to allow easy access to the data for those less familiar with and without the tools to accomplish microphysical data processing. Detailed examples of the CMP show its potential and some of its limitations. This approach may be a first step toward developing a generalized microphysics format and an associated community-oriented, non-proprietary software package for microphysics data processing, initiatives that would likely broaden community access to and use of microphysics datasets.
Author
Algorithms; TRMM Satellite; Precipitation (Meteorology); Data Processing

20080014180 North Carolina State Univ., Raleigh, NC, USA

Observations of Precipitation Size and Fall Speed Characteristics within Coexisting Rain and Wet Snow

Yuter, Sandra E.; Kingsmill, David E.; Nance, Louisa B.; Loeffler-Mang, Martin; Journal of Applied Meteorology and Climatology; October 2006; Volume 45, Issue 10, pp. 1450-1464; In English

Contract(s)/Grant(s): NNG04GJ15G; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1175/JAM2406.1

Ground-based measurements of particle size and fall speed distributions using a Particle Size and Velocity (PARSIVEL) disdrometer are compared among samples obtained in mixed precipitation (rain and wet snow) and rain in the Oregon Cascade Mountains and in dry snow in the Rocky Mountains of Colorado. Coexisting rain and snow particles are distinguished using a classification method based on their size and fall speed properties. The bimodal distribution of the particles' joint fall speed-size characteristics at air temperatures from 0.5 to 0 C suggests that wet-snow particles quickly make a transition to rain once melting has progressed sufficiently. As air temperatures increase to 1.5 C, the reduction in the number of very large aggregates with a diameter > 10 mm coincides with the appearance of rain particles larger than 6 mm. In this setting. very large raindrops appear to be the result of aggregates melting with minimal breakup rather than formation by coalescence. In contrast to dry snow and rain, the fall speed for wet snow has a much weaker correlation between increasing size and increasing fall speed. Wet snow has a larger standard deviation of fall speed (120%-230% relative to dry snow) for a given particle size. The average fall speed for observed wet-snow particles with a diameter greater than or equal to 2.4 mm is 2 m/s with a standard deviation of 0.8 m/s. The large standard deviation is likely related to the coexistence of particles of similar physical size with different percentages of melting. These results suggest that different particle sizes are not required for aggregation since wet-snow particles of the same size can have different fall speeds. Given the large standard deviation of fall speeds in wet snow, the collision efficiency for wet snow is likely larger than that of dry snow. For particle sizes between 1 and 10 mm in diameter within mixed precipitation, rain constituted I % of the particles by volume within the isothermal layer at 0 C and 4% of the particles by volume for the region just below the isothermal layer where air temperatures rise from 0' to 0.5'C. As air temperatures increased above 0.5 C, the relative proportions of rain versus snow particles shift dramatically and raindrops become dominant. The value of 0.5 C for the sharp transition in volume fraction from snow to rain is slightly lower than the range from 1 .l to 1.7 C often used in hydrological models.

Author

Drop Size; Rain; Raindrops; Size Distribution; Snow; Precipitation Measurement; Velocity

20080014190 NASA Langley Research Center, Hampton, VA, USA

Airborne Observations of the Spatial and Temporal Variability of Tropospheric Carbon Dioxide during the INTEX-B Campaign

Vay, Stephanie A.; Choi, Younghoon; Woo, Jung-Hun; Barrick, John D.; Sachse, Glen W.; Blake, Donald; Avery, Melody A.; Fuelberg, Henry; Nolf, Scott; December 11, 2006; 1 pp.; In English; 2006 AGU Fall Meeting, 11-15 Dec. 2006, San Francisco, CA, USA

Contract(s)/Grant(s): WBS 281945.02.37.01.08; Copyright; Avail.: Other Sources; Abstract Only

The Intercontinental Chemical Transport Experiment-North America (INTEX-NA) is an international field campaign envisioned to investigate the transport and transformation of gases and aerosols on transcontinental/intercontinental scales and assess their impact on air quality and climate. Phase B (INTEX-B) of the mission was conducted during a 10- week period from March 1 to May 15, 2006 and focused initially on pollution outflow from the Mexico City Metropolitan Area, later addressing the transport of pollution from Asia to North America during springtime meteorological conditions. During the deployment, fast-response (1-s resolution) CO2 measurements were recorded aboard the NASA DC-8 providing valuable regional-scale information on carbon sources and sinks over sparsely sampled areas of North America and adjacent ocean basins. When coupled with the enormously sophisticated chemistry payload on the DC-8, these measurements collectively afford extremely powerful multi-tracer constraints for carbon source/sink attribution. Preliminary examination of the two data sets from the INTEX-B campaign, acquired one month apart, reveals not only the influence of the CO2 seasonal cycle, but also the preponderance of human population and industrial activity in the northern hemisphere. In this presentation, a synergy of the ensemble of airborne and surface observations, bottomup emission inventories, as well as transport history are invoked in a GIS framework to elucidate the source/sink processes reflected in the observations. The airborne CO2 data, along with simultaneous surface measurements (e.g. NOAA ESRL), are examined to establish the vertical distribution and variability of

CO2 as a function of location. The role of localized sources, long-range transport, the biosphere, stratospheric exchange, and dynamical processes on the CO2 spatial variability observed throughout the tropospheric column will be discussed.
Author
Carbon Dioxide; North America; Spatial Distribution; Temporal Distribution; Troposphere; Gas Transport; Air Quality; Climatology

20080014210 NASA Langley Research Center, Hampton, VA, USA
Aerosol and Cloud Microphysical Characteristics of Rifts and Gradients in Maritime Stratocumulus Clouds
Sharon, Tarah M.; Albrecht, Bruce A.; Jonsson, Haflidi H.; Minnis, Patrick; Khaiyer, Mandana M.; Van Reken, Timothy; Seinfeld, John; Flagan, Rick; Journal of the Atmospheric Sciences; January 31, 2008; Volume 63, No. 3, pp. 983-997; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): 23-621-30-96; Copyright; Avail.: CASI: A04, Hardcopy

A cloud rift is characterized as a large-scale, persistent area of broken, low reflectivity stratocumulus clouds usually surrounded by a solid deck of stratocumulus. A rift observed off the coast of Monterey Bay, California on 16 July 1999 was studied to compare the aerosol and cloud microphysical properties in the rift with those of the surrounding solid stratus deck. Variables measured from an instrumented aircraft included temperature, water vapor, and cloud liquid water. These measurements characterized the thermodynamic properties of the solid deck and rift areas. Microphysical measurements made included aerosol, cloud drop and drizzle drop concentrations and cloud condensation nuclei (CCN) concentrations. The microphysical characteristics in a solid stratus deck differ substantially from those of a broken, cellular rift where cloud droplet concentrations are a factor of 2 lower than those in the solid cloud. Further, CCN concentrations were found to be about 3 times greater in the solid cloud area compared with those in the rift and aerosol concentrations showed a similar difference as well. Although drizzle was observed near cloud top in parts of the solid stratus cloud, the largest drizzle rates were associated with the broken clouds within the rift area. In addition to marked differences in particle concentrations, evidence of a mesoscale circulation near the solid cloud rift boundary is presented. This mesoscale circulation provides a mechanism for maintaining a rift, but further study is required to understand the initiation of a rift and the conditions that may cause it to fill.
Author
Aerosols; Cloud Physics; Geological Faults; Stratocumulus Clouds; Climatology

48
OCEANOGRAPHY

Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics; and marine resources. For related information see also *43 Earth Resources and Remote Sensing*.

20080013426 Science Systems and Applications, Inc., Bay Saint Louis, MS, USA
Coral Reef Remote Sensing Using Simulated VIIRS and LDCM Imagery
Estep, Leland; Spruce, Joseph P.; [2008]; 1 pp.; In English; 2008 Ocean Sciences Meeting, 2-7 Mar. 2008, Orlando, Fl, USA
Contract(s)/Grant(s): NNS04AB54T
Report No.(s): SSTI-2220-0128; No Copyright; Avail.: Other Sources; Abstract Only

The Rapid Prototyping Capability (RPC) node at NASA Stennis Space Center, MS, was used to simulate NASA next-generation sensor imagery over well-known coral reef areas: Looe Key, FL, and Kaneohe Bay, HI. The objective was to assess the degree to which next-generation sensor systems-the Visible/Infrared Imager/Radiometer Suite (VIIRS) and the Landsat Data Continuity Mission (LDCM)- might provide key input to the National Oceanographic and Atmospheric Administration (NOAA) Integrated Coral Observing Network (ICON)/Coral Reef Early Warning System (CREWS) Decision Support Tool (DST). The DST data layers produced from the simulated imagery concerned water quality and benthic classification map layers. The water optical parameters of interest were chlorophyll (Chl) and the absorption coefficient (a). The input imagery used by the RPC for simulation included spaceborne (Hyperion) and airborne (AVIRIS) hyperspectral data. Specific field data to complement and aid in validation of the overflight data was used when available. The results of the experiment show that the next-generation sensor systems are capable of providing valuable data layer resources to NOAA s ICON/CREWS DST.
Author
Remote Sensing; Coral Reefs; Rapid Prototyping; Infrared Radiometers; Early Warning Systems; Classifications; Water Quality; Oceanography

51
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*.

20080013414 NASA Johnson Space Center, Houston, TX, USA

A Human Espophageal Epithelial Cell Model for Study of Radiation Induced Cancer and DNA Damage Repair

Huff, Janice L.; Patel, Zarana S.; Hada, Megumi; Cucinotta, Francis A.; [2008]; 1 pp.; In English; 37th COSPAR Scientific Assembly, 13-20 Jul. 2008, Montreal, Canada; Copyright; Avail.: Other Sources; Abstract Only

For cancer risk assessment in astronauts and for countermeasure development, it is essential to understand the molecular mechanisms of radiation carcinogenesis and how these mechanisms are influenced by exposure to the types of radiation found in space. We are developing an in vitro model system for the study of radiation-induced initiation and progression of esophageal carcinoma, a type of cancer found to have a significant enhancement in incidence in the survivors of the atomic bomb detonations in Japan. Here we present the results of our preliminary characterization of both normal and hTERT immortalized esophageal epithelial cells grown in 2-dimensional culture. We analyzed DNA repair capacity by measuring the kinetics of formation and loss of - H2AX foci following radiation exposure. Additionally, we analyzed induction of chromosomal aberrations using 3-color fluorescence in situ hybridization (FISH). Data were generated using both low LET (gamma rays) and high LET ions (1000 MeV/nucleon iron).

Author

Cancer; Risk; Esophagus; Epithelium; Deoxyribonucleic Acid; Models; Molecular Biology; Cells (Biology)

20080013432 NASA Johnson Space Center, Houston, TX, USA

International Space Station USOS Potable Water Dispenser Development

Shaw, Laura A.; Barreda, Jose L.; [2008]; 7 pp.; In English; 38th International Conference on Environmental Systems, 29 Jun. - 3 Jul. 2008, San Francisco, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 401769.06.05.01.02.03; Copyright; Avail.: CASI: A02, Hardcopy

The International Space Station (ISS) Russian Segment currently provides potable water dispensing capability for crewmember food and beverage rehydration. All ISS crewmembers rehydrate Russian and U.S. style food packages from this location. A new USA On-orbit Segment (USOS) Potable Water Dispenser (PWD) is under development. This unit will provide additional potable water dispensing capability to support an onorbit crew of six. The PWD is designed to provide incremental quantities of hot and ambient temperature potable water to U.S. style food packages. It will receive iodinated water from the Fuel Cell Water Bus in the U.S. Laboratory element. The unit will provide potable-quality water, including active removal of biocidal iodine prior to dispensing. A heater assembly contained within the unit will be able to supply up to 2.0 liters of hot water (65 to 93oC) every thirty minutes. This quantity will allow three to four crewmembers to rehydrate their food and beverages from this location during a single meal. The unit is designed to remain functional for up to ten years with replacement of limited life items such as filters. It will be the size of two stacked Shuttle Middeck lockers (approximately the size of two small suitcases) and integrated into a science payload rack in the U.S. Laboratory element. Providing potable-quality water at the proper temperature for food and beverage reconstitution is critical to maintaining crew health and well-being. The numerous engineering challenges as well as human factors and safety considerations during the concept, design, and prototyping are outlined in this paper.

Author

Potable Water; International Space Station; Human Factors Engineering; Water Temperature; Dispensers; Health; Aerospace Medicine

20080013463 NASA Johnson Space Center, Houston, TX, USA

Three-Dimensionally Engineered Normal Human Lung Tissue-Like Assemblies: Target Tissues for Human Respiratory Viral Infections

Goodwin, Thomas J.; McCarthy, M.; Lin, Y-H.; Deatly, A. M.; March 2008; 34 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS9-17720

Report No.(s): NASA/TP-2008-214771; S-1022; Copyright; Avail.: CASI: A03, Hardcopy

In vitro three-dimensional (3D) human lung epithelio-mesenchymal tissue-like assemblies (3D hLEM TLAs), from this point forward referred to as TLAs, were engineered in rotating wall vessel technology to mimic the characteristics of in vivo

tissues, thus providing a tool to study human respiratory viruses and host cell and viral interactions. The TLAs were bioengineered onto collagen-coated cyclodextran microcarriers using primary human mesenchymal bronchial-tracheal cells as the foundation matrix and an adult human bronchial epithelial immortalized cell line as the overlying component. The resulting TLAs share significant characteristics with in vivo human respiratory epithelium including polarization, tight junctions, desmosomes, and microvilli. The presence of tissue-like differentiation markers including villin, keratins, and specific lung epithelium markers, as well as the production of tissue mucin, further confirm that these TLAs differentiated into tissues functionally similar to in vivo tissues. Increasing virus titers for human respiratory syncytial virus and the detection of membrane bound glycoproteins over time confirm productive infection with the virus. Therefore, we assert TLAs mimic aspects of the human respiratory epithelium and provide a unique capability to study the interactions of respiratory viruses and their primary target tissue independent of the host's immune system.
Author
In Vitro Methods and Tests; Tissue Engineering; Lungs; Respiratory Diseases; Tissue Culturing

20080014097 NASA Johnson Space Center, Houston, TX, USA
Exercise Increases the Cardiovascular Stimulus Provided by Artificial Gravity
Howarth, M. S.; Moore, F. B.; Hinghofer-Szalkay, H.; Jezova, D.; Diedrich, A.; Ferris, M. B.; Schlegel, T. T.; Pathwardhan, A. R.; Knapp, C. F.; Evans, J. M.; [2008]; 1 pp.; In English; 29th Annual ISGP Meeting: Life in Space for Life on Earth, 22-27 Jun. 2008, Angers, France; Copyright; Avail.: Other Sources; Abstract Only

We investigated fluid shifts and regulatory responses to variations of posture, exercise, Gz level and radius of rotation in subjects riding NASA Ames 20G centrifuge. Results are from 4 protocols that address radius and exercise effects only. Protocol A: After 10 min supine control, 12 healthy men (35 plus or minus 9 yr, 82.8 plus or minus 7.9 kg) were exposed to rotational 1 Gz (2.5 m radius) for 2 min followed by 20 min alternating between 1 and 1.25 Gz. Blood samples were taken pre and post spin. Protocol B: Same as A, but lower limb exercise (70% V02max) preceded ramps to 1.25 Gz. Protocol C: Same as A but radius of rotation 8.3 m. Protocol D: Same as B but at 8.3 m. The 8 subjects who completed all protocols, increased heart rate (HR) from control, on average, by: A: 5, B: 39, C: 11, D: 44 bpm. For thoracic fluid volume, (bioimpedance), the 8 subjects changed from control, on average: A: -394, B: -548, C: -537, D: -708 mL. For thigh fluid volume, changes from control, on average, were: A: -137, B: 129, C: -75, D: 159 mL. Hematocrit changes from control were: A: 2.3, B: 3.5, C: 2.3, D: 4.3 %. Radius effects were mild and included greater loss of fluid from the thorax, less fluid loss from the thigh and increased heart rate at the longer radius. Pre-acceleration exercise effects were more dramatic and included additional loss of fluid from the chest, increased fluid volume of the thigh, increased hematocrit and greater heart rate increases. We propose that short bouts of intense exercise can be used to magnify the cardiovascular stress delivered by artificial gravity (AG) training and the combination of AG with exercise training can be fine-tuned to preserve orthostatic tolerance of astronauts during spaceflight.
Author
Artificial Gravity; Cardiovascular System; Fluid Shifts (Biology); Regulatory Mechanisms (Biology); Stimuli; Manned Space Flight; Physical Exercise

20080014098 NASA Johnson Space Center, Houston, TX, USA
Adaptation of the Skeletal System during Long-duration Spaceflight
Sibonga, Jean D.; Cavanagh, Peter R.; Lang, Thomas F.; LeBlanc, Adrian D.; Schneider, Victor S.; Shackelford, Linda C.; Smith, Scott M.; Vico, Laurence; [2008]; 43 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

This review will highlight evidence from crew members flown on space missions greater than 90 days to suggest that the adaptations of the skeletal system to mechanical unloading may predispose crew members to an accelerated onset of osteoporosis after return to Earth. By definition, osteoporosis is a skeletal disorder - characterized by low bone mineral density and structural deterioration - that reduces the ability of bones to resist fracture under the loading of normal daily activities. Involutional or agerelated osteoporosis is readily recognized as a syndrome afflicting the elderly population because of the insipid and asymptomatic nature of bone loss that does not typically manifest as fractures until after age approximately 60. It is not the thesis of this review to suggest that spaceflight-induced bone loss is similar to bone loss induced by metabolic bone disease; rather this review draws parallels between the rapid and earlier loss in females that occurs with menopause and the rapid bone loss in middle-aged crew members that occurs with spaceflight unloading and how the cumulative effects of spaceflight and ageing could be detrimental, particularly if skeletal effects are totally or partially irreversible. In brief, this report will provide detailed evidence that long-duration crew members, exposed to the weightlessness of space for the typical long-duration (4-6 months) mission on Mir or the International Space Station -- 1. Display bone resorption that is aggressive,

that targets normally weight-bearing skeletal sites, that is uncoupled to bone formation and that results in areal BMD deficits that can range between 6-20% of preflight BMD; 2. Display compartment-specific declines in volumetric BMD in the proximal femur (a skeletal site of clinical interest) that significantly reduces its compressive and bending strength and which may account for the loss in hip bone strength (i.e., force to failure); 3. Recover BMD over a post-flight time period that exceeds spaceflight exposure but for which the restoration of whole bone strength remains an open issue and may involve structural alteration; and 4. Display risk factors for bone loss -- such as the negative calcium balance and down-regulated calcium-regulating hormones in response to bone atrophy -- that can be compounded by the constraints of conducting mission operations (inability to provide essential nutrients and vitamins). The full characterization of the skeletal response to mechanical unloading in space is not complete. In particular, countermeasures used to date have been inadequate and it is not yet known whether more appropriate countermeasures can prevent the changes in bone that have been found in previous flights, knowledge gaps related to the effects of prolonged (greater than or equal to 6 months) space exposure and to partial gravity environments are substantial, and longitudinal measurements on crew members after spaceflight are required to assess the full impact on skeletal recovery.

Author

Adaptation; Musculoskeletal System; Long Duration Space Flight; Life Sciences; Manned Space Flight; Microgravity

20080014101 NASA Johnson Space Center, Houston, TX, USA

Non-DBS DNA Repair Genes Regulate Radiation-induced Cytogenetic Damage Repair and Cell Cycle Progression

Zhang, Ye; Rohde, Larry H.; Emami, Kamal; Casey, Rachael; Wu, Honglu; [2008]; 2 pp.; In English; 54th Annual Meeting of the Radiation Research, 21-25 Sep. 2008, Boston, MA, USA; Copyright; Avail.: Other Sources; Abstract Only

Changes of gene expression profile are one of the most important biological responses in living cells after ionizing radiation (IR) exposure. Although some studies have shown that genes up-regulated by IR may play important roles in DNA damage repair, the relationship between the regulation of gene expression by IR, particularly genes not known for their roles in DSB repair, and its impact on cytogenetic responses has not been systematically studied. In the present study, the expression of 25 genes selected on the basis of their transcriptional changes in response to IR was individually knocked down by transfection with small interfering RNA in human fibroblast cells. The purpose of this study is to identify new roles of these selected genes on regulating DSB repair and cell cycle progression , as measured in the micronuclei formation and chromosome aberration. In response to IR, the formation of MN was significantly increased by suppressed expression of 5 genes: Ku70 in the DSB repair pathway, XPA in the NER pathway, RPA1 in the MMR pathway, and RAD17 and RBBP8 in cell cycle control. Knocked-down expression of 4 genes (MRE11A, RAD51 in the DSB pathway, SESN1, and SUMO1) significantly inhibited cell cycle progression, possibly because of severe impairment of DNA damage repair. Furthermore, loss of XPA, P21, or MLH1 expression resulted in both significantly enhanced cell cycle progression and increased yields of chromosome aberrations, indicating that these gene products modulate both cell cycle control and DNA damage repair. Most of the 11 genes that affected cytogenetic responses are not known to have clear roles influencing DBS repair. Nine of these 11 genes were up-regulated in cells exposed to gamma radiation, suggesting that genes transcriptionally modulated by IR were critical to regulate the biological consequences after IR.

Author

Deoxyribonucleic Acid; Gene Expression Regulation; Cytology; Life Sciences; Ionizing Radiation; Chromosome Aberrations; Gene Expression

20080014102 NASA Johnson Space Center, Houston, TX, USA

Strategies of Healthy Adults Walking on a Laterally Oscillating Treadmill

Brady, Rachel A.; Peters, Brian T.; Bloomberg, Jacob J.; [2008]; 18 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NCC9-58; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080014102

We mounted a treadmill on top of a six degree-of-freedom motion base platform to investigate locomotor responses produced by healthy adults introduced to a dynamic walking surface. The experiment examined self-selected strategies employed by participants when exposed to continuous, sinusoidal lateral motion of the support surface while walking. Torso translation and step width were used to classify responses used to stabilize gait in a novel, dynamic environment. Two response categories emerged. Participants tended to either fix themselves in space (FIS), allowing the treadbelt to move laterally beneath them, or they fixed themselves to the base (FTB), moving laterally as the motion base oscillated. The degree of fixation in both extremes varied across participants. This finding suggests that normal adults have innate and varied preferences for reacquiring

gait stability, some depending more heavily on vision (FIS group) and others on proprioception (FTB group). Keywords: Human locomotion, Unstable surface, Treadmill, Adaptation, Stability
Author
Treadmills; Walking; Degrees of Freedom; Locomotion; Proprioception; Surface Stability; Torso

20080014195 NASA Johnson Space Center, Houston, TX, USA
The Importance of the International Space Station for Life Sciences Research: Past and Future
Robinson, Julie A.; Evans, C. A.; Tate, Judy; [2008]; 1 pp.; In English; Life in Space for Life on Earth, 22-27 Jun. 2008, Angers, France; Copyright; Avail.: Other Sources; Abstract Only

The International Space Station (ISS) celebrates ten years of operations in 2008. While the station did not support permanent human crews during the first two years of operations, it hosted a few early science experiments months before the first international crew took up residence in November 2000. Since that time, science returns from the ISS have been growing at a steady pace. To date, early utilization of the U.S. Operating Segment of ISS has fielded nearly 200 experiments for hundreds of ground-based investigators supporting U.S. and international partner research. This paper will summarize the life science accomplishments of early research aboard the ISS both applied human research for exploration, and research on the effects of microgravity on life. At the 10-year point, the scientific returns from ISS should increase at a rapid pace. During the 2008 calendar year, the laboratory space and research facilities (both pressurized and external) will be tripled, with multiple scientific modules that support a wide variety of research racks and science and technology experiments conducted by all of the International Partners. A milestone was reached in February 2008 with the launch and commissioning of ESA s Columbus module and in March of 2008 with the first of three components of the Japanese Kibo laboratory. Although challenges lie ahead, the realization of the international scientific partnership provides new opportunities for scientific collaboration and broadens the research disciplines engaged on ISS. As the ISS nears completion of assembly in 2010, we come to full international utilization of the facilities for research. Using the past as an indicator, we are now able to envision the multidisciplinary contributions to improving life on Earth that the ISS can make as a platform for life sciences research.
Author
Life Sciences; International Space Station; Spacecrews; Microgravity

20080014237 NASA Johnson Space Center, Houston, TX, USA; Kentucky Univ., KY, USA
Thoracic Impedance as a Potential Indicator of Gz-induced Presyncope
Howarth, M. S.; Moore, F. B.; Hinghofer-Szalkay, H.; Jezova, D.; Diedrich, A.; Ferris, M. B.; Patwardhan, A. R.; Knapp, C. F.; Evans, J. M.; [2008]; 1 pp.; In English; Experimental Biology 2008, 5-9 Apr. 2008, San Diego, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): WKU52611; Copyright; Avail.: CASI: A01, Hardcopy

We investigated fluid shifts and regulatory responses to variations of posture, exercise, Gz level and radius of rotation in subjects riding NASA Ames 20G centrifuge. Results are from 4 protocols that address radius and exercise effects only. Protocol A: After 10 min supine control, 12 healthy men (35 9 yr, 82.8 7.9 kg) were exposed to rotational 1 Gz (2.5 m radius) for 2 min followed by 20 min alternating between 1 and 1.25 Gz. Blood samples were taken pre and post spin. Protocol B: Same as A, but lower limb exercise (70% V02max) preceded ramps to 1.25 Gz. Protocol C: Same as A but radius of rotation 8.3 m. Protocol D: Same as B but at 8.3 m. The 8 subjects who completed all protocols, increased heart rate (HR) from control by: A: 5, B: 39, C: 11, D: 44 bpm; and the 4 who did not: A: 6, B: 35, C: 20, D: 50 bpm. For thoracic fluid volume, (bioimpedance), the 8 subjects changed from control: A: -394, B: -548, C: -537, D: -708 mL; and the 4: A: -516, B: -652, C: -583, D: -1263 mL. The 4 subjects lost more thoracic fluid volume than the 8, especially in protocol D. A slightly greater increase in HR for the 4 compared to the 8 was not adequate to maintain cardiac output during D. Our data support the concept that thoracic impedance can detect inability to return adequate fluid to the heart, thereby predicting presyncope.
Author
Fluid Shifts (Biology); Impedance; Thorax; Regulatory Mechanisms (Biology); Cardiovascular System; Artificial Gravity

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*.

20080013375 NASA Johnson Space Center, Houston, TX, USA

Impaired Cytogenetic Damage Repair and Cell Cycle Regulation in Response to Ionizing Radiation in Human Fibroblast Cells with Individual Knock-down of 25 Genes

Zhang, Ye; Rohde, Larry; Emami, Kamal; Hammond, Dianne; Casey, Rachael; Mehta, Satish; Jeevarajan, Antony; Pierson, Duane; Wu, Honglu; [2008]; 32 pp.; In English; Original contains color and black and white illustrations; Copyright;
Avail.: CASI: A03, Hardcopy

Changes of gene expression profile are one of the most important biological responses in living cells after ionizing radiation (IR) exposure. Although some studies have demonstrated that genes with upregulated expression induced by IR may play important roles in DNA damage sensing, cell cycle checkpoint and chromosomal repair, the relationship between the regulation of gene expression by IR and its impact on cytogenetic responses to ionizing radiation has not been systematically studied. In our present study, the expression of 25 genes selected based on their transcriptional changes in response to IR or from their known DNA repair roles were individually knocked down by siRNA transfection in human fibroblast cells. Chromosome aberrations (CA) and micronuclei (MN) formation were measured as the cytogenetic endpoints. Our results showed that the yield of MN and/or CA formation were significantly increased by suppressed expression of 5 genes that included Ku70 in the DSB repair pathway; XPA in the NER pathway; RPA1 in the MMR pathway; RAD17 and RBBP8 in cell cycle control. Knocked-down expression of 4 genes including MRE11A, RAD51 in the DSB pathway, and SESN1 and SUMO1 showed significant inhibition of cell cycle progression, possibly because of severe impairment of DNA damage repair. Furthermore, loss of XPA, p21 and MLH1 expression resulted in both enhanced cell cycle progression and significantly higher yield of cytogenetic damage, indicating the involvement of these gene products in both cell cycle control and DNA damage repair. Of these 11 genes that affected the cytogenetic response, 9 were up-regulated in the cells exposed to gamma radiation, suggesting that genes transcriptionally modulated by IR were critical to regulating the biological consequences after IR. Failure to express these IR-responsive genes, such as by gene mutation, could seriously change the outcome of the post IR scenario and lead to carcinogenesis.
Author

Biological Effects; Cells (Biology); Chromosome Aberrations; Chromosomes; Deoxyribonucleic Acid; Gene Expression Regulation; Ionizing Radiation; Physiological Responses; Mutagens; Radiation Effects

20080013420 NASA Johnson Space Center, Houston, TX, USA

Vertical Jump Height is more Strongly Associated with Velocity and Work Performed Prior to Take-off

Bentley, J. R.; Loehr, J. A.; DeWitt, J. K.; Lee, S. M. C.; English, K. L.; Nash, R. E.; Leach, M. A.; Hagan, R. D.; [2008]; 1 pp.; In English; National Strength and Conditioning Association, 9-12 Jul. 2008, Las Vegas, NV, USA; No Copyright;
Avail.: Other Sources; Abstract Only

Vertical jump (VJ) height is commonly used as a measure of athletic capability in strength and power sports. Although VJ has been shown to be a predictor of athletic performance, it is not clear which kinetic ground reaction force (GRF) variables, such as peak force (PF), peak power (PP), peak velocity (PV), total work (TW) or impulse (Imp) are the best correlates. To determine which kinetic variables (PF, PP, PV, TW, and Imp) best correlate with VJ height. Twenty subjects (14 males, 6 females) performed three maximal countermovement VJs on a force platform (Advanced Mechanical Technology, Inc., Watertown, MA, USA). VJ jump height was calculated as the difference between standing reach and the highest reach point measured using a Vertec. PF, PP, PV, TW, and Imp were calculated using the vertical GRF data sampled at 1000 Hz from the lowest point in the countermovement through the concentric portion until take-off. GRF data were normalized to body mass measured using a standard scale (Detecto, Webb City, MO, USA). Correlation coefficients were computed between each GRF variable and VJ height using a Pearson correlation. VJ height (43.4 plus or minus 9.1 cm) was significantly correlated (p less than 0.001) with PF (998 plus or minus 321 N; r=0.51), PP (1997 plus or minus 772 W; r=0.69), PV (2.66 plus or minus 0.40 m (raised dot) s(sup -1); r=0.85), TW (259 plus or minus 93.0 kJ; r=0.82), and Imp (204 plus or minus 51.1 N(raised dot)s; r=0.67). Although all variables were correlated to VJ height, PV and TW were more strongly correlated to VJ height than PF, PP, and Imp. Therefore, since TW is equal to force times displacement, the relative displacement of the center of mass

along with the forces applied during the upward movement of the jump are critical determinants of VJ height. PV and TW are key determinants of VJ height, and therefore successful training programs to increase VJ height should focus on rapid movement (PV) and TW by increasing power over time rather than focusing on PF alone.
Author
Physical Exercise; Height; Sports Medicine; Body Kinematics; Velocity Distribution

20080013451 NASA Johnson Space Center, Houston, TX, USA
Space Radiation Induced Cytogenetic Damage in the Blood Lymphocytes of Astronauts
George, K.; Cucinotta, F. A.; [2008]; 2 pp.; In English; 59th International Astronautical Congress - Abstracts, 29 Sep. - 3 Oct. 2008, Glasgow, Scotland, UK; Copyright; Avail.: Other Sources; Abstract Only

Cytogenetic analysis of astronauts blood lymphocytes provides a direct in vivo measurement of space radiation damage, which takes into account individual radiosensitivity and considers the influence of microgravity and other stress conditions. We present our latest analyses of chromosome damage in astronauts blood lymphocytes assessed by fluorescence in situ hybridization (FISH) chromosome painting and collected at various times beginning directly after return from space to several years after flight. Dose was derived from frequencies of chromosome exchanges using preflight calibration curves, and the Relative Biological Effect (RBE) was estimated by comparison with individually measured physically absorbed doses. Values for average RBE were compared to the average quality factor (Q), from direct measurements of the lineal energy spectra using a tissue-equivalent proportional counter (TEPC) and radiation transport codes. Results prove that cytogenetic biodosimetry analyses on blood collected within a week or two of return from space provides a reliable estimate of equivalent radiation dose and risk after protracted exposure to space radiation of a few months or more. However, data collected several months or years after flight suggests that the yield of chromosome translocations may decline with time after the mission, indicating that retrospective doses may be more difficult to estimate. In addition, limited data on multiple flights show a lack of correlation between time in space and translocation yields. Data from one crewmember, who has participated in two separate long-duration space missions and has been followed up for over 10 years, provide limited information on the effect of repeat flights and show a possible adaptive response to space radiation exposure.
Author
Blood; Lymphocytes; Astronauts; Radiation Damage; Relative Biological Effectiveness (RBE); Extraterrestrial Radiation; Chromosomes; Radiation Tolerance; Radiation Transport; Biological Effects

20080013484 NASA Johnson Space Center, Houston, TX, USA
Lower Body Negative Pressure Treadmill Exercise and Resistive Exercise Countermeasures Maintain Physiologic Function in Women during Simulated Microgravity
Macias, B. R.; Schneider, S. M.; Lee, S. M. C.; Guinet, P.; Hughson, R. L.; Smith, Scott M.; Watenpaugh, D. E.; Hargens, A. R.; [2008]; 1 pp.; In English; Experimental Biology 2008, 5-9 Apr. 2008, San Diego, CA, USA
Contract(s)/Grant(s): NNJ04HF71G; NNJ04HF72G
Report No.(s): WISE-200; Copyright; Avail.: Other Sources; Abstract Only

We hypothesized that supine LBNP treadmill exercise combined with Flywheel resistive exercise maintains upright physiologic responses following 60-days of head-down tilt (HDT) bed rest (BR). METHODS: 16 healthy women (age 25-40 years) underwent 60-days HDT (-6deg.) BR. Women were assigned to either a non-exercise control group (CON, n=8) or to an exercise group (EX, n=8). EX subjects performed a 40-min, variable intensity LBNP exercise protocol at foot-ward forces between 1.0-1.1 times body weight, followed by 10- min of resting LBNP 3-4 days/week. Resistive exercise of maximal concentric and eccentric supine leg press and heel raise exercises were performed using a flywheel ergometer 2-3 days/week. IRBs approved this study with informed/written consent. RESULTS: Post-BR VO2pk was not different in EX (-3.3+/-1.2%) but decreased significantly in CON (-21.2+/-2.1%), $p < 0.05$. Post-BR orthostatic tolerance time (mean se) decreased significantly less in EX (19.3+/-1.3 to 14.4+/-1.5 min) than in CON (17.5+/-0.1 to 9.1+/- 1.5 min), p=0.03. Post-BR muscle strength decreased significantly in CON, but was preserved in EX. Post-BR bone resorption was greater than pre-BR in both groups ($p<0.05$). Bone formation markers, were significantly elevated ($p<0.05$) in EX than in CON. CONCLUSIONS: Supine LBNP treadmill exercise along with flywheel resistive exercise maintains upright exercise capacity, orthostatic responses and muscle strength during 60-days HDT BR.
Author
Physical Exercise; Physiology; Lower Body Negative Pressure; Bone Demineralization; Body Weight; Bed Rest; Treadmills

20080013529 NASA Johnson Space Center, Houston, TX, USA

Description of the NASA Hypobaric Decompression Sickness Database (1982-1998)

Wessel, J. H., III; Conkin, J.; [2008]; 1 pp.; In English; 79th Annual Scientific Meeting of the Aerospace Conference, 11-15 May 2008, Boston, MA, USA; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The availability of high-speed computers, data analysis software, and internet communication are compelling reasons to describe and make available computer databases from many disciplines. Methods: Human research using hypobaric chambers to understand and then prevent decompression sickness (DCS) during space walks has been conducted at the Johnson Space Center (JSC) from 1982 to 1998. The data are archived in the NASA Hypobaric Decompression Sickness Database, within an Access 2003 Relational Database. Results: There are 548 records from 237 individuals that participated in 31 unique tests. Each record includes physical characteristics, the denitrogenation procedure that was tested, and the outcome of the test, such as the report of a DCS symptom and the intensity of venous gas emboli (VGE) detected with an ultrasound Doppler bubble detector as they travel in the venous blood along the pulmonary artery on the way to the lungs. We documented 84 cases of DCS and 226 cases where VGE were detected. The test altitudes were 10.2, 10.1, 6.5, 6.0, and 4.3 pounds per square inch absolute (psia). 346 records are from tests conducted at 4.3 psia, the operating pressure of the current U.S. space suit. 169 records evaluate the Staged 10.2 psia Decompression Protocol used by the Space Shuttle Program. The mean exposure time at altitude was 242.3 minutes (SD = 80.6), with a range from 120 to 360 minutes. Among our test subjects, 96 records of exposures are females. The mean age of all test subjects was 31.8 years (SD = 7.17), with a range from 20 to 54 years. Discussion: These data combined with other published databases and evaluated with metaanalysis techniques would extend our understanding about DCS. A better understanding about the cause and prevention of DCS would benefit astronauts, aviators, and divers.

Author

Hypobaric Atmospheres; Decompression Sickness; Computer Programs; Data Bases; Pressure Reduction; Extravehicular Activity; Denitrogenation

20080013532 NASA Johnson Space Center, Houston, TX, USA

Gastrointestinal Physiology During Head Down Tilt Bedrest in Human Subjects

Vaksman, Z.; Guthienz, J.; Putcha, L.; [2008]; 1 pp.; In English; 29th Annual ISGP Meeting: Life in Space for Life on Earth, 22-27 Jun. 2008, Angers, France; Copyright; Avail.: Other Sources; Abstract Only

Introduction: Gastrointestinal (GI) motility plays a key role in the physiology and function of the GI tract. It directly affects absorption of medications and nutrients taken by mouth, in addition to indirectly altering GI physiology by way of changes in the microfloral composition and biochemistry of the GI tract. Astronauts have reported nausea, loss of appetite and constipation during space flight all of which indicate a reduction in GI motility and function similar to the one seen in chronic bed rest patients. The purpose of this study is to determine GI motility and bacterial proliferation during -6 degree head down tilt bed rest (HTD). Methods: Healthy male and female subjects between the ages of 25-40 participated in a 60 day HTD study protocol. GI transit time (GITT) was determined using lactulose breath hydrogen test and bacterial overgrowth was measured using glucose breath hydrogen test. H. Pylori colonization was determined using C13-urea breath test (UBIT#). All three tests were conducted on 9 days before HDT, and repeated on HDT days 2, 28, 58, and again on day 7 after HDT. Results: GITT increased during HTD compared to the respective ambulatory control values; GITT was significantly lower on day 7 after HTD. A concomitant increase in bacterial colonization was also noticed during HDT starting after approximately 28 days of HDT. However, H. Pylori proliferation was not recorded during HDT as indicated by UBIT#. Conclusion: GITT significantly decreased during HDT with a concomitant increase in the proliferation of GI bacterial flora but not H. pylori.

Author

Gastrointestinal System; Bed Rest; Head Down Tilt; Locomotion; Astronauts; Bacteria; Human Beings

20080013562 NASA Johnson Space Center, Houston, TX, USA

Assessment of Medical Risks and Optimization of their Management using Integrated Medical Model

Fitts, Mary A.; Madurai, Siram; Butler, Doug; Kerstman, Eric; Risin, Diana; [2008]; 2 pp.; In English; International Astronautical Congress, 29 Sep. - 3 Oct. 2008, Glasgow, Scotland, UK; Copyright; Avail.: Other Sources; Abstract Only

The Integrated Medical Model (IMM) Project is a software-based technique that will identify and quantify the medical needs and health risks of exploration crew members during space flight and evaluate the effectiveness of potential mitigation strategies. The IMM Project employs an evidence-based approach that will quantify probability and consequences of defined in-flight medical risks, mitigation strategies, and tactics to optimize crew member health. Using stochastic techniques, the IMM will ultimately inform decision makers at both programmatic and institutional levels and will enable objective assessment of crew health and optimization of mission success using data from relevant cohort populations and from the

astronaut population. The objectives of the project include: 1) identification and documentation of conditions that may occur during exploration missions (Baseline Medical Conditions List [BMCL), 2) assessment of the likelihood of conditions in the BMCL occurring during exploration missions (incidence rate), 3) determination of the risk associated with these conditions and quantify in terms of end states (Loss of Crew, Loss of Mission, Evacuation), 4) optimization of in-flight hardware mass, volume, power, bandwidth and cost for a given level of risk or uncertainty, and .. validation of the methodologies used.
Derived from text
Aerospace Medicine; Flight Crews; Health; Spacecrews; Risk; Stochastic Processes; Astronauts

20080013604 NASA Johnson Space Center, Houston, TX, USA
Integrated Suit Test 1 - A Study to Evaluate Effects of Suit Weight, Pressure, and Kinematics on Human Performance during Lunar Ambulation
Gernhardt, Michael L.; Norcross, Jason; Vos, Jessica R.; [2008]; 11 pp.; In English; 38th International Conference on Environmental Systems, 29 Jun.-2 Jul. 2008, San Francisco, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): 731384.10.31.01.01; Copyright; Avail.: CASI: A03, Hardcopy

In an effort to design the next generation Lunar suit, NASA has initiated a series of tests aimed at understanding the human physiological and biomechanical affects of space suits under a variety of conditions. The first of these tests was the EVA Walkback Test (ICES 2007-01-3133). NASA-JSC assembled a multi-disciplinary team to conduct the second test of the series, titled Integrated Suit Test 1 (IST-1), from March 6 through July 24, 2007. Similar to the Walkback Test, this study was performed with the Mark III (MKIII) EVA Technology Demonstrator suit, a treadmill, and the Partial Gravity Simulator in the Space Vehicle Mock-Up Facility at Johnson Space Center. The data collected for IST-1 included metabolic rates, ground reaction forces, biomechanics, and subjective workload and controllability feedback on both suited and unsuited (shirt-sleeve) astronaut subjects. For IST-1 the center of gravity was controlled to a nearly perfect position while the weight, pressure and biomechanics (waist locked vs. unlocked) were varied individually to evaluate the effects of each on the ability to perform level (0 degree incline) ambulation in simulated Lunar gravity. The detailed test methodology and preliminary key findings of IST-1 are summarized in this report.
Author
Biodynamics; Extravehicular Activity; Human Performance; Kinematics; Lunar Gravitation; Space Suits; Pressure Effects; Weight (Mass)

20080014099 NASA Johnson Space Center, Houston, TX, USA
Stability of Formulations Contained in the Pharmaceutical Payload Aboard Space Missions
Putcha, Lakshmi; Du, Brian; Daniels, Vernie; Boyd, Jason L.; Crady, Camille; Satterfield, Rick; [2008]; 1 pp.; In English; Life in Space for Life on Earth Symposium, 22-27 Jun. 2008, Angers, France; No Copyright; Avail.: Other Sources; Abstract Only

Efficacious pharmaceuticals with adequate shelf life are essential for successful space medical operations in support of space exploration missions. Physical and environmental factors unique to space missions such as vibration, G forces and ionizing radiation may adversely affect stability of pharmaceuticals intended for standard care of astronauts aboard space missions. Stable pharmaceuticals, therefore, are of paramount importance for assuring health and wellness of astronauts in space. Preliminary examination of stability of formulations from Shuttle and International Space Station (ISS) medical kits revealed that some of these medications showed physical and chemical degradation after flight raising concern of reduced therapeutic effectiveness with these medications in space. A research payload experiment was conducted with a select set of formulations stowed aboard a shuttle flight and on ISS. The payload consisted of four identical pharmaceutical kits containing 31 medications in different dosage forms that were transported to the International Space Station (ISS) aboard the Space Shuttle, STS 121. One of the four kits was stored on the shuttle and the other three were stored on the ISS for return to Earth at six months intervals on a pre-designated Shuttle flight for each kit; the shuttle kit was returned to Earth on the same flight. Standard stability indicating physical and chemical parameters were measured for all pharmaceuticals returned from the shuttle and from the first ISS increment payload along with ground-based matching controls. Results were compared between shuttle, ISS and ground controls. Evaluation of data from the three paradigms indicates that some of the formulations exhibited significant degradation in space compared to respective ground controls; a few formulations were unstable both on the ground and in space. An increase in the number of pharmaceuticals from ISS failing USP standards was noticed compared to those from the shuttle flight. A comprehensive evaluation of results is in progress.
Author
Drugs; Storage Stability; Pharmacology; Chemical Properties; Degradation; Payloads; Space Missions; Service Life

20080014155 NASA Johnson Space Center, Houston, TX, USA

Human Space Flight Challenges: Get a Leg Up

Lloyd, Charles W.; March 27, 2008; 23 pp.; In English; National Science Teachers Association Conference, 27 -30 Mar. 2008, Boston, MA, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy ONLINE: http://hdl.handle.net/2060/20080014155

This viewgraph presentation reviews some of the challenges that spaceflight imposes on the Human system. It describes four of the signs and symptoms of fluid shift in the astronaut when they fly in low earth orbit. It describes how the leg muscles influence blood flow It also outlines the four phases of 'fluid shift' and where the majority of the central volume of blood is located in the body And it reviews other changes to the body systems as a result of Fluid Shift

CASI

Blood Flow; Fluid Shifts (Biology); Space Flight; Physiological Effects; Gravitational Physiology; Hemodynamic Responses; Microgravity

20080014196 NASA Johnson Space Center, Houston, TX, USA

Space Nutrition: Effects on Bone and Potential Nutrition Countermeasures

Smith, Scott M.; [2008]; 1 pp.; In English; 28th Annual ISGP Meeting: Life in Space for Life on Earth, 22-27 Jun. 2008, Angers, France; No Copyright; Avail.: Other Sources; Abstract Only

Optimal nutrition will be critical for crew members who embark on space exploration missions. Nutritional assessment provides an opportunity to ensure that crewmembers begin their missions in optimal nutritional status, to document changes during a mission and , if necessary, to provide intervention to maintain that status throughout the mission, and to assesses changes after landing in order to facilitate the return to their normal status as soon as possible after landing. We report here the findings from our nutritional assessment of the US astronauts who participated in the first eight International Space Station (ISS) missions. Bone loss during space flight remains one of the most critical challenges to astronaut health on space exploration missions. An increase in bone resorption of ISS crew members after flight was indicated by several markers. Vitamin D status also remains a challenge for long-duration space travelers, who lack ultraviolet light exposure in the shielded craft. Many nutrients affect bone, including calcium, protein, fatty acids, sodium, and others. Data supporting their potential as countermeasures for space flight, as published in many papers, will be reviewed in this presentation. Defining nutrient requirements, and being able to provide and maintain those nutrients on exploration missions, will be critical for maintaining crew member health. Please note, this abstract is not required for the meeting. A presentation on the topics described above will be given. This abstract is for travel documentation only.

Author

Nutrition; Bone Demineralization; Countermeasures; Proteins; Ultraviolet Radiation; Space Exploration; Flight Crews; Health

20080014221 Civil Aerospace Medical Inst., Oklahoma City, OK, USA

Field Evaluation of Whole Airliner Decontamination Technologies - Wide-body Aircraft with Dual-use Application for Railcars

Gale, William F.; Gale, Hyacinth S.; Watson, Jean; February 2008; 18 pp.; In English; Original contains black and white illustrations

Report No.(s): DOT/FAA/AM-08/4; Copyright; Avail.: CASI: A03, Hardcopy

The outcome of a field evaluation of decontamination of a wide-body aircraft using AeroClave's thermal decontamination system both as a stand-alone technology and as a means of delivering STERIS vaporized hydrogen peroxide (VHP(R) is discussed. The report is submitted in the context of a decontamination technology selection exercise, laboratory work conducted on the efficacy of thermal decontamination, and as a follow-on to a field evaluation performed previously on a McDonnell Douglas DC-9 aircraft. The thermal decontamination system appears to be capable of reproducing temperatures needed for an efficacious antiviral process. However, work will be required to improve the temperature control and humidity levels attainable. The thermal decontamination + VHP add-in combination was found to be sporicidal at numerous locations within the cabin. The impact of issues relating to the failure to deactivate Biological Indicators (BIs) in certain locations with limited peroxide penetration, condensation of peroxide within the cabin, and more generally, issues related to the presence of

residual peroxide in the cabin after aeration need to be addressed. Serious weather-related disruptions and a limited budget, coupled with a tight schedule, precluded these concerns being addressed on this occasion. Overall, the field evaluation of both the stand-alone thermal decontamination system and the VHP add-in can be described as successful.
Author
Decontamination; Hydrogen Peroxide; Cleaning; Transport Aircraft

20080014222 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
Functional Genomics Group--Program Description
Burian, Dennis; February 2008; 16 pp.; In English; Original contains black and white illustrations
Report No.(s): DOT/FAA/AM-08/5; No Copyright; Avail.: CASI: A03, Hardcopy

Regulation of gene expression is a complex process that exquisitely responds to the environment to maintain cellular and, ultimately, organismal homeostasis. Gene expression research is undertaken at the Federal Aviation Administration as a means of discovering sets of biomarkers that change in response to environmental factors that affect aviation safety. This article reviews mechanisms of gene regulation and discusses how genomics is changing the way medicine is practiced today as a means of demonstrating that molecular medicine is here to stay. Next, the protocols that have been developed into a cohesive workflow to perform gene expression analysis are presented. Environmental factors currently under investigation are delineated, followed by a discussion of other factors of interest for future research. We believe this research will benefit the aviation industry by improving the accuracy of the data used to write regulation, thus improving the already remarkable safety record of the aviation industry and decreasing medical risks to flight crew.
Author
Biomarkers; Gene Expression; Gene Expression Regulation; Medical Science

20080014233 NASA Johnson Space Center, Houston, TX, USA
Ambiguous Tilt and Translation Motion Cues in Astronauts after Space Flight
Clement, G.; Harm, D. L.; Rupert, A. H.; Beaton, K. H.; Wood, S. J.; [2008]; 1 pp.; In English; 29th Annual ISGP Meeting: Life in Space for Life on Earth, 22-27 Jun. 2008, Angers, France; Copyright; Avail.: Other Sources; Abstract Only

Adaptive changes during space flight in how the brain integrates vestibular cues with visual, proprioceptive, and somatosensory information can lead to impaired movement coordination, vertigo, spatial disorientation, and perceptual illusions following transitions between gravity levels. This joint ESA-NASA pre- and post-flight experiment is designed to examine both the physiological basis and operational implications for disorientation and tilt-translation disturbances in astronauts following short-duration space flights. The first specific aim is to examine the effects of stimulus frequency on adaptive changes in eye movements and motion perception during independent tilt and translation motion profiles. Roll motion is provided by a variable radius centrifuge. Pitch motion is provided by NASA's Tilt-Translation Sled in which the resultant gravitoinertial vector remains aligned with the body longitudinal axis during tilt motion (referred to as the Z-axis gravitoinertial or ZAG paradigm). We hypothesize that the adaptation of otolith-mediated responses to these stimuli will have specific frequency characteristics, being greatest in the mid-frequency range where there is a crossover of tilt and translation. The second specific aim is to employ a closed-loop nulling task in which subjects are tasked to use a joystick to null-out tilt motion disturbances on these two devices. The stimuli consist of random steps or sum-of-sinusoids stimuli, including the ZAG profiles on the Tilt-Translation Sled. We hypothesize that the ability to control tilt orientation will be compromised following space flight, with increased control errors corresponding to changes in self-motion perception. The third specific aim is to evaluate how sensory substitution aids can be used to improve manual control performance. During the closed-loop nulling task on both devices, small tactors placed around the torso vibrate according to the actual body tilt angle relative to gravity. We hypothesize that performance on the closed-loop tilt control task will be improved with this tactile display feedback of tilt orientation. The current plans include testing on eight crewmembers following Space Shuttle missions or short stay onboard the International Space Station. Measurements are obtained pre-flight at L-120 (plus or minus 30), L-90 (plus or minus 30), and L-30, (plus or minus 10) days and post-flight at R+0, R+1, R+2 or 3, R+4 or 5, and R+8 days. Pre-and post-flight testing (from R+1 on) is performed in the Neuroscience Laboratory at the NASA Johnson Space Center on both the Tilt-Translation Device and a variable radius centrifuge. A second variable radius centrifuge, provided by DLR for another joint ESA-NASA project, has been installed at the Baseline Data Collection Facility at Kennedy Space Center to collect data immediately after landing. ZAG was initiated with STS-122/1E and the first post-flight testing will take place after STS-123/1JA landing.
Author
Astronauts; Cues; Motion Perception; Manned Space Flight; Vestibules; Neurology; Aerospace Medicine

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*.

20080013376 NASA Johnson Space Center, Houston, TX, USA

Propensity and Risk Assessment for Solar Particle Events: Consideration of Integral Fluence at High Proton Energies

Kim, Myung-Hee; Hayat, Matthew J.; Feiveson, alan H.; Cucinotta, Francis A.; [2008]; 1 pp.; In English; 37th COSPAR Scientific Assembly, 13-20 Jul. 2008, Montreal, Canada; Copyright; Avail.: Other Sources; Abstract Only

For future space missions with longer duration, exposure to large solar particle events (SPEs) with high energy levels is the major concern during extra-vehicular activities (EVAs) on the lunar and Mars surface. The expected SPE propensity for large proton fluence was estimated from a non-homogeneous Poisson model using the historical database for measurements of protons with energy > 30 MeV, Phi(sub 30). The database includes a continuous data set for the past 5 solar cycles. The resultant SPE risk analysis for a specific mission period was made including the 95% confidence level. In addition to total particle intensity of SPE, the detailed energy spectra of protons especially at high energy levels were recognized as extremely important parameter for the risk assessment, since there remains a significant cancer risks from those energetic particles for large events. Using all the recorded proton fluence of SPEs for energies >60 and >100 MeV, Phi(sub 60) and Phi(sub 100), respectively, the expected propensities of SPEs abundant with high energy protons were estimated from the same non-homogeneous Poisson model and the representative cancer risk was analyzed. The dependencies of risk with different energy spectra, for e.g. between soft and hard SPEs, were evaluated. Finally, we describe approaches to improve radiation protection of astronauts and optimize mission planning for future space missions.

Author

Mission Planning; Solar Corpuscular Radiation; Extravehicular Activity; Solar Radiation Shielding; Radiation Protection; Solar Flares; Risk

20080013377 Lockheed Martin Mission Services Co., USA

Evolution of the Mobile Information SysTem (MIST)

Litaker, Harry L., Jr.; Thompson, Shelby; Archer, Ronald D.; [2008]; 1 pp.; In English; Texas Regional HFES One Day Conference 2008, 18 Apr. 2008, Austin, TX, USA; Copyright; Avail.: Other Sources; Abstract Only

The Mobile Information SysTem (MIST) had its origins in the need to determine whether commercial off the shelf (COTS) technologies could improve intervehicular activities (IVA) on International Space Station (ISS) crew maintenance productivity. It began with an exploration of head mounted displays (HMDs), but quickly evolved to include voice recognition, mobile personal computing, and data collection. The unique characteristic of the MIST lies within its mobility, in which a vest is worn that contains a mini-computer and supporting equipment, and a headband with attachments for a HMD, lipstick camera, and microphone. Data is then captured directly by the computer running Morae(TM) or similar software for analysis. To date, the MIST system has been tested in numerous environments such as two parabolic flights on NASA's C-9 microgravity aircraft and several mockup facilities ranging from ISS to the Altair Lunar Sortie Lander. Functional capabilities have included its lightweight and compact design, commonality across systems and environments, and usefulness in remote collaboration. Human Factors evaluations of the system have proven the MIST's ability to be worn for long durations of time (approximately four continuous hours) with no adverse physical deficits, moderate operator compensation, and low workload being reported as measured by Corlett Bishop Discomfort Scale, Cooper-Harper Ratings, and the NASA Total Workload Index (TLX), respectively. Additionally, through development of the system, it has spawned several new applications useful in research. For example, by only employing the lipstick camera, microphone, and a compact digital video recorder (DVR), we created a portable, lightweight data collection device. Video is recorded from the participants point of view (POV) through the use of the camera mounted on the side of the head. Both the video and audio is recorded directly into the DVR located on a belt around the waist. This data is then transferred to another computer for video editing and analysis. Another application has been discovered using simulated flight, in which, a kneeboard is replaced with mini-computer and the HMD to project flight paths and glide slopes for lunar ascent. As technologies evolve, so will the system and its application for research and space system operations.

Author

Commercial Off-the-Shelf Products; Human Factors Engineering; Information Systems; Mobility; Astronaut Performance; Spacecraft Environments; Extravehicular Activity

20080013378 NASA Johnson Space Center, Houston, TX, USA

Functional Mobility Testing: A Novel Method to Create Suit Design Requirements

England, Scott A.; Benson, Elizabeth A.; Rajulu, Sudhakar L.; [2008]; 7 pp.; In English; Digital Human Modeling Conference 2008, 17-19 Jun. 2008, Pittsburgh, PA, USA; Original contains color and black and white illustrations

Report No.(s): 08DHM-0067; Copyright; Avail.: Other Sources

This study was performed to aide in the creation of design requirements for the next generation of space suits that more accurately describe the level of mobility necessary for a suited crewmember through the use of an innovative methodology utilizing functional mobility. A novel method was utilized involving the collection of kinematic data while 20 subjects (10 male, 10 female) performed pertinent functional tasks that will be required of a suited crewmember during various phases of a lunar mission. These tasks were selected based on relevance and criticality from a larger list of tasks that may be carried out by the crew. Kinematic data was processed through Vicon BodyBuilder software to calculate joint angles for the ankle, knee, hip, torso, shoulder, elbow, and wrist. Maximum functional mobility was consistently lower than maximum isolated mobility. This study suggests that conventional methods for establishing design requirements for human-systems interfaces based on maximal isolated joint capabilities may overestimate the required mobility. Additionally, this method provides a valuable means of evaluating systems created from these requirements by comparing the mobility available in a new spacesuit, or the mobility required to use a new piece of hardware, to this newly established database of functional mobility.

Author

Mobility; Space Suits; Astronaut Locomotion; Astronaut Performance; Body Kinematics

20080013429 NASA Johnson Space Center, Houston, TX, USA

International Space Station Environmental Control and Life Support Emergency Response Verification for Node 1

Williams, David E.; [2008]; 16 pp.; In English; International Conferenceon Environmental Systems, 29 Jun. - 3 Jul. 2008, San Francisco, CA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 401769.06.01.01.01

Report No.(s): 08ICES-0229; Copyright; Avail.: Other Sources

The International Space Station (ISS) Node 1 Environmental Control and Life Support (ECLS) System is comprised of five subsystems: Atmosphere Control and Supply (ACS), Atmosphere Revitalization (AR), Fire Detection and Suppression (FDS), Temperature and Humidity Control (THC), and Water Recovery and Management (WRM). This paper provides a summary of the Node 1 Emergency Response capability, which includes nominal and off-nominal FDS operation, off nominal ACS operation, and off-nominal THC operation. These subsystems provide the capability to help aid the crew members during an emergency cabin depressurization, a toxic spill, or a fire. The paper will also provide a discussion of the detailed Node 1 ECLS Element Verification methodologies for operation of the Node 1 Emergency Response hardware operations utilized during the Qualification phase.

Author

International Space Station; Life Support Systems; Environmental Control; Fire Fighting; Emergencies

20080013454 NASA Johnson Space Center, Houston, TX, USA

Generation of Boundary Manikin Anthropometry

Young, Karen S.; Margerum, Sarah; Barr, Abbe; Ferrer, Mike A.; Rajulu, Sudhakar; [2008]; 7 pp.; In English; 38th International Conference on Environmental Systems, 29 Jun. - 2 Jul. 2008, San Francisco, CA, USA; Original contains color illustrations

Report No.(s): 08ICES-0290; Copyright; Avail.: CASI: A02, Hardcopy

The purpose of this study was to develop 3D digital boundary manikins that are representative of the anthropometry of a unique population. These digital manikins can be used by designers to verify and validate that the components of the spacesuit design satisfy the requirements specified in the Human Systems Integration Requirements (HSIR) document. Currently, the HSIR requires the suit to accommodate the 1st percentile American female to the 99th percentile American male. The manikin anthropometry was derived using two methods: Principal Component Analysis (PCA) and Whole Body Posture Based Analysis (WBPBA). PCA is a statistical method for reducing a multidimensional data set by using eigenvectors and eigenvalues. The goal is to create a reduced data set that encapsulates the majority of the variation in the population. WBPBA is a multivariate analytical approach that was developed by the Anthropometry and Biomechanics Facility (ABF) to identify the extremes of the population for a given body posture. WBPBA is a simulation-based method that finds extremes in a population based on anthropometry and posture whereas PCA is based solely on anthropometry. Both methods yield a list of subjects and their anthropometry from the target population; PCA resulted in 20 female and 22 male subjects anthropometry and WBPBA resulted in 7 subjects' anthropometry representing the extreme subjects in the target population. The subjects

anthropometry is then used to 'morph' a baseline digital scan of a person with the same body type to create a 3D digital model that can be used as a tool for designers, the details of which will be discussed in subsequent papers.
Author
Anthropometry; Biodynamics; Posture; Systems Integration

20080013523 NASA Johnson Space Center, Houston, TX, USA
Physiologic Responses and Biomechanical Aspects of Motorized and Nonmotorized Treadmill Exercise: A Ground-Based Evaluation of Treadmills for Use on the International Space Station
Stuart, M. C.; DeWitt, John K.; Laughlin, Mitzi S.; Norcross, Jason; Smith, Cassie; Hagan, R. Donald; March 2008; 100 pp.; In English; Original contains color and black and white illustrations
Report No.(s): NASA/TP-2008-213734; S-992; Copyright; Avail.: CASI: A05, Hardcopy

Space flight-induced deconditioning includes the loss of aerobic exercise capacity, orthostatic tolerance, muscle strength and endurance, and bone mineral density. These reductions may compromise crew members ability to perform mission-critical activities and prolong the return to activities of daily living postlanding. Further, altered locomotion and neuromuscular activation patterns following space flight may impair the ability of space travelers to ambulate during extraterrestrial activities, emergency egress, or normal activities upon return to Earth. Although lacking the orthostatic stress of upright exercise in normal gravity (1g), it is believed that treadmill exercise during microgravity protects exercise and metabolic capacities, simulates 1g loads to the musculoskeletal system, and stimulates neuromuscular patterns required for locomotion. It is currently employed as a countermeasure to space flight deconditioning during long-duration missions aboard the station. The purpose of this study is to compare the acute metabolic and cardiovascular responses to, as well as the kinetic and kinematic aspects of, short-duration TVIS-M, TVIS-NM, and BD-1 treadmill exercise in relation to a standard laboratory treadmill exercise. Study findings will provide valuable information regarding ongoing use of treadmill exercise as a countermeasure to musculoskeletal and cardiovascular deconditioning associated with space flight and assist in the development of future treadmill exercise prescriptions.
Author
Deconditioning; Physical Exercise; Orthostatic Tolerance; Bone Mineral Content; Treadmills; Physiological Responses; Biodynamics

20080013530 NASA Johnson Space Center, Houston, TX, USA
Life Support Systems for Lunar Landers
Anderson, Molly; [2008]; 5 pp.; In English; International Conference on Environmental Systems, 30 Jun. - 2 Jul. 2008, San Francisco, CA, USA
Report No.(s): 08ICES-0132; Copyright; Avail.: CASI: A01, Hardcopy

Engineers designing life support systems for NASA s next Lunar Landers face unique challenges. As with any vehicle that enables human spaceflight, the needs of the crew drive most of the lander requirements. The lander is also a key element of the architecture NASA will implement in the Constellation program. Many requirements, constraints, or optimization goals will be driven by interfaces with other projects, like the Crew Exploration Vehicle, the Lunar Surface Systems, and the Extravehicular Activity project. Other challenges in the life support system will be driven by the unique location of the vehicle in the environments encountered throughout the mission. This paper examines several topics that may be major design drivers for the lunar lander life support system. There are several functional requirements for the lander that may be different from previous vehicles or programs and recent experience. Some of the requirements or design drivers will change depending on the overall Lander configuration. While the configuration for a lander design is not fixed, designers can examine how these issues would impact their design and be prepared for the quick design iterations required to optimize a spacecraft.
Author
Life Support Systems; Lunar Surface; Space Flight; Constellation Program; Functional Design Specifications

20080013531 NASA Johnson Space Center, Houston, TX, USA
Helmet Exhalation Capture System (HECS) Sizing Evaluation for an Advanced Space Suit Portable Life Support System
Paul, Heather L.; Waguespack, Glenn M.; Paul, Thomas H.; Conger, Bruce C.; [2008]; 17 pp.; In English; International Conference on Environmental Systems, 29 Jun. - 3 Jul. 2008, San Francisco, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 903184.04.02.03.01; Copyright; Avail.: CASI: A03, Hardcopy

As part of NASA s initiative to develop an advanced portable life support system (PLSS), a baseline schematic has been

chosen that includes gaseous oxygen in a closed circuit ventilation configuration. Supply oxygen enters the suit at the back of the helmet and return gases pass over the astronaut s body to be extracted at the astronaut s wrists and ankles through the liquid cooling and ventilation garment (LCVG). The extracted gases are then treated using a rapid cycling amine (RCA) system for carbon dioxide and water removal and activated carbon for trace gas removal before being mixed with makeup oxygen and reintroduced into the helmet. Thermal control is provided by a suit water membrane evaporator (SWME). As an extension of the original schematic development, NASA evaluated several Helmet Exhalation Capture System (HECS) configurations as alternatives to the baseline. The HECS configurations incorporate the use of full contact masks or non-contact masks to reduce flow requirements within the PLSS ventilation subsystem. The primary scope of this study was to compare the alternatives based on mass and volume considerations; however other design issues were also briefly investigated. This paper summarizes the results of this sizing analysis task.
Author
Helmets; Portable Life Support Systems; Temperature Control; Ventilation; Oxygen; Carbon Dioxide Removal; Systems Engineering; Liquid Cooling; Exhalation

20080013594 Tec-Masters, Inc., Huntsville, AL, USA
An Overview of the Microgravity Science Glovebox (MSG) Facility, and the Gravity-Dependent Phenomena Research Performed in the MSG on the International Space Station (ISS)
Spivey, Reggie A.; Sheredy, William A.; Flores, Ginger; January 07, 2008; 18 pp.; In English; 46th AIAA Aerospace Sciences Meeting, 7-10 Jan. 2008, Reno, NV, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

The Microgravity Science Glovebox (MSG) is a double rack facility aboard the International Space Station (ISS) designed for gravity-dependent phenomena investigation handling. The MSG has been operating in the ISS US Laboratory Module since July 2002. The MSG facility provides an enclosed working area for investigation manipulation and observation, The MSG's unique design provides two levels of containment to protect the ISS crew from hazardous operations. Research investigations operating inside the MSG are provided a large 255 liter work volume, 1000 watts of dc power via a versatile supply interface (120, 28, +/-12, and 5 Vdc), 1000 watts of cooling capability, video and data recording and real time downlink, ground commanding capabilities, access to ISS Vacuum Exhaust and Vacuum Resource Systems, and gaseous nitrogen supply. With these capabilities, the MSG is an ideal platform for research required to advance the technology readiness levels (TRL) needed for the Crew Exploration Vehicle and the Exploration Initiative. Areas of research that will benefit from investigations in the MSG include thermal management, fluid physics, spacecraft fire safety, materials science, combustion, reaction control systems, in situ fabrication and repair, and advanced life support technologies. This paper will provide a detailed explanation of the MSG facility, a synopsis of the research that has already been accomplished in the MSG and an overview of investigations planning to operate in the MSG. In addition, this paper will address possible changes to the MSG utilization process that will be brought about by the transition to ISS as a National Laboratory.
Author
Microgravity; International Space Station; Gravitational Effects; Life Support Systems; Vacuum Systems; Aerospace Safety; Temperature Control; Exhaust Systems; Data Recording

20080013633 NASA Langley Research Center, Hampton, VA, USA
Simulation Evaluation of Synthetic Vision as an Enabling Technology for Equivalent Visual Operations
Kramer, Lynda J.; Williams, Steven P.; Bailey, Randall E.; March 16, 2008; 15 pp.; In English; SPIE Defense and Security Symposium 2008, 16-20 Mar. 2008, Orlando, FL, USA; Original contains color illustrations
Contract(s)/Grant(s): 609866.02.07.07.02; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013633

Enhanced Vision (EV) and synthetic vision (SV) systems may serve as enabling technologies to meet the challenges of the Next Generation Air Transportation System (NextGen) Equivalent Visual Operations (EVO) concept ? that is, the ability to achieve or even improve on the safety of Visual Flight Rules (VFR) operations, maintain the operational tempos of VFR, and even, perhaps, retain VFR procedures independent of actual weather and visibility conditions. One significant challenge lies in the definition of required equipage on the aircraft and on the airport to enable the EVO concept objective. A piloted simulation experiment was conducted to evaluate the effects of the presence or absence of Synthetic Vision, the location of this information during an instrument approach (i.e., on a Head-Up or Head-Down Primary Flight Display), and the type of airport lighting information on landing minima. The quantitative data from this experiment were analyzed to begin the definition of performance-based criteria for all-weather approach and landing operations. Objective results from the present study showed that better approach performance was attainable with the head-up display (HUD) compared to the head-down

display (HDD). A slight performance improvement in HDD performance was shown when SV was added, as the pilots descended below 200 ft to a 100 ft decision altitude, but this performance was not tested for statistical significance (nor was it expected to be statistically significant). The touchdown data showed that regardless of the display concept flown (SV HUD, Baseline HUD, SV HDD, Baseline HDD) a majority of the runs were within the performance-based defined approach and landing criteria in all the visibility levels, approach lighting systems, and decision altitudes tested. For this visual flight maneuver, RVR appeared to be the most significant influence in touchdown performance. The approach lighting system clearly impacted the pilot's ability to descend to 100 ft height above touchdown based on existing Federal Aviation Regulation (FAR) 91.175 using a 200 ft decision height, but did not appear to influence touchdown performance or approach path maintenance Author

Enhanced Vision; Simulation; Technology Utilization; Air Transportation

20080014091 NASA Johnson Space Center, Houston, TX, USA

A Freezable Heat Exchanger for Space Suit Radiator Systems

Nabity, James A.; Mason, Georgia R.; Copeland, Robert J.; Trevino, Luis a.; 2008; 9 pp.; In English; 38th International Conference on Environmental Systems, 29 Jun. - 3 Jul. 2008, San Francisco, CA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNJ07JB39C

Report No.(s): 08ICES-0174; Copyright; Avail.: Other Sources

During an ExtraVehicular Activity (EVA), both the heat generated by the astronaut s metabolism and that produced by the Portable Life Support System (PLSS) must be rejected to space. The heat sources include the heat of adsorption of metabolic CO2, the heat of condensation of water, the heat removed from the body by the liquid cooling garment and the load from the electrical components. Although the sublimator hardware to reject this load weighs only 1.58 kg (3.48 lbm), an additional 3.6 kg (8 lbm) of water are loaded into the unit, most of which is sublimated and lost to space, thus becoming the single largest expendable during an eight-hour EVA. Using a radiator to reject heat from the astronaut during an EVA can reduce the amount of expendable water consumed in the sublimator. Radiators have no moving parts and are thus highly reliable. Past freezable radiators have been too heavy, but the weight can be greatly reduced by placing a small and freeze tolerant heat exchanger between the astronaut and radiator, instead of making the very large radiator freeze tolerant. Therefore, the key technological innovation to improve space suit radiator performance was the development of a lightweight and freezable heat exchanger that accommodates the variable heat load generated by the astronaut. Herein, we present the heat transfer performance of a newly designed heat exchanger that endured several freeze / thaw cycles without any apparent damage. The heat exchanger was also able to continuously turn down or turn up the heat rejection to follow the variable load. Author

Heat Exchangers; Space Suits; Portable Life Support Systems; Extravehicular Activity; Liquid Cooling

20080014093 NASA Johnson Space Center, Houston, TX, USA

Development of Urine Receptacle Assembly for the Crew Exploration Vehicle

Cibuzar, Branelle Rae; Thomas, Evan; Peterson, Laurie; Goforth, Johanna; [2008]; 10 pp.; In English; 38th International Conference on Environmental Systems, 29 Jun. - 3 Jul. 2008, San Francisco, CA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): 644423.06.31.03.12.10

Report No.(s): 08ICES-0224; Copyright; Avail.: Other Sources

The Urine Receptacle Assembly (URA) initially was developed for Apollo as a primary means of urine collection. The aluminum housing with stainless steel honeycomb insert provided all male crewmembers with a non-invasive means of micturating into a urine capturing device and then venting to space. The performance of the URA was a substantial improvement over previous devices but its performance was not well understood. The Crew Exploration Vehicle (CEV) program is exploring the URA as a contingency liquid waste management system for the vehicle. URA improvements are required to meet CEV requirements, including: consumables minimization, flow performance, acceptable hygiene standards, crew comfort, and female crewmember capability. This paper presents the results of a historical review of URA performance during the Apollo program, recent URA performance tests on the reduced gravity aircraft flight under varying flow conditions, and a proposed development plan for the URA to meet CEV needs.

Author

Waste Management; Liquid Wastes; Performance Tests; Hygiene; Consumables (Spacecraft); Urine; Management Systems

20080014094 NASA Johnson Space Center, Houston, TX, USA
Lessons Learned from the Node 1 Fire Detection and Suppression Subsystem Design
Williams, David E.; [2008]; 8 pp.; In English; International Conference on Environmental Systems, 29 Jun. - 3 Jul. 2008, San Francisco, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): 401769.06.01.01.01
Report No.(s): 08ICES-0232; Copyright; Avail.: Other Sources

This paper will provide an overview of the International Space Station (ISS) Environmental Control and Life Support (ECLS) design of the Node 1 Fire Detection and Suppression (FDS) subsystem and it will document some of the lessons that have been learned to date for this subsystem.
Author
Fire Extinguishers; Fire Prevention; International Space Station; General Overviews; Portable Life Support Systems

55
EXOBIOLOGY

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see *52 Aerospace Medicine*; on animals and plants see *51 Life Sciences*. For psychological and behavioral effects of aerospace environments see *53 Behavioral Sciences*.

20080013413 NASA Johnson Space Center, Houston, TX, USA
'Nano' Scale Biosignatures and the Search for Extraterrestrial Life
Oehler, D. Z.; Robert, F.; Meibom, A.; Mostefaoui, S.; Selo, M.; Walter, M. R.; Sugitani, K.; Allwood, A.; Mimura, K.; Gibson, E. K.; March 10, 2008; 2 pp.; In English; 39th Lunar and Planetary Science Conference, 10-14 Mar. 2008, League City, TX, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

A critical step in the search for remnants of potential life forms on other planets lies in our ability to recognize indigenous fragments of ancient microbes preserved in some of Earth's oldest rocks. To this end, we are building a database of nano-scale chemical and morphological characteristics of some of Earth's oldest organic microfossils. We are primarily using the new technology of Nano-Secondary ion mass spectrometry (NanoSIMS) which provides in-situ, nano-scale elemental analysis of trace quantities of organic residues. The initial step was to characterize element composition of well-preserved, organic microfossils from the late Proterozoic (0.8 Ga) Bitter Springs Formation of Australia. Results from that work provide morphologic detail and nitrogen/carbon ratios that appear to reflect the well-established biological origin of these 0.8 Ga fossils.
Author
Biomarkers; Extraterrestrial Life; Fossils; Biogeochemistry; Microorganisms; Life Detectors

20080013431 NASA Johnson Space Center, Houston, TX, USA
Diversity and Physiology of Siderophilic Cyanobacteria: Implication for the Bioenergetics
Brown, Igor; Sarkisova, Svetlana; Thomas-Kerprta, Kathie; McKay, David S.; [2008]; 2 pp.; In English; Molecular Bioenergetics of Cyanobacteria, 29 Mar. - 3 Apr. 2008, Sant Feliu de Guixols, Spain; Copyright; Avail.: CASI: A01, Hardcopy

Prior to 2.4 Ga, global oceans were likely significantly enriched in soluble iron (Rouxel, Bekker, Edwards, 2005), a condition that is not conducive to the growth of most contemporary mesophilic cyanobacteria (CB). Recent studies of the mechanisms of iron-deficiency stress in CB suggest that contemporary mesophilic freshwater and marine B underwent long-term adaptation to a permanent decrease in soluble iron in the ocean environment (Boyer, et al., 1987; Braun, Hantke, and Koster, 1998). Of all extant environments, iron-depositing hot springs may constitute the most appropriate natural models for analysis of the transition of ancestral cyanobacteria (CB) or protocyanobacteria (PCB) (Olson, 2001) from anoxygenic photosynthesis to oxygenic one and biogeochemical processes in the late Archean and early Paleoproterozoic eras. In particular, Olson (2001) proposed the definition for PCB and postulated that the common ancestor of PCB and CB might well have used Fe(OH)+ as the principal electron donor for CO2 fixation (Widdel, et al., 1993; Ehrenreich and Widdel, 1994; Pierson and Olson, 1989; Olson, 2006). Olson (2001) proposed that the driving force for the evolution of RC2, in addition to RC1, was the necessity to use Fe(OH)+ effectively for CO2 fixation in the absence of reduced sulfur compounds. The global decrease of dissolved environmental reduced iron could have been the driving force for the transition from anoxygenic to oxygenic photosynthesis (Brown et al., 2007). Despite the insights into the ecology, evolutionary biology, paleogeobiochemistry, and astrobiology the examination of iron depositing hot springs (IDHS) could potentially provide, very

few studies dedicated to the diversity and physiology of cyanobacteria inhabiting IDHS have been conducted. Here we describe the phylogeny, physiology and ultrastructure and biogeochemical activity of several recent CB isolates from two different greater Yellowstone area IDHS, e.g. LaDuke and Chocolate Pots. Phylogenetic analysis of 16S rRNA genes indicated that 6 of 12 new isolates examined could not be placed within established CB genera. Some of the isolates exhibited pronounced requirements for elevated iron concentrations, with maximum growth rates observed when 0.4-1 mM Fe(3+) was present in the media. However, the pronounced effect of iron limitation on the proliferation of siderophilic CB can be observed only after several passages through iron 'free' media. TEM studies of several species of siderophilic CB revealed that the cultures JSC-3 and -11 are probably capable of some sort of pinocytosis of precipitated iron. This phenomenon may explain high tolerance of siderophilic CB to iron deficit. We also found that the stimulation of the growth of siderophilic CB by oxidized iron is accompanied by the decrease of O2 evolution by some species after addition Fe(2+) in iron 'free' medium. Author

Biogeochemistry; Photosynthesis; Mesophiles; Ecology; Biological Evolution; Bacteria; Polychlorinated Biphenyls; Exobiology

61
COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20080013512 NASA Langley Research Center, Hampton, VA, USA

Verification of a Byzantine-Fault-Tolerant Self-stabilizing Protocol for Clock Synchronization

Malekpour, Mahyar R.; March 2008; 13 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): WBS 645846.02.07.07.06; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080013512

This paper presents the mechanical verification of a simplified model of a rapid Byzantine-fault-tolerant self-stabilizing protocol for distributed clock synchronization systems. This protocol does not rely on any assumptions about the initial state of the system except for the presence of sufficient good nodes, thus making the weakest possible assumptions and producing the strongest results. This protocol tolerates bursts of transient failures, and deterministically converges within a time bound that is a linear function of the self-stabilization period. A simplified model of the protocol is verified using the Symbolic Model Verifier (SMV). The system under study consists of 4 nodes, where at most one of the nodes is assumed to be Byzantine faulty. The model checking effort is focused on verifying correctness of the simplified model of the protocol in the presence of a permanent Byzantine fault as well as confirmation of claims of determinism and linear convergence with respect to the self-stabilization period. Although model checking results of the simplified model of the protocol confirm the theoretical predictions, these results do not necessarily confirm that the protocol solves the general case of this problem. Modeling challenges of the protocol and the system are addressed. A number of abstractions are utilized in order to reduce the state space.

Author

Fault Tolerance; Time Synchronization; Mathematical Models; Stabilization

20080014137 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Sequencing System Building Blocks: Using a Component Architecture for Sequencing Software

Streiffert, Barbara A.; O'Reilly, Taifun; June 19, 2006; 17 pp.; In English; SpaceOps Conference, 16-24 Jun. 2006, Rome, Italy; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40707

Over the last few years software engineering has made significant strides in making more flexible architectures and designs possible. However, at the same time, spacecraft have become more complex and flight software has become more sophisticated. Typically spacecraft are often one-of-a-kind entities that have different hardware designs, different capabilities, different instruments, etc. Ground software has become more complex and operations teams have had to learn a myriad of tools that all have different user interfaces and represent data in different ways. At Jet Propulsion Laboratory (JPL) these themes have collided to require a new approach to producing ground system software. Two different groups have been looking at tackling this particular problem. One group is working for the JPL Mars Technology Program in the Mars Science Laboratory (MSL) Focused Technology area. The other group is the JPL Multi-Mission Planning and Sequencing Group. The

major concept driving these two approaches on a similar path is to provide software that can be a more cohesive flexible system that provides a set of planning and sequencing system of services. This paper describes the efforts that have been made to date to create a unified approach from these disparate groups.
Author
Computer Programming; Sequencing; Software Engineering

20080014188 NASA Langley Research Center, Hampton, VA, USA
Software Tools for Developing and Simulating the NASA LaRC CMF Motion Base
Bryant, Richard B., Jr.; Carrelli, David J.; August 21, 2006; 11 pp.; In English; AIAA Modeling and Simulation Technologies Conference and Exhibit, 21-24 Aug. 2006, Keystone, CO, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 316922.07.10
Report No.(s): AIAA Paper-2006-6363; Copyright; Avail.: CASI: A03, Hardcopy

The NASA Langley Research Center (LaRC) Cockpit Motion Facility (CMF) motion base has provided many design and analysis challenges. In the process of addressing these challenges, a comprehensive suite of software tools was developed. The software tools development began with a detailed MATLAB/Simulink model of the motion base which was used primarily for safety loads prediction, design of the closed loop compensator and development of the motion base safety systems1. A Simulink model of the digital control law, from which a portion of the embedded code is directly generated, was later added to this model to form a closed loop system model. Concurrently, software that runs on a PC was created to display and record motion base parameters. It includes a user interface for controlling time history displays, strip chart displays, data storage, and initializing of function generators used during motion base testing. Finally, a software tool was developed for kinematic analysis and prediction of mechanical clearances for the motion system. These tools work together in an integrated package to support normal operations of the motion base, simulate the end to end operation of the motion base system providing facilities for software-in-the-loop testing, mechanical geometry and sensor data visualizations, and function generator setup and evaluation.
Author
Cockpits; Computerized Simulation; Software Development Tools; Motion; Systems Engineering

20080014217 NASA Johnson Space Center, Houston, TX, USA
Information Extraction for System-Software Safety Analysis: Calendar Year 2007 Year-End Report
Malin, Jane T.; [2008]; 11 pp.; In English; No Copyright; Avail.: CASI: A03, Hardcopy

This annual report describes work to integrate a set of tools to support early model-based analysis of failures and hazards due to system-software interactions. The tools perform and assist analysts in the following tasks: 1) extract model parts from text for architecture and safety/hazard models; 2) combine the parts with library information to develop the models for visualization and analysis; 3) perform graph analysis on the models to identify possible paths from hazard sources to vulnerable entities and functions, in nominal and anomalous system-software configurations; 4) perform discrete-time-based simulation on the models to investigate scenarios where these paths may play a role in failures and mishaps; and 5) identify resulting candidate scenarios for software integration testing. This paper describes new challenges in a NASA abort system case, and enhancements made to develop the integrated tool set.
Author
Information Systems; Extraction; Program Verification (Computers); Systems Engineering; Safety Factors; Graph Theory

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.

20080013539 NASA Langley Research Center, Hampton, VA, USA
Biology Inspired Approach for Communal Behavior in Sensor Networks
Jones, Kennie H.; Lodding, Kenneth N.; Olariu, Stephan; Wilson, Larry; Xin, Chunsheng; January 04, 2006; 10 pp.; In English; 39th Hawaii International Conference on Systems Sciences, 4-7 Jan. 2006, Kauai, HI, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): 23-090-20-ii; Copyright; Avail.: CASI: A02, Hardcopy

Research in wireless sensor network technology has exploded in the last decade. Promises of complex and ubiquitous

control of the physical environment by these networks open avenues for new kinds of science and business. Due to the small size and low cost of sensor devices, visionaries promise systems enabled by deployment of massive numbers of sensors working in concert. Although the reduction in size has been phenomenal it results in severe limitations on the computing, communicating, and power capabilities of these devices. Under these constraints, research efforts have concentrated on developing techniques for performing relatively simple tasks with minimal energy expense assuming some form of centralized control. Unfortunately, centralized control does not scale to massive size networks and execution of simple tasks in sparsely populated networks will not lead to the sophisticated applications predicted. These must be enabled by new techniques dependent on local and autonomous cooperation between sensors to effect global functions. As a step in that direction, in this work we detail a technique whereby a large population of sensors can attain a global goal using only local information and by making only local decisions without any form of centralized control.
Author
Wireless Communication; Sensors; Communication Networks; Technology Assessment; Microelectromechanical Systems

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*.

20080013453 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Robotic Exploration of Moon and Mars: Thematic Education Approach
Allen, J S.; Tobola, K. W.; Lowes, L. L.; Betrue, R.; March 10, 2008; 2 pp.; In English; 39th Lunar and Planetary Science Conference, 10-14 Mar. 2008, League City, TX, USA
Contract(s)/Grant(s): NNJ05HI05C; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013453

Safe, sustained, affordable human and robotic exploration of the Moon, Mars, and beyond is a major NASA goal. Robotic exploration of the Moon and Mars will help pave the way for an expanded human presence in our solar system. To help share the robotic exploration role in the Vision for Space Exploration with classrooms, informal education groups, and the public, our team researched and consolidated the thematic story components and associated education activities into a useful education materials set for educators. We developed the set of materials for a workshop combining NASA Science Mission Directorate and Exploration Systems Mission Directorate engineering, science, and technology to train informal educators on education activities that support the robotic exploration themes. A major focus is on the use of robotic spacecraft and instruments to explore and prepare for the human exploration of the Moon and Mars.
Author
Space Exploration; Robotics; Systems Engineering; Spacecraft Instruments; Education

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20080013495 NASA Langley Research Center, Hampton, VA, USA
Directed Design of Experiments (DOE) for Determining Probability of Detection (POD) Capability of NDE Systems (DOEPOD)
Generazio, Ed; August 27, 2007; 42 pp.; In English; 50th Annual Air Transportation Association (ATA) Non-Destructive Testing (NDT) Forum, 37-30 Aug. 2007, Orlando, Fl, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 939904.05.07; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013495

This viewgraph presentation reviews some of the issues that people who specialize in Non destructive evaluation (NDE) have with determining the statistics of the probability of detection. There is discussion of the use of the binominal distribution, and the probability of hit. The presentation then reviews the concepts of Directed Design of Experiments for Validating

Probability of Detection of Inspection Systems (DOEPOD). Several cases are reviewed, and discussed. The concept of false calls is also reviewed.
CASI
Detection; Experiment Design; Nondestructive Tests; Probability Theory; Statistical Analysis

20080013588 NASA Langley Research Center, Hampton, VA, USA
Directed Design of Experiments (DOE) for Determining Probability of Detection (POD) Capability of NDE Systems (DOEPOD)
Generazio, Edward R.; July 22, 2007; 41 pp.; In English; 34th Annual Review of Progress in Quantitative Nondestructive Evaluation (QNDE 2007), 22-27 Jul. 2007, Golden, CO, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013588

This viewgraph presentation reviews some of the problems that are encountered by designers of Non-Destructive Examination (NDE) have in determining the probability of detection. According to the author "[the] NDE community should not blindly accept statistical results due to lack of knowledge.' This is an attempt to bridge the gap between people doing NDE, and statisticians.
CASI
Detection; Experiment Design; Nondestructive Tests; Probability Theory; Statistical Analysis

71
ACOUSTICS

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution*. For aircraft noise see also *02 Aerodynamics* and *07 Aircraft Propulsion and Power*.

20080014106 NASA Langley Research Center, Hampton, VA, USA
Increased Fidelity in Prediction Methods For Landing Gear Noise
Lopes, Leonard V.; Brentner, Kenneth S.; Morris, Philip J.; Lockhard, David P.; May 08, 2006; 13 pp.; In English; 12th AIAA/CEAS Aeroacoustics Conference, 8-10 May 2006, Cambridge, MA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAG1-03025; WBS 561581.02.08; Copyright; Avail.: CASI: A03, Hardcopy

An aeroacoustic prediction scheme has been developed for landing gear noise. The method is designed to handle the complex landing gear geometry of current and future aircraft. The gear is represented by a collection of subassemblies and simple components that are modeled using acoustic elements. These acoustic elements are generic, but generate noise representative of the physical components on a landing gear. The method sums the noise radiation from each component of the undercarriage in isolation accounting for interference with adjacent components through an estimate of the local upstream and downstream flows and turbulence intensities. The acoustic calculations are made in the code LGMAP, which computes the sound pressure levels at various observer locations. The method can calculate the noise from the undercarriage in isolation or installed on an aircraft for both main and nose landing gear. Comparisons with wind tunnel and flight data are used to initially calibrate the method, then it may be used to predict the noise of any landing gear. In this paper, noise predictions are compared with wind tunnel data for model landing gears of various scales and levels of fidelity, as well as with flight data on fullscale undercarriages. The present agreement between the calculations and measurements suggests the method has promise for future application in the prediction of airframe noise.
Author
Aeroacoustics; Aerodynamic Noise; Gears; Landing Gear; Wind Tunnel Tests; Mathematical Models; Prediction Analysis Techniques

20080014202 NASA Langley Research Center, Hampton, VA, USA
Finite Element Development of Honeycomb Panel Configurations with Improved Transmission Loss
Grosveld, Ferdinand W.; Palumbo, Daniel L.; Klos, Jacob; Castle, William D.; December 03, 2006; 15 pp.; In English; INTER-NOISE 2006 - 35th International Congress and Exposition on Noise Control Engineering, 3-6 Dec. 2006, Honolulu, HI, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 561581.02.08.07; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080014202

The higher stiffness-to-mass ratio of a honeycomb panel compared to a homogeneous panel results in a lower acoustic

critical frequency. Above the critical frequency the panel flexural wave speed is acoustically fast and the structure becomes a more efficient radiator with associated lower sound transmission loss. Finite element models of honeycomb sandwich structures are presented featuring areas where the core is removed from the radiating face sheet disrupting the supersonic flexural and shear wave speeds that exist in the baseline honeycomb panel. These modified honeycomb panel structures exhibit improved transmission loss for a pre-defined diffuse field sound excitation. The models were validated by the sound transmission loss of honeycomb panels measured in the Structural Acoustic Loads and Transmission (SALT) facility at the NASA Langley Research Center. A honeycomb core panel configuration is presented exhibiting a transmission loss improvement of 3-11 dB compared to a honeycomb baseline panel over a frequency range from 170 Hz to 1000 Hz. The improved transmission loss panel configuration had a 5.1% increase in mass over the baseline honeycomb panel, and approximately twice the deflection when excited by a static force.
Author
Finite Element Method; Honeycomb Structures; Transmission Loss; Panels; Acoustics; Mathematical Models

20080014207 NASA Langley Research Center, Hampton, VA, USA
Effects of Angle of Attack and Velocity on Trailing Edge Noise
Hutcheson, Florence V.; Brooks, Thomas F.; International Journal of Aeroacoustics; [2006]; Volume 5, No. 1, pp. 39-66; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): 781-10-11; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080014207

Trailing edge (TE) noise measurements for a NACA 63-215 airfoil model are presented, providing benchmark experimental data for a cambered airfoil. The effects of flow Mach number and angle of attack of the airfoil model with different TE bluntnesses are shown. Far-field noise spectra and directivity are obtained using a directional microphone array. Standard and diagonal removal beamforming techniques are evaluated employing tailored weighting functions for quantitatively accounting for the distributed line character of TE noise. Diagonal removal processing is used for the primary database as it successfully removes noise contaminates. Some TE noise predictions are reported to help interpret the data, with respect to flow speed, angle of attack, and TE bluntness on spectral shape and peak levels. Important findings include the validation of a TE noise directivity function for different airfoil angles of attack and the demonstration of the importance of the directivity function s convective amplification terms.
Author
Aeroacoustics; Angle of Attack; Trailing Edges; Anechoic Chambers; Noise Prediction (Aircraft); Cambered Wings

20080014228 NASA Langley Research Center, Hampton, VA, USA
Ultrasonics Equipped Crimp Tool: A New Technology for Aircraft Wiring Safety
Yost, William T.; Perey, Daniel F.; Cramer, Elliott; March 06, 2006; 28 pp.; In English; 9th Joint FAA/DoD/NASA Conference on Aging Aircraft, 6-9 Mar. 2006, Atlanta, GA, USA; Original contains color illustrations
Contract(s)/Grant(s): 698259.02.07.07
Report No.(s): Paper No. 221; LAR-16575-1; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080014228

We report on the development of a new measurement technique to quantitatively assess the condition of wire crimp connections. This ultrasonic (UT) method transmits high frequency sound waves through the joint under inspection. The wire-crimp region filters and scatters the ultrasonic energy as it passes through the crimp and wire. The resulting output (both time and frequency domains) provides a quantitative measure of the joint quality that is independent and unaffected by current. Crimps of poor mechanical and electrical quality will result in low temporal output and will distort the spectrum into unique and predictable patterns, depending on crimp ‘quality’. This inexpensive, real-time measurement system can provide certification of crimps as they are made and recertification of existing wire crimps currently in service. The measurements for re-certification do not require that the wire be disconnected from its circuit. No other technology exists to measure in-situ the condition of wire joints (no electrical currents through the crimp are used in this analytical technique). We discuss the signals obtained from this instrument, and correlate these signals with destructive wire pull tests.
Author
Sound Waves; Ultrasonics; Folding; Electric Connectors; Electric Wire; Ultrasonic Tests; Acoustic Measurement

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*.

20080014212 NASA Langley Research Center, Hampton, VA, USA
Nucleon-Nucleon Total Cross Section
Norbury, John W.; March 2008; 18 pp.; In English
Contract(s)/Grant(s): WBS 651549.02.07.01
Report No.(s): NASA/TP-2008-215116; L-19396; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080014212

The total proton-proton and neutron-proton cross sections currently used in the transport code HZETRN show significant disagreement with experiment in the GeV and EeV energy ranges. The GeV range is near the region of maximum cosmic ray intensity. It is therefore important to correct these cross sections, so that predictions of space radiation environments will be accurate. Parameterizations of nucleon-nucleon total cross sections are developed which are accurate over the entire energy range of the cosmic ray spectrum.
Author
Nucleon-Nucleon Interactions; Parameterization; Neutron Cross Sections; Nuclear Reactions; Elastic Scattering

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*.

20080013572 NASA Langley Research Center, Hampton, VA, USA
High-sensitivity Cryogenic Temperature Sensors using Pressurized Fiber Bragg Gratings
Wu, Meng-Chou; DeHaven, Stanton L.; [2006]; 7 pp.; In English; Photonics Europe 2006, 3-7 Apr. 2006, Strasbourg, France; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013572

Cryogenic temperature sensing was studied using a pressurized fiber Bragg grating (PFBG). The PFBG was obtained by simply applying a small diametric load to a regular fiber Bragg grating (FBG), which was coated with polyimide of a thickness of 11 micrometers. The Bragg wavelength of the PFBG was measured at temperatures from 295 to 4.2 K. A pressure-induced transition occurred at 200 K during the cooling cycle. As a result the temperature sensitivity of the PFBG was found to be nonlinear but reach 24 pm/K below 200 K, more than three times the regular FBG. For the temperature change from 80 K to 10 K, the PFBG has a total Bragg wavelength shift of about 470 pm, 10 times more than the regular FBG. From room temperature to liquid helium temperature the PFBG gives a total wavelength shift of 3.78 nm, compared to the FBG of 1.51 nm. The effect of the coating thickness on the temperature sensitivity of the gratings is also discussed.
Author
Bragg Gratings; Cryogenic Temperature; Sensitivity; Temperature Sensors; Pressurizing; Optical Fibers

20080014142 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Hyper-Parametric Oscillations in a Whispering Gallery Mode Fluorite Resonator
Savchenkov, Anatoliy; Strekalov, Dmitry; Mohageg, Makan; Ilchenko, Vladimir; Matsko, Andrey; Maleki, Lute; October 10, 2004; 11 pp.; In English; Frontiers in Optics, 88th Annual OSA Meeting, 10-14 Oct. 2004, Rochester, NY, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40659

This viewgraph presentation summarizes the hyper-parametric oscillations observations of the fluorite resonator. The reporters have observed various nonlinear effects in ultra-high Q crystalline whispering gallery mode (WGM) resonators. In particular, it was demonstrated a low threshold optical hyper-parametric oscillations in a high-Q (Q=1010) CaF2 WGM

resonator. The oscillations result from the resonantly enhanced four-wave-mixing occurring due to Kerr nonlinearity of the material.
CASI
Fluorite; Oscillations; Resonators; Whispering Gallery Modes

20080014178 NASA Langley Research Center, Hampton, VA, USA
Effects of Coating and Diametric Load on Fiber Bragg Gratings as Cryogenic Temperature Sensors
Wu, meng-Chou; Pater, Ruth H.; DeHaven, Stanton L.; March 09, 2008; 10 pp.; In English; SPIE Smart Structures and Materials and Nondestructive Evaluation and Health Monitoring, 9-13 Mar. 2008, San Diego, CA, USA; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 645846.02.07.07.02
Report No.(s): Paper-6933-3; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080014178

Cryogenic temperature sensing was demonstrated using pressurized fiber Bragg gratings (PFBGs) with polymer coating of various thicknesses. The PFBG was obtained by applying a small diametric load to a regular fiber Bragg grating (FBG). The Bragg wavelengths of FBGs and PFBG were measured at temperatures from 295 K to 4.2 K. The temperature sensitivities of the FBGs were increased by the polymer coating. A physical model was developed to relate the Bragg wavelength shifts to the thermal expansion coefficients, Young's moduli, and thicknesses of the coating polymers. When a diametric load of no more than 15 N was applied to a FBG, a pressure-induced transition occurred at 200 K during the cooling cycle. The pressure induced transition yielded PFBG temperature sensitivities three times greater than conventional FBGs for temperatures ranging from 80 to 200 K, and ten times greater than conventional fibers for temperatures below 80 K. PFBGs were found to produce an increased Bragg wavelength shift of 2.2 nm compared to conventional FBGs over the temperature range of 4.2 to 300 K. This effect was independent of coating thickness and attributed to the change of the fiber thermo-optic coefficient.
Author
Coating; Optical Fibers; Bragg Gratings; Cryogenic Temperature; Temperature Sensors; Pressurizing

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20080014043 NASA Marshall Space Flight Center, Huntsville, AL, USA
Turing Structures and Coupled Particle Transport in Space Plasmas
Barghouty, A. F.; El-Nemr, K. W.; Baird, J. K.; [2007]; 10 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Energetic (suprathermal), charged particles in hot, magnetized plasma are known to be intimately coupled to the plasma for their acceleration and transport. For many space applications the dynamics is described by a set of coupled Fokker-Planck equations. In a collisionless plasma, particle-particle coupling can be affected in a number of ways. This paper explores effects of particle-particle coupling via nonlinear source terms on the characteristics of these particles. By exploiting a coupled, nonlinear reactive-diffusive system, we demonstrate the possible existence of Turing structures in a two-particle Fokker-Planck model. In this model, diffusion in energy space is taken to be due to scattering m a turbulent magnetic field, while systematic energy losses and gains are generic. The analogy suggests that patterns can emerge with a strong dependence on the magnetic turbulence but a rather weak one on the coupled particles attributes. We believe this heuristic, but rather suggestive application of Turing morphogenesis theory to models of energetic particles in space, has the potential to help to explain some observed structures in the exceedingly complex space database.
Author
Transport Properties; Charged Particles; High Temperature Plasmas; Plasmas (Physics); Plasma Diffusion; Collisionless Plasmas; Energy Dissipation; Nonlinear Systems; Diffusivity

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*.

20080014156 NASA Johnson Space Center, Houston, TX, USA

In the Shade of Affluence: The Inequitable Distribution of the Urban Heat Island

Harlan, Sharon L.; Brazel, Anthony J.; Jenerette, G. Darrel; Jones, Nancy S.; Larsen, Larissa; Prashad, Lela; Research in Social Problems and Public Policy; 2008; ISSN 0196-1152; Volume 15, pp. 173-202; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NSF SES 0216281; NSF DEB 97114833; NSF DGE 9987612; NSF DEB 9421535; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1016/S0196-1152(07)15005-5

The urban heat island is an unintended consequence of humans building upon rural and native landscapes. We hypothesized that variations in vegetation and land use patterns across an urbanizing regional landscape would produce a temperature distribution that was spatially heterogeneous and correlated with the social characteristics of urban neighborhoods. Using biophysical and social data scaled to conform to US census geography, we found that affluent whites were more likely to live in vegetated and less climatically stressed neighborhoods likely to live in than low-income Latinos in Phoenix, Arizona. Affluent neighborhoods had cooler summer temperatures that reduced exposure to outdoor heat-related health risks, especially during a heat wave period. In addition to being warmer, poorer neighborhoods lacked critical resources in their physical and social environments to help them cope with extreme heat. Increased average temperatures due to climate change are expected to exacerbate the impacts of urban heat islands.

Author

Climate Change; Heat Islands; Vegetation; Cities; Residential Areas; Urban Research; Suburban Areas

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20080013500 United Space Alliance, Houston, TX, USA

Best Practices for Researching and Documenting Lessons Learned

Goodman, John L.; [2007]; 19 pp.; In English; Copyright; Avail.: CASI: A03, Hardcopy

Identification, resolution, and avoidance of technical and programmatic issues are important for ensuring safe and successful space missions. Although the importance of applying lessons learned to reduce risk is frequently stressed, there is little material available to help technical and management personnel research and document lessons learned. Collecting, researching, identifying, and documenting lessons learned that will be useful to current and future management and engineering personnel is not always a straightforward task. This white paper presents lessons learned and best practices concerning the research and documentation of technical and organizational lessons learned. It is intended to enable organizations to initiate or improve lessons learned research and documentation efforts. The content of this white paper is based on four technical lessons learned projects conducted by the United Space Alliance (USA) Flight Design and Dynamics Department, in support of the NASA/JSC Flight Design and Dynamics Division. Each project published a report, titled as follows: GPS Lessons Learned From the ISS, Space Shuttle and X-38; Lessons Learned From Seven Space Shuttle Missions; Space Shuttle Rendezvous and Proximity Operations Experience Report; and Navigation Technical History with Lessons Learned. The four projects were different in availability of subject matter experts and primary source material, subject scope, and the level of effort required to produce the final report. However, generic lessons can be drawn from all of them. The best practices will be discussed by the phases of report research and development: Defining Report Requirements, Project Organization, and Schedule, Collection and Analysis of Source Material, Writing and Integrating the Report, and Review and Revision of the Report.

Derived from text

Space Shuttle Missions; Space Transportation System Flights; Project Management; Aerospace Safety

83
ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

20080013584 NASA Marshall Space Flight Center, Huntsville, AL, USA
Marshall Space Flight Center Small Business Opportunities
Garrison, Lynn; November 15, 2007; 35 pp.; In English; Original contains black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013584

This viewgraph presentation reviews the small business opportunities that are available with the Marshall Space Flight Center. It includes information on all forms of opportunities available and information sources: subcontracting, websites, contacts and a separate section on Small Business Innovation Research (SBIR) & Small Business Technology Transfer (STTR) Programs
CASI
Commerce; NASA Programs; Technology Utilization; Aerospace Technology Transfer; Technology Transfer

84
LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes aviation law; space law and policy; international law; international cooperation; and patent policy.

20080013479 Government Accountability Office, Washington, DC, USA
Space Acquisitions: Major Space Programs Still at Risk for Cost and Schedule Increases
March 04, 2008; 21 pp.; In English; Original contains black and white illustrations
Report No.(s): GAO-08-552T; No Copyright; Avail.: CASI: A03, Hardcopy

Each year, the Department of Defense (DOD) spends billions of dollars to acquire space-based capabilities to support current military and other government operations as well as to enable DOD to transform the way it collects and disseminates information, gathers data on adversaries, and attacks targets. At the same time, the majority of major acquisition programs in DOD's space portfolio have experienced problems during the past two decades that have driven up cost and schedules and increased technical risks. This document reports on the Government Accountability Office's testimony before the U.S. Senate's Committee on Armed Services, Subcommittee on Strategic Forces. The GAO reports that the DOD has taken a number of actions to address ongoing cost and scheduling increases. These include initiatives at the department level that will affect all major weapons programs, as well as changes in course within specific Air Force programs. Most notable, the Air Force has sustained its commitment to reduce technology risks in programs and acted to restructure new programs so that its space portfolio can be more affordable. These actions are a step in the right direction and will be effective, particularly if they are complemented by more accurate cost estimating; continued prioritization of investments; actions to address capacity shortfalls, such as low-cost launch and shortages of staff in program offices; and changes to acquisition policies to reflect the best practices the Air Force is committing to.
Derived from text
Defense Program; Space Programs; Operating Costs; Scheduling; Government/Industry Relations

88
SPACE SCIENCES (GENERAL)

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through 93*.

20080013399 NASA Johnson Space Center, Houston, TX, USA
Triple F - A Comet Nucleus Sample Return Mission
Kueppers, Michael; Keller, Horst Uwe; Kuhrt, Ekkehard; A'Hearn, Michael; Altwegg, Kathrin; Betrand, Regis; Busemann, Henner; Capria, Maria Teresa; Colangeli, Luigi, et al.; January 10, 2008; 51 pp.; In English; To appear in the Journal of Experimental Astronomy; projected release date March 2008; Original contains color illustrations; Copyright; Avail.: CASI: A04, Hardcopy

The Triple F (Fresh From the Fridge) mission, a Comet Nucleus Sample Return, has been proposed to ESA s Cosmic

Vision program. A sample return from a comet enables us to reach the ultimate goal of cometary research. Since comets are the least processed bodies in the solar system, the proposal goes far beyond cometary science topics (like the explanation of cometary activity) and delivers invaluable information about the formation of the solar system and the interstellar molecular cloud from which it formed. The proposed mission would extract three samples of the upper 50 cm from three locations on a cometary nucleus and return them cooled to Earth for analysis in the laboratory. The simple mission concept with a touch-and-go sampling by a single spacecraft was proposed as an M-class mission in collaboration with the Russian space agency ROSCOSMOS.
Author
Comet Nuclei; Extraction; Sample Return Missions; Molecular Clouds; Interstellar Matter; Comets

20080013577 Jacobs Engineering Group, Inc., Huntsville, AL, USA
Surface Landing Site Weather Analysis for NASA's Constellation Program
Altino, Karen M.; Burns, K. L.; January 20, 2008; 10 pp.; In English; American Meteorological Society Annual Meeting, 20-24 Jan. 2008, New Orleans, LA, USA; Original contains color illustrations
Contract(s)/Grant(s): NNM05AB50C; Copyright; Avail.: CASI: A02, Hardcopy

Weather information is an important asset for NASA's Constellation Program in developing the next generation space transportation system to fly to the International Space Station, the Moon and, eventually, to Mars. Weather conditions can affect vehicle safety and performance during multiple mission phases ranging from pre-launch ground processing of the Ares vehicles to landing and recovery operations, including all potential abort scenarios. Meteorological analysis is art important contributor, not only to the development and verification of system design requirements but also to mission planning and active ground operations. Of particular interest are the surface weather conditions at both nominal and abort landing sites for the manned Orion capsule. Weather parameters such as wind, rain, and fog all play critical roles in the safe landing of the vehicle and subsequent crew and vehicle recovery. The Marshall Space Flight Center (MSFC) Natural Environments Branch has been tasked by the Constellation Program with defining the natural environments at potential landing zones. This paper wiI1 describe the methodology used for data collection and quality control, detail the types of analyses performed, and provide a sample of the results that cab be obtained.
Author
Constellation Program; Surface Properties; Rain; Landing Sites; Ground Operational Support System; Fog; Space Weather

20080013595 NASA Marshall Space Flight Center, Huntsville, AL, USA
An EXPRESS Rack Overview and Support for Microgravity Research on the International Space Station (ISS)
Pelfrey, Joseph J.; Jordan, Lee P.; January 07, 2008; 7 pp.; In English; 46th AIAA Aerospace Sciences Meeting, 7-10 Jan . 2008, Reno, NV, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013595

The EXpedite the PRocessing of Experiments to Space Station or EXPRESS Rack System has provided accommodations and facilitated operations for microgravity-based research payloads for over 6 years on the International Space Station (ISS). The EXPRESS Rack accepts Space Shuttle middeck type lockers and International Subrack Interface Standard (ISIS) drawers, providing a modular-type interface on the ISS. The EXPRESS Rack provides 28Vdc power, Ethernet and RS-422 data interfaces, thermal conditioning, vacuum exhaust, and Nitrogen supply for payload use. The EXPRESS Rack system also includes payload checkout capability with a flight rack or flight rack emulator prior to launch, providing a high degree of confidence in successful operations once an-orbit. In addition, EXPRESS trainer racks are provided to support crew training of both rack systems and subrack operations. Standard hardware and software interfaces provided by the EXPRESS Rack simplify the integration processes for ISS payload development. The EXPRESS Rack is designed to accommodate multidiscipline research, allowing for the independent operation of each subrack payload within a single rack. On-orbit operations began for the EXPRESS Rack Project on April 24, 2001, with one rack operating continuously to support high-priority payloads. The other on-orbit EXPRESS Racks operate based on payload need and resource availability. Over 50 multi-discipline payloads have now been supported on-orbit by the EXPRESS Rack Program. Sustaining engineering, logistics, and maintenance functions are in place to maintain hardware, operations and provide software upgrades. Additional EXPRESS Racks are planned for launch prior to ISS completion in support of long-term operations and the planned transition of the U.S. Segment to a National Laboratory.
Author
Microgravity; International Space Station; Payloads; Computer Programs; Data Systems; Logistics

20080013599 NASA Marshall Space Flight Center, Huntsville, AL, USA

Using Space Weather Variability in Evaluation the Radiation Environment Specifications for NASA's Constellation Program

Coffey, Victoria N.; Minow, Joseph I.; Bruce, Margaret; Howard, James W.; January 20, 2008; 1 pp.; In English; American Meteorological Society Annual Meeting, 20-24 Jan. 2008, New Orleans, LA, USA; Copyright; Avail.: Other Sources; Abstract Only

Hardware design environments for NASA's Constellation Program-the Vision for Space Exploration program to design and build new vehicles for servicing low Earth orbit and the Moon and beyond-have been developed that are necessarily conservative in nature to assure robust hardware design and development required to build space systems which will meet operational goals in a wide range of space environments, This presentation will describe the rationale used to establish the space radiation and plasma design environments specified for a variety of applications including total ionizing radiation dose, dose rate effects, and spacecraft charging and will compare the design environments with 'space weather' variability to evaluate the applicability of the design environments and potential vulnerabilities of the system to extreme space weather events.

Author

Constellation Program; Space Weather; Spacecraft Charging; Low Earth Orbits; Ionizing Radiation; Aerospace Environments; Extraterrestrial Radiation; Radiation Effects

20080013625 Raytheon Co., Huntsville, AL, USA; NASA Marshall Space Flight Center, Huntsville, AL, USA

The 2006 Kennedy Space Center Range Reference Atmosphere Model Validation Study and Sensitivity Analysis to the Performance of the National Aeronautics and Space Administration's Space Shuttle Vehicle

Burns, Lee; Decker, Ryan; Harrington, Brian; Merry, Carl; January 20, 2008; 1 pp.; In English; 88th American Meteorological Society Annual Meeting, 13th Conference on Aviation, Range and Aerospace Meteorology, 20-24 Jan. 2008, New Orleans, LA, USA

Contract(s)/Grant(s): NNM05AB50C; Copyright; Avail.: Other Sources; Abstract Only

The Kennedy Space Center (KSC) Range Reference Atmosphere (RRA) is a statistical model that summarizes wind and thermodynamic atmospheric variability from surface to 70 km. The National Aeronautics and Space Administration's (NASA) Space Shuttle program, which launches from KSC, utilizes the KSC RRA data to evaluate environmental constraints on various aspects of the vehicle during ascent. An update to the KSC RRA was recently completed. As part of the update, the Natural Environments Branch at NASA's Marshall Space Flight Center (MSFC) conducted a validation study and a comparison analysis to the existing KSC RRA database version 1983. Assessments to the Space Shuttle vehicle ascent profile characteristics were performed by JSC/Ascent Flight Design Division to determine impacts of the updated model to the vehicle performance. Details on the model updates and the vehicle sensitivity analyses with the update model are presented.

Author

NASA Space Programs; Atmospheric Models; Thermodynamics; Space Shuttles; Reference Atmospheres

20080014085 NASA Marshall Space Flight Center, Huntsville, AL, USA

Using Space Weather Variability in Evaluating the Environment Design Specifications for NASA'S Constellation Program

Coffey, Victoria N.; Minow, Joseph I.; Bruce, Margaret B.; Blackwell, William C.; Howard, James W.; January 20, 2008; 15 pp.; In English; 5th AMS Space Weather Symposium, 20-22 Jan. 2008, New Orleans, LA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

Spectral models of solar particle events and trapped radiation belts are necessary for the design requirements of total ionizing radiation dose, single event effects, and spacecraft charging. Space radiation and plasma environment specifications for hardware design are necessarily conservative to assure system robustness for a wide range of space environments.

Derived from text

Constellation Program; Spacecraft Charging; Radiation Effects; Robustness (Mathematics); Solar Corpuscular Radiation; Aerospace Environments; Design Analysis; Space Weather

20080014143 NASA Marshall Space Flight Center, Huntsville, AL, USA

The 2006 Cape Canaveral Air Force Station Range Reference Atmosphere Model Validation Study and Sensitivity Analysis to the National Aeronautics and Space Administration's Space Shuttle

Decler. Ruam L/; Burns, Lee; Merry, Carl; Harrington, Brian; January 20, 2008; 6 pp.; In English; 13th Conference on Aviation, Range and Aerospace Meteorology, 20-24 Jan. 2008, New Orleans, LA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A02, Hardcopy

The Pet6n region of northern Guatemala contains some of the most significant Mayan archeological sites in Latin America. It was in this region that the Maya civilization began, flourished, and abruptly disappeared. Remote sensing technology is helping to locate and map ancient Maya sites that are threatened today by accelerating deforestation and looting. Thematic Mapper, IKONOS, and QuickBird satellite, and airborne STAR-3i and AIRSAR radar data, combined with Global Positioning System (GPS) technology, are successfully detecting ancient Maya features such as sites, roadways, canals, and water reservoirs. Satellite imagery is also being used to map the bajos, which are seasonally flooded swamps that cover over 40% of the land surface. Through the use of various airborne and satellite sensor systems we have been able to detect and map ancient causeways, temples, reservoirs, and land forms, and locate these features on the ground through GPS technology. Recently, we have discovered that there is a strong relationship between a tropical forest vegetation signature in satellite imagery and the location of archeological sites. We believe that the use of limestone and lime plasters in ancient Maya construction affects the moisture, nutrition, and plant species of the surface vegetation. We have mapped these vegetation signatures in the imagery and verified through field survey that they are indicative of archeological sites. Through the use of remote sensing and GIS technology it is possible to identify unrecorded archeological features in a dense tropical forest environment and monitor these cultural features for their protection.

Derived from text

Atmospheric Models; Reference Atmospheres; NASA Programs; Global Positioning System; Remote Sensing

20080014163 NASA Marshall Space Flight Center, Huntsville, AL, USA

Surface Landing Site Weather Analysis for Constellation Program

Altino, Karen M.; Burns, K. Lee; January 20, 2008; 1 pp.; In English; 88th Annual American Meteorological Society Meeting, 20-24 Jan. 2008, New Orleans, LA, USA

Contract(s)/Grant(s): NNM05AB50C; Copyright; Avail.: Other Sources; Abstract Only

Weather information is an important asset for NASA's Constellation Program in developing the next generation space transportation system to fly to the International Space Station, the Moon and, eventually, to Mars. Weather conditions can affect vehicle safety and performance during multiple mission phases ranging from pre-launch ground processing to landing and recovery operations, including all potential abort scenarios. Meteorological analysis is an important contributor, not only to the development and verification of system design requirements but also to mission planning and active ground operations. Of particular interest are the surface atmospheric conditions at both nominal and abort landing sites for the manned Orion capsule. Weather parameters such as wind, rain, and fog all play critical roles in the safe landing of the vehicle and subsequent crew and vehicle recovery. The Marshall Space Flight Center Natural Environments Branch has been tasked by the Constellation Program with defining the natural environments at potential landing zones. Climatological time series of operational surface weather observations are used to calculate probabilities of occurrence of various sets of hypothetical vehicle constraint thresholds, Data are available for numerous geographical locations such that statistical analysis can be performed for single sites as well as multiple-site network configurations. Results provide statistical descriptions of how often certain weather conditions are observed at the site(s) and the percentage that specified criteria thresholds are matched or exceeded. Outputs are tabulated by month and hour of day to show both seasonal and diurnal variation. This paper will describe the methodology used for data collection and quality control, detail the types of analyses performed, and provide a sample of the results that can be obtained,

Author

Constellation Program; Ground Operational Support System; Climatology; Annual Variations; Statistical Analysis; Surface Properties; Probability Theory; Meteorology; Time Series Analysis

20080014218 NASA Johnson Space Center, Houston, TX, USA

Summary of the Science Performed Onboard the International Space Station within the USA Orbital Segment during Increments 16 and 17

Jules, Kenol; Istasse, Eric; Stenuit, Hilde; Murakami, Jeiji; Yoshizaki, Izumi; Johnson-Green, Perry; [2008]; 1 pp.; In English; 59th International Astronautical Congress, 29 Sep. - 3 Oct. 2008, Glasgow, UK; Copyright; Avail.: Other Sources; Abstract Only

With the launch of the STS-122 on February 7, 2008, which delivered the European Columbus science module and the

upcoming STS-124 flight, which will deliver the Japanese Kibo science module in May 2008, the International Space Station will become truly International with Europe and Japan joining the USA of America and Russia to perform science on a continuous basis in a wide spectrum of science disciplines. The last science module, Kibo, of the USA Orbital Segment (USOS) will be mated to the station on time to celebrate its first decade in low Earth orbit in October 2008 (end of Increment 17), thus ushering in the second decade of the station with all the USOS science modules mated and performing science. The arrival of the Kibo science module will also mark continuous human presence on the station for eighty eight (88) months, and, with the addition of the ESA science module during the STS-122 flight, the USOS will be made up of four space agencies: CSA, ESA, JAXA and NASA, spanning three continents. With the additional partners coming onboard with different research needs, every effort is being made to coordinate science across the USOS segment in an integrated manner for the benefit of all parties. One of the objectives of this paper is to discuss the integrated manner in which science planning/replanning and prioritization during the execution phase of an increment is being done. The main focus, though, of this paper is to summarize and to discuss the science performed during Increments 16 and 17 (October 2007 to October 2008). The discussion will focus mainly on the primary objectives of each investigation and their associated hypotheses that were investigated during these two Increments. Also, preliminary science results will be discussed for each of the investigation as science results availability permit. Additionally, the paper will briefly touch on what the science complement for these two increments was and what was actually accomplished due to real time science implementation and constraints. Finally, the paper will briefly discuss the science research complements for the next three Increments: Increments 18 to 20, in order to preview how much science might be accomplished during these three upcoming Increments of the station next decade.
Author
Space Transportation System Flights; International Space Station; Low Earth Orbits; Columbus Module; Real Time Operation; Launching

20080014229 NASA Langley Research Center, Hampton, VA, USA
Science Overview
Bruning, Claus; Ko, Malcolm; Lee, David; Miake-Lye, Richard; March 20, 2006; 15 pp.; In English; LTTG Technology Review Meeting, 20-24 Mar, 2006, London, UK; Copyright; Avail.: CASI: A03, Hardcopy

This report presents an overview of the latest scientific consensus understanding of the effect of aviation emissions on the atmosphere for both local air quality and climate change in order to provide a contextual framework for raising future questions to help assess the environmental benefits of technology goals. The questions may take the form of what are the environmental benefits that would result if goals are achieved, what are the consequences for other aviation pollutants, and whether tools exist to evaluate the trade-off. In addition to this documents, presentations will be made at the meeting to illustrate current developing views on these subjects. To facilitate studies on trade-offs among environmental impacts from aviation, one must start with scientific investigations that quantify the impacts. A second step is to select representative metrics with policy relevance so that diverse impacts can be put on the same common scale. The IPCC Special Report on Aviation (IPCC, 1999) serves as an excellent example of the first step. The report was produced by IPCC's Working Group 1, whose mandate is to provide the assessment of the scientific aspects of the climate system and climate change. An example of the second step is Witt et al. (2005), a study commissioned by the Environment DG of the European Commission. Within the context of CAEP, step 1 is aligned with the responsibilities of the Research Focal Points, while step 2 is more related to activities of FESG. These steps are likely to be iterative as proposed policy options will raise new science questions, and new science will expand or limit policy options. Past experiences show that clearly defined policy-related scientific needs will help focus the scientific community to marshal their intellects to provide the needed answers.
Derived from text
Air Quality; General Overviews; Technology Assessment; Exhaust Emission; Civil Aviation; Aircraft Engines; Aerospace Sciences

89
ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20080013433 Mei Associates, Inc., Houston, TX, USA
Measurement Techniques for Hypervelocity Impact Test Fragments
Hill, Nicole E.; [2008]; 1 pp.; In English; 59th International Astronautical Congress, 29 Sep. - 3 Oct. 2008, Glasgow, Scotland, UK; Copyright; Avail.: Other Sources; Abstract Only

The ability to classify the size and shape of individual orbital debris fragments provides a better understanding of the

orbital debris environment as a whole. The characterization of breakup fragmentation debris has gradually evolved from a simplistic, spherical assumption towards that of describing debris in terms of size, material, and shape parameters. One of the goals of the NASA Orbital Debris Program Office is to develop high-accuracy techniques to measure these parameters and apply them to orbital debris observations. Measurement of the physical characteristics of debris resulting from groundbased, hypervelocity impact testing provides insight into the shapes and sizes of debris produced from potential impacts in orbit. Current techniques for measuring these ground-test fragments require determination of dimensions based upon visual judgment. This leads to reduced accuracy and provides little or no repeatability for the measurements. With the common goal of mitigating these error sources, allaying any misunderstandings, and moving forward in fragment shape determination, the NASA Orbital Debris Program Office recently began using a computerized measurement system. The goal of using these new techniques is to improve knowledge of the relation between commonly used dimensions and overall shape. The immediate objective is to scan a single fragment, measure its size and shape properties, and import the fragment into a program that renders a 3D model that adequately demonstrates how the object could appear in orbit. This information would then be used to aid optical methods in orbital debris shape determination. This paper provides a description of the measurement techniques used in this initiative and shows results of this work. The tradeoffs of the computerized methods are discussed, as well as the means of repeatability in the measurements of these fragments. This paper serves as a general description of methods for the measurement and shape analysis of orbital debris.
Author
Fragments; Hypervelocity Impact; Impact Tests; Space Debris

20080013486 National Optical Astronomy Observatories, Tucson, AZ, USA; National Solar Observatory, Tucson, AZ, USA
NOAO/NSO Newsletter: Issue 92
December 2007; 45 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources
Science Highlights include: A 15.65 Solar-Mass Black Hole in an Eclipsing Binary in M33; Observations of Mercury's Sodium Tail; Mesospheric Winds on Venus from High Spectral; and Resolution Observations of CO2.
Derived from text
Black Holes (Astronomy); Eclipsing Binary Stars; Stellar Mass; Mercury (Planet); Mesosphere

90
ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20080013551 NASA Marshall Space Flight Center, Huntsville, AL, USA
Chasing a Comet with a Solar Sail
Stough, Robert W.; Heaton, Andrew F.; Whorton, Mark S.; January 27, 2008; 9 pp.; In English; AAS/AIAA Space Flight Mechanics Conference, 27-31 Jan. 2008, Galveston, TX, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013551
Solar sail propulsion systems enable a wide range of missions that require constant thrust or high delta-V over long mission times. One particularly challenging mission type is a comet rendezvous mission. This paper presents optimal low-thrust trajectory designs for a range of sailcraft performance metrics and mission transit times that enables a comet rendezvous mission. These optimal trajectory results provide a trade space which can be parameterized in terms of mission duration and sailcraft performance parameters such that a design space for a small satellite comet chaser mission is identified. These results show that a feasible space exists for a small satellite to perform a comet chaser mission in a reasonable mission time.
Author
Comets; Solar Sails; Propulsion System Configurations; Space Rendezvous; Trajectories; Flyby Missions

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*.

20080013379 NASA Johnson Space Center, Houston, TX, USA
Checking Contamination during Storage of Carbonaceous Chondrites for Micro FTIR Measurements
Zolensky, Michael E.; [2008]; 2 pp.; In English; Japan Geoscience Union Meeting 2008, 25-30 May 2008, Chiba, Japan; Copyright; Avail.: Other Sources; Abstract Only

We examined organic contamination by Fourier transform infrared micro spectroscopic (micro FTIR) measurements of carbonaceous chondrite samples. Carbonaceous chondrites, Tagish Lake (C2), Murchison (CM2) and Moss (CO3), and some mineral powder samples pressed on aluminum plates were measured by micro FTIR before and after storage in several containers with silicone rubber mat. During storage, samples did not touch directly anything except the holding aluminum plates. The carbonaceous chondrites containing hydrous minerals (Tagish Lake and Murchison) pressed on aluminum plates and measured by transmission-reflection micro FTIR measurements were found to be contaminated during storage after only one day, as revealed by an increase of approximately 2965 /cm and approximately 1260 /cm peaks. The Moss meteorite which contains no hydrous minerals, did not show an increase of these peaks, indicating no organic contamination. This difference is probably related to the differing mineralogy and physical properties (including porosity and permeability) of these chondrites. Hydrous minerals such as antigorite, muscovite, montmorillonite and silica gel showed organic contamination by the same infrared measurements, while anhydrous materials such as SiO2 and KBr showed no contamination. These results indicate importance of surface OH groups for the organic contamination. Organic contamination was found on silica gel samples pressed on aluminum plates when they were stored within containers including silicone rubber, silicone grease or adhesive tape. Long path gas cell FTIR measurements for silicone rubber indicated methylsiloxane oligomers were released from the silicone rubber. In-situ heating infrared measurements on the contaminated antigorite and Tagish Lake showed decrease of the 1262 /cm (Si-CH3) and 2963 /cm (CH3) peaks from room temperature to 200-300 C indicating desorption of volatile contaminants. These results indicate that careful preparation and storage are essential for FTIR measurements on precious astromaterial samples such as meteorites, IDPs and samples returned from comets, asteroids and Mars. Every possible contamination source should be evaluated before anything is done to these samples.
Author
Carbonaceous Chondrites; Meteoritic Composition; Contamination; Contaminants; Materials Handling

20080013380 NASA Johnson Space Center, Houston, TX, USA
Sulfur and Iron Speciation in Gas-rich Impact-melt Glasses from Basaltic Shergottites Determined by Microxanes
Sutton, S. R.; Rao, M. N.; Nyquist, L. E.; March 10, 2008; 2 pp.; In English; 39th Lunar and Planetary Science Conference, 10-14 Mar. 2008, League City, TX, USA; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Sulfur is abundantly present as sulfate near Martian surface based on chemical and mineralogical investigations on soils and rocks in Viking, Pathfinder and MER missions. Jarosite is identified by Mossbauer studies on rocks at Meridian and Gusev, whereas MgSO4 is deduced from MgO - SO3 correlations in Pathfinder MER and Viking soils. Other sulfate minerals such as gypsum and alunogen/ S-rich aluminosilicates and halides are detected only in martian meteorites such as shergottites and nakhlites using SEM/FE-SEM and EMPA techniques. Because sulfur has the capacity to occur in multiple valence states, determination of sulfur speciation (sulfide/ sulfate) in secondary mineral assemblages in soils and rocks near Mars surface may help us understand whether the fluid-rock interactions occurred under oxidizing or reducing conditions. To understand the implications of these observations for the formation of the Gas-rich Impact-melt (GRIM) glasses, we determined the oxidation state of Fe in the GRIM glasses using Fe K micro-XANES techniques.
Author
Basalt; Glass; Impact Melts; Iron; Nakhlites; Shergottites; Sulfur; Meteoritic Composition

20080013384 NASA Johnson Space Center, Houston, TX, USA
Potential of a New Lunar Surface Radiator Concept for Hot Lunar Thermal Environments
Ochoa, Dustin A.; Vogel, Matthew R.; Trevino, Luis A.; Stephan, Ryan A.; [2008]; 9 pp.; In English; 38th International Conference on Environmental Systems, 29 Jun. - 3 Jul. 2008, San Francisco, CA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 831288.03.04
Report No.(s): 08ICES-0315; Copyright; Avail.: Other Sources

The optimum radiator configuration in hot lunar thermal environments is one in which the radiator is parallel to the ground

and has no view to the hot lunar surface. However, typical spacecraft configurations have limited real estate available for top-mounted radiators, resulting in a desire to use the spacecraft s vertically oriented sides. Vertically oriented, flat panel radiators will have a large view factor to the lunar surface, and thus will be subjected to significant incident lunar infrared heat. Consequently, radiator fluid temperatures will need to exceed approx.325 K (assuming standard spacecraft radiator optical properties) in order to provide positive heat rejection at lunar noon. Such temperatures are too high for crewed spacecraft applications in which a heat pump is to be avoided. A recent study of vertically oriented radiator configurations subjected to lunar noon thermal environments led to the discovery of a novel radiator concept that yielded positive heat rejection at lower fluid temperatures. This radiator configuration, called the Upright Lunar Terrain Radiator Assembly (ULTRA), has exhibited superior performance to all previously analyzed concepts in terms of heat rejection in the lunar noon thermal environment. A key benefit of the ULTRA is the absence of louvers or other moving parts and its simple geometry. Analysis of the ULTRA for a lunar extravehicular activity (EVA) portable life support system (PLSS) is shown to provide moderate heat rejection, on average, at all solar incident angles assuming an average radiator temperature of 294 K, whereas prior concepts exhibited insignificant heat rejection or heat absorption at higher incident angles. The performance of the ULTRA for a lunar lander is also discussed and compared to the performance of a vertically oriented, flat panel radiator at various lunar latitudes.
Author
Thermal Environments; Lunar Environment; Extravehicular Activity; Life Support Systems; Spacecraft Radiators; Thermal Absorption; Spacecraft Configurations; Hot Surfaces

20080013392 NASA Langley Research Center, Hampton, VA, USA
Overview of the MEDLI Project
Gazarik, Michael J.; Hwang, Helen; Little, Alan; Cheatwood, Neil; Wright, Michael; Herath, Jeff; [2007]; 10 pp.; In English; 5th International Planetary Probe Workshop, 23-29 Jun. 2007, Bordeaux, France; Original contains color illustrations
Contract(s)/Grant(s): WBS 980340; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013392

The Mars Science Laboratory Entry, Descent, and Landing Instrumentation (MEDLI) Project's objectives are to measure aerothermal environments, sub-surface heatshield material response, vehicle orientation, and atmospheric density for the atmospheric entry and descent phases of the Mars Science Laboratory (MSL) entry vehicle. The flight science objectives of MEDLI directly address the largest uncertainties in the ability to design and validate a robust Mars entry system, including aerothermal, aerodynamic and atmosphere models, and thermal protection system (TPS) design. The instrumentation suite will be installed in the heatshield of the MSL entry vehicle. The acquired data will support future Mars entry and aerocapture missions by providing measured atmospheric data to validate Mars atmosphere models and clarify the design margins for future Mars missions. MEDLI thermocouple and recession sensor data will significantly improve the understanding of aeroheating and TPS performance uncertainties for future missions. MEDLI pressure data will permit more accurate trajectory reconstruction, as well as separation of aerodynamic and atmospheric uncertainties in the hypersonic and supersonic regimes. This paper provides an overview of the project including the instrumentation design, system architecture, and expected measurement response.
Author
Mars Sample Return Missions; Atmospheric Entry; Mars Landing; Descent; Data Acquisition; Mars Surface; Space Laboratories; Landing Instruments

20080013395 NASA Langley Research Center, Hampton, VA, USA
Structural Definition and Mass Estimation of Lunar Surface Habitats for the Lunar Architecture Team Phase 2 (LAT-2) Study
Dorsey, John T.; Wu, K, Chauncey; Smith, Russell W.; March 03, 2008; 31 pp.; In English; Earth and Space Conference 2008, 3-5 Mar. 2008, Long Beach, CA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 441261.04.20.04.04; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013395

The Lunar Architecture Team Phase 2 study defined and assessed architecture options for a Lunar Outpost at the Moon's South Pole. The Habitation Focus Element Team was responsible for developing concepts for all of the Habitats and pressurized logistics modules particular to each of the architectures, and defined the shapes, volumes and internal layouts considering human factors, surface operations and safety requirements, as well as Lander mass and volume constraints. The Structures Subsystem Team developed structural concepts, sizing estimates and mass estimates for the primary Habitat structure. In these studies, the primary structure was decomposed into a more detailed list of components to be sized to gain greater insight into concept mass contributors. Structural mass estimates were developed that captured the effect of major

design parameters such as internal pressure load. Analytical and empirical equations were developed for each structural component identified. Over 20 different hard-shell, hybrid expandable and inflatable soft-shell Habitat and pressurized logistics module concepts were sized and compared to assess structural performance and efficiency during the study. Habitats were developed in three categories; Mini Habs that are removed from the Lander and placed on the Lunar surface, Monolithic habitats that remain on the Lander, and Habitats that are part of the Mobile Lander system. Each category of Habitat resulted in structural concepts with advantages and disadvantages. The same modular shell components could be used for the Mini Hab concept, maximizing commonality and minimizing development costs. Larger Habitats had higher volumetric mass efficiency and floor area than smaller Habitats (whose mass was dominated by fixed items such as domes and frames). Hybrid and pure expandable Habitat structures were very mass-efficient, but the structures technology is less mature, and the ability to efficiently package and deploy internal subsystems remains an open issue.
Author
Space Habitats; Moon; Lunar Surface; Lunar Environment; Lunar Exploration; Lunar Shelters

20080013410 NASA Johnson Space Center, Houston, TX, USA
Sm-Nd for Norite 78236 and Eucrite Y980318/433: Implications for Planetary and Solar System Processes
Nyquist, L. E.; Shih, C-Y.; Reese, Y. D.; March 10, 2008; 2 pp.; In English; 39th Lunar and Planetary Science Conference, 10-14 Mar. 2008, League City, TX, USA; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Here, we compare Sm-147-Nd-143 and Sm-146-Nd-142 data for lunar norite 78236 to those for approximately 4.54-4.56 Ga old cumulate eucrite Yamato 980318/433 and show that the norite data are compatible with its derivation from an isotopic reservoir similar to that from whence the eucrite pair came. Thus, lunar-like Sm-Nd isotopic systematics are not unique to the Earth-Moon system.
Derived from text
Solar System; Meteorites; Meteoritic Composition

20080013411 NASA Johnson Space Center, Houston, TX, USA
Andreyivanovite: A Second New Phosphide from the Kaidun Meteorite
Zolensky, Michael; [2008]; 17 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): RTOP 152-11-40-23; Copyright; Avail.: CASI: A03, Hardcopy

Andreyivanovite (ideally FeCrP) is another new phosphide species from the Kaidun meteorite, which fell in South Yemen in 1980. Kaidun is a unique breccia containing an unprecedented variety of fragments of different chondritic as well as achondritic lithologies. Andreyivanovite was found as individual grains and linear arrays of grains with a maximum dimension of 8 m within two masses of Fe-rich serpentine. In one sample it is associated with Fe-Ni-Cr sulfides and florenskyite (FeTiP). Andreyivanovite is creamy white in reflected light, and its luster is metallic. The average of nine electron microprobe analyses yielded the formula Fe(Cr0.587 Fe0.150 V0.109 Ti0.081 Ni0.060 Co0.002)P. Examination of single grains of andreyivanovite using Laue patterns collected by in-situ synchrotron X-ray diffraction (XRD), and by electron backscattered diffraction revealed that it is isostructural with florenskyite; we were unable to find single crystals of sufficient quality to perform a complete structure analysis. Andreyivanovite crystallizes in the space group Pnma, and has the anti-PbCl2 structure. Previously-determined cell constants of synthetic material [a = 5.833(1), b = 3.569(1), c = 6.658(1) A] were consistent with our XRD work. We used the XPOW program to calculate a powder XRD pattern; the 5 most intense reflections are d = 2.247 (I = 100), 2.074 (81), 2.258 (46), 1.785 (43), and 1.885 A (34). Andreyivanovite is the second new phosphide to be described from the Kaidun meteorite. Andreyivanovite could have formed as a result of cooling and crystallization of a melted precursor consisting mainly of Fe-Ni metal enriched in P, Ti, and Cr. Serpentine associated with andreyivanovite would then have formed during aqueous alteration on the parent asteroid. It is also possible that the andreyivanovite could have formed during aqueous alteration, however, artificial FeTiP has been synthesized only during melting experiments, at low oxygen fugacity, and there is no evidence that a hydrothermal genesis is reasonable.
Author
Breccia; Crystallization; Lithology; Meteorites; Phosphides; Meteoritic Composition; Mineralogy

20080013416 NASA Johnson Space Center, Houston, TX, USA
Beagle 2 the Moon: An Experimental Package to Measure Polar Ice and Volatiles in Permanently Shadowed Areas or Beneath the Lunar Surface
Gibson, E. K.; McKay, D. S.; Pillinger, C. T.; Wright, I. P.; Sims, M. R.; Richter, L.; March 10, 2008; 2 pp.; In English; 39th

Lunar and Planetary Science Conference, 10-14 Mar. 2008, League City, TX, USA; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

NASA has announced the selection of several Lunar Science Sortie Concept Studies for potential scientific payloads with future Lunar Missions. The Beagle 2 scientific package was one of those chosen for study. Near the beginning of the next decade will see the launch of scientific payloads to the lunar surface to begin laying the foundations for the return to the moon in the Vision for Space Exploration. Shortly thereafter, astronauts will return to the lunar surface with the ability to place scientific packages on the surface that will provide information about lunar resources and compositions of materials in permanently shadowed regions of the moon (1). One of the important questions which must be answered early in the program is whether there are lunar resources which would facilitate 'living off the land' and not require the transport of resources and consumables from Earth (2). The Beagle science package developed to seek the signatures of life on Mars is the ideal payload (3) to use on the lunar surface for determining the nature of hydrogen, water and lunar volatiles found in the polar regions which could support the Vision for Space Exploration.

Derived from text

Lunar Resources; Lunar Surface; Moon; Payloads; In Situ Resource Utilization; Lunar Composition

20080013417 NASA Johnson Space Center, Houston, TX, USA

What We Might Know About Gusev Crater if the Mars Exploration Rover Spirit Mission were Coupled with a Mars Sample Return Mission

Morris, Richard V.; [2008]; 1 pp.; In English; Ground Truth from Mars: Science Payoff, 21-23 Apr. 2008, Albuquerque, NM, USA; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080013417

The science instruments on the Mars Exploration Rover (MER) Spirit have provided an enormous amount of chemical and mineralogical data during more than 1450 sols of exploration at Gusev crater. The Moessbauer (MB) instrument identified 10 Fe-bearing phases at Gusev Crater: olivine, pyroxene, ilmenite, chromite, and magnetite as primary igneous phases and nanophase ferric oxide (npOx), goethite, hematite, a ferric sulfate, and pyrite/marcusite as secondary phases. The Miniature Thermal Emission Spectrometer (Mini-TES) identified some of these Fe-bearing phases (olivine and pyroxene), non-Fe-bearing phases (e.g., feldspar), and an amorphous high-SiO2 phase near Home Plate. Chemical data from the Alpha Particle X-Ray Spectrometer (APXS) provided the framework for rock classification, chemical weathering/alteration, and mineralogical constraints. APXS-based mineralogical constraints include normative calculations (with Fe(3+)/FeT from MB), elemental associations, and stoichiometry (e.g., 90% SiO2 implicates opalline silica). If Spirit had cached a set of representative samples and if those samples were returned to the Earth for laboratory analysis, what value is added by Mars Sample return (MSR) over and above the mineralogical and chemical data provided by MER?

Derived from text

Mars Craters; Mars Exploration; Mars Sample Return Missions; Mineralogy; Mars Roving Vehicles

20080013418 NASA Johnson Space Center, Houston, TX, USA

Minimizing EVA Airlock Time and Depress Gas Losses

Trevino, Luis A.; Lafuse, Sharon A.; [2008]; 10 pp.; In English; 38th International Conference on Environmental Systems, 29 Jun. - 3 Jul. 2008, San Francisco, CA, USA; Original contains color and black and white illustrations

Report No.(s): 08ICES-0305; Copyright; Avail.: Other Sources

This paper describes the need and solution for minimizing EVA airlock time and depress gas losses using a new method that minimizes EVA out-the-door time for a suited astronaut and reclaims most of the airlock depress gas. This method consists of one or more related concepts that use an evacuated reservoir tank to store and reclaim the airlock depress gas. The evacuated tank can be an inflatable tank, a spent fuel tank from a lunar lander descent stage, or a backup airlock. During EVA airlock operations, the airlock and reservoir would be equalized at some low pressure, and through proper selection of reservoir size, most of the depress gas would be stored in the reservoir for later reclamation. The benefit of this method is directly applicable to long duration lunar and Mars missions that require multiple EVA missions (up to 100, two-person lunar EVAs) and conservation of consumables, including depress pump power and depress gas. The current ISS airlock gas reclamation method requires approximately 45 minutes of the astronaut s time in the airlock and 1 KW in electrical power. The proposed method would decrease the astronaut s time in the airlock because the depress gas is being temporarily stored in a reservoir tank for later recovery. Once the EVA crew is conducting the EVA, the volume in the reservoir would be pumped back to the cabin at a slow rate. Various trades were conducted to optimize this method, which include time to equalize the airlock with the evacuated reservoir versus reservoir size, pump power to reclaim depress gas versus time allotted, inflatable reservoir pros and

cons (weight, volume, complexity), and feasibility of spent lunar nitrogen and oxygen tanks as reservoirs.
Author
Air Locks; Extravehicular Activity; Gas Recovery; International Space Station; Space Missions; Lunar Surface

20080013419 NASA Johnson Space Center, Houston, TX, USA
Gusev Crater on Mars: Wet and Dry
Yen, Albert; Gellert, Ralf; Morris, Richard; [2008]; 2 pp.; In English; 38th COSPAR Scientific Assembly, 13-20 Jul. 2008, Montreal, Canada; Copyright; Avail.: Other Sources; Abstract Only

The Mars Exploration Rover Spirit has traversed over 7.5 km in 1470 sols of operations at the Gusev Crater landing site. Chemical and mineralogical evidence from approximately 200 in-situ samples indicate various degrees of exposure to liquid water, from wet and saturated to dry and unaltered. (1) Six samples with concentrations of amorphous silica between 60 and 95 wt% were discovered in a small valley less than 50 meters in length. Associated enrichments in titanium oxide, relatively insoluble at low pH, suggest that these silica deposits formed as a result of acidic leaching processes. Liquid water interactions with these surface materials were necessary to remove cations solubilized in the low pH environment or to concentrate silica in solution prior to precipitation. (2) Hydrated ferric sulfates are found in subsurface deposits which have the unmistakable chemical signatures of nearby rocks. The movement of hydrothermal fluids and/or fumarolic vapors through local rocks prior to precipitation of these materials is suggested by these observations. (3) Goethite (alpha-FeOOH), a mineral phase which requires water to form, represents 20% to 35% of the iron in numerous rock samples (Clovis Class) on the West Spur of the Columbia Hills. Alteration of iron under aqueous conditions is clearly indicated by this presence of goethite. (4) Nearly isochemical signatures are found in elemental analyses of over ten distinct samples (Wishstone/Watchtower class rocks), yet the ratio of ferric iron to total iron varies from 0.4 to 0.95. Small quantities of water, insufficient to flush cations from the samples, were likely responsible for this weathering. (5) Bromine, a trace element readily mobilized by water, is found in high concentrations in certain rock interiors and is enhanced in subsurface soils, consistent with transport to localized cold traps by water thin-films. (6) Also relevant to the characterizing the role of liquid water is the discovery of an areally extensive ultramafic sequence of rocks where over 70% of the iron is in unaltered olivine and the ferric to total iron ratio is 0.1. This result indicates that certain materials at the martian surface have been protected from aqueous alteration.
Author
Hydroxides; Mars Craters; Mars Landing Sites; Mars Surface; Mars (Planet); Extraterrestrial Water; Planetary Composition; Geochemistry

20080013421 NASA Johnson Space Center, Houston, TX, USA
Desert Research and Technology Studies 2007 Report
Romig, Barbara; Kosmo, Joseph; Ross, Amy; Bernard, Craig; Aitchison, Lindsay; [2008]; 23 pp.; In English; International Conference on Environmental Systems, 29 Jun. - 3 Jul. 2008, San Francisco, CA, USA; Original contains color illustrations; No Copyright; Avail.: Other Sources

During the first two weeks of September 2007, the National Aeronautics and Space Administration (NASA) Johnson Space Center (JSC) Advanced Extravehicular Activity (AEVA) team led the field test portion of the 2007 Desert Research and Technology Studies (D-RATS) in the Flagstaff, AZ area. The Desert RATS field test activity is the year-long culmination of various individual science and advanced engineering discipline areas technology and operations development efforts into a coordinated field test demonstration under representative (analog) planetary surface terrain conditions. The 2007 Desert RATS was the tenth RATS field test and was the most focused test to date with participants from seven NASA field centers, a variety of NASA support contractors, and one other government agency. The main test objective was to demonstrate two operational concepts for lunar outpost activities/assembly to inform future Constellation Architecture Team (CAT) studies. The two tasks were a site survey for lunar outpost (using the Science, Crew, Operations, and Utility Testbed (SCOUT) rover) and deployment of a solar power system with cables. For both of these tasks, the team acquired quantitative data on human-robot interaction that can be used to determine task efficiency indexes to compare the operational scenarios of robots, humans, and human robot teams. The team also measured the effects of 5-10 seconds of a lunar time delay on telerobotic operations. The second major test objective was to demonstrate two technologies for Extravehicular Activity (EVA) and robotic operations: a lithium-ion battery for the space suit Portable Life Support System (PLSS) and autonomy software to coordinate robot activities. Data regarding requirements for technology development, hardware design, operations, and interfaces were gathered from the test activities. The test was extremely successful with all teams meeting all primary test objectives. This paper summarizes Desert RATS 2007 test hardware, detailed test objectives, test operations, and test results.
Author
Deserts; Research and Development; Autonomy; Technology Utilization; Systems Engineering; Avionics

20080013425 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Reorientation of Mini-Moons: Enceladus and Miranda
Pappalardo, Robert T.; Nimmo, Francis; Moore, Jeff; May 25, 2006; 32 pp.; In English; UCLA Planetary Science Seminar, 25 May 2006, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40711

This viewgraph presentation describes the reorientation of the Mini-Moons of Enceladus and Miranda. The hot spots of Enceladus and its relationship to Miranda is also presented.
CASI
Enceladus; Miranda; Orientation; Solar System

20080013430 NASA Johnson Space Center, Houston, TX, USA
The Mars Phoenix Thermal Evolved-Gas Analysis: The Role of an Organic Free Blank in the Search for Organics
Lauer, H. V., Jr.; Ming, Douglas W.; Sutter, B.; Golden, D. C.; Morris, Richard V.; Boynton, W. V.; March 10, 2008; 2 pp.; In English; 39th Lunar and Planetary Science Conference, 10-14 Mar. 2008, League City, TX, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The Thermal Evolved-Gas Analyzer (TEGA) instrument onboard the 2007 Phoenix Lander will perform differential scanning calorimetry (DSC) and evolved-gas analysis of soil samples collected from the surface. Data from the instrument will be compared with Mars analog mineral standards, collected under TEGA Mars-like conditions to identify the volatile-bearing mineral phases [1] (e.g., Fe-oxyhydroxides, phyllosilicates, carbonates, and sulfates) found in the Martian soil. Concurrently, the instrument will be looking for indications of organics that might also be present in the soil. Organic molecules are necessary building blocks for life, although their presence in the ice or soil does not indicate life itself. The spacecraft will certainly bring organic contaminants to Mars even though numerous steps were taken to minimize contamination during the spacecraft assembly and testing. It will be essential to distinguish possible Mars organics from terrestrial contamination when TEGA instrument begins analyzing icy soils. To address the above, an Organic Free Blank (OFB) was designed, built, tested, and mounted on the Phoenix spacecraft providing a baseline for distinguishing Mars organics from terrestrial organic contamination. Our objective in this report is to describe some of the considerations used in selecting the OFB material and then report on the processing and analysis of the final candidate material
Author
Soil Sampling; Mars Environment; Carbonates; Gas Detectors; Contaminants; Mineralogy; Mars Surface; Gas Analysis; Heat Measurement

20080013471 NASA Langley Research Center, Hampton, VA, USA
2007 Mars Phoenix Entry, Descent, and Landing Simulation and Modeling Analysis
Prince, Jill L.; Grover, Myron R.; Desai, Prasun N.; Queen, Eric M.; June 25, 2007; 23 pp.; In English; 5th International Planetary Probe Workshop, 23-29 Jun. 2007, Bordeaux, France; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013471

This viewgraph presentation reviews the entry, descent, and landing of the 2007 Mars Phoenix lander. Aerodynamics characteristics along with Monte Carlo analyses are also presented for launch and landing site opportunities.
CASI
Descent; Landing Simulation; Mars Landing; Mars (Planet); Ascent; Mathematical Models

20080013488 NASA Stennis Space Center, Stennis Space Center, MS, USA
Exploiting Lunar Natural and Augmented Thermal Environments for Exploration and Research
Ryan, Robert E.; Underwood, Lauren W.; McKellip, Rodney; Brannon, David P.; Russell, Kristen J.; March 10, 2008; 1 pp.; In English; 39th Lunar and Planetary Science Conference, 10-14 March 2008, League City, TX, USA; Original contains color illustrations
Contract(s)/Grant(s): NNS04AB54T
Report No.(s): SSTI-2220-0160; Copyright; Avail.: CASI: A01, Hardcopy

Near the poles of the Moon, there are permanently shadowed craters whose surface temperatures never exceed 100 K. Craters within craters, commonly referred to as double-shaded craters, have areas where even colder regions exist with, in many cases, temperatures that should never exceed 50 K. The presence of water ice possibly existing in permanently shaded areas of the moon has been hypothesized, discussed, and studied since Watson et al. [1] predicted the possibility of ice on the

moon. Ingersoll et al. [2] estimated that the maximum sublimation rate for ice is less than 1 cm per billion years for these types of environments. These potential ice stores have many uses for lunar exploration, potentially providing precious water and rocket fuel for any human exploration or future colonization. The temperatures within these regions offer unprecedented high-vacuum cryogenic environments, which in their natural state could support cryogenic applications such as high-temperature superconductors and associated devices that could be derived. The potential application of naturally occurring cryogenic environments in conjunction with simple methods to augment these environments to achieve even colder temperatures opens the potential use of many additional cryogenic techniques. Besides ice stores and the potential for continuous solar illumination for power production, the unique cryogenic conditions at the lunar poles provide an environment that could reduce the power, weight, and total mass that would have to be carried from the Earth to the Moon for lunar exploration and research.
Derived from text
Thermal Environments; Lunar Exploration; High Temperature Superconductors; Craters; Surface Temperature

20080013494 NASA Langley Research Center, Hampton, VA, USA; Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Entry, Descent, and Landing Mission Design for the Crew Exploration Vehicle Thermal Protection System Qualification Flight Test
Ivanov, Mark; Strauss, William; Maddock, Robert; June 23, 2007; 2 pp.; In English; 5th International Planetary Probe Workshop, 23-29 Jun. 2007, Bordeaux, France; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 092837.04.01.03.05.04; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013494
The TORCH team was challenged to generate the lowest cost mission design solution that meets the CEV aerothermal test objectives on a sub-scale flight article. The test objectives resulted from producing representative lunar return missions and observing the aerothermal envelopes of select surface locations on the CEV. From these aerothermal envelopes, two test boxes were established: one for high shear and one for high radiation. The unique and challenging trajectory design objective for the flight test was to fly through these aerothermal boxes in shear, pressure, heat flux, and radiation while also not over testing. These test boxes, and the max aerothermal limits, became the driving requirements for defining the mission design.
Derived from text
Descent; Flight Tests; Thermal Protection; Space Shuttles; Crew Exploration Vehicle; Aerothermodynamics

20080013502 NASA Johnson Space Center, Houston, TX, USA
Antarctic Meteorite Newsletter, Volume 31, No. 1
Satterwhite, Cecilia, Editor; Righter, Kevin, Editor; February 2008; 28 pp.; In English; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013502
This newsletter reports 418 new meteorites from the 2004 and 2006 ANSMET seasons from the Cumulus Hills (CMS), LaPaz Ice Field (LAP), Graves Nunataks (GRA), Grosvenor Mountains (GRO), Larkman Nunatak (LAR), MacAlpine Hills (MAC), Miller Range (MIL), Roberts Massif (RBT), and Scott Glacier (SCO). These new samples include one iron, 1 eucrite, 1 mesosiderite, 6 CK chondrites (2 with pairing), 2 CV3 chondrites, 1 CM1, 7 CM2 (4 with pairing), 3 CR2 (2 with pairing), and one each of a type 3 L and H chondrites. The CK6 chondrites (LAR 06869, 06872, 06873) are unusual in that they have no discernable chondrules, extremely fine-grained texture, and are full of veins. This newsletter represents a break from recent newsletters in which we have announced many unusual and popular samples, including new lunar and martian meteorites, an unusual achondrite (GRA 06128 and 06129 the topic of a special session at this years LPSC).
Derived from text
Antarctic Regions; Meteorite Craters; Petrology; Mineralogy; SNC Meteorites; Meteoritic Composition

20080013517 NASA Langley Research Center, Hampton, VA, USA
Lunar Architecture Team - Phase 2 Habitat Volume Estimation: 'Caution When Using Analogs'
Rudisill, Marianne; Howard, Robert; Griffin, Brand; Green, Jennifer; Toups, Larry; Kennedy, Kriss; March 03, 2008; 11 pp.; In English; Earth and Space Conference 2008, 3-5 Mar. 2008, Long Beach, CA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 986249.01.11.20.24.04; Copyright; Avail.: CASI: A03, Hardcopy
The lunar surface habitat will serve as the astronauts' home on the moon, providing a pressurized facility for all crew

living functions and serving as the primary location for a number of crew work functions. Adequate volume is required for each of these functions in addition to that devoted to housing the habitat systems and crew consumables. The time constraints of the LAT-2 schedule precluded the Habitation Team from conducting a complete 'bottoms-up' design of a lunar surface habitation system from which to derive true volumetric requirements. The objective of this analysis was to quickly derive an estimated total pressurized volume and pressurized net habitable volume per crewmember for a lunar surface habitat, using a principled, methodical approach in the absence of a detailed design. Five 'heuristic methods' were used: historical spacecraft volumes, human/spacecraft integration standards and design guidance, Earth-based analogs, parametric 'sizing' tools, and conceptual point designs. Estimates for total pressurized volume, total habitable volume, and volume per crewmember were derived using these methods. All method were found to provide some basis for volume estimates, but values were highly variable across a wide range, with no obvious convergence of values. Best current assumptions for required crew volume were provided as a range. Results of these analyses and future work are discussed.
Author
Lunar Surface; Lunar Shelters; Habitability; Structural Design; Pressure; Heuristic Methods; Design Analysis

20080013552 NASA Marshall Space Flight Center, Huntsville, AL, USA
Environment Challenges for Exploration of the Moon
Minow, Joseph I.; Blackwell, William C., Jr.; Coffey, Victoria N.; Cooke, William B.; Howard, James W.; Parker, Linda N.; Sharp, John; Schunck, Greg; Suggs. Robert W.; Wang, Joseph W.; January 23, 2008; 73 pp.; In English; 2007 American Geophysical Union Fall Meeting, 23-29 Jan. 2008, Barrow, AK, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A04, Hardcopy

NASA's Constellation Program is designing a new generation of human rated launch and space transportation vehicles to first replace the Space Shuttle fleet, then support develop of a permanent human habitat on the Moon, and ultimately prepare for human exploration of Mars. The ambitious first step beyond low Earth orbit is to develop the infrastructure required for conducting missions to a variety of locations on the lunar surface for periods of a week and establishment of a permanent settlement at one of the lunar poles where crews will serve for periods on the order of approx.200 days. We present an overview of the most challenging aspects of the lunar environment that will need to be addressed when developing transport and habitat infrastructure for long term human presence on the Moon including low temperatures and dusty regolith surfaces, radiation environments due to galactic cosmic rays and solar energetic particles, charging of lunar infrastructure when exposed to lunar plasma environments, and secondary meteor environments generated by primary impacts on the lunar surface.
Author
Lunar Environment; Constellation Program; Launch Vehicles; Space Transportation; Habitats

20080013601 NASA Langley Research Center, Hampton, VA, USA
Titan Explorer Entry, Descent and Landing Trajectory Design
Fisher, Jody L.; Lindberg, Robert E.; Lockwood, Mary Kae; February 08, 2006; 15 pp.; In English; 29th Annual AAS Guidance and Control Conference, 4-8 Feb. 2006, Breckenridge, CO, USA; Original contains color illustrations
Report No.(s): AAS 06-077; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013601

The Titan Explorer mission concept includes an orbiter, entry probe and inflatable airship designed to take remote and in-situ measurements of Titan's atmosphere. A modified entry, descent and landing trajectory at Titan that incorporates mid-air airship inflation (under a parachute) and separation is developed and examined for Titan Explorer. The feasibility of mid-air inflation and deployment of an airship under a parachute is determined by implementing and validating an airship buoyancy and inflation model in the trajectory simulation program, Program to Optimize Simulated Trajectories II (POST2). A nominal POST2 trajectory simulation case study is generated which examines different descent scenarios by varying airship inflation duration, orientation, and separation. The buoyancy model incorporation into POST2 is new to the software and may be used in future trajectory simulations. Each case from the nominal POST2 trajectory case study simulates a successful separation between the parachute and airship systems with sufficient velocity change as to alter their paths to avoid collision throughout their descent. The airship and heatshield also separate acceptably with a minimum distance of separation from the parachute system of 1.5 km. This analysis shows the feasibility of airship inflation on a parachute for different orientations, airship separation at various inflation times, and preparation for level-flight at Titan.
Author
Descent Trajectories; Titan Atmosphere; Atmospheric Entry; Remote Sensing; Space Exploration; Space Missions

20080013635 NASA Langley Research Center, Hampton, VA, USA

Synthetic Vision for Lunar and Planetary Landing Vehicles

Williams, Steven P.; Arthur, Jarvis (Trey) J., III; Shelton, Kevin J.; Prinzel, Lawrence J., III; Norman, R. Michael; March 16, 2008; 12 pp.; In English; SPIE Defense and Security Symposium 2008, 16-20 Mar. 2008, Orlando, FL, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

The Crew Vehicle Interface (CVI) group of the Integrated Intelligent Flight Deck Technologies (IIFDT) has done extensive research in the area of Synthetic Vision (SV), and has shown that SV technology can substantially enhance flight crew situation awareness, reduce pilot workload, promote flight path control precision and improve aviation safety. SV technology is being extended to evaluate its utility for lunar and planetary exploration vehicles. SV may hold significant potential for many lunar and planetary missions since the SV presentation provides a computer-generated view of the terrain and other significant environment characteristics independent of the outside visibility conditions, window locations, or vehicle attributes. SV allows unconstrained control of the computer-generated scene lighting, terrain coloring, and virtual camera angles which may provide invaluable visual cues to pilots/astronauts and in addition, important vehicle state information may be conformally displayed on the view such as forward and down velocities, altitude, and fuel remaining to enhance trajectory control and vehicle system status. This paper discusses preliminary SV concepts for tactical and strategic displays for a lunar landing vehicle. The technical challenges and potential solutions to SV applications for the lunar landing mission are explored, including the requirements for high resolution terrain lunar maps and an accurate position and orientation of the vehicle that is essential in providing lunar Synthetic Vision System (SVS) cockpit displays. The paper also discusses the technical challenge of creating an accurate synthetic terrain portrayal using an ellipsoid lunar digital elevation model which eliminates projection errors and can be efficiently rendered in real-time.

Author

Enhanced Vision; Flight Crews; Lunar Landing; Planetary Landing; Transport Aircraft; Display Devices

20080014092 NASA Johnson Space Center, Houston, TX, USA

Constellation Architecture Team-Lunar: Lunar Habitat Concepts

Toups, Larry; Kennedy, Kriss J.; [2008]; 2 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): 342806.06.02.10; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080014092

This paper will describe lunar habitat concepts that were defined as part of the Constellation Architecture Team-Lunar (CxAT-Lunar) in support of the Vision for Space Exploration. There are many challenges to designing lunar habitats such as mission objectives, launch packaging, lander capability, and risks. Surface habitats are required in support of sustaining human life to meet the mission objectives of lunar exploration, operations, and sustainability. Lunar surface operations consist of crew operations, mission operations, EVA operations, science operations, and logistics operations. Habitats are crewed pressurized vessels that include surface mission operations, science laboratories, living support capabilities, EVA support, logistics, and maintenance facilities. The challenge is to deliver, unload, and deploy self-contained habitats and laboratories to the lunar surface. The CxAT-Lunar surface campaign analysis focused on three primary trade sets of analysis. Trade set one (TS1) investigated sustaining a crew of four for six months with full outpost capability and the ability to perform long surface mission excursions using large mobility systems. Two basic habitat concepts of a hard metallic horizontal cylinder and a larger inflatable torus concept were investigated as options in response to the surface exploration architecture campaign analysis. Figure 1 and 2 depicts the notional outpost configurations for this trade set. Trade set two (TS2) investigated a mobile architecture approach with the campaign focused on early exploration using two small pressurized rovers and a mobile logistics support capability. This exploration concept will not be described in this paper. Trade set three (TS3) investigated delivery of a ‘core’ habitation capability in support of an early outpost that would mature into the TS1 full outpost capability. Three core habitat concepts were defined for this campaign analysis. One with a four port core habitat, another with a 2 port core habitat, and the third investigated leveraging commonality of the lander ascent module and airlock pressure vessel hard shell. The paper will describe an overview of the various habitat concepts and their functionality. The Crew Operations area includes basic crew accommodations such as sleeping, eating, hygiene and stowage. The EVA Operations area includes additional EVA capability beyond the suit-port airlock function such as redundant airlock(s), suit maintenance, spares stowage, and suit stowage. The Logistics Operations area includes the enhanced accommodations for 180 days such as closed loop life support systems hardware, consumable stowage, spares stowage, interconnection to the other Hab units, and a common

interface mechanism for future growth and mating to a pressurized rover. The Mission & Science Operations area includes enhanced outpost autonomy such as an IVA glove box, life support, and medical operations.
Author
Accommodation; Life Support Systems; Habitats; Extravehicular Activity; Lunar Exploration; Logistics Management; Feedback Control

20080014235 NASA Johnson Space Center, Houston, TX, USA
Spacesuit Water Membrane Evaporator Development for Lunar Missions
Vogel, Matt R.; Peterson, Keith; Zapata, Felipe, III; Dillon, Paul; Trevino, Luis A.; [2008]; 9 pp.; In English; International Conference on Environmental Systems, 29 Jun. - 3 Jul. 2008, San Francisco,CA, USA; Original contains color illustrations
Report No.(s): 2008-402-0313; Copyright; Avail.: CASI: A02, Hardcopy

For future lunar extra-vehicular activities (EVA), one method under consideration for rejecting crew and electronics heat involves evaporating water through a hydrophobic, porous Teflon membrane. A Spacesuit Water Membrane Evaporator (SWME) prototype using the Teflon membrane was tested successfully by Ungar and Thomas (2001) with predicted performance matching test data well. The above referenced work laid the foundation for the design of the SWME development unit, which is being considered for service in the Constellation System Spacesuit Element (CSSE) Portable Life Support System (PLSS). Multiple PLSS SWME configurations were considered on the basis of thermal performance, mass, volume, and performance and manufacturing risk. All configurations were a variation of an alternating concentric water and vapor channel configuration or a stack of alternating rectangular water and vapor channels. Supporting thermal performance trades mapped maximum SWME heat rejection as a function of water channel thickness, vapor channel thickness, channel length, number of water channels, porosity of the membrane structural support, and backpressure valve throat area. Preliminary designs of each configuration were developed to determine total mass and volume as well as to understand manufacturing issues. Review of configurations led to the selection of a concentric annulus configuration that meets the requirements of 800 watts (W) of heat rejection. Detailed design of the SWME development unit will be followed by fabrication of a prototype test unit, with thermal testing expected to start in 2008.
Author
Evaporators; Space Suits; Water; Lunar Exploration; Space Missions; Extravehicular Activity; Hydrophobicity; Membranes

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*.

20080013522 NASA Langley Research Center, Hampton, VA, USA
Mars Radiation Risk Assessment and Shielding Design for Long-term Exposure to Ionizing Space Radiation
Tripathi, Ram K.; Nealy, John E.; November 23, 2007; 9 pp.; In English; 2008 IEEE Aerospace Conference, 1-8 Mar. 2008, Big Sky, MT, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 651549.02.07.01
Report No.(s): IEEEAC Paper 1291, Version 4; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080013522

NASA is now focused on the agency's vision for space exploration encompassing a broad range of human and robotic missions including missions to Moon, Mars and beyond. As a result, there is a focus on long duration space missions. NASA is committed to the safety of the missions and the crew, and there is an overwhelming emphasis on the reliability issues for space missions and the habitat. The cost-effective design of the spacecraft demands a very stringent requirement on the optimization process. Exposure from the hazards of severe space radiation in deep space and/or long duration missions is a critical design constraint and a potential 'show stopper'. Thus, protection from the hazards of severe space radiation is of paramount importance to the agency's vision. It is envisioned to have long duration human presence on the Moon for deep space exploration. The exposures from ionizing radiation - galactic cosmic radiation and solar particle events - and optimized shield design for a swing-by and a long duration Mars mission have been investigated. It is found that the technology of today is inadequate for safe human missions to Mars, and revolutionary technologies need to be developed for long duration and/or

deep space missions. The study will provide a guideline for radiation exposure and protection for long duration missions and career astronauts and their safety.
Author
Mars Missions; Extraterrestrial Radiation; Ionizing Radiation; Radiation Dosage; Spacecraft Design; Long Duration Space Flight; Aerospace Safety; Radiation Shielding

20080013533 NASA Johnson Space Center, Houston, TX, USA
High- and low-LET Radiation-induced Chromosome Aberrations in Human Epithelial Cells Cultured in 3-dimensional Matrices
Hada, M.; George K.; Cucinotta, F. A.; Wu, H.; [2008]; 1 pp.; In English; 54th Annual Meeting of the Radiation Research Society, 21-25 Sep. 2008, Boston, MA, USA; Copyright; Avail.: Other Sources; Abstract Only

Energetic heavy ions pose a great health risk to astronauts who participate in extended ISS missions and will be an even greater concern for future manned lunar and Mars missions. High-LET heavy ions are particularly effective in causing various biological effects, including cell inactivation, genetic mutations, cataracts and cancer induction. Most of these biological endpoints are closely related to chromosomal damage, which can be utilized as a biomarker for radiation insults. Previously, we had studied low- and high-LET radiation-induced chromosome aberrations in human epithelial cells cultured in 2-dimension (2D) using the multicolor banding fluorescence in situ hybridization (mBAND) technique. However, it has been realized that the biological response to radiation insult in a 2D in vitro cellular environment can differ significantly from the response in 3-dimension (3D) or at the actual tissue level. In this study, we cultured human epithelial cells in 3D to provide a more suitable model for human tissue. Human mammary epithelial cells (CH184B5F5/M10) were grown in Matrigel to form 3D structures, and exposed to Fe-ions at NASA Space Radiation Laboratory (NSRL) at the Brookhaven National Laboratory or 137Cs-gamma radiation source at the University of Texas MD Anderson Cancer Center. After exposure, cells were allowed to repair for 16hr before dissociation and subcultured at low density in 2D. G2 and metaphase chromosomes in the first cell cycle were collected in the first cell cycle after irradiation using a chemical-induced premature chromosome condensation (PCC) technique, and chromosome aberrations were analyzed using mBAND technique. With this technique, individually painted chromosomal bands on one chromosome allowed the identification of interchromosomal aberrations (translocation to unpainted chromosomes) and intrachromosomal aberrations (inversions and deletions within a single painted chromosome). Our data indicate a significant difference in the chromosome aberration yield between 2D and 3D cell cultures after gamma exposures, but not after Fe ion exposures. Therefore, the Relative Biological Effect (RBE) for induction of chromosome aberrations obtained in a 2D model may not accurately represent RBE values obtained for tissue exposure.
Author
Heavy Ions; Biological Effects; Genetics; Mutations; Cataracts; Cancer; Chromosome Aberrations; Physiological Responses; Relative Biological Effectiveness (RBE)

Subject Term Index

Personal Author Index