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WHAT'S INSIDE

NASA STI Program ... in Profile

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

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

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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

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01
AERONAUTICS (GENERAL)

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

20070018034 NASA Langley Research Center, Hampton, VA, USA

Terrain Portrayal for Synthetic Vision Systems Head-Down Displays Evaluation Results

Hughes, Monica F.; Glaab, Louis J.; April 2007; 144 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 609866.02.07.07

Report No.(s): NASA/TP-2007-214864; L-19222; No Copyright; Avail.: CASI: A07, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070018034

A critical component of SVS displays is the appropriate presentation of terrain to the pilot. At the time of this study, the relationship between the complexity of the terrain presentation and resulting enhancements of pilot SA and pilot performance had been largely undefined. The terrain portrayal for SVS head-down displays (TP-HDD) simulation examined the effects of two primary elements of terrain portrayal on the primary flight display (PFD): variations of digital elevation model (DEM) resolution and terrain texturing. Variations in DEM resolution ranged from sparsely spaced (30 arc-sec) to very closely spaced data (1 arc-sec). Variations in texture involved three primary methods: constant color, elevation-based generic, and photo-realistic, along with a secondary depth cue enhancer in the form of a fishnet grid overlay.

Author

Terrain; Enhanced Vision; Display Devices; Digital Elevation Models; Simulation; Pilot Performance

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.

20070018155 NASA Ames Research Center, Moffett Field, CA, USA

Influence of Initial Vorticity Distribution on Axisymmetric Vortex Breakdown and Reconnection

Young, Larry A.; Jan. 11, 2007; 26 pp.; In English; AIAA Aerospace Sciences Meeting, 8-11 Jan. 2007, Reno, NV, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070018155

An analytical treatment has been developed to study some of the axisymmetric vortex breakdown and reconnection fluid dynamic processes underlying body-vortex interactions that are frequently manifested in rotorcraft and propeller-driven fixed-wing aircraft wakes. In particular, the presence of negative vorticity in the inner core of a vortex filament (one example of which is examined in this paper) subsequent to 'cutting' by a solid body has a profound influence on the vortex reconnection, leading to analog flow behavior similar to vortex breakdown phenomena described in the literature. Initial vorticity distributions (three specific examples which are examined) without an inner core of negative vorticity do not exhibit vortex breakdown and instead manifest diffusion-like properties while undergoing vortex reconnection. Though this work focuses on laminar vortical flow, this work is anticipated to provide valuable insight into rotary-wing aerodynamics as well as other types of vortical flow phenomena.

Author

Aircraft Configurations; Vortex Breakdown; Vortices; Vortex Filaments

20070018202 NASA Langley Research Center, Hampton, VA, USA

Validation of the Lockheed Martin Morphing Concept with Wind Tunnel Testing

Ivanco, Thomas G.; Scott, Robert C.; Love, Michael H.; Zink Scott; Weisshaar, Terrence A.; [2007]; 17 pp.; In English; 48th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 23-26 Apr. 2007, Waikiki, HI, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 561581.02.08

Report No.(s): AIAA 2007-2235; Copyright; Avail.: CASI: A03, Hardcopy

The Morphing Aircraft Structures (MAS) program is a Defense Advanced Research Projects Agency (DARPA) led effort to develop morphing flight vehicles capable of radical shape change in flight. Two performance parameters of interest are loiter time and dash speed as these define the persistence and responsiveness of an aircraft. The geometrical characteristics that optimize loiter time and dash speed require different geometrical planforms. Therefore, radical shape change, usually involving wing area and sweep, allows vehicle optimization across many flight regimes. The second phase of the MAS program consisted of wind tunnel tests conducted at the NASA Langley Transonic Dynamics Tunnel to demonstrate two morphing concepts and their enabling technologies with large-scale semi-span models. This paper will focus upon one of those wind tunnel tests that utilized a model developed by Lockheed Martin Aeronautics Company (LM). Wind tunnel success criteria were developed by NASA to support the DARPA program objectives. The primary focus of this paper will be the demonstration of the DARPA objectives by systematic evaluation of the wind tunnel model performance relative to the defined success criteria. This paper will also provide a description of the LM model and instrumentation, and document pertinent lessons learned. Finally, as part of the success criteria, aeroelastic characteristics of the LM derived MAS vehicle are also addressed. Evaluation of aeroelastic characteristics is the most detailed criterion investigated in this paper. While no aeroelastic instabilities were encountered as a direct result of the morphing design or components, several interesting and unexpected aeroelastic phenomenon arose during testing.

Author

Wind Tunnel Tests; Aeroelasticity; Planforms; Wind Tunnel Models; Transonic Wind Tunnels

20070018260 NASA Dryden Flight Research Center, Edwards, CA, USA

F-15B Quiet Spike(TradeMark) Aeroservoelastic Flight-Test Data Analysis

Kukreja, Sunil L.; May 2007; 22 pp.; In English; Original contains black and white illustrations

Report No.(s): NASA/TM-2007-214618; H-2713; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070018260

System identification is utilized in the aerospace community for development of simulation models for robust control law design. These models are often described as linear, time-invariant processes and assumed to be uniform throughout the flight envelope. Nevertheless, it is well known that the underlying process is inherently nonlinear. Over the past several decades the controls and biomedical communities have made great advances in developing tools for the identification of nonlinear systems. In this report, we show the application of one such nonlinear system identification technique, structure detection, for the analysis of Quiet Spike(TradeMark)(Gulfstream Aerospace Corporation, Savannah, Georgia) aeroservoelastic flight-test data. Structure detection is concerned with the selection of a subset of candidate terms that best describe the observed output. Structure computation as a tool for black-box modeling may be of critical importance for the development of robust, parsimonious models for the flight-test community. The objectives of this study are to demonstrate via analysis of Quiet Spike(TradeMark) aeroservoelastic flight-test data for several flight conditions that: linear models are inefficient for modelling aeroservoelastic data, nonlinear identification provides a parsimonious model description whilst providing a high percent fit for cross-validated data and the model structure and parameters vary as the flight condition is altered.

Author

Aeroservoelasticity; Systems Analysis; Flight Tests; System Identification; Data Structures; Control Theory; Flight Envelopes; Nonlinear Systems

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.

20070018008 Civil Aerospace Medical Inst., Oklahoma City, OK, USA, Boeing Co., Tukwila, WA, USA
Predicting Subjective Workload Ratings: A Comparison and Synthesis of Operational and Theoretical Models
Crutchfield, Jerry; Rosenberg, Craig; March 2007; 13 pp.; In English
Contract(s)/Grant(s): AM-BHRR-522
Report No.(s): DOT/FAA/AM-07/6; No Copyright; Avail.: CASI: A03, Hardcopy

Output fiom a computer simulation of two air traffic control (ATC) scenarios was fit to workload ratings that ATC subject-matter experts provided while observing each scenario in real time. Simulation output enabled regression analyses that tested the assumptions of a variety of workload prediction models. These included both operational models that use observable situational and behavioral variables (e.g., number of aircraft and communications by type) and theoretical models that use queuing and cognitive architecture variables (e.g., activities performed, amount of busy time, and sensory and cognitive resource usage). Results suggested the models that included number of activities performed weighted by priority accounted for the highest amount of variance in subjective workload ratings.
Author
Air Traffic Control; Mathematical Models; Predictions; Workloads (Psychophysiology)

20070018266 NASA Johnson Space Center, Houston, TX, USA
Safely Containing Frangible Materials used in Space Flight Equipment
Bernstein, Karen S.; May 16, 2007; 16 pp.; In English; Space Safety in a Global World, 14-16 May 2007, Chicago, IL, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018266

Glass fragments in a habitable zero-g environment can be very hazardous to the crew, with a potential for causing eye injuries or inhalation mishaps. With the advent of the Space Shuttle Program, NASA had to manage many shatterable items in the habitable compartment, brought to the spacecraft by payload developers, NASA experiments, crew equipment and the vehicle's own avionics and other instrumentation. This effort has continued in the International Space Station Program, and will be a part of every future manned space effort.
Derived from text
Fragmentation; Glass; Manned Space Flight; Containment; International Space Station; Onboard Equipment; Brittle Materials

20070018289 NASA Langley Research Center, Hampton, VA, USA
Going Below Minimums: The Efficacy of Display Enhanced/Synthetic Vision Fusion for Go-Around Decisions during Non-Normal Operations
Prinzel, Lawrence J., III; Kramer, Lynda J.; Bailey, Randall E.; Apr. 23, 2007; 6 pp.; In English; 14th International Symposium on Aviation Psychology, 23-26 Apr. 2007, Dayton, OH, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 609866.02.07.07.01; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018289

The use of enhanced vision systems in civil aircraft is projected to increase rapidly as the Federal Aviation Administration recently changed the aircraft operating rules under Part 91, revising the flight visibility requirements for conducting approach and landing operations. Operators conducting straight-in instrument approach procedures may now operate below the published approach minimums when using an approved enhanced flight vision system that shows the required visual references on the pilot's Head-Up Display. An experiment was conducted to evaluate the complementary use of synthetic vision systems and enhanced vision system technologies, focusing on new techniques for integration and/or fusion of synthetic and enhanced vision technologies and crew resource management while operating under these newly adopted rules.

Experimental results specific to flight crew response to non-normal events using the fused synthetic/enhanced vision system are presented.
Author
Enhanced Vision; Head-Up Displays; Flight Operations; Aircraft Landing; Civil Aviation; Decision Making

20070018290 NASA Langley Research Center, Hampton, VA, USA
Cockpit Technology for Prevention of General Aviation Runway Incursions
Prinzel, Lawrence J., III; Jones, Denise R.; Apr. 23, 2007; 6 pp.; In English; 14th International Symposium on Aviation Psychology, 23-26 Apr. 2007, Dayton, OH, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 609866.02.07.07.01; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018290

General aviation accounted for 74 percent of runway incursions but only 57 percent of the operations during the four-year period from fiscal year (FY) 2001 through FY2004. Elements of the NASA Runway Incursion Prevention System were adapted and tested for general aviation aircraft. Sixteen General Aviation pilots, of varying levels of certification and amount of experience, participated in a piloted simulation study to evaluate the system for prevention of general aviation runway incursions compared to existing moving map displays. Pilots flew numerous complex, high workload approaches under varying weather and visibility conditions. A rare-event runway incursion scenario was presented, unbeknownst to the pilots, which represented a typical runway incursion situation. The results validated the efficacy and safety need for a runway incursion prevention system for general aviation aircraft.
Author
Cockpits; Display Devices; Runway Incursions; Visibility; Safety; Certification; Simulation

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.

20070018015 NASA Ames Research Center, Moffett Field, CA, USA
What Happened, and Why: Toward an Understanding of Human Error Based on Automated Analyses of Incident Reports, Volume 2
Ferryman, Thomas A.; Posse, Christian; Rosenthal, Loren J.; Srivastava, Ashok N.; Statler, Irving C.; December 2006; 36 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): WU 457280.02.07.01.07
Report No.(s): NASA/TP-2006-213490; A070001; Copyright; Avail.: CASI: A03, Hardcopy

The objective of the Aviation System Monitoring and Modeling project of NASA's Aviation Safety and Security Program was to develop technologies to enable proactive management of safety risk, which entails identifying the precursor events and conditions that foreshadow most accidents. Information about what happened can be extracted from quantitative data sources, but the experiential account of the incident reporter is the best available source of information about why an incident happened. In Volume I, the concept of the Scenario was introduced as a pragmatic guide for identifying similarities of what happened based on the objective parameters that define the Context and the Outcome of a Scenario. In this Volume II, that study continues into the analyses of the free narratives to gain understanding as to why the incident occurred from the reporter s perspective. While this is just the first experiment, the results of our approach are encouraging and indicate that it will be possible to design an automated analysis process guided by the structure of the Scenario that can achieve the level of consistency and reliability of human analysis of narrative reports.
Author
Aircraft Safety; Reliability Analysis; Error Analysis; Human Performance; Flight Safety; Risk; Design Analysis

20070018156 NASA Dryden Flight Research Center, Edwards, CA, USA
Quiet Spike(TradeMark) Build-up Ground Vibration Testing Approach
Spivey, Natalie D.; Herra, Claudia Y.; Truax, Roger; Pak, Chan-gi; Freund, Donald; Apr. 26, 2007; 21 pp.; In English; 48th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 23-26 Apr. 2007, Waikiki, HI, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

Flight tests of Gulfstream Aerospace Corporation s Quiet Spike(TradeMark) hardware were recently completed on the NASA Dryden Flight Research Center F-15B airplane. NASA Dryden uses a modified F-15B airplane as a testbed aircraft to cost-effectively fly flight research experiments that are typically mounted underneath the F-15B airplane, along the fuselage centerline. For the Quiet Spike(TradeMark) experiment, however, instead of a centerline mounting, a relatively long forward-pointing boom was attached to the radar bulkhead of the F-15B airplane. The Quiet Spike(TradeMark) experiment is a stepping-stone to airframe structural morphing technologies designed to mitigate the sonic-boom strength of business jets over land. The Quiet Spike(TradeMark) boom is a concept in which an aircraft s noseboom would be extended prior to supersonic acceleration. This morphing effectively lengthens the aircraft, thus reducing the peak sonic-boom amplitude, but is also expected to partition the otherwise strong bow shock into a series of reduced-strength, noncoalescing shocklets. Prior to flying the Quiet Spike(TradeMark) experiment on the F-15B airplane several ground vibration tests were required to understand the Quiet Spike(TradeMark) modal characteristics and coupling effects with the F-15B airplane. However, due to the flight hardware availability and compressed schedule requirements, a 'traditional' ground vibration test of the mated F-15B Quiet Spike(TradeMark) ready-for- flight configuration did not leave sufficient time available for the finite element model update and flutter analyses before flight testing. Therefore, a 'nontraditional' ground vibration testing approach was taken. This paper provides an overview of each phase of the 'nontraditional' ground vibration testing completed for the Quiet Spike(TradeMark) project which includes the test setup details, instrumentation layout, and modal results obtained in support of the structural dynamic modeling and flutter analyses.
Author
Vibration Tests; Ground Tests; Flight Tests; Structural Analysis; Shock Waves; Sonic Booms

20070018200 Aerospace Computing, Inc., Mountain View, CA, USA
Preliminary Sizing of 120-Passenger Advanced Civil Rotorcraft Concepts
vanAken, Johannes M.; Sinsay, Jeffrey D.; Jan. 20, 2006; 36 pp.; In English; AHS International Vertical Lift Aircraft Design Conference, 18-20 Jan. 2006, San Francisco, CA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNA04AA18B; Copyright; Avail.: Other Sources

The results of a preliminary sizing study of advanced civil rotorcraft concepts that are capable of carrying 120 passengers over a range of 1,200 nautical miles are presented. The cruise altitude of these rotorcraft is 30,000 ft and the cruise velocity is 350 knots. The mission requires a hover capability, creating a runway independent solution, which might aid in reducing strain on the existing airport infrastructure. Concepts studied are a tiltrotor, a tandem rotor compound, and an advancing blade concept. The first objective of the study is to determine the relative merits of these designs in terms of mission gross weight, engine size, fuel weight, aircraft purchase price, and direct operating cost. The second objective is to identify the enabling technology for these advanced heavy lift civil rotorcraft.
Author
Civil Aviation; Helicopter Design; Rotary Wing Aircraft; Heavy Lift Helicopters; Passenger Aircraft; Air Transportation; Size Determination

20070018210 NASA Dryden Flight Research Center, Edwards, CA, USA
Aeroelastic Model Structure Computation for Envelope Expansion
Kukreja, Sunil L.; Apr. 23, 2007; 6 pp.; In English; 48th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 23 Apr. 2007, Waikiki, HI, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018210

Structure detection is a procedure for selecting a subset of candidate terms, from a full model description, that best describes the observed output. This is a necessary procedure to compute an efficient system description which may afford greater insight into the functionality of the system or a simpler controller design. Structure computation as a tool for black-box modelling may be of critical importance in the development of robust, parsimonious models for the flight-test community. Moreover, this approach may lead to efficient strategies for rapid envelope expansion which may save significant development time and costs. In this study, a least absolute shrinkage and selection operator (LASSO) technique is investigated for computing efficient model descriptions of nonlinear aeroelastic systems. The LASSO minimises the residual sum of squares

by the addition of an l(sub 1) penalty term on the parameter vector of the traditional 2 minimisation problem. Its use for structure detection is a natural extension of this constrained minimisation approach to pseudolinear regression problems which produces some model parameters that are exactly zero and, therefore, yields a parsimonious system description. Applicability of this technique for model structure computation for the F/A-18 Active Aeroelastic Wing using flight test data is shown for several flight conditions (Mach numbers) by identifying a parsimonious system description with a high percent fit for cross-validated data.
Author
Aeroelasticity; Mathematical Models; Nonlinearity; Aircraft Structures

20070018258 NASA Dryden Flight Research Center, Edwards, CA, USA
NASA Access 5 Integrated Project Team (IPT) Project Deliverables
Aug. 31, 2005; 71 pp.; In English; Original contains color and black and white illustrations
Report No.(s): DFRC-239; Copyright; Avail.: CASI: A04, Hardcopy

Three sources have been considered to provide information allowing the evaluation of the Collision Conflict Avoidance (CCA) functional requirements: existing data, simulation, and flight test. The existing data sources that have been evaluated have been found to be lacking in two areas: The actual data that was recorded and missing elements to the system architecture. Many previous tests addressing collision avoidance were conducted without a remote operator. As such, they are missing critical elements that are required to assess the CCA functional requirements. Tests such as ERAST were conducted with all of the UAS elements. However, ERAST tests were conducted as a demonstration and the data recorded was of end-to-end performance. Many contributing elements of the system were not individually recorded or were recorded at a data rate insufficient for the purposes of evaluating the CCA functional requirements.
Author
Collision Avoidance; Flight Tests; Functional Design Specifications; Data Simulation; Flight Simulation

20070018296 NASA Langley Research Center, Hampton, VA, USA
Integrated Aerodynamic/Structural/Dynamic Analyses of Aircraft with Large Shape Changes
Samareh, Jamshid A.; Chwalowski, Pawel; Horta, Lucas G.; Piatak, David J.; McGowan, Anna-Maria R.; Apr. 23, 2007; 20 pp.; In English; 48th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 23-26 Apr. 2007, Waikiki, HI, USA; Original contains color and black and white illustrations
Report No.(s): AIAA Paper 2007-2346; Copyright; Avail.: CASI: A03, Hardcopy

The conceptual and preliminary design processes for aircraft with large shape changes are generally difficult and time-consuming, and the processes are often customized for a specific shape change concept to streamline the vehicle design effort. Accordingly, several existing reports show excellent results of assessing a particular shape change concept or perturbations of a concept. The goal of the current effort was to develop a multidisciplinary analysis tool and process that would enable an aircraft designer to assess several very different morphing concepts early in the design phase and yet obtain second-order performance results so that design decisions can be made with better confidence. The approach uses an efficient parametric model formulation that allows automatic model generation for systems undergoing radical shape changes as a function of aerodynamic parameters, geometry parameters, and shape change parameters. In contrast to other more self-contained approaches, the approach utilizes off-the-shelf analysis modules to reduce development time and to make it accessible to many users. Because the analysis is loosely coupled, discipline modules like a multibody code can be easily swapped for other modules with similar capabilities. One of the advantages of this loosely coupled system is the ability to use the medium-to high-fidelity tools early in the design stages when the information can significantly influence and improve overall vehicle design. Data transfer among the analysis modules are based on an accurate and automated general purpose data transfer tool. In general, setup time for the integrated system presented in this paper is 2-4 days for simple shape change concepts and 1-2 weeks for more mechanically complicated concepts. Some of the key elements briefly described in the paper include parametric model development, aerodynamic database generation, multibody analysis, and the required software modules as well as examples for a telescoping wing, a folding wing, and a bat-like wing.
Author
Aerodynamic Configurations; Dynamic Structural Analysis; Aircraft Structures; Shapes; Aircraft Models; Computational Fluid Dynamics

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.

20070018018 NASA Ames Research Center, Moffett Field, CA, USA

In-Flight Validation of a Pilot Rating Scale for Evaluating Failure Transients in Electronic Flight Control Systems

Kalinowski, Kevin F.; Tucker, George E.; Moralez, Ernesto, III; May 11, 2006; 11 pp.; In English; American Helicopter Society 62nd Annual Forum, 9-11 May 2006, Phoenix, AZ, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

Engineering development and qualification of a Research Flight Control System (RFCS) for the Rotorcraft Aircrew Systems Concepts Airborne Laboratory (RASCAL) JUH-60A has motivated the development of a pilot rating scale for evaluating failure transients in fly-by-wire flight control systems. The RASCAL RFCS includes a highly-reliable, dual-channel Servo Control Unit (SCU) to command and monitor the performance of the fly-by-wire actuators and protect against the effects of erroneous commands from the flexible, but single-thread Flight Control Computer. During the design phase of the RFCS, two piloted simulations were conducted on the Ames Research Center Vertical Motion Simulator (VMS) to help define the required performance characteristics of the safety monitoring algorithms in the SCU. Simulated failures, including hard-over and slow-over commands, were injected into the command path, and the aircraft response and safety monitor performance were evaluated. A subjective Failure/Recovery Rating (F/RR) scale was developed as a means of quantifying the effects of the injected failures on the aircraft state and the degree of pilot effort required to safely recover the aircraft. A brief evaluation of the rating scale was also conducted on the Army/NASA CH-47B variable stability helicopter to confirm that the rating scale was likely to be equally applicable to in-flight evaluations. Following the initial research flight qualification of the RFCS in 2002, a flight test effort was begun to validate the performance of the safety monitors and to validate their design for the safe conduct of research flight testing. Simulated failures were injected into the SCU, and the F/RR scale was applied to assess the results. The results validate the performance of the monitors, and indicate that the Failure/Recovery Rating scale is a very useful tool for evaluating failure transients in fly-by-wire flight control systems.

Author

Fly By Wire Control; Pilot Ratings; Airborne/Spaceborne Computers; Actuators; Electronic Control; Flight Control; Flight Tests

20070018157 NASA Langley Research Center, Hampton, VA, USA

Synthetic Vision Systems - Operational Considerations Simulation Experiment

Kramer, Lynda J.; Williams, Steven P.; Bailey, Randall E.; Glaab, Louis J.; Apr. 13, 2007; 16 pp.; In English; SPIE Defense and Security Symposium 2007, 9-13 Apr. 2007, Orlando, FL, USA; Original contains color and black and white illustrations Contract(s)/Grant(s): WBS 609866.02.07.07.01; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070018157

Synthetic vision is a computer-generated image of the external scene topography that is generated from aircraft attitude, high-precision navigation information, and data of the terrain, obstacles, cultural features, and other required flight information. A synthetic vision system (SVS) enhances this basic functionality with real-time integrity to ensure the validity of the databases, perform obstacle detection and independent navigation accuracy verification, and provide traffic surveillance. Over the last five years, NASA and its industry partners have developed and deployed SVS technologies for commercial, business, and general aviation aircraft which have been shown to provide significant improvements in terrain awareness and reductions in the potential for Controlled-Flight-Into-Terrain incidents/accidents compared to current generation cockpit technologies. It has been hypothesized that SVS displays can greatly improve the safety and operational flexibility of flight in Instrument Meteorological Conditions (IMC) to a level comparable to clear-day Visual Meteorological Conditions (VMC), regardless of actual weather conditions or time of day. An experiment was conducted to evaluate SVS and SVS-related technologies as well as the influence of where the information is provided to the pilot (e.g., on a Head-Up or Head-Down Display) for consideration in defining landing minima based upon aircraft and airport equipage. The 'operational considerations' evaluated under this effort included reduced visibility, decision altitudes, and airport equipage requirements, such as approach lighting systems, for SVS-equipped aircraft. Subjective results from the present study suggest that synthetic vision imagery on both head-up and head-down displays may offer benefits in situation awareness; workload; and approach

and landing performance in the visibility levels, approach lighting systems, and decision altitudes tested.
Author
Visibility; Head-Up Displays; Real Time Operation; Surveillance; Accuracy; Flight Instruments; Display Devices; Enhanced Vision; Aircraft Landing; Systems Simulation

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.

20070018165 NASA Glenn Research Center, Cleveland, OH, USA
An Introduction to Thermodynamic Performance Analysis of Aircraft Gas Turbine Engine Cycles Using the Numerical Propulsion System Simulation Code
Jones, Scott M.; March 2007; 48 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 984754.02.07.03.12.02
Report No.(s): NASA/TM-2007-214690; E-15876; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018165

This document is intended as an introduction to the analysis of gas turbine engine cycles using the Numerical Propulsion System Simulation (NPSS) code. It is assumed that the analyst has a firm understanding of fluid flow, gas dynamics, thermodynamics, and turbomachinery theory. The purpose of this paper is to provide for the novice the information necessary to begin cycle analysis using NPSS. This paper and the annotated example serve as a starting point and by no means cover the entire range of information and experience necessary for engine performance simulation. NPSS syntax is presented but for a more detailed explanation of the code the user is referred to the NPSS User Guide and Reference document (ref. 1).
Author
Jet Propulsion; Gas Turbine Engines; Aircraft Engines; Computer Systems Simulation; Computerized Simulation; Thermodynamic Cycles

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.

20070018027 Florida Univ., FL, USA
Identification and Control of Aircrafts using Multiple Models and Adaptive Critics
Principe, Jose C.; April 2007; 12 pp.; In English
Contract(s)/Grant(s): NNL04AA43G; WBS 561581.02.08.07.14.03; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018027

We compared two possible implementations of local linear models for control: one approach is based on a self-organizing map (SOM) to cluster the dynamics followed by a set of linear models operating at each cluster. Therefore the gating function is hard (a single local model will represent the regional dynamics). This simplifies the controller design since there is a one to one mapping between controllers and local models. The second approach uses a soft gate using a probabilistic framework based on a Gaussian Mixture Model (also called a dynamic mixture of experts). In this approach several models may be active at a given time, we can expect a smaller number of models, but the controller design is more involved, with potentially better noise rejection characteristics. Our experiments showed that the SOM provides overall best performance in high SNRs, but the performance degrades faster than with the GMM for the same noise conditions. The SOM approach required about an order of magnitude more models than the GMM, so in terms of implementation cost, the GMM is preferable. The design of the SOM is straight forward, while the design of the GMM controllers, although still reasonable, is more involved and needs more care in the selection of the parameters. Either one of these locally linear approaches outperform global nonlinear controllers based on neural networks, such as the time delay neural network (TDNN). Therefore, in essence the local model approach warrants practical implementations. In order to call the attention of the control community for this design methodology we extended successfully the multiple model approach to PID controllers (still today the most widely used control scheme in the industry), and wrote a paper on this subject. The echo state network (ESN) is a recurrent neural network with the special characteristics

that only the output parameters are trained. The recurrent connections are preset according to the problem domain and are fixed. In a nutshell, the states of the reservoir of recurrent processing elements implement a projection space, where the desired response is optimally projected. This architecture trades training efficiency by a large increase in the dimension of the recurrent layer. However, the power of the recurrent neural networks can be brought to bear on practical difficult problems. Our goal was to implement an adaptive critic architecture implementing Bellman s approach to optimal control. However, we could only characterize the ESN performance as a critic in value function evaluation, which is just one of the pieces of the overall adaptive critic controller. The results were very convincing, and the simplicity of the implementation was unparalleled.
Derived from text
Adaptive Control; Mathematical Models; Linearity; Aircraft Control

20070018161 California Univ., Davis, CA, USA
Piloted Simulation Study of Rudder Pedal Force/Feel Characteristics
Hess, Ronald A.; 2007; 27 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNL06-AA04A; WBS 457280.02.07.07.03; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018161

A piloted, fixed-base simulation was conducted in 2006 to determine optimum rudder pedal force/feel characteristics for transport aircraft. As part of this research, an evaluation of four metrics for assessing rudder pedal characteristics previously presented in the literature was conducted. This evaluation was based upon the numerical handling qualities ratings assigned to a variety of pedal force/feel systems used in the simulation study. It is shown that, with the inclusion of a fifth metric, most of the rudder pedal force/feel system designs that were rated poorly by the evaluation pilots could be identified. It is suggested that these metrics form the basis of a certification requirement for transport aircraft.
Author
Transport Aircraft; Rudders; Controllability; Simulation; Pedals

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)*.

20070018311 NASA Marshall Space Flight Center, Huntsville, AL, USA
Staffing the ISS Control Centers: Lessons Learned from Long-Duration Human Space Flight
Olsen, Carrie D.; Horvath, Timothy J.; Davis, Sally P.; 2006; 12 pp.; In English; SpaceOps 2006, 19-23 Jun. 2006, Rome, Italy; Copyright; Avail.: Other Sources; Abstract Only

The International Space Station (ISS) has been in operation with a permanent human presence in space for over five years, and plans for continued operations stretch ten years into the future. Ground control and support operations are, likewise, a 15-year enterprise. This long-term, 24-hour per day, 7 day per week support has presented numerous challenges in the areas of ground crew training, initial and continued certification, and console staffing. The Mission Control Center in Houston, Texas and the Payload Operations Center in Huntsville, Alabama have both tackled these challenges, with similar, yet distinct, approaches. This paper describes the evolution of the staffing and training policies of both control centers in a chronological progression. The relative merits and shortcomings of the various policies employed are discussed and a summary of 'lessons learned' is presented. Finally, recommendations are made as best practices for future long-term space missions.
Author
International Space Station; Policies; Ground Crews; Education

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*.

20070018186 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Space Technology 5 Launch and Operations
O'Donnell, James R.; Concha, Marco A.; Morrissey, James R.; Placanica, Samuel J.; Russo, Angela M.; Tsai, Dean C.; February 07, 2007; 20 pp.; In English; 30th Annual AAS Guidance and Control Conference, 3-7 Feb. 2007, Breckenridge, CO, USA; Original contains black and white illustrations
Report No.(s): AAS 07-091; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018186

The three spacecraft that made up the Space Technology 5 (ST5) mission were successfully launched and deployed from their Pegasus launch vehicle on March 22, 2006. Final contact with the spacecraft occurred on June 30, 2006, with all Level 1 requirements met. By the end of the mission, all ST5 technologies had been validated, all on-board attitude control system (ACS) modes had been successfully demonstrated, and the desired constellation configurations had been achieved to demonstrate the ability of small spacecraft to take quality science measurements, However, during those 100 days (ST5 was planned to be a 90-day mission), there were a number of anomalies that made achieving the mission goals very challenging. This paper will discuss: the chronology of the ST5 launch and early operations, work performed to diagnose and work-around a sun sensor anomaly, spacecraft tests devised to demonstrate correct operation of all onboard ACS modes, the maneuver plan performed to achieve the desired constellation, investigations performed by members of the ST5 GN&C and Science teams of an anomalous spin down condition, and the end-of-life orbit and passivating operations performed on the three spacecraft. Author
Spacecraft Launching; Technology Utilization; Space Missions; Aerospace Engineering

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*.

20070018017 NASA Ames Research Center, Moffett Field, CA, USA
Trade Studies of Space Launch Architectures using Modular Probabilistic Risk Analysis
Mathias, Donovan L.; Go, Susie; May 19, 2006; 9 pp.; In English; 8th Probabalistic Safety Assessment and Magagermen (PSAM8) Conference, 14-19 May 2006, New Orleans, LA, USA; Original contains color illustrations
Report No.(s): PSAM-0210; Copyright; Avail.: Other Sources

A top-down risk assessment in the early phases of space exploration architecture development can provide understanding and intuition of the potential risks associated with new designs and technologies. In this approach, risk analysts draw from their past experience and the heritage of similar existing systems as a source for reliability data. This top-down approach captures the complex interactions of the risk driving parts of the integrated system without requiring detailed knowledge of the parts themselves, which is often unavailable in the early design stages. Traditional probabilistic risk analysis (PRA) technologies, however, suffer several drawbacks that limit their timely application to complex technology development programs. The most restrictive of these is a dependence on static planning scenarios, expressed through fault and event trees. Fault trees incorporating comprehensive mission scenarios are routinely constructed for complex space systems, and several commercial software products are available for evaluating fault statistics. These static representations cannot capture the dynamic behavior of system failures without substantial modification of the initial tree. Consequently, the development of dynamic models using fault tree analysis has been an active area of research in recent years. This paper discusses the implementation and demonstration of dynamic, modular scenario modeling for integration of subsystem fault evaluation modules using the Space Architecture Failure Evaluation (SAFE) tool. SAFE is a C++ code that was originally developed to support NASA s Space Launch Initiative. It provides a flexible framework for system architecture definition and trade studies. SAFE supports extensible modeling of dynamic, time-dependent risk drivers of the system and functions at the level of fidelity for which design and failure data exists. The approach is scalable, allowing inclusion of additional information as detailed data becomes available. The tool performs a Monte Carlo analysis to provide statistical estimates. Example results of an

architecture system reliability study are summarized for an exploration system concept using heritage data from liquid-fueled expendable Saturn V/Apollo launch vehicles.
Author
Spacecraft Launching; Saturn 5 Launch Vehicles; Architecture (Computers); Systems Integration; Space Exploration; Monte Carlo Method; Dynamic Characteristics; Risk; Dynamic Models

20070018240 NASA Johnson Space Center, Houston, TX, USA
SAFER Inspection of Space Shuttle Thermal Protection System
Scoville, Zebulon C.; Rajula, Sudhakar; [2005]; 18 pp.; In English; Space 2005, 30 Aug. - 1 Sep. 2005, Long Beach, CA,, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018240

In the aftermath of the space shuttle Columbia accident, it quickly became clear that new methods would need to be developed that would provide the capability to inspect and repair the shuttle's thermal protection system (TPS). A boom extension to the Remote Manipulator System (RMS) with a laser topography sensor package was identified as the primary means for measuring the damage depth in acreage tile as well as scanning Reinforced Carbon- Carbon (RCC) surfaces. However, concern over the system's fault tolerance made it prudent to investigate alternate means of acquiring close range photographs and contour depth measurements in the event of a failure. One method that was identified early was to use the Simplified Aid For EVA Rescue (SAFER) propulsion system to allow EVA access to damaged areas of concern. Several issues were identified as potential hazards to SAFER use for this operation. First, the ability of an astronaut to maintain controlled flight depends upon efficient technique and hardware reliability. If either of these is insufficient during flight operations, a safety tether must be used to rescue the crewmember. This operation can jeopardize the integrity of the Extra-vehicular Mobility Unit (EMU) or delicate TPS materials. Controls were developed to prevent the likelihood of requiring a tether rescue, and procedures were written to maximize the chances for success if it cannot be avoided. Crewmember ability to manage tether cable tension during nominal flight also had to be evaluated to ensure it would not negatively affect propellant consumption. Second, although propellant consumption, flight control, orbital dynamics, and flight complexity can all be accurately evaluated in Virtual Reality (VR) Laboratory at Johnson Space Center, there are some shortcomings. As a crewmember's hand is extended to simulate measurement of tile damage, it will pass through the vehicle without resistance. In reality, this force will push the crewmember away from the vehicle, and could induce a moment which, if strong enough, could saturate the attitude control system in SAFER. This raises the concern that additional propellant will be consumed to maintain controlled flight. To account for this, the fidelity of the Virtual Reality simulation was improved to include the effect of crewmember contact with the vehicle during SAFER flight. In addition, while participating in VR simulations, the subject is in shirt sleeves and sits in a chair. This does not provide a flight-like representation of body position awareness. To prevent inadvertent contact with tile or RCC, other facilities were utilized to establish crew preferences for body attitude and tool configuration. Finally, a study was performed to determine if attitude constraints are needed for the Space shuttle and International Space Station to reduce SAFER flight difficulty.
Author
Thermal Protection; International Space Station; Flight Operations; Remote Manipulator System; Tiles; Inspection; Hazards; Attitude Control; Damage; Safety

20070018243 United Space Alliance, Houston, TX, USA
Rendezvous and Proximity Operations of the Space Shuttle
Goodman, John L.; July 21, 2005; 17 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAS9-20000; Copyright; Avail.: CASI: A03, Hardcopy

Space Shuttle rendezvous missions present unique challenges that were not fully recognized when the Shuttle was designed. Rendezvous targets could be passive (i.e., no lights or transponders), and not designed to facilitate Shuttle rendezvous, proximity operations, and retrieval. Shuttle reaction control system jet plume impingement on target spacecraft presented induced dynamics, structural loading, and contamination concerns. These issues, along with limited reaction control system propellant in the Shuttle nose, drove a change from the legacy Gemini/Apollo coelliptic profile to a stable orbit profile, and the development of new proximity operations techniques. Multiple scientific and on-orbit servicing missions, and crew exchange, assembly and replenishment flights to Mir and to the International Space Station drove further profile and piloting

technique changes. These changes included new proximity operations, relative navigation sensors, and new computer generated piloting cues. However, the Shuttle's baseline rendezvous navigation system has not required modification to place the Shuttle at the proximity operations initiation point for all rendezvous missions flown.
Author
Space Rendezvous; Space Shuttle Orbiters; Space Navigation; Spacecraft Docking; Rendezvous Trajectories

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*.

20070018228 NASA Goddard Space Flight Center, Greenbelt, MD, USA
SpaceWire Plug and Play Updates
Rakow, Glenn; [2007]; 19 pp.; In English; SpaceWire Working Group, 17-19 Jan. 2007, Noordwijk, Netherlands; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018228

This viewgraph presentation reviews the work of the SpaceWire Plug N Play Workgroup. (SpW PnP WG). The chief product of SpW PnP WG will be to develop specification of necessary hardware features required in support upper layer (software) PnP implementations.
CASI
Telecommunication; Data Links; Spacecraft Communication; Data Transmission

20070018309 NASA Johnson Space Center, Houston, TX, USA
Three Years of Global Positioning System Experience on International Space Station
Gomez, Susan; December 2005; 24 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): 401769.06.04.01.02.03
Report No.(s): NASA/TM-2005-213715; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018309

The International Space Station global positioning systems (GPS) receiver was activated in April 2002. Since that time, numerous software anomalies surfaced that had to be worked around. Some of the software problems required waivers, such as the time function, while others required extensive operator intervention, such as numerous power cycles. Eventually, enough anomalies surfaced that the three pieces of code included in the GPS unit have been re-written and the GPS units were upgraded. The technical aspects of the problems are discussed, as well as the underlying causes that led to the delivery of a product that has had numerous problems. The technical aspects of the problems included physical phenomena that were not well understood, such as the affect that the ionosphere would have on the GPS measurements. The underlying causes were traced to inappropriate use of legacy software, changing requirements, inadequate software processes, unrealistic schedules, incorrect contract type, and unclear ownership responsibilities.
Author
Anomalies; Global Positioning System; International Space Station

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\fSafety*.

20070018026 NASA Johnson Space Center, Houston, TX, USA
An Attempt to Observe Debris from the Breakup of a Titan 3C-4 Transtage
Barker, E. S.; Matney, M. J.; Yanagisawa, T.; Liou, J.-C.; Abercromby, K. J.; Rodriquez, H. M.; Horstman, M. F.; Seitzer, P.; [2007]; 2 pp.; In English; 2007 AMOS Technical Conference, 12-15 Sep. 2007, Maui, HI, USA; Copyright; Avail.: Other Sources; Abstract Only

In February 2007 dedicated observations were made of the orbital space predicted to contain debris from the breakup of

the Titan 3C-4 transtage back on February 21, 1992. These observations were carried out on the Michigan Orbital DEbris Survey Telescope (MODEST) in Chile with its 1.3deg field of view. The search region or orbital space (inclination and right ascension of the ascending node (RAAN) was predicted using NASA#s LEGEND (LEO-to-GEO Environment Debris) code to generate a Titan debris cloud. Breakup fragments are created based on the NASA Standard Breakup Model (including fragment size, area-to-mass (A/M), and delta-V distributions). Once fragments are created, they are propagated forward in time with a subroutine GEOPROP. Perturbations included in GEOPROP are those due to solar/lunar gravity, radiation pressure, and major geopotential terms. Barker, et. al, (AMOS Conference Proceedings, 2006, pp. 596-604) used similar LEGEND predictions to correlate survey observations made by MODEST (February 2002) and found several possible night-to-night correlations in the limited survey dataset. One conclusion of the survey search was to dedicate a MODEST run to observing a GEO region predicted to contain debris fragments and actual Titan debris objects (SSN 25000, 25001 and 30000). Such a dedicated run was undertaken with MODEST between February 17 and 23, 2007 (UT dates). MODEST#s limiting magnitude of 18.0 (S\N approx.10) corresponds to a size of 22cm assuming a diffuse Lambertian albedo of 0.2. However, based on observed break-up data, we expect most debris fragments to be smaller than 22cm which implies a need to increase the effective sensitivity of MODEST for smaller objects. MODEST#s limiting size can be lowered by increasing the exposure time (20 instead of 5 seconds) and applying special image processing. The special processing combines individual CCD images to detect faint objects that are invisible on a single CCD image. Sub-images are cropped from six consecutive CCD images with pixel shifts between images being consistent with the predicted movement of a Titan object. A median image of all the sub-images is then created leaving only those objects with the proper Titan motion. Limiting the median image in this manner brings the needed computer time to process all images taken on one night down to about 50 hours of CPU time.

Author

Space Debris; Charge Coupled Devices; Field of View; Titan 4 Launch Vehicle; Image Processing; Fragments; Geopotential; Lunar Gravitation

20070018032 QSS Group, Inc., Cleveland, OH, USA

In-Space Repair of Reinforced Carbon-Carbon Thermal Protection System Structures

Singh, Mrityunjay; June 3, 2006; 39 pp.; In English; 11th International Ceramics Congress - CIMTEC 2006, 3-9 Jun. 2006, Acireale, Italy; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC06ZA12A; WBS 376-70-30; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070018032

Advanced repair and refurbishment technologies are critically needed for the thermal protection system of current space transportation system as well as for future Crew Exploration Vehicles (CEV). The damage to these components could be caused by impact during ground handling or due to falling of ice or other objects during launch. In addition, in-orbit damage includes micrometeoroid and orbital debris impact as well as different factors (weather, launch acoustics, shearing, etc.) during launch and re-entry. The GRC developed GRABER (Glenn Refractory Adhesive for Bonding and Exterior Repair) material has shown multiuse capability for repair of small cracks and damage in reinforced carbon-carbon (RCC) material. The concept consists of preparing an adhesive paste of desired ceramic with appropriate additives and then applying the paste to the damaged/cracked area of the RCC composites with adhesive delivery system. The adhesive paste cures at 100-120 C and transforms into a high temperature ceramic during simulated entry conditions. A number of plasma torch and ArcJet tests were carried out to evaluate the crack repair capability of GRABER materials for Reinforced Carbon-Carbon (RCC) composites. For the large area repair applications, integrated system for tile and leading edge repair (InSTALER) have been developed. In this presentation, critical in-space repair needs and technical challenges as well as various issues and complexities will be discussed along with the plasma performance and post test characterization of repaired RCC materials.

Author

Thermal Protection; Carbon-Carbon Composites; Space Transportation System; Damage; Cracks; Performance Tests; Leading Edges; High Temperature; Composite Structures

20070018036 NASA Langley Research Center, Hampton, VA, USA

Simulating Space Capsule Water Landing with Explicit Finite Element Method

Wang, John T.; Lyle, Karen H.; [2007]; 19 pp.; In English; 48th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 23-26 Apr. 2007, Waikiki, HI, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 644423.04.31.04.40.43.50

Report No.(s): AIAA Paper 2007-1779; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070018036

A study of using an explicit nonlinear dynamic finite element code for simulating the water landing of a space capsule was performed. The finite element model contains Lagrangian shell elements for the space capsule and Eulerian solid elements for the water and air. An Arbitrary Lagrangian Eulerian (ALE) solver and a penalty coupling method were used for predicting the fluid and structure interaction forces. The space capsule was first assumed to be rigid, so the numerical results could be correlated with closed form solutions. The water and air meshes were continuously refined until the solution was converged. The converged maximum deceleration predicted is bounded by the classical von Karman and Wagner solutions and is considered to be an adequate solution. The refined water and air meshes were then used in the models for simulating the water landing of a capsule model that has a flexible bottom. For small pitch angle cases, the maximum deceleration from the flexible capsule model was found to be significantly greater than the maximum deceleration obtained from the corresponding rigid model. For large pitch angle cases, the difference between the maximum deceleration of the flexible model and that of its corresponding rigid model is smaller. Test data of Apollo space capsules with a flexible heat shield qualitatively support the findings presented in this paper.
Author
Water Landing; Space Capsules; Finite Element Method; Pitch (Inclination); Simulation; Deceleration; Heat Shielding

20070018087 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Parallel Estimation and Control Architectures for Deep-Space Formation Flying Spacecraft
Hadaegh, Fred Y.; Smith, Roy S.; July 24, 2006; 19 pp.; In English; World Automation Congress, 24 Jul. 2006, Budapest, Hungary; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/39864

The formation flying of precisely controlled spacecraft in deep space can be used to implement optical instruments capable of imaging planets in other solar systems. The distance of the formation from Earth necessitates a significant level of autonomy and each spacecraft must base its actions on its estimates of the location and velocity of the other spacecraft. Precise coordination and control is the key requirement in such missions and the flow of information between spacecraft must be carefully designed. Doing this in an efficient and optimal manner requires novel techniques for the design of the on-board estimators. The use of standard Kalman filter-based designs can lead to unanticipated dynamics--which we refer to as disagreement dynamics--in the estimators' errors. We show how communication amongst the spacecraft can be designed in order to control all of the dynamics within the formation. We present several results relating the topology of the communication network to the resulting closed-loop control dynamics of the formation. The consequences for the design of the control, communication and coordination are discussed.
Author
Formation Flying; Communication Networks; Deep Space; Imaging Techniques; Kalman Filters; Optical Equipment

20070018135 NASA Johnson Space Center, Houston, TX, USA
Laboratory Reproduction and Failure Analysis of Cracked Orbiter Reaction Control System Niobium Thruster Injectors
Jacobs, Jeremy B.; Castner, Willard L.; [2007]; 33 pp.; In English; Aging Air Craft 2007 Conference, 14-19 Apr. 2007, Palm Spring, CA, USA; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018135

A viewgraph presentation describing cracks and failure analysis of an orbiter reaction control system is shown. The topics include: 1) Endeavour STS-113 Landing; 2) RCS Thruster; 3) Thruster Cross-Section; 4) RCS Injector; 5) RCS Thruster, S/N 120l 6) Counterbore Cracks; 7) Relief Radius Cracks; 8) RCS Thruster Cracking History; 9) Thruster Manufacturing Timelines; 10) Laboratory Reproduction of Injector Cracking; 11) The Brownfield Specimen; 12) HF EtchantTests/Specimen Loading; 13) Specimen #3 HF + 600F; 14) Specimen #3 IG Fracture; 15) Specimen #5 HF + 600F; 16) Specimen #5 Popcorn ; 17) Specimen #5 Cleaned and Bent; 18) HF Exposure Test Matrix; 19) Krytox143AC Tests; 20) KrytoxTests/Specimen Loading; 21) Specimen #13 Krytox + 600F; and 22) KrytoxExposure Test Matrix.
CASI
Cracks; Failure Analysis; Injectors; Niobium; Reaction Control; Endeavour (Orbiter); Manufacturing; Thrust Control

20070018178 NASA White Sands Test Facility, NM, USA

Oxygen Concentration Flammability Thresholds of Selected Aerospace Materials Considered for the Constellation Program

Hirsch, David B.; Williams, James H.; Harper, Susan A.; Beeson, Harold; Pedley, Michael D.; [2007]; 4 pp.; In English; 2nd IAASS Conference Space Safety in Global World, 14-16 May 2007, Chicago, Il, USA; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070018178

Materials selection for spacecraft is based on an upward flammability test conducted in a quiescent environment in the highest expected oxygen concentration environment. The test conditions and its pass/fail test logic do not provide sufficient quantitative materials flammability information for an advanced space exploration program. A modified approach has been suggested determination of materials self-extinguishment limits. The flammability threshold information will allow NASA to identify materials with increased flammability risk from oxygen concentration and total pressure changes, minimize potential impacts, and allow for development of sound requirements for new spacecraft and extraterrestrial landers and habitats. This paper provides data on oxygen concentration self-extinguishment limits under quiescent conditions for selected materials considered for the Constellation Program.

Author

Flammability; Oxygen; NASA Space Programs; Spacecraft Construction Materials

20070018201 NASA Ames Research Center, Moffett Field, CA, USA

System Analysis Applied to Autonomy: Application to Human-Rated Lunar/Mars Landers

Young, Larry A.; Sep. 21, 2006; 23 pp.; In English; AIAA Space 2006, 19-21 Sep. 2006, San Jose, CA, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070018201

System analysis is an essential technical discipline for the modern design of spacecraft and their associated missions. Specifically, system analysis is a powerful aid in identifying and prioritizing the required technologies needed for mission and/or vehicle development efforts. Maturation of intelligent systems technologies, and their incorporation into spacecraft systems, are dictating the development of new analysis tools, and incorporation of such tools into existing system analysis methodologies, in order to fully capture the trade-offs of autonomy on vehicle and mission success. A 'system analysis of autonomy' methodology will be outlined and applied to a set of notional human-rated lunar/Mars lander missions toward answering these questions: 1. what is the optimum level of vehicle autonomy and intelligence required? and 2. what are the specific attributes of an autonomous system implementation essential for a given surface lander mission/application in order to maximize mission success? Future human-rated lunar/Mars landers, though nominally under the control of their crew, will, nonetheless, be highly automated systems. These automated systems will range from mission/flight control functions, to vehicle health monitoring and prognostication, to life-support and other 'housekeeping' functions. The optimum degree of autonomy afforded to these spacecraft systems/functions has profound implications from an exploration system architecture standpoint.

Author

Automatic Control; Autonomy; Flight Control; Systems Analysis; Manned Spacecraft; Landing Modules; Spacecraft Design; Systems Engineering; Spacecraft Control

20070018273 NASA Johnson Space Center, Houston, TX, USA

Methodology for Prototyping Increased Levels of Automation for Spacecraft Rendezvous Functions

Hart, Jeremy J.; Valasek, John; [2007]; 26 pp.; In English; AIAA Infotech Conference, 9-11 May 2007, Sonoma, CA, USA; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

The Crew Exploration Vehicle necessitates higher levels of automation than previous NASA vehicles, due to program requirements for automation, including Automated Rendezvous and Docking. Studies of spacecraft development often point to the locus of decision-making authority between humans and computers (i.e. automation) as a prime driver for cost, safety, and mission success. Therefore, a critical component in the Crew Exploration Vehicle development is the determination of the correct level of automation. To identify the appropriate levels of automation and autonomy to design into a human space flight vehicle, NASA has created the Function-specific Level of Autonomy and Automation Tool. This paper develops a

methodology for prototyping increased levels of automation for spacecraft rendezvous functions. This methodology is used to evaluate the accuracy of the Function-specific Level of Autonomy and Automation Tool specified levels of automation, via prototyping. Spacecraft rendezvous planning tasks are selected and then prototyped in Matlab using Fuzzy Logic techniques and existing Space Shuttle rendezvous trajectory algorithms.
Author
Orbital Rendezvous; Spacecraft Docking; Space Rendezvous; Crew Exploration Vehicle; Spacecraft Design; Safety

20070018274 NASA Johnson Space Center, Houston, TX, USA
International Space Station Materials: Selected Lessons Learned
Golden, Johnny L.; [2007]; 3 pp.; In English; 2nd IAASS Conference, 14-16 May 2007, Chicago, IL, USA
Contract(s)/Grant(s): NAS15-10000; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018274

The International Space Station (ISS) program is of such complexity and scale that there have been numerous issues addressed regarding safety of materials: from design to manufacturing, test, launch, assembly on-orbit, and operations. A selection of lessons learned from the ISS materials perspective will be provided. Topics of discussion are: flammability evaluation of materials with connection to on-orbit operations; toxicity findings for foams; compatibility testing for materials in fluid systems; and contamination control in precision clean systems and critical space vehicle surfaces.
Author
International Space Station; Safety; Flammability; Spacecraft Launching; Toxicity; Foams

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*.

20070018154 NASA Glenn Research Center, Cleveland, OH, USA
NASA Glenn Research in Controls and Diagnostics for Intelligent Aerospace Propulsion Systems
Garg, Sanjay; [2007]; 27 pp.; In English; Integrated Condition Management (ICM) 2006 UKIP Media and Events, 14-16 Nov. 2006, Anaheim, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 732759.03.01.02.17; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018154

With the increased emphasis on aircraft safety, enhanced performance and affordability, and the need to reduce the environmental impact of aircraft, there are many new challenges being faced by the designers of aircraft propulsion systems. The Controls and Dynamics Branch (CDB) at NASA (National Aeronautics and Space Administration) Glenn Research Center (GRC) in Cleveland, Ohio, is leading and participating in various projects in partnership with other organizations within GRC and across NASA, the U.S. aerospace industry, and academia to develop advanced controls and health management technologies that will help meet these challenges through the concept of Intelligent Propulsion Systems. This presentation describes the current CDB activities in support of the NASA Aeronautics Research Mission, with an emphasis on activities under the Integrated Vehicle Health Management (IVHM) and Integrated Resilient Aircraft Control (IRAC) projects of the Aviation Safety Program. Under IVHM, CDB focus is on developing advanced techniques for monitoring the health of the aircraft engine gas path with a focus on reliable and early detection of sensor, actuator and engine component faults. Under IRAC, CDB focus is on developing adaptive engine control technologies which will increase the probability of survival of aircraft in the presence of damage to flight control surfaces or to one or more engines. The technology development plans are described as well as results from recent research accomplishments.
Author
Propulsion System Configurations; NASA Programs; Aircraft Control; Flight Safety; Propulsion System Performance; Spacecraft Propulsion; Engine Control; Control Surfaces; Adaptive Control

20070018214 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Proposed SpaceWire Redundancy Mechanism

Rakow, Glenn; January 18, 2007; 9 pp.; In English; SpaceWire Working Group Meeting, 17-18 Jan. 2007, Noordwijk, Netherlands; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070018214

This viewgraph presentation reviews a possible mechanism and benefits of SpaceWire redundancy.

CASI

Redundancy; Spacecraft Communication; Interprocessor Communication

20070018256 United Space Alliance, Houston, TX, USA

Case Study of the Space Shuttle Cockpit Avionics Upgrade Software

Ferguson, Roscoe C.; Thompson, Hiram C.; [2005]; 11 pp.; In English; 24th Digital Avionics Systems Conference (DASC), 30 Oct. - 3 Nov. 2005, Washington, DC, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NAS9-20000; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070018256

The purpose of the Space Shuttle Cockpit Avionics Upgrade project was to reduce crew workload and improve situational awareness. The upgrade was to augment the Shuttle avionics system with new hardware and software. An early version of this system was used to gather human factor statistics in the Space Shuttle Motion Simulator of the Johnson Space Center for one month by multiple teams of astronauts. The results were compiled by NASA Ames Research Center and it was was determined that the system provided a better than expected increase in situational awareness and reduction in crew workload. Even with all of the benefits nf the system, NASA cancelled the project towards the end of the development cycle. A major success of this project was the validation of the hardware architecture and software design. This was significant because the project incorporated new technology and approaches for the development of human rated space software. This paper serves as a case study to document knowledge gained and techniques that can be applied for future space avionics development efforts. The major technological advances were the use of reflective memory concepts for data acquisition and the incorporation of Commercial off the Shelf (COTS) products in a human rated space avionics system. The infused COTS products included a real time operating system, a resident linker and loader, a display generation tool set, and a network data manager. Some of the successful design concepts were the engineering of identical outputs in multiple avionics boxes using an event driven approach and inter-computer communication, a reconfigurable data acquisition engine, the use of a dynamic bus bandwidth allocation algorithm. Other significant experiences captured were the use of prototyping to reduce risk, and the correct balance between Object Oriented and Functional based programming.

Author

Avionics; Situational Awareness; Workloads (Psychophysiology); Software Engineering; Data Acquisition; Computer Programming; Real Time Operation; Interprocessor Communication

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*.

20070018162 NASA Glenn Research Center, Cleveland, OH, USA

NASA's Advanced Radioisotope Power Conversion Technology Development Status

Anderson, David J.; Sankovic, John; Wilt, David; Abelson, Robert D.; Fleurial, Jean-Pierre; April 2007; 26 pp.; In English; IEEE Aerospace Conference, 4-9 Mar. 2007, Big Sky, MT, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 138494.01.04.01

Report No.(s): NASA/TM-2007-214487; IEEEAC Paper 1610; E-15778; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070018162

NASA's Advanced Radioisotope Power Systems (ARPS) project is developing the next generation of radioisotope power conversion technologies that will enable future missions that have requirements that cannot be met by either photovoltaic systems or by current radioisotope power systems (RPSs). Requirements of advanced RPSs include high efficiency and high specific power (watts/kilogram) in order to meet future mission requirements with less radioisotope fuel and lower mass so that these systems can meet requirements for a variety of future space applications, including continual operation surface

missions, outer-planetary missions, and solar probe. These advances would enable a factor of 2 to 4 decrease in the amount of fuel required to generate electrical power. Advanced RPS development goals also include long-life, reliability, and scalability. This paper provides an update on the contractual efforts under the Radioisotope Power Conversion Technology (RPCT) NASA Research Announcement (NRA) for research and development of Stirling, thermoelectric, and thermophotovoltaic power conversion technologies. The paper summarizes the current RPCT NRA efforts with a brief description of the effort, a status and/or summary of the contractor's key accomplishments, a discussion of upcoming plans, and a discussion of relevant system-level benefits and implications. The paper also provides a general discussion of the benefits from the development of these advanced power conversion technologies and the eventual payoffs to future missions (discussing system benefits due to overall improvements in efficiency, specific power, etc.).
Author
Technology Utilization; Thermophotovoltaic Conversion; Radioisotope Heat Sources; Space Missions; Thermoelectricity

20070018197 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Li-Ion Battery Studies at NASA/Goddard Space Flight Center
Lee, Leonine; Rao, Gopalakrishna M.; Nov. 16, 2006; 69 pp.; In English; 2006 NASA Aerospace Batter Workshop, 14-16 Nov. 2006, Huntsville, AL, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A04, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018197

This viewgraph presentation reviews NASA and GSFC's interest in Lithium Ion Batteries as power suupplies for space usage, the tests, and results on several commercially available batteries. Severl batteries were tested for Geosynchronous orbit, Low Earth Orbit, and Low Lunar Orbit conditions.
CASI
Lithium; Metal Ions; Lithium Batteries; Storage Batteries

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*.

20070018136 NASA Johnson Space Center, Houston, TX, USA
Strategies to Mitigate Ammonia Release on the International Space Station
Macatangay, Ariel V.; Prokhorov, Kimberlee S.; Sweterlitsch, Jeffrey J.; 2007; 12 pp.; In English; International Conference on Environmental Systems, 9-12 Jul. 2007, Chicago, IL, USA; Original contains color and black and white illustrations
Report No.(s): 07ICES-276; Copyright; Avail.: Other Sources

International Space Station (ISS) is crucial to its continuous operation. Off-nominal situations can arise from virtually any aspect of ISS operations. One situation of particular concern is the inadvertent release of a chemical into the ISS atmosphere. In sufficient quantities, a chemical release can render the ISS uninhabitable regardless of the chemical s toxicity as a result of its effect on the hardware used to maintain the environment. This is certainly true with system chemicals which are integral components to the function and purpose of the system. Safeguards, such as design for minimum risk, multiple containment, hazard assessments, rigorous safety reviews, and others, are in place to minimize the probability of a chemical release to the ISS environment thereby allowing the benefits of system chemicals to outweigh the risks associated with them. The thermal control system is an example of such a system. Heat generated within the ISS is transferred from the internal thermal control system (ITCS) to the external thermal control system (ETCS) via two, single-barrier interface heat exchangers (IFHX). The ITCS and ETCS are closed-loop systems which utilize water and anhydrous ammonia, respectively, as heat-transfer fluids. There is approximately 1200 lbs. (208 gallons) of anhydrous ammonia in the ETCS circulating through the two heat exchangers, transferring heat from the ITCS water lines. At the amounts present in the ETCS, anhydrous ammonia is one system chemical that can easily overwhelm the station atmosphere scrubbing capabilities and render the ISS uninhabitable in the event of a catastrophic rupture. Although safeguards have certainly minimized the risk of an ammonia release into the Station atmosphere, credible release scenarios and controls to manage these scenarios are examined.
Author
International Space Station; Ammonia; Toxicity; Risk; Containment

24
COMPOSITE MATERIALS

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

20070018031 QSS Group, Inc., Cleveland, OH, USA
Advanced Ceramic Matrix Composites (CMCs) for High Temperature Applications
Somgj. \h; October 9, 2005; 43 pp.; In English; Plenary Lecture at the International Symposium on High Temperature Ceramics, 9-13 Oct. 2005, Selb, Germany; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAS3-00145; WBS 376-70-30; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018031

Advanced ceramic matrix composites (CMCs) are enabling materials for a number of demanding applications in aerospace, energy, and nuclear industries. In the aerospace systems, these materials are being considered for applications in hot sections of jet engines such as the combustor liner, vanes, nozzle components, nose cones, leading edges of reentry vehicles, and space propulsion components. Applications in the energy and environmental industries include radiant heater tubes, heat exchangers, heat recuperators, gas and diesel particulate filters, and components for land based turbines for power generation. These materials are also being considered for use in the first wall and blanket components of fusion reactors. In the last few years, a number of CMC components have been developed and successfully tested for various aerospace and ground based applications. However, a number of challenges still remain slowing the wide scale implementation of these materials. They include robust fabrication and manufacturing, assembly and integration, coatings, property modeling and life prediction, design codes and databases, repair and refurbishment, and cost. Fabrication of net and complex shape components with high density and tailorable matrix properties is quite expensive, and even then various desirable properties are not achievable. In this presentation, a number of examples of successful CMC component development and testing will be provided. In addition, critical need for robust manufacturing, joining and assembly technologies in successful implementation of these systems will be discussed.
Author
Ceramic Matrix Composites; Aerospace Industry; Jet Engines; High Temperature; Vanes; Nose Cones; Leading Edges; Reentry Vehicles; Heat Exchangers

20070018033 Ohio Aerospace Inst., Cleveland, OH, USA
Brazing of Carbon Carbon Composites to Cu-clad Molybdenum for Thermal Management Applications
Singh, M.; Asthana, R.; Shpargel, T\g P.; Materials Science and Engineering A; 2007; ISSN 0921-5093; Vols. 452-453, pp. 699-704; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNC06ZA12A; WBS 22-973-80-50; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1016/j.msea.2006.11.031

Advanced carbon carbon composites were joined to copper-clad molybdenum (Cu/Mo) using four active metal brazes containing Ti (Cu ABA, Cusin-1 ABA, Ticuni, and Ticusil) for potential use in thermal management applications. The brazed joints were characterized using scanning electron microscopy (SEM), energy dispersive spectroscopy (EDS) and Knoop microhardness measurements across the joint region. Metallurgically sound C-C/Cu/Mo joints, devoid of interfacial cracks formed in all cases. The joint interfaces were preferentially enriched in Ti, with Cu ABA joints exhibiting the largest interfacial Ti concentrations. The microhardness measurements revealed hardness gradients across the joint region, with a peak hardness of 300-350 KHN in Cusin-1 ABA and Ticusil joints and 200-250 KHN in Cu ABA and Ticuni joints, respectively.
Author
Brazing; Carbon-Carbon Composites; Cladding; Copper; Molybdenum; Temperature Control

20070018090 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Testing of Carbon Fiber Composite Overwrapped Pressure Vessel Stress-Rupture Lifetime
Grimes-Ledesma, Lorie; Phoenix, S. Leigh; Beeson, Harold; Yoder, Tommy; Greene, Nathaniel; September 17, 2006; 15 pp.; In English; ASC/ASTM 21st Annual Technical Conference of the American Society for Composite, 17-20 Sep. 2006, Dearborn, MI, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/39869

This paper contains summaries of testing procedures and analysis of stress rupture life testing for two stress rupture test programs, one for Kevlar COPVs performed at Lawrence Livermore National Laboratory, and the other a joint study between NASA JSC White Sands Test Facility and the Jet Propulsion Laboratory. These will be discussed in detail including test setup

and issues encountered during testing. Lessons learned from testing in these two programs will be discussed.
Author
Pressure Vessels; Fiber Composites; Composite Wrapping; Stress Analysis; Kevlar (Trademark)

20070018150 NASA Glenn Research Center, Cleveland, OH, USA
Thin Film Ceramic Strain Sensor Development for Harsh Environments
Wrbanek, John D.; Fralick, Gustave; May 23, 2005; 23 pp.; In English; 53rd International Instrumentation Symposium (ISS), 3 May 2007, Tulsa, OK, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 698259.02.03.02; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018150

The need to consider ceramic sensing elements is brought about by the temperature limits of metal thin film sensors in propulsion system applications. In order to have a more passive method of negating changes of resistance due to temperature, an effort is underway at NASA GRC to develop high temperature thin film ceramic static strain gauges for application in turbine engines, specifically in the fan and compressor modules on blades. Other applications include on aircraft hot section structures and on thermal protection systems. The near-term interim goal of this research effort was to identify candidate thin film ceramic sensor materials to test for viability and provide a list of possible thin film ceramic sensor materials and corresponding properties to test for viability. This goal was achieved by conducting a thorough literature search for ceramics that have the potential for application as high temperature thin film strain gauges chemically and physically compatible and selecting potential candidate materials for with NASA GRC's microfabrication procedures and substrates.
Author
Ceramics; Metal Films; Strain Gages; Thin Films; Sensors; Fabrication

20070018177 NASA Glenn Research Center, Cleveland, OH, USA
High Pressure Burner Rig Testing of Advanced Environmental Barrier Coatings for Si3N4 Turbine Components
Zhu, Dongming; Fox, Dennis S.; Pastel, Robert T.; January 22, 2007; 12 pp.; In English; The 31st International Cocoa Beach Conference & Exposition on Advanced Ceramics & Composites, 22 - 26 Jan. 2007, Daytona Beach, FL, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018177

Advanced thermal and environmental barrier coatings are being developed for Si3N4 components for turbine engine propulsion applications. High pressure burner rig testing was used to evaluate the coating system performance and durability. Test results demonstrated the feasibility and durability of the coating component systems under the simulated engine environments.
Author
Burners; High Pressure; Silicon Nitrides; Turbine Engines; Components; Thermal Control Coatings

20070018231 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Space Environment Effects on Materials : An Overview
Garrett, Henry B.; June 26, 2006; 22 pp.; In English; National Space and Missile Materials Symposium, 26-30 Jun. 2006, Orlando, FL, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/39878

A general overview on the space environment and its effects on materials is presented. The topics include: 1) Impact of Space Effects on Spacecraft Costs; 2) Space Environment Effects on Spacecraft by Source; 3) Primary Source of Space Effects: The Sun; 4) The Earth's Environment; 5) Trapped Radiation Belts; 6) Aurora Are Everywhere; 7) Spacecraft Interactions; 8) Atmospheric Effects; 9) Contaminant Effects on Materials; 10) Meteoroid/Debris Effects on Materials; 11) Spacecraft Surface Charging; 12) Surface Discharge Effects; 13) Internal Electrostatic Discharge--Satellite Killer; 14) Plasma Interactions DS-1 Ion Engines; 15) Radiation Effects on Spacecraft Systems and Materials; 16) Total Ionizing Dose Effects Total Ionizing Dose Effects; 17) Man-Made Sources of Space Effects Man-Made Sources of Space Effects; and 18) Space Environments Versus Interactions.
CASI
Aerospace Environments; General Overviews; Radiation Effects; Composite Materials

20070018286 NASA Glenn Research Center, Cleveland, OH, USA

Polymer Composites Corrosive Degradation: A Computational Simulation

Chamis, Christos C.; Minnetyan, Levon; May 16, 2007; 9 pp.; In English; 6th International Symposium on Advanced Composites (COMP2007-008), 16-18 May 2007, Corfu, Greece; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.1503

Report No.(s): COMP2007-008; Copyright; Avail.: CASI: A02, Hardcopy

A computational simulation of polymer composites corrosive durability is presented. The corrosive environment is assumed to manage the polymer composite degradation on a ply-by-ply basis. The degradation is correlated with a measured pH factor and is represented by voids, temperature and moisture which vary parabolically for voids and linearly for temperature and moisture through the laminate thickness. The simulation is performed by a computational composite mechanics computer code which includes micro, macro, combined stress failure and laminate theories. This accounts for starting the simulation from constitutive material properties and up to the laminate scale which exposes the laminate to the corrosive environment. Results obtained for one laminate indicate that the ply-by-ply degradation degrades the laminate to the last one or the last several plies. Results also demonstrate that the simulation is applicable to other polymer composite systems as well.

Author

Polymer Matrix Composites; Laminates; Corrosion; Degradation; Failure; Simulation; Durability

20070018287 NASA Glenn Research Center, Cleveland, OH, USA

Progressive Fracture of Laminated Fiber-Reinforced Composite Stiffened Plate Under Pressure

Gotsis, Pascalis K.; Abdi, Frank; Chamis, Christos C.; Tsouros, Konstantinos; May 16, 2007; 5 pp.; In English; 6th International Symposium on Advanced Composites (COMP2007-022), 16-18 May 2007, Corfu, Greece; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.15.03

Report No.(s): COMP2007-022; Copyright; Avail.: CASI: A01, Hardcopy

S-Glass/epoxy laminated fiber-reinforced composite stiffened plate structure with laminate configuration (0/90)5 was simulated to investigate damage and fracture progression, under uniform pressure. For comparison reasons a simple plate was examined, in addition with the stiffened plate. An integrated computer code was used for the simulation. The damage initiation began with matrix failure in tension, continuous with damage and/or fracture progression as a result of additional matrix failure and fiber fracture and followed by additional interply delamination. Fracture through the thickness began when the damage accumulation was 90%. After that stage, the cracks propagate rapidly and the structures collapse. The collapse load for the simple plate is 21.57 MPa (3120 psi) and for the stiffened plate 25.24 MPa (3660 psi).

Author

Epoxy Matrix Composites; Glass Fiber Reinforced Plastics; Fracturing; Fiber Composites; Simulation; Loads (Forces); Crack Initiation; Delaminating; Collapse

20070018344 NASA Langley Research Center, Hampton, VA, USA

Cohesive Elements for Shells

Davila, Carlos G.; Camanho, Pedro P.; Turon, Albert; April 2007; 27 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 732759.07.09

Report No.(s): NASA/TP-2007-214869; L-19341; Copyright; Avail.: CASI: A03, Hardcopy

A cohesive element for shell analysis is presented. The element can be used to simulate the initiation and growth of delaminations between stacked, non-coincident layers of shell elements. The procedure to construct the element accounts for the thickness offset by applying the kinematic relations of shell deformation to transform the stiffness and internal force of a zero-thickness cohesive element such that interfacial continuity between the layers is enforced. The procedure is demonstrated by simulating the response and failure of the Mixed Mode Bending test and a skin-stiffener debond specimen. In addition, it is shown that stacks of shell elements can be used to create effective models to predict the inplane and delamination failure modes of thick components. The results indicate that simple shell models can retain many of the necessary predictive attributes of much more complex 3D models while providing the computational efficiency that is necessary for design.

Author

Cohesion; Shells (Structural Forms); Mathematical Models; Mechanical Properties; Delaminating; Simulation

25
INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

Includes the analysis, synthesis, and use of inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see category *34 Fluid Dynamics and Thermodynamics*. For astrochemistry see category *90\fAstrophysics*.

20070018129 NASA Ames Research Center, Moffett Field, CA, USA
Near Infrared Spectra of H2O/HCN Mixtures
Mastrapa, R. M.; Bernstein, M. P.; Sanford, S. A.; January 2006; 2 pp.; In English; Lunar and Planetary Science Conference, 13-17 Mar. 2006, Houston, TX, USA; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018129

Cassini's VIMS has already returned exciting results interpreting spectra of Saturn's icy satellites. The discovery of unidentified features possibly due to CN compounds inspired the work reported here. We wanted to test HCN as a possibility for explaining these features, and also explore how the features of HCN change when mixed with H2O. We have previously noted that mixing H20 and CO2 produces new spectral features and that those features change with temperature and mixing ratio.
Derived from text
Hydrocyanic Acid; Icy Satellites; Infrared Spectra; Water; Saturn Satellites

20070018204 NASA Glenn Research Center, Cleveland, OH, USA
High-Temperature Desulfurization of Heavy Fuel-Derived Reformate Gas Streams for SOFC Applications
Flytzani-Stephanopoulos, Maria; Surgenor, Angela D.; March 2007; 14 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NNC04GB21G; WBS 561581.02.08.03.16.02
Report No.(s): NASA/TM-2007-214686; E-15844; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018204

Desulfurization of the hot reformate gas produced by catalytic partial oxidation or autothermal reforming of heavy fuels, such as JP-8 and jet fuels, is required prior to using the gas in a solid oxide fuel cell (SOFC). Development of suitable sorbent materials involves the identification of sorbents with favorable sulfidation equilibria, good kinetics, and high structural stability and regenerability at the SOFC operating temperatures (650 to 800 C). Over the last two decades, a major barrier to the development of regenerable desulfurization sorbents has been the gradual loss of sorbent performance in cyclic sulfidation and regeneration at such high temperatures. Mixed oxide compositions based on ceria were examined in this work as regenerable sorbents in simulated reformate gas mixtures and temperatures greater than 650 C. Regeneration was carried out with dilute oxygen streams. We have shown that under oxidative regeneration conditions, high regeneration space velocities (greater than 80,000 h(sup -1)) can be used to suppress sulfate formation and shorten the total time required for sorbent regeneration. A major finding of this work is that the surface of ceria and lanthanan sorbents can be sulfided and regenerated completely, independent of the underlying bulk sorbent. This is due to reversible adsorption of H2S on the surface of these sorbents even at temperatures as high as 800 C. La-rich cerium oxide formulations are excellent for application to regenerative H2S removal from reformate gas streams at 650 to 800 C. These results create new opportunities for compact sorber/regenerator reactor designs to meet the requirements of solid oxide fuel cell systems at any scale.
Author
Desulfurizing; Gas Streams; High Temperature Gases; Regenerators; Solid Oxide Fuel Cells; Jet Engine Fuels

20070018235 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Advanced Catalysts for Fuel Cells
Narayanan, Sekharipuram R.; Whitacre, Jay; Valdez, T. I.; May 17, 2006; 26 pp.; In English; Department of Energy, Annual Program Review, 17 May 2006, Washington, DC, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/39862

This viewgraph presentation reviews the development of catalyst for Fuel Cells. The objectives of the project are to reduce the cost of stack components and reduce the amount of precious metal used in fuel cell construction. A rapid combinatorial screening technique based on multi-electrode thin film array has been developed and validated for identifying catalysts for oxygen reduction; focus shifted from methanol oxidation in FY05 to oxygen reduction in FY06. Multi-electrode arrays of thin film catalysts of Pt-Ni and Pt-Ni-Zr have been deposited. Pt-Ni and have been characterized electrochemically and structurally.

Pt-Ni-Zr and Pt-Ni films show higher current density and onset potential compared to Pt. Electrocatalytic activity and onset potential are found to be strong function of the lattice constant. Thin film Pt(59)Ni(39)Zr(2) can provide 10 times the current density of thin film Pt. Thin film Pt(59)Ni(39)Zr(2) also shows 65mV higher onset potential than Pt.
CASI
Electrocatalysts; Fuel Cells; Oxygen; Thin Films; Platinum Compounds

26
METALS AND METALLIC MATERIALS

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

20070018063 Ohio Aerospace Inst., Cleveland, OH, USA
Brazing of Stainless Steel to Yttria-Stabilized Zirconia Using Gold-Based Brazes for Solid Oxide Fuel Cell Applications
Singh, M.; Shpargel, T. P.; Asthana, R.; International Journal of Applied Ceramic Tecnology; 2007; Volume 4, No. 2, pp. 119-133; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NNC06ZA12A; Copyright; Avail.: Other Sources

Two gold-base active metal brazes (gold-ABA and gold-ABA-V) were evaluated for oxidation resistance to 850 C, and used to join yttria-stabilized zirconia (YSZ) to a corrosion-resistant ferritic stainless steel for possible use in solid oxide fuel cells. Thermogravimetric analysis and optical microscopy and scanning electron microscopy coupled with energy-dispersive spectroscopy were used to evaluate the braze oxidation behavior, and microstructure and composition of the YSZ/braze/steel joints. Both gold-ABA and gold-ABA-V exhibited nearly linear oxidation kinetics at 850 C, with gold-ABA-V showing faster oxidation than gold-ABA. Both brazes produced metallurgically sound YSZ/steel joints due to chemical interactions of Ti and V with the YSZ and steel substrates.
Author
Brazing; Solid Oxide Fuel Cells; Stainless Steels; Yttria-Stabilized Zirconia; Gold

20070018152 NASA Glenn Research Center, Cleveland, OH, USA
Evaluation of Erosion Resistance of Advanced Turbine Thermal Barrier Coatings
Zhu, Dongming; Kuczmarski, Maria A.; Miller, Robert A.; Cuy, Michael D.; January 22, 2007; 16 pp.; In English; 31st International Cocoa Beach Conference and Exposition on Advanced Ceramics and Composites, 21-26 Jan. 2007, Daytona Beach, FL, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 22-714-30-26; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018152

The erosion resistant turbine thermal barrier coating system is critical to aircraft engine performance and durability. By demonstrating advanced turbine material testing capabilities, we will be able to facilitate the critical turbine coating and subcomponent development and help establish advanced erosion-resistant turbine airfoil thermal barrier coatings design tools. The objective of this work is to determine erosion resistance of advanced thermal barrier coating systems under simulated engine erosion and/or thermal gradient environments, validating advanced turbine airfoil thermal barrier coating systems based on nano-tetragonal phase toughening design approaches.
Author
Thermal Control Coatings; Corrosion Resistance; Turbines; Erosion

27
NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see *24 Composite Materials*.

20070018127 NASA Johnson Space Center, Houston, TX, USA
Removal of Perfluorinated Grease Components from NTO Oxidizer
McClure, Mark B.; Greene, Ben; Johnson, Harry T.; [2004]; 10 pp.; In English; 32nd and 21st JANNAF PDCS S and EPS Joint Meeting, 26-30 Jul. 2004, Seattle, WA, USA; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018127

Perfluorinated greases are typically used as a thread lubricant in the assembly of non-welded nitrogen tetroxide (NTO)

oxidizer systems. These greases, typically a perfluoroalkylether, with suspended polytetrafluoroethylene (PTFE) micropowder, have attractive lubricating properties toward threaded components and are relatively chemically inert toward NTO oxidizers. A major drawback, however, is that perfluoroalkylether greases are soluble or dispersible in NTO oxidizers and can contaminate the propellant. The result is propellant that fails the non-volatile residue (NVR) specification analyses and that may have negative effects on test hardware performance and lifetime. Consequently, removal of the grease contaminants from NTO may be highly desirable. Methods for the removal of perfluorinated grease components from NTO oxidizers including distillation, adsorption, filtration, and adjustment of temperature are investigated and reported in this work. Solubility or dispersibility data for the perfluoroalkylether oil (Krytox(tm)143 AC) component of a perfluorinated grease (Krytox 240 AC) and for Krytox 240 AC in NTO were determined and are reported.
Author
Greases; Nitrogen Tetroxide; Oxidizers; Solubility; Removal; Extraction

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*.

20070018082 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Robust Bioinformatics Recognition with VLSI Biochip Microsystem
Lue, Jaw-Chyng L.; Fang, Wai-Chi; July 13, 2006; 2 pp.; In English; IEEE/NLM Life Science Systems and Applications Workshop, 13-14 Jul. 2006, Bethesda, MD, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/39879

A microsystem architecture for real-time, on-site, robust bioinformatic patterns recognition and analysis has been proposed. This system is compatible with on-chip DNA analysis means such as polymerase chain reaction (PCR)amplification. A corresponding novel artificial neural network (ANN) learning algorithm using new sigmoid-logarithmic transfer function based on error backpropagation (EBP) algorithm is invented. Our results show the trained new ANN can recognize low fluorescence patterns better than the conventional sigmoidal ANN does. A differential logarithmic imaging chip is designed for calculating logarithm of relative intensities of fluorescence signals. The single-rail logarithmic circuit and a prototype ANN chip are designed, fabricated and characterized.
Author
Deoxyribonucleic Acid; Backpropagation (Artificial Intelligence); Very Large Scale Integration; Imaging Techniques; Real Time Operation; Pattern Recognition; Machine Learning; Chips

20070018084 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
A 260-340 GHz Dual Chip Frequency Tripler for THz Frequency Multiplier Chains
Maestrini, Alain; Tripon-Canseliet, Charlotte; Ward, John S.; Gill, John J.; Mehdi, Imran; September 18, 2006; 1 pp.; In English; 31st International Conferenceon Infrared and Millimeter Waves, 18-22 Sep. 2006, Shanghai, China; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/39888

We designed and fabricated a fix-tuned balanced frequency tripler working in the 260-340 GHz band to be the first stage of a x3x3x3 multiplier chain to 2.7 THz. The design of a dual-chip version of this multiplier featuring an input splitter / output combiner as part of the input / output matching networks of both chips - with no degradation of the expected bandwidth and efficiency- will be presented.
Author
Frequency Multipliers; Chips; Bandwidth; Diodes

20070018128 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Actel Parts Usage in GSFC Projects
Sahu, Kusum; March 9, 2006; 11 pp.; In English; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018128

The purpose of this paper is to provide an overview of the Actel field programmable gate array (FPGA) issues and investigations to date, provide information to GSFC parts engineers on the risks associated with the use of these parts in flight, provide procurement options for their respective projects, and provide general guidance for use of these devices if no other acceptable options exist.
Author
Field-Programmable Gate Arrays; Procurement; Spacecraft Electronic Equipment; Radiation Effects

20070018142 NASA Goddard Space Flight Center, Greenbelt, MD, USA
CMOS Ultra Low Power Radiation Tolerant (CULPRiT) Microelectronics
Yeh, Penshu; Maki, Gary; January 2007; 7 pp.; In English; AIAA Region I. YPSE-06, 10 Nov. 2006, Baltimore, MD, USA; Original contains color illustrations; Copyright; Avail.: CASI: A02, Hardcopy

Space Electronics needs Radiation Tolerance or hardness to withstand the harsh space environment: high-energy particles can change the state of the electronics or puncture transistors making them disfunctional. This viewgraph document reviews the use of CMOS Ultra Low Power Radiation Tolerant circuits for NASA's electronic requirements.
CASI
Circuits; Microelectronics; Radiation Tolerance; Circuit Protection

20070018144 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Evaluation of Li/CF(x)Cells For Aerospace Applications
Vaidyanathan, Hari; Rao, Gopalakrishna M.; [2007]; 21 pp.; In English; 2006 NASA Aerospace Battery Workshop NASA Marshall Space Flight Center, 14-16 Nov. 2006, Hunsville, AL, USA; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

Panasonic commercialized LiICF(x) cell technology in the 1970's. This technology was a promising primary battery for Aerospace applications such as: Exploration missions, Launch vehicles, Tools and more. This technology offers Wide operation temperature range, Low self-discharge and High specific energy CF(x) cathode material has a theoretical specific energy of 2260 Wh/Kg. Specific energy however achieved as of now is only 10% of theoretical value unless used at a very low rate of C/1000. Research both at Government Labs and Industries is currently in progress to improve the performance. This viewgraph presentation describes the cells, and reviews the results of some of the research using tables and charts.
CASI
Primary Batteries; Storage Batteries; Lithium Batteries; Lithium Compounds

20070018174 NASA Johnson Space Center, Houston, TX, USA
NASA RFID Applications
Fink, Patrick, Ph.D.; Kennedy, Timothy, Ph.D; Powers, Anne; Haridi, Yasser; Chu, Andrew; Lin, Greg; Yim, Hester; Byerly, Kent, Ph.D.; Barton, Richard, Ph.D.; Khayat, Michael, Ph.D.; Studor, George; Brocato, Robert; Ngo, Phong; Arndt, G. D., Ph.D.; Gross, Julia; Phan, Chau; Ni, David, Ph.D.; Dusl, John; Dekome, Kent; April 19, 2007; 26 pp.; In English; Maine Space Grant Consortium Annual Meeting, 20 Apr. 2007, University of Maine, Portland, ME, USA; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

This viewgraph document reviews some potential uses for Radio Frequency Identification in space missions. One of these is inventory management in space, including the methods used in Apollo, the Space Shuttle, and Space Station. The potential RFID uses in a remote human outpost are reviewed. The use of Ultra-Wideband RFID for tracking are examined such as that used in Sapphire DART The advantages of RFID in passive, wireless sensors in NASA applications are shown such as: Micrometeoroid impact detection and Sensor measurements in environmental facilities The potential for E-textiles for wireless and RFID are also examined.
Author
Radio Frequencies; Space Missions; Identifying

20070018233 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
An Initiative Toward Reliable Long-Duration Operation of Diode Lasers in Space
Tratt, David M.; Amzajerdian, Farzin; Stephen, Mark A.; Shapiro, Andrew A.; June 13, 2006; 31 pp.; In English; 19th Solid State and Diode Laser Technology Review, Albuquerque, New Mexico, June 13, 2006, 13 Jun. 2006, Albuquerque, NM, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/39881

This viewgraph presentation reviews the workings of the Laser Diode Arrays (LDA) working group. The group facilitates focused interaction between the LDA user and provider communities and it will author standards document for the specification and qualification of LDA's for operation in the space environment. It also reviews the NASA test and evaluation facilities that are available to the community.
CASI
Semiconductor Lasers; Spaceborne Lasers; Diodes; Arrays

20070018345 NASA Langley Research Center, Hampton, VA, USA
Review of Polyimides Used in the Manufacturing of Micro Systems
Wilson, William C.; Atkinson, Gary M.; April 2007; 16 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 136905.02.04.04.06
Report No.(s): NASA/TM-2007-214870; L-19339; Copyright; Avail.: CASI: A03, Hardcopy

Since their invention, polyimides have found numerous uses in MicroElectroMechanical Systems (MEMS) technology. Polyimides can act as photoresist, sacrificial layers, structural layers, and even as a replacement for silicon as the substrate during MEMS fabrication. They enable fabrication of both low and high aspect ratio devices. Polyimides have been used to fabricate expendable molds and reusable flexible molds. Development of a variety of devices that employ polyimides for sensor applications has occurred. Micro-robotic actuator applications include hinges, thermal actuators and residual stress actuators. Currently, polyimides are being used to create new sensors and devices for aerospace applications. This paper presents a review of some of the many uses of polyimides in the development of MEMS devices, including a new polyimide based MEMS fabrication process.
Author
Fabrication; Manufacturing; Microelectromechanical Systems; Polyimides; Aerospace Engineering

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*.

20070018028 National Center for Space Exploration Research on Fluids and Combustion, Cleveland, OH, USA
Thermal Vibrational Convection in a Two-phase Stratified Liquid
Chang, Qingming; Alexander, J. Iwan D.; January 26, 2007; 19 pp.; In English
Contract(s)/Grant(s): NAG8-1727; NCC3-975; WBS 825080.01.02; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018028

The response of a two-phase stratified liquid system subject to a vibration parallel to an imposed temperature gradient is analyzed using a hybrid thermal lattice Boltzmann method (HTLB). The vibrations considered correspond to sinusoidal translations of a rigid cavity at a fixed frequency. The layers are thermally and mechanically coupled. Interaction between gravity-induced and vibration-induced thermal convection is studied. The ability of applied vibration to enhance the flow, heat transfer and interface distortion is investigated. For the range of conditions investigated, the results reveal that the effect of vibrational Rayleigh number and vibrational frequency on a two-phase stratified fluid system is much different than that for a single-phase fluid system. Comparisons of the response of a two-phase stratified fluid system with a single-phase fluid system are discussed.
Author
Temperature Gradients; Free Convection; Vibration; Rayleigh Number; Stratified Flow; Gravitation; Frequencies

20070018064 NASA Glenn Research Center, Cleveland, OH, USA
Catalytic Ignition and Upstream Reaction Propagation in Monolith Reactors
Struk, Peter M.; Dietrich, Daniel L.; Miller, Fletcher J.; T'ien, James S.; January 8, 2007; 13 pp.; In English; 45th AIAA Aerospace Sciences Meeting and Exhibit, 8-11 Jan. 2007, Reno, NV, USA; Original contains color illustrations
Contract(s)/Grant(s): NNC04AA29A
Report No.(s): AIAA Paper-2007-0984; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018064

Using numerical simulations, this work demonstrates a concept called back-end ignition for lighting-off and pre-heating

a catalytic monolith in a power generation system. In this concept, a downstream heat source (e.g. a flame) or resistive heating in the downstream portion of the monolith initiates a localized catalytic reaction which subsequently propagates upstream and heats the entire monolith. The simulations used a transient numerical model of a single catalytic channel which characterizes the behavior of the entire monolith. The model treats both the gas and solid phases and includes detailed homogeneous and heterogeneous reactions. An important parameter in the model for back-end ignition is upstream heat conduction along the solid. The simulations used both dry and wet CO chemistry as a model fuel for the proof-of-concept calculations; the presence of water vapor can trigger homogenous reactions, provided that gas-phase temperatures are adequately high and there is sufficient fuel remaining after surface reactions. With sufficiently high inlet equivalence ratio, back-end ignition occurs using the thermophysical properties of both a ceramic and metal monolith (coated with platinum in both cases), with the heat-up times significantly faster for the metal monolith. For lower equivalence ratios, back-end ignition occurs without upstream propagation. Once light-off and propagation occur, the inlet equivalence ratio could be reduced significantly while still maintaining an ignited monolith as demonstrated by calculations using complete monolith heating.
Author
Ignition; Upstream; Catalytic Activity; Combustion; Mathematical Models; Chemical Reactions; Integrated Circuits

20070018065 NASA Glenn Research Center, Cleveland, OH, USA
An Initial Non-Equilibrium Porous-Media Model for CFD Simulation of Stirling Regenerators
Tew, Roy; Simon, Terry; Gedeon, David; Ibrahim, Mounir; Rong, Wei; June 26, 2006; 23 pp.; In English; 4th International Energy Conversion Engineering Conference (IECEC-2006), 26-29 Jun. 2006, San Diego, CA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS138494.04.01.01
Report No.(s): AIAA Paper 2006-4003; Copyright; Avail.: CASI: A03, Hardcopy

The objective of this paper is to define empirical parameters (or closwre models) for an initial thermai non-equilibrium porous-media model for use in Computational Fluid Dynamics (CFD) codes for simulation of Stirling regenerators. The two CFD codes currently being used at Glenn Research Center (GRC) for Stirling engine modeling are Fluent and CFD-ACE. The porous-media models available in each of these codes are equilibrium models, which assmne that the solid matrix and the fluid are in thermal equilibrium at each spatial location within the porous medium. This is believed to be a poor assumption for the oscillating-flow environment within Stirling regenerators; Stirling 1-D regenerator models, used in Stirling design, we non-equilibrium regenerator models and suggest regenerator matrix and gas average temperatures can differ by several degrees at a given axial location end time during the cycle. A NASA regenerator research grant has been providing experimental and computational results to support definition of various empirical coefficients needed in defining a noa-equilibrium, macroscopic, porous-media model (i.e., to define 'closure' relations). The grant effort is being led by Cleveland State University, with subcontractor assistance from the University of Minnesota, Gedeon Associates, and Sunpower, Inc. Friction-factor and heat-transfer correlations based on data taken with the NASAlSunpower oscillating-flow test rig also provide experimentally based correlations that are useful in defining parameters for the porous-media model; these correlations are documented in Gedeon Associates' Sage Stirling-Code Manuals. These sources of experimentally based information were used to define the following terms and parameters needed in the non-equilibrium porous-media model: hydrodynamic dispersion, permeability, inertial coefficient, fluid effective thermal conductivity (including themal dispersion and estimate of tortuosity effects}, and fluid-solid heat transfer coefficient. Solid effective thermal conductivity (including the effect of tortuosity) was also estimated. Determination of the porous-media model parameters was based on planned use in a CFD model of Infinia's Stirling Technology Demonstration Convertor (TDC), which uses a random-fiber regenerator matrix. The non-equilibrium porous-media model presented is considered to be an initial, or 'draft,' model for possible incorporation in commercial CFD codes, with the expectation that the empirical parameters will likely need to be updated once resulting Stirling CFD model regenerator and engine results have been analyzed. The emphasis of the paper is on use of available data to define empirical parameters (and closure models) needed in a thermal non-equilibrium porous-media model for Stirling regenerator simulation. Such a model has not yet been implemented by the authors or their associates. However, it is anticipated that a thermal non-equilibrium model such as that presented here, when iacorporated in the CFD codes, will improve our ability to accurately model Stirling regenerators with CFD relative to current thermal-equilibrium porous-media models.
Author
Computational Fluid Dynamics; Simulation; Stirling Engines; Porous Materials; Mathematical Models; Regeneration (Engineering)

20070018163 Toledo Univ., OH, USA

Experimental Study of Transitional Flow Behavior in a Simulated Low Pressure Turbine

Sohn, Ki Hyeon; DeWitt, Kenneth J.; March 2007; 226 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NCC3-288; WBS 561581.02.08.03.02.01

Report No.(s): NASA/CR-2007-214670; E-15806; No Copyright; Avail.: CASI: A11, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070018163

A detailed investigation of the flow physics occurring on the suction side of a simulated Low Pressure Turbine (LPT) blade was performed. A contoured upper wall was designed to simulate the pressure distribution of an actual LPT airfoil onto a flat lower plate. The experiments were carried out for the Reynolds numbers of 35,000, 70,000, 100,000, and 250,000 with four levels of freestream turbulence ranging from 1 to 4 percent. For the three lower Reynolds numbers, the boundary layer on the flat plate was separated and formed a bubble. The size of laminar separation bubble was measured to be inversely proportional to the freestream turbulence levels and Reynolds numbers. However, no separation was observed for the Re = 250,000 case. The transition on a separated flow was found to proceed through the formation of turbulent spots in the free shear layer as evidenced in the intermittency profiles for Re = 35,000, 70,000, and 100,000. Spectral data show no evidence of Kelvin-Helmholtz of Tollmien-Schlichting instability waves in the free shear layer over a separation bubble (bypass transition). However, the flow visualization revealed the large vortex structures just outside of the bubble and their development to turbulent flow for Re = 50,000, which is similar to that in the free shear layer (separated-flow transition). Therefore, it is fair to say that the bypass and separated-flow transition modes coexist in the transition flows over the separation bubble of certain conditions. Transition onset and end locations and length determined from intermittency profiles decreased as Reynolds number and freestream turbulence levels increase.

Author

Low Pressure; Transition Flow; Turbine Blades; Computerized Simulation; Turbomachinery; Wind Tunnel Tests; Gas Turbine Engines

20070018164 Michigan Univ., Flint, MI, USA

Preliminary Assessment of Turbomachinery Codes

Mazumder, Quamrul H.; March 2007; 14 pp.; In English

Contract(s)/Grant(s): NNC06ZA42A; WBS 561581.02.08.03.21.03

Report No.(s): NASA/CR-2007-214687; E-15871; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070018164

This report assesses different CFD codes developed and currently being used at Glenn Research Center to predict turbomachinery fluid flow and heat transfer behavior. This report will consider the following codes: APNASA, TURBO, GlennHT, H3D, and SWIFT. Each code will be described separately in the following section with their current modeling capabilities, level of validation, pre/post processing, and future development and validation requirements. This report addresses only previously published and validations of the codes. However, the codes have been further developed to extend the capabilities of the codes.

Author

Computational Fluid Dynamics; Fluid Flow; Turbomachinery; Heat Transfer; Computer Programs

20070018198 Rowan Univ., Glassboro, NJ, USA

Experimental Measurements of Two-dimensional Planar Propagating Edge Flames

Villa-Gonzalez, Marcos; Marchese, Anthony J.; Easton, John W.; Miller, Fletcher J.; Proceedings of the Combustion Institute (PID153970); 2007; Volume 31, pp. 939-946; In English; 31st International Symposium on Combustion, 5 Aug. 2006, Heidelberg, Germany

Contract(s)/Grant(s): WBS 567524.04.02.01; Copyright; Avail.: Other Sources; Abstract Only

The study of edge flames has received increased attention in recent years. This work reports the results of a recent study into two-dimensional, planar, propagating edge flames that are remote from solid surfaces (called here, free-layer flames, as opposed to layered flames along floors or ceilings). They represent an ideal case of a flame propagating down a flammable plume, or through a flammable layer in microgravity. The results were generated using a new apparatus in which a thin stream of gaseous fuel is injected into a low-speed laminar wind tunnel thereby forming a flammable layer along the centerline. An airfoil-shaped fuel dispenser downstream of the duct inlet issues ethane from a slot in the trailing edge. The air and ethane mix due to mass diffusion while flowing up towards the duct exit, forming a flammable layer with a steep lateral fuel concentration gradient and smaller axial fuel concentration gradient. We characterized the flow and fuel concentration fields in the duct using hot wire anemometer scans, flow visualization using smoke traces, and non-reacting, numerical modeling

using COSMOSFloWorks. In the experiment, a hot wire near the exit ignites the ethane air layer, with the flame propagating downwards towards the fuel source. Reported here are tests with the air inlet velocity of 25 cm/s and ethane flows of 967-1299 sccm, which gave conditions ranging from lean to rich along the centerline. In these conditions the flame spreads at a constant rate faster than the laminar burning rate for a premixed ethane air mixture. The flame spread rate increases with increasing transverse fuel gradient (obtained by increasing the fuel flow rate), but appears to reach a maximum. The flow field shows little effect due to the flame approach near the igniter, but shows significant effect, including flow reversal, well ahead of the flame as it approaches the airfoil fuel source.
Author
Flame Propagation; Flames; Wind Tunnel Tests; Two Dimensional Flow; Trailing Edges

20070018199 NASA Ames Research Center, Moffett Field, CA, USA
Blade-Vortex Interaction (BVI) Noise and Airload Prediction Using Loose Aerodynamic/Structural Coupling
Sim, B. W.; Lim, J. W.; May 11, 2007; 18 pp.; In English; HS 62nd Annual Forum, 9-11 May 2006, Phoenix, AZ, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAS2-03144; Copyright; Avail.: Other Sources

Predictions of blade-vortex interaction (BVI) noise, using blade airloads obtained from a coupled aerodynamic and structural methodology, are presented. This methodology uses an iterative, loosely-coupled trim strategy to cycle information between the OVERFLOW-2 (CFD) and CAMRAD-II (CSD) codes. Results are compared to the HART-II baseline, minimum noise and minimum vibration conditions. It is shown that this CFD/CSD state-of-the-art approach is able to capture blade airload and noise radiation characteristics associated with BVI. With the exception of the HART-II minimum noise condition, predicted advancing and retreating side BVI for the baseline and minimum vibration conditions agrees favorably with measured data. Although the BVI airloads and noise amplitudes are generally under-predicted, this CFD/CSD methodology provides an overall noteworthy improvement over the lifting line aerodynamics and free-wake models typically used in CSD comprehensive analysis codes.
Author
Blade Slap Noise; Blade-Vortex Interaction; Computational Fluid Dynamics; Noise Prediction; Interactional Aerodynamics; Helicopters

20070018259 NASA Langley Research Center, Hampton, VA, USA, George Washington Univ., Newport News, VA, USA
A Supersonic Argon/Air Coaxial Jet Experiment for Computational Fluid Dynamics Code Validation
Clifton, Chandler W.; Cutler, Andrew D.; April 2007; 52 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNL06AA07A; WBS 599489.02.07.07.03.02
Report No.(s): NASA/CR-2007-214866; No Copyright; Avail.: CASI: A04, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018259

A non-reacting experiment is described in which data has been acquired for the validation of CFD codes used to design high-speed air-breathing engines. A coaxial jet-nozzle has been designed to produce pressure-matched exit flows of Mach 1.8 at 1 atm in both a center jet of argon and a coflow jet of air, creating a supersonic, incompressible mixing layer. The flowfield was surveyed using total temperature, gas composition, and Pitot probes. The data set was compared to CFD code predictions made using Vulcan, a structured grid Navier-Stokes code, as well as to data from a previous experiment in which a He-O2 mixture was used instead of argon in the center jet of the same coaxial jet assembly. Comparison of experimental data from the argon flowfield and its computational prediction shows that the CFD produces an accurate solution for most of the measured flowfield. However, the CFD prediction deviates from the experimental data in the region downstream of x/D = 4, underpredicting the mixing-layer growth rate.
Author
Computational Fluid Dynamics; Supersonic Speed; Air Breathing Engines; Mixing Layers (Fluids); Flow Distribution; Gas Composition; Argon; Air Jets

20070018292 NASA Langley Research Center, Hampton, VA, USA
An Aeroelastic Analysis of a Thin Flexible Membrane
Scott, Robert C.; Bartels, Robert E.; Kandil, Osama A.; Apr. 23, 2007; 17 pp.; In English; 48th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 23-26 Apr. 2007, Waikiki, HI, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 98454
Report No.(s): AIAA Paper 2007-2316; Copyright; Avail.: CASI: A03, Hardcopy

Studies have shown that significant vehicle mass and cost savings are possible with the use of ballutes for aero-capture. Through NASA's In-Space Propulsion program, a preliminary examination of ballute sensitivity to geometry and Reynolds number was conducted, and a single-pass coupling between an aero code and a finite element solver was used to assess the static aeroelastic effects. There remain, however, a variety of open questions regarding the dynamic aeroelastic stability of membrane structures for aero-capture, with the primary challenge being the prediction of the membrane flutter onset. The purpose of this paper is to describe and begin addressing these issues. The paper includes a review of the literature associated with the structural analysis of membranes and membrane utter. Flow/structure analysis coupling and hypersonic flow solver options are also discussed. An approach is proposed for tackling this problem that starts with a relatively simple geometry and develops and evaluates analysis methods and procedures. This preliminary study considers a computationally manageable 2-dimensional problem. The membrane structural models used in the paper include a nonlinear finite-difference model for static and dynamic analysis and a NASTRAN finite element membrane model for nonlinear static and linear normal modes analysis. Both structural models are coupled with a structured compressible flow solver for static aeroelastic analysis. For dynamic aeroelastic analyses, the NASTRAN normal modes are used in the structured compressible flow solver and 3rd order piston theories were used with the finite difference membrane model to simulate utter onset. Results from the various static and dynamic aeroelastic analyses are compared.
Author
Aeroelasticity; Membrane Structures; Flexibility; Ballutes; Aerospace Systems; Computational Fluid Dynamics; Flutter Analysis

20070018339 NASA Langley Research Center, Hampton, VA, USA
Stochastic Characterization of Flutter using Historical Wind Tunnel Data
Heeg, Jennifer; [2007]; 18 pp.; In English; 48th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 23-26 Apr. 2007, Waikiki, HI, USA; Original contains color illustrations
Report No.(s): AIAA 2007-1769; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018339

Methods for predicting the onset of flutter during an experiment are traditionally applied treating the data as deterministic values. Uncertainty and variation in the data is often glossed over by using best-fit curves to represent the information. This paper applies stochastic treatments to wind tunnel data obtained for the Piezoelectric Aeroelastic Response Tailoring Investigation model. These methods include modal amplitude tracking, modal frequency tracking and several applications of the flutter margin method. The flutter margin method was developed by Zimmerman and Weissenburger, and extended by Poirel, Dunn and Porter to incorporate uncertainty. Much of the current work follows the future work recommendations of Poirel, Dunn and Porter.
Author
Aeroelasticity; Flutter; Stochastic Processes; Wind Tunnel Tests; Piezoelectricity; Mathematical Models

20070018340 NASA Langley Research Center, Hampton, VA, USA
Recent Enhancements to the Development of CFD-Based Aeroelastic Reduced-Order Models
Silva, Walter A.; [2007]; 11 pp.; In English; 48th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 23-26 Apr. 2007, Waikiki, HI, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 984754; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018340

Recent enhancements to the development of CFD-based unsteady aerodynamic and aeroelastic reduced-order models (ROMs) are presented. These enhancements include the simultaneous application of structural modes as CFD input, static aeroelastic analysis using a ROM, and matched-point solutions using a ROM. The simultaneous application of structural modes as CFD input enables the computation of the unsteady aerodynamic state-space matrices with a single CFD execution, independent of the number of structural modes. The responses obtained from a simultaneous excitation of the CFD-based unsteady aerodynamic system are processed using system identification techniques in order to generate an unsteady aerodynamic state-space ROM. Once the unsteady aerodynamic state-space ROM is generated, a method for computing the static aeroelastic response using this unsteady aerodynamic ROM and a state-space model of the structure, is presented. Finally, a method is presented that enables the computation of matchedpoint solutions using a single ROM that is applicable over a range of dynamic pressures and velocities for a given Mach number. These enhancements represent a significant advancement of unsteady aerodynamic and aeroelastic ROM technology.
Author
Aeroelasticity; Computational Fluid Dynamics; Mathematical Models; Aeroelastic Research Wings; Dynamic Structural Analysis; Aircraft Configurations

20070018341 NASA Langley Research Center, Hampton, VA, USA

Simultaneous Excitation of Multiple-Input Multiple-Output CFD-Based Unsteady Aerodynamic Systems

Silva, Walter A.; [2007]; 15 pp.; In English; 48th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 23-26 Apr. 2007, Waikiki, HI, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 984754; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070018341

A significant improvement to the development of CFD-based unsteady aerodynamic reduced-order models (ROMs) is presented. This improvement involves the simultaneous excitation of the structural modes of the CFD-based unsteady aerodynamic system that enables the computation of the unsteady aerodynamic state-space model using a single CFD execution, independent of the number of structural modes. Four different types of inputs are presented that can be used for the simultaneous excitation of the structural modes. Results are presented for a flexible, supersonic semi-span configuration using the CFL3Dv6.4 code.

Author

Computational Fluid Dynamics; Excitation; MIMO (Control Systems); Mathematical Models; Unsteady Aerodynamics

35
INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography. For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Avionics and Aircraft Instrumentation*; and *19 Spacecraft Instrumentation and Astrionics*.

20070018234 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

High Resolution Global Topography of Itokawa from Hayabusa Imaging and LIDAR Data

Gaskell, Robert W.; Barnouin-Jha, O. S.; Scheeres, D. J.; Mukai, T.; Hirata, N.; Abe, S.; Saito, J.; Hashimoto, T.; Ishiguro, M.; Kubota, T.; May 23, 2006; 13 pp.; In English; AGU Spring Meeting, 23-26 May 2006, Baltimore, MD, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/39858

This viewgraph document reviews the topography of the Itokawa asteroid. It summarizes some of the relevant information about the asteroid, and how using the imaging from Hayabusa and LIDAR data, a topographic image of Itokawa was derived.

CASI

Asteroids; Imaging Techniques; Topography; Image Enhancement; Image Processing; Photogrammetry; Terrain Analysis

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*.

20070018159 NASA Langley Research Center, Hampton, VA, USA

Improving Lifetime of Quasi-CW Laser Diode Arrays for Pumping 2-Micron Solid State Lasers

Amzajerdian, Farzin; Meadows, Byron L.; Baker, Nathaniel R.; Barnes, Bruce W.; Singh, Upendra N.; Kavaya, Michael J.; Apr. 13, 2007; 8 pp.; In English; SPIE Defense and Security Symposium, 9-13 Apr. 2007, Orlando, FL, USA; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 478643.02.02.02.12; Copyright; Avail.: CASI: A02, Hardcopy

Operating high power laser diode arrays in long pulse regime of about 1 msec, which is required for pumping 2-micron thulium and holmium-based lasers, greatly limits their useful lifetime. This paper describes performance of laser diode arrays operating in long pulse mode and presents experimental data on the active region temperature and pulse-to-pulse thermal cycling that are the primary cause of their premature failure and rapid degradation. This paper will then offer a viable approach for determining the optimum design and operational parameters leading to the maximum attainable lifetime.

Author

High Power Lasers; Semiconductor Lasers; Solid State Lasers; Thermal Cycling Tests; Continuous Wave Lasers; Design Analysis; Holmium; Thulium

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*.

20070018030 Rhode Island Univ., RI, USA

Dynamic Fracture Initiation Toughness at Elevated Temperatures With Application to the New Generation of Titanium Aluminide Alloys, Chapter 8

Shazly, Mostafa; Prakash, Vikas; Draper, Susan; Shukla, Arun, Editor; 2006; 17 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAG3-2677; NSF CMS-99-08189; WBS 599489.02.07.03.06; Copyright; Avail.: Other Sources

Recently, a new generation of titanium aluminide alloy, named Gamma-Met PX, has been developed with better rolling and post-rolling characteristics. I'revious work on this alloy has shown the material to have higher strengths at room and elevated temperatures when compared with other gamma titanium aluminides. In particular, this new alloy has shown increased ductility at elevated temperatures under both quasi-static and high strain rate uniaxial compressive loading. However, its high strain rate tensile ductility at room and elevated temperatures is limited to approx. 1%. In the present chapter, results of a study to investigate the effects of loading rate and test temperature on the dynamic fracture initiation toughness in Gamma-Met PX are presented. Modified split Hopkinson pressure bar was used along with high-speed photography to determine the crack initiation time. Three-point bend dynamic fracture experiments were conducted at impact speeds of approx. 1 m/s and tests temperatures of up-to 1200 C. The results show that thc dynamic fracture initiation toughness decreases with increasing test temperatures beyond 600 C. Furthermore, thc effect of long time high temperature air exposure on the fracture toughness was investigated. The dynamic fracture initiation toughness was found to decrease with increasing exposure time. The reasons behind this drop are analyzed and discussed.

Author

Titanium Aluminides; Compression Loads; Fracture Strength; Temperature Effects; Crack Initiation; Ductility; Time Temperature Parameter; Strain Rate; Loading Rate

20070018167 NASA Johnson Space Center, Houston, TX, USA

Development and Testing of the Contaminant Insensitive Sublimator

Leimkuehler, Thomas O.; Stephan, Ryan A.; Jul. 9, 2007; 6 pp.; In English; 37th International Conference on Environmental Systems, 9-12 Jul. 2007, Chicago, IL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): 119103.04.01.01.01.10

Report No.(s): 07ICES-87; Copyright; Avail.: Other Sources

Sublimators have been used for heat rejection for a variety of space applications including the Apollo Lunar Module and the Extravehicular Mobility Unit (EMU). Some of the attractive features of sublimators are that they are compact, lightweight, and self-regulating. One of the drawbacks of previous designs has been sensitivity to non-volatile contamination in the feedwater, which can clog relatively small pores (approx. 3-6 micrometers) in the porous plates where ice forms and sublimates. A new design that is less sensitive to contaminants is being developed at the Johnson Space Center (JSC). This paper describes the design, fabrication, and testing of the Contaminant Insensitive Sublimator (CIS) Engineering Development Unit (EDU).

Author

Contaminants; Fabrication; Sublimation; Sensitivity; Product Development; Mechanical Engineering

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*.

20070018035 NASA Langley Research Center, Hampton, VA, USA
An Investigation of High-Cycle Fatigue Models for Metallic Structures Exhibiting Snap-Through Response
Przekop, Adam; Rizzi, Stephen A.; Sweitzer, Karl A.; [2007]; 18 pp.; In English; 48th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference; Original contains color illustrations
Contract(s)/Grant(s): WBS 599489.02.99.01.07
Report No.(s): AIAA Paper 2007-2204; Copyright; Avail.: CASI: A03, Hardcopy

A study is undertaken to develop a methodology for determining the suitability of various high-cycle fatigue models for metallic structures subjected to combined thermal-acoustic loadings. Two features of this problem differentiate it from the fatigue of structures subject to acoustic loading alone. Potentially large mean stresses associated with the thermally pre- and post-buckled states require models capable of handling those conditions. Snap-through motion between multiple post-buckled equilibrium positions introduces very high alternating stress. The thermal-acoustic time history response of a clamped aluminum beam structure with geometric and material nonlinearities is determined via numerical simulation. A cumulative damage model is employed using a rainflow cycle counting scheme and fatigue estimates are made for 2024-T3 aluminum using various non-zero mean fatigue models, including Walker, Morrow, Morrow with true fracture strength, and MMPDS. A baseline zero-mean model is additionally considered. It is shown that for this material, the Walker model produces the most conservative fatigue estimates when the stress response has a tensile mean introduced by geometric nonlinearity, but remains in the linear elastic range. However, when the loading level is sufficiently high to produce plasticity, the response becomes more fully reversed and the baseline, Morrow, and Morrow with true fracture strength models produce the most conservative fatigue estimates.
Author
Beams (Supports); Fracture Strength; Acoustic Fatigue; Aluminum Alloys; Loads (Forces)

20070018141 NASA Johnson Space Center, Houston, TX, USA
Numerical Strip-Yield Calculation of CTOD and CTOA
Beek, Joachim; Forman, Royce; Shivakumar, V.; [2007]; 13 pp.; In English; 10th Joint DoD/NASA/FAA Conference on Aging, 16-19 Apr. 2007, Palm Springs, CA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

A recently developed numerical method based on the strip yield analysis approach was used to calculate the Crack Tip Opening Displacement (CTOD) and Crack Tip Opening Angle (CTOA) for a number of complex crack configurations of practical interest. This method is an adaptation of the dislocation-density based boundary element method. In this Boundary Element approach, crack-face opening displacements are obtained at any point on a crack using a series of definite integrals evaluated exactly in closed form for a variety of crack geometries, including infinite or finite extent, with arbitrarily applied loading conditions.
Author
Crack Opening Displacement; Crack Tips; Cracks

20070018347 NASA Langley Research Center, Hampton, VA, USA
Structural Analysis Methods for Structural Health Management of Future Aerospace Vehicles
Tesler, Alexander; April 2007; 17 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 457280.02.07.07.05
Report No.(s): NASA/TM-2007-214871; L-19343; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018347

Two finite element based computational methods, Smoothing Element Analysis (SEA) and the inverse Finite Element Method (iFEM), are reviewed, and examples of their use for structural health monitoring are discussed. Due to their versatility, robustness, and computational efficiency, the methods are well suited for real-time structural health monitoring of future space vehicles, large space structures, and habitats. The methods may be effectively employed to enable real-time processing of sensing information, specifically for identifying three-dimensional deformed structural shapes as well as the internal loads. In addition, they may be used in conjunction with evolutionary algorithms to design optimally distributed sensors. These

computational tools have demonstrated substantial promise for utilization in future Structural Health Management (SHM) systems.
Author
Aerospace Vehicles; Finite Element Method; Structural Design; Systems Health Monitoring; Large Space Structures; Dynamic Structural Analysis

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*.

20070018173 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Satellite to Ground-based LIDAR Comparisons using MPLNET Data Products
Berkoff, T.A.; Belcher, L.; Campbell, J.; Spinhirne, J.; Welton, E. J.; [2007]; 4 pp.; In English; 3rd Symposium on Lidar Atmospheric Applications, American Meteorology Conference, 14 - 18 Jan. 2007, San Antonio, TX, USA; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The Micro-Pulse Lidar Network (MPLNET) is a network of ground-based lidar systems that provide continuous long-term observations of aerosol and cloud properties at approximately 10 different locations around the globe. Each site in the network uses an elastic scattering lidar co-located with a sunphotometer to provide data products of aerosol optical physical properties. Data products from sites are available on a next-day basis from the MPLNET website. Expansion of the network is based on partnering with research groups interested in joining MPLNET. Results have contributed to a variety of studies including aerosol transport studies and satellite calibration and validation efforts. One of the key motivations for MPLNET is to contribute towards the calibration and validation of satellite-based lidars such as GLAS/ICESAT and CALIPSO. MPLNET is able to provide comparison to several of the key aerosol and cloud CALIPSO data products including: layer height and thickness, optical depth, backscatter and extinction profiles, and the extinction-to-backscatter ratio.
Derived from text
Aerosols; Calibrating; Optical Properties; Optical Radar; Satellite Observation; Comparison

20070018182 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Using Remotely-Sensed Estimates of Soil Moisture to Infer Soil Texture and Hydraulic Properties across a Semi-arid Watershed
Santanello, Joseph A.; Peters-Lidard, Christa D.; Garcia, Matthew E.; Mocko, David M.; Tischler, Michael A.; Moran, M. Susan; Thoma, D. P.; [2007]; 58 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): UMCP/NCC5-374; Copyright; Avail.: CASI: A04, Hardcopy

Near-surface soil moisture is a critical component of land surface energy and water balance studies encompassing a wide range of disciplines. However, the processes of infiltration, runoff, and evapotranspiration in the vadose zone of the soil are not easy to quantify or predict because of the difficulty in accurately representing soil texture and hydraulic properties in land surface models. This study approaches the problem of parameterizing soils from a unique perspective based on components originally developed for operational estimation of soil moisture for mobility assessments. Estimates of near-surface soil moisture derived from passive (L-band) microwave remote sensing were acquired on six dates during the Monsoon '90 experiment in southeastern Arizona, and used to calibrate hydraulic properties in an offline land surface model and infer information on the soil conditions of the region. Specifically, a robust parameter estimation tool (PEST) was used to calibrate the Noah land surface model and run at very high spatial resolution across the Walnut Gulch Experimental Watershed. Errors in simulated versus observed soil moisture were minimized by adjusting the soil texture, which in turn controls the hydraulic properties through the use of pedotransfer functions. By estimating a continuous range of widely applicable soil properties such as sand, silt, and clay percentages rather than applying rigid soil texture classes, lookup tables, or large parameter sets as in previous studies, the physical accuracy and consistency of the resulting soils could then be assessed. In addition, the sensitivity of this calibration method to the number and timing of microwave retrievals is determined in relation to the temporal patterns in precipitation and soil drying. The resultant soil properties were applied to an extended time period demonstrating the improvement in simulated soil moisture over that using default or county-level soil parameters. The methodology is also applied to an independent case at Walnut Gulch using a new soil moisture product from active (C-band) radar imagery with much lower spatial and temporal resolution. Overall, results demonstrate the potential to gain physically

meaningful soils information using simple parameter estimation with few but appropriately timed remote sensing retrievals. Author

Soil Moisture; Textures; Watersheds; Arid Lands; Earth Surface; Remote Sensing; Hydraulics

20070018253 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Microwave Signatures of Snow on Sea Ice: Observations

Markus, Thorsten; Cavalieri, Donald J.; Gasiewski, Albin J.; Klein, Marian; Maslanik, James A.; Powell, Dylan C.; Stankov, B. Boba; Stroeve, Julienne C.; Sturm, Matthew; IEEE Transactions on Geoscience and Remote Sensing; [2006]; Volume 44, No. 11, pp. 3081-3090; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1109/TGRS.2006.883134

Part of the Earth Observing System Aqua Advanced Microwave Scanning Radiometer (AMSR-E) Arctic sea ice validation campaign in March 2003 was dedicated to the validation of snow depth on sea ice and ice temperature products. The difficulty with validating these two variables is that neither can currently be measured other than in situ. For this reason, two aircraft flights on March 13 and 19,2003, were dedicated to these products, and flight lines were coordinated with in situ measurements of snow and sea ice physical properties. One flight was in the vicinity of Barrow, AK, covering Elson Lagoon and the adjacent Chukchi and Beaufort Seas. The other flight was farther north in the Beaufort Sea (about 73 N, 147.5 W) and was coordinated with a Navy ice camp. The results confirm the AMSR-E snow depth algorithm and its coefficients for first-year ice when it is relatively smooth. For rough first-year ice and for multiyear ice, there is still a relationship between the spectral gradient ratio of 19 and 37 GHz, but a different set of algorithm coefficients is necessary. Comparisons using other AMSR-E channels did not provide a clear signature of sea ice characteristics and, hence, could not provide guidance for the choice of algorithm coefficients. The limited comparison of in situ snow-ice interface and surface temperatures with 6-GHz brightness temperatures, which are used for the retrieval of ice temperature, shows that the 6-GHz temperature is correlated with the snow-ice interface temperature to only a limited extent. For strong temperature gradients within the snow layer, it is clear that the 6-GHz temperature is a weighted average of the entire snow layer.

Author

Microwave Signatures; Sea Ice; Snow; Geophysics; Remote Sensing; Arctic Ocean

45
ENVIRONMENT POLLUTION

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

20070018194 NASA Johnson Space Center, Houston, TX, USA

A Discussion on Personnel Exposure to Posttest Byproducts from a 50-cal. Light Gas Gun

Henderson, Don; Rodriquez, Karen; [2007]; 2 pp.; In English; Aeroballistic Range Association Conference, 3 Oct. 2005, Houston, TX, USA; Copyright; Avail.: Other Sources; Abstract Only

In January of 2002, employees working in the Hypervelocity Test Facility (HTF) at White Sands Test Facility (WSTF) began to notice common physical complaints. These included loss of smell, loss of taste, skin irritation, a burning sensation of the mucus membranes, and redness and chapping of the lips. These conditions extended to home during the weekends and throughout holiday breaks as well. Concerns about air contaminants were raised with regard to the operation of the .50-cal. two-stage light gas gun (2SLGG). Employees suspected that these conditions might be caused by air contaminants from small leaks at the gun pump tube joint at the breech, and exhaust gas entrainment into the WAC systems. The WSTF Industrial Hygienist (IH) was notified and samples were collected using the MIRAN infrared spectrometer (real time) air sampler on 08 January 2002 at the SO-cal. gun. The results from this screening test suggested the need for more detailed investigations with analytical sampling and analysis.

Author

Air Pollution; Exhaust Gases; Light Gas Guns; Biological Effects; Human Reactions

20070018288 NASA Glenn Research Center, Cleveland, OH, USA

An Assessment of NASA Aeropropulsion Technologies: A System Study

Tong, Michael T.; Jones, Scott M.; Haller, William J.; 2007; 9 pp.; In English; ISABE 2007, 2-7 Sep. 2007, Beijing, China; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.13.05

Report No.(s): ISABE-2007-1285; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070018288

Aviation industry s robust growth rate has given rise to growing concerns about the contribution that aviation emissions will make to local air quality and global climate change. Over the last several years, NASA has been engaged in the development of aeropropulsion technologies with specific objectives to reduce aircraft emissions. A system analysis was performed to evaluate the potential impact of these propulsion technologies on aircraft CO2 (directly proportional to fuel burn) and NOx reductions. A large subsonic aircraft, with two 396-kN thrust (85,000-pound) engines was chosen for the study. Performance benefit estimates are presented for each technology, with a summary of potential emissions reduction possible from the development of these technologies. The results show that NASA s aeropropulsion technologies have the potential to significantly reduce the CO2 and NO(x) emissions. The results are used to support informed decision-making on the development of aeropropulsion technology portfolio for CO2 and NO(x) reductions.
Author
Nitrogen Oxides; Climate Change; Carbon Dioxide; Air Quality; Aircraft Engines; Systems Analysis; Aircraft Industry

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*.

20070018055 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Toward a Better Quantitative Understanding of Polar Stratospheric Ozone Loss
Frieler, K.; Rex, M.; Salawitch, R. J.; Canty, T.; Streibel, M.; Stimpfle, R. M.; Pfeilsticker, K.; Dorf, M.; Weisenstein, D. K.; Godin-Beekmann, S.; Geophysical Research Letters; May 27, 2006; ISSN 0094-8276; Volume 33; 4 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NNH04CC39C; BMBF Proj. AFO 2000/07ATC08; BMBF Proj. 50FE0017; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1029/2005GL025466

Previous studies have shown that observed large O3 loss rates in cold Arctic Januaries cannot be explained with current understanding of the loss processes, recommended reaction kinetics, and standard assumptions about total stratospheric chlorine and bromine. Studies based on data collected during recent field campaigns suggest faster rates of photolysis and thermal decomposition of ClOOCl and higher stratospheric bromine concentrations than previously assumed. We show that a model accounting for these kinetic changes and higher levels of BrO can largely resolve the January Arctic O3 loss problem and closely reproduces observed Arctic O3 loss while being consistent with observed levels of ClO and ClOOCl. The model also suggests that bromine catalyzed O3 loss is more important relative to chlorine catalyzed loss than previously thought. Author
Ozone; Stratosphere; Polar Regions; Quantitative Analysis; Ozone Depletion

20070018158 NASA Langley Research Center, Hampton, VA, USA
Remote Raman Sensor System for Testing of Rocks and Minerals
Garcia, Christopher S.; Abedin, M. Nurul; Sharma, Shiv K.; Misra, Anupam K.; Ismail, Syed; Sanford, Stephen P.; Elsayed-Ali, Hani; Apr. 13, 2007; 9 pp.; In English; SPIE Defense and Security Symposium, 9-13 Apr. 2007, Orlando, FL, USA; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 953033.02.07.06; Copyright; Avail.: CASI: A02, Hardcopy

Recent and future explorations of Mars and lunar surfaces through rovers and landers have spawned great interest in developing an instrument that can perform in-situ analysis of minerals on planetary surfaces. Several research groups have anticipated that for such analysis, Raman spectroscopy is the best suited technique because it can unambiguously provide the composition and structure of a material. A remote pulsed Raman spectroscopy system for analyzing minerals was demonstrated at NASA Langley Research Center in collaboration with the University of Hawaii. This system utilizes a 532 nm pulsed laser as an excitation wavelength, and a telescope with a 4-inch aperture for collecting backscattered radiation. A spectrograph equipped with a super notch filter for attenuating Rayleigh scattering is used to analyze the scattered signal. To form the Raman spectrum, the spectrograph utilizes a holographic transmission grating that simultaneously disperses two spectral tracks on the detector for increased spectral range. The spectrum is recorded on an intensified charge-coupled device (ICCD) camera system, which provides high gain to allow detection of inherently weak Stokes lines. To evaluate the performance of the system, Raman standards such as calcite and naphthalene are analyzed. Several sets of rock and gemstone samples obtained from Ward s Natural Science are tested using the Raman spectroscopy system. In addition, Raman spectra

of combustible substances such acetone and isopropanol are also obtained. Results obtained from those samples and combustible substances are presented.
Author
Raman Spectroscopy; Remote Sensors; Minerals; Rocks; Mars Surface; Planetary Surfaces; Pulsed Lasers

20070018239 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Distant Magnetotail Under Long Duration, Very Northward IMF Conditions: October 22-24, 2003
Fairfield, Donald H.; Oieroset, M.; Raeder, J.; Lepping, R. P.; Newell, P. T.; Wind, S.; [2006]; 1 pp.; In English; 2006 AGU Fall Meeting, 11-15 Dec. 2006, San Francisco, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

A unique 32 hour interval of very northward Interplanetary Magnetic Field (IMF) on October 22-24, 2003 created a exceptionally thick cold dense magnetotail plasma sheet, a small polar cap and accompanying small tail lobe. These features were detected by the Cluster DMSP and FAST spacecraft and modeled by a global simulation as described in papers by Oieroset et al. (2005) and Li et al. (2005). During the same interval the Wind spacecraft was passing through the center of the magnetotail about 130 Re downstream of Earth. Wind results will be described that reveal a very unusual magnetotail characterized by (1) continual tailward flow of 200-400 km/s with densities in the range 0.2-3/cc, both of whch are clearly less than those expected in the magnetosheath, (2) a mostly northward Bz but with a predominant Bx field component with sign reversals indicating crossings between the two hemispheres of the tail, and (3) velocity waves superposed on the downstream flow with peak-to-peak amplitudes of 100 to 200 km/s, periods of 10 to 20 minutes and clockwise polarization. Low altitude DMSP and Fast measurements reveal an auroral oval with enhanced latitudinal thickness and a small polar cap filled with structured precipitzting electrons and few ions. A new global MHD simulation of the event exhibits a highly elliptical tail of diminished cross-section at 130 Re with major axis aligned with the northward IMF. The tail current sheet also tends to be aligned in a north-south direction with the two tail hemispheres to the east and west with their polarities depending on prior history of the IMF. The simulation appears to be consistent with many, but not all, of the observations. High latitude cusp reconnection and subsequent downtail flow of closed field lines may explain the tail structure, but the waves are more likely due to the Kelvin-Helmholtz instability often thought to occur during northward IMF conditions.
Author
Interplanetary Magnetic Fields; Magnetotails; Long Duration Space Flight; Geophysics

20070018262 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Effects of Finite Element Resolution in the Simulation of Magnetospheric Particle Motion
Hansen, Richard; December 2006; 51 pp.; In English; Original contains color and black and white illustrations
Report No.(s): NASA/TM-2006-214148; Rept-2006-02036-0; No Copyright; Avail.: CASI: A04, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018262

This document describes research done in conjunction with a degree program. The purpose of the research was to compare particle trajectories in a specified set of global electric and magnetic fields; to study the effect of mesh spacing, resulting in an evaluation of adequate spacing resolution; and to study time-dependent fields in the context of substorm dipolarizations of the magnetospheric tail.
Author
Magnetic Fields; Particle Trajectories; Spacing; Electric Fields; Particle Motion

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20070018139 NASA Goddard Space Flight Center, Greenbelt, MD, USA
[Space Weather Impact on the Electricity Market]
SaintCyr, O. Chris; [2007]; 4 pp.; In English; Original contains color illustrations; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018139

Forbes & St. Cyr (2004, hereafter 'FISC') have provided evidence that the electricity market can be impacted by space weather. Our analysis indicated that the estimated market impact for PJM was 3.7 % or approximately $500 million dollars over the 19 month sample period. Kappenman has taken exception to this estimate and contends that we have exaggerated the magnitude of the problem that space weather poses to PJM. There are four specific issues: (1) he claims that we have ignored

relevant literature; (2) he asserts that Dst is not an appropriate proxy for GICs in PJM; (3) he charges that our findings are inconsistent with the impact of the 17 September 2000 storm; and (4) he alleges that our discussion of October 2003 storms is misleading. In our article, we have explained our methodology, multivariate regression analysis, with a particular focus on how it compares to correlation analysis. We have also explained the limitations of our analysis. We noted that '...While the Dstlprice relationship was found to be robust, the precise estimate should be treated with a relatively high degree of caution given that econometric modeling is not an exact science as well as the fact that the measure of space weather may be a poor proxy for GICs' (paragraph 96). We have also noted that additional research using local magnetometer data are needed (paragraph 97). We did not claim that that our findings for PJM are representative of the impact of space weather on other power grids. On the contrary, we noted that ... 'Only analysis of other power grids will tell. ' (paragraph 97). Kappenman inaccurately asserts that we have indicated that our findings . . . 'imply much higher total costs are likely across the US and elsewhere in the world.' He also inaccurately asserts that we have claimed that ' . . . Dst is the most suited proxy for GIC in the PJM grid.. .' Moreover, he inaccurately refers to our analysis as a correlation study that uses Dst as quasi-binary indicator.
Derived from text
Electricity; Space Weather; Market Research; Storms (Meteorology)

20070018143 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Effects of Lightning NO(x) Production during the July 21 EULINOX Storm studied with a 3-D Cloud-scale Chemical Transport Model
Ott, Lesley E.; Pickering, Kenneth E.; Stenchikov, Georgiy L.; Huntrieser, Heidi; Schumann, Ulrich; [2007]; 62 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): ENV4-CT97-0409; NAG5-11276; NSF ATM0004120; NSF ATM9912336; Copyright; Avail.: CASI: A04, Hardcopy

The July 21,1998 thunderstonn observed during the European Lightning Nitrogen Oxides Project (EULINOX) project was simulated using the three-dimensional Goddard Cumulus Ensemble (GCE) model. The simulation successfully reproduced a number of observed storm features including the splitting of the original cell into a southern cell which developed supercell characteristics, and a northern cell which became multicellular. Output from the GCE simulation was used to drive an offline cloud-scale chemical transport model which calculates tracer transport and includes a parameterization of lightning NO(x) production which uses observed flash rates as input. Estimates of lightning NO(x) production were deduced by assuming various values of production per intracloud and production per cloud-to-ground flash and comparing the results with in-cloud aircraft observations. The assumption that both types of flashes produce 360 moles of NO per flash on average compared most favorably with column mass and probability distribution functions calculated from observations. This assumed production per flash corresponds to a global annual lightning NOx source of 7 Tg N per yr. Chemical reactions were included in the model to evaluate the impact of lightning NO(x), on ozone. During the storm, the inclusion of lightning NOx in the model results in a small loss of ozone (on average less than 4 ppbv) at all model levels. Simulations of the chemical environment in the 24 hours following the storm show on average a small increase in the net production of ozone at most levels resulting from lightning NO(x), maximizing at approximately 5 ppbv per day at 5.5 km. Between 8 and 10.5 km, lightning NO(x) causes decreased net ozone production.
Author
Lightning; Nitrogen Oxides; Atmospheric Models; Ozone; Chemical Reactions; Atmospheric Chemistry; Atmospheric Electricity

20070018145 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Coupled GCM-Cloud Resolving Modeling System, and A Regional Scale Model to Study Precipitation Processes
Tao, Wei-Kuo; [2006]; 1 pp.; In English; University Corp. for Atmospheric Research, 11-16 Feb. 2006, Seoul, Korea, Republic of; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018145

Recent GEWEX Cloud System Study (GCSS) model comparison projects have indicated that cloud-resolving models (CRMs) agree with observations better than traditional single-column models in simulating various types of clouds and cloud systems from different geographic locations. Current and future NASA satellite programs can provide cloud, precipitation, aerosol and other data at very fine spatial and temporal scales. It requires a coupled global circulation model (GCM) and cloud-scale model (termed a super-parameterization or multi-scale modeling framework, MMF) to use these satellite data to improve the understanding of the physical processes that are responsible for the variation in global and regional climate and hydrological systems. The use of a GCM will enable global coverage, and the use of a CRM will allow for better and more sophisticated physical parameterization. NASA satellite and field campaign cloud related datasets can provide initial

conditions as well as validation for both the MMF and CRMs. The Goddard MMF is based on the 2D Goddard Cumulus Ensemble (GCE) model and the Goddard finite volume general circulation model (fvGCM), and it has started production runs with two years results (1 998 and 1999).
Author
Clouds (Meteorology); Atmospheric General Circulation Models; Cumulus Clouds; Climatology; Atmospheric Models; Aerosols

20070018179 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Water Vapor Profiling From CoSSIR Radiometric Measurements
Wang, J. R.; Chang, L. A.; Monosmith, B.; Zhang, Z.; [2007]; 1 pp.; In English; American Geophysical Union (AGU) Fall Meeting, 11-16 Dec. 2006, San Francisco, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

Previous millimeter-wave radiometry for water vapor profiling, by either airborne or satellite sensors, has been limited to frequencies less than or equal to 183 GHz. The retrievals are generally limited to an altitude range of 0-10 km. The additional measurements at the frequencies of 380.2 plus or minus 0.8, 380.2 plus or minus 1.8, 380.2 plus or minus 3.3, and 380.2 plus or minus 6.2 GHz provided by the new airborne Compact Scanning Submillimeter-wave Imaging Radiometer (CoSSIR) can extend this profiling capability up to an altitude of about 15 km. Furthermore, the retrievals can be performed over both land and water surfaces in the tropics without much difficulty. These properties are demonstrated by recent CoSSIR measurements on board the NASA WB-57 aircraft during CR-AVE in January 2006. Retrievals of water vapor mixing ratio were performed at eight altitude levels of 1, 3, 5, 7, 9, 11, 13, and 15 km from CoSSIR data sets acquired at observational angles of 0 and 53.4 degrees, and the results were compared with other available measurements from the same aircraft and near-concurrent satellites. A comparison of the variations of mixing ratios retrieved from CoSSIR and those derived from the Meteorological Measurement System (MMS) in the aircraft vicinity, along the path of the transit flight on January 14, 2006, appears to show some connection, although the measurements were referring to different altitudes. A very good agreement was found between the collocated values of total precipitable water derived from the CoSSIR-retrieved water vapor profiles and those estimated from TMI (TRMM Microwave Imager)
Author
Imaging Techniques; Radiometers; Submillimeter Waves; Water Vapor; Scanning; Meteorological Instruments

20070018181 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Goddard Snow Radiance Assimilation Project: An Integrated Snow Radiance and Snow Physics Modeling Framework for Snow/cold Land Surface Modeling
Kim, E.; Tedesco, M.; Reichle, R.; Choudhury, B.; Peters-Lidard C.; Foster, J.; Hall, D.; Riggs, G.; September 2006; 1 pp.; In English; American Geophysical Union, 11-15 Dec. 2006, San Francisco, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

Microwave-based retrievals of snow parameters from satellite observations have a long heritage and have so far been generated primarily by regression-based empirical 'inversion' methods based on snapshots in time. Direct assimilation of microwave radiance into physical land surface models can be used to avoid errors associated with such retrieval/inversion methods, instead utilizing more straightforward forward models and temporal information. This approach has been used for years for atmospheric parameters by the operational weather forecasting community with great success. Recent developments in forward radiative transfer modeling, physical land surface modeling, and land data assimilation are converging to allow the assembly of an integrated framework for snow/cold lands modeling and radiance assimilation. The objective of the Goddard snow radiance assimilation project is to develop such a framework and explore its capabilities. The key elements of this framework include: a forward radiative transfer model (FRTM) for snow, a snowpack physical model, a land surface water/energy cycle model, and a data assimilation scheme. In fact, multiple models are available for each element enabling optimization to match the needs of a particular study. Together these form a modular and flexible framework for self-consistent, physically-based remote sensing and water/energy cycle studies. In this paper we will describe the elements and the integration plan. All modules will operate within the framework of the Land Information System (LIS), a land surface modeling framework with data assimilation capabilities running on a parallel-node computing cluster. Capabilities for assimilation of snow retrieval products are already under development for LIS. We will describe plans to add radiance-based assimilation capabilities. Plans for validation activities using field measurements will also be discussed.
Author
Radiance; Snow Cover; Land; Models; Earth Surface; Remote Sensing; Cold Weather

20070018241 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Lightning Return-Stroke Current Waveforms Aloft, from Measured Field Change, Current, and Channel Geometry
Willett, J. C.; LeVine, D. M.; Idone, V. P.; October 05, 2006; 104 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A06, Hardcopy

Three-dimensional reconstructions of six rocket-triggered lightning channels are derived from stereo photographs. These reconstructed channels are used to infer the behavior of the current in return strokes above the ground from current waveforms measured at the channel base and electric-field-change waveforms measured at a range of 5.2 kilometers for 24 return strokes in these channels. Streak photographs of 14 of the same strokes are analyzed to determine the rise times, propagation speeds, and amplitudes of relative light intensity for comparison with the electrical inferences. Results include the following: 1) The fine structure of the field-change waveforms that were radiated by these subsequent return strokes can be explained, in large part, by channel geometry. 2) The average 10 - 90% rise time of the stroke current increased by about a factor of seven in our sample, from an observed 0.31 plus or minus 0.17 microseconds at the surface to an inferred 2.2 plus or minus 0.5 microcseconds at 1 kilometer path length above the surface. 3) The three-dimensional propagation speed of the current front averaged 1.80 plus or minus 0.24 X 10(exp 8) meters per second over channel lengths typically greater than 1 kilometer. 4) Assuming that the measured current was entirely due to the return stroke forced an unreasonably large and abrupt reduction in inferred current amplitude over the first few tens of meters above the surface, especially in cases when the leader was bright relative to its stroke. Therefore, a significant fraction of the current at the surface was probably due to the leader, at least in such cases. 5) Peak return-stroke currents decreased by approximately 37 plus or minus 12% from 100 meters to 1 kilometer of path length above the surface. Because of uncertainty about how to partition the measured current between leader and return stroke, we are unable to infer the variation of current amplitude near the ground.
Author
Lightning; Waveforms; Channels; Earth Sciences; Electric Fields; Electric Current; Geophysics

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*.

20070018147 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Remote Sensing Reflectance and Inherent Optical Properties in the Mid-mesohaline Chesapeake Bay
Tzortziou, Maria; Subramaniam, Ajit; Herman, Jay R.; Gallegos, Charles L.; Neal, Patrick J.; Harding, Lawrence W., Jr.; [2006]; 57 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): R826943-01-0; Copyright; Avail.: CASI: A04, Hardcopy

We used an extensive set of bio-optical data and radiative transfer (RT) model simulations of radiation fields to investigate relationships between inherent optical properties and remotely sensed quantities in the optically complex, mid-mesohaline Chesapeake Bay waters. Field observations showed that the chlorophyll algorithms used by the MODIS (MODerate resolution Imaging Spectroradiometer) ocean color sensor (i.e. Chlor_a, chlor_MODIS, chlor_a_3 products) do not perform accurately in these Case 2 waters. This is because, when applied to waters with high concentrations of chlorophyll, all MODIS algorithms are based on empirical relationships between chlorophyll concentration and blue-green wavelength remote sensing reflectance (Rrs) ratios that do not account for the typically strong blue-wavelength absorption by non-covarying, dissolved and non-algal particulate components. Stronger correlation was observed between chlorophyll concentration and Rrs ratios in the red (i.e. Rrs(677)/Rrs(554)) where dissolved and non-algal particulate absorption become exponentially smaller. Regionally-specific algorithms that are based on the phytoplankton optical properties in the red wavelength region provide a better basis for satellite monitoring of phytoplankton blooms in these Case 2 waters. Good optical closure was obtained between independently measured Rrs spectra and the optical properties of backscattering, b(sub b), and absorption, a, over the wide range of in-water conditions observed in the Chesapeake Bay. Observed variability in the quantity f/Q (proportionality factor in the relationship between Rrs and the water inherent optical properties ratio b(sub b)/(a+b(sub b)) was consistent with RT model calculations for the specific measurement geometry and water bio-optical characteristics. Data and model results showed that f/Q values in these Case 2 coastal waters are not considerably different from those estimated in previous studies for Case 1 waters. Variation in surface backscattering significantly affected Rrs magnitude across the visible spectrum and was most strongly correlated (R(sup 2)=0.88) with observed variability in Rrs at 670 nm. Surface values of particulate backscattering were strongly correlated with non-algal particulate absorption, a(sub nap), in the blue wavelengths (R(sup 2)=0.83). These results, along with the measured values of backscattering fraction magnitude and non-algal particulate

absorption spectral slope, suggest that suspended non-algal particles with high inorganic content are the major water constituents regulating b(sub b) variability in the mid-mesohaline Chesapeake Bay. Remote retrieval of surface b(sub b) and (a(sub nap), from Rrs(670) can be used in regionally-specific satellite algorithms to separate contribution by non-algal particles and dissolved organic matter to total light absorption in the blue, and monitor non-algal suspended particle concentration and distribution in these Case 2 waters.
Author
Remote Sensing; Reflectance; Optical Properties; Chesapeake Bay (US); Radiative Transfer; Radiation Distribution; Chlorophylls; Algorithms; MODIS (Radiometry); Imaging Spectrometers

20070018261 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Remote Versus Local Forcing of Chlorophyll Variability in the South Atlantic Bight
Signorini, Sergio R.; McClain, Charles R.; December 29, 2006; 74 pp.; In English; Original contains color illustrations
Report No.(s): NASA/TM-2006-214145; Rept-2007-00229-0; Copyright; Avail.: CASI: A04, Hardcopy

This TM documents results of analyses addressing the local versus remote forcing of chlorophyll variability on the shelf and slope regions of the South Atlantic Bight (SAB) based on satellite-derived products and a limited amount of in situ data. This study is part of a larger multi-disciplinary, multi-institutional effort to study the Eastern U.S. Continental Shelf carbon budget (U.S. Eastern Continental Shelf Carbon Budget: Modeling, Data Assimilation, and Analysis, U.S. ECoS), a project funded by the NASA Earth System Enterprise Interdisciplinary Science Program that started in the summer of 2004.
Author
Bays (Topographic Features); Earth Sciences; In Situ Measurement; Continental Shelves; Chlorophylls

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*.

20070018044 NASA Johnson Space Center, Houston, TX, USA
Vestibular and Non-vestibular Contributions to Eye Movements that Compensate for Head Rotations during Viewing of Near Targets
Han, Yanning H.; Kumar, Arun N.; Reschke, Millard F.; Somers, Jeffrey T.; Dell'Osso, Louis F.; Leigh, R. John; [2004]; 46 pp.; In English; Copyright; Avail.: CASI: A03, Hardcopy

We studied horizontal eye movements induced by en-bloc yaw rotation, over a frequency range 0.2 - 2.8 Hz, in 10 normal human subjects as they monocularly viewed a target located at their near point of focus. We measured gain and phase relationships between eye-in-head velocity and head velocity when the near target was either earth-fixed or head-fixed. During viewing of the earth-fixed near target,median gain was 1.49 (range 1.24 - 1.87) at 0.2 Hz for the group of subjects, but declined at higher frequencies, so that at 2.8 Hz median gain was 1.08 (range 0.68 - 1.67). During viewing of the head-fixed near target, median gain was 0.03 (range 0.01 - 0.10) at 0.2 Hz for the group of subjects, but increased at higher frequencies, so that at 2.8 Hz median gain was 0.71 (range 0.28 - 0.94). We estimated the vestibular contribution to these responses (vestibulo-ocular reflex gain, Gvor) by applying transient head perturbations (peak acceleration\g 1,000 deg's(exp 2)) during sinusoidal rotation under the two viewing conditions. Median Gvor, estimated \h 70m after the onset of head perturbation, was 0.98 (range 0.39 - 1.42) while viewing the earth-fixed near target, and 0.97 (range 0.37 - 1.33) while viewing the head-fixed near target. For the group of subjects, 9 out of 10 subjects showed no sigificant difference of Gvor between the two viewing conditions (p \g 0.053) at all test frequencies. Since Gvor accounted for only approximately 73% of the overall response gain during viewing of the earth-fixed target, we investigated the relative contributions of non-vestibular factors. When subjects viewed the earth-fixed target under strobe illumination, to eliminate retinal image slip information, the gain of compensatory eye movements declined compared with viewing in ambient room light. During sum-of-sine head rotations, while viewing the earth-fixed target, to minimize contributions from predictive mechanisms, gain also declined Nonetheless, simple superposition of smooth-pursuit tracking of sinusoidal target motion could not fully account for the overall response at higher frequencies, suggesting other non-vestibular contributions. During binocular viewing conditions when vergence angle was significantly greater than monocular viewing (p \h 0.001), this gain of compensatory eye movements did not show proportional change; indeed, gain could not be correlated with vergence angle during monocular or binocular viewing. We conclude that several separate factors contribute to generate eye rotations during sinusoidal yaw head rotations while viewing a near target;

these include the VOR, visual-tracking eye movements that utilize retinal image motion, predictive eye movements and, possibly, other unidentified nonvestibular factors. For these experiments, vergence was not an important determinant of response gain.
Author
Eye (Anatomy); Eye Movements; Image Motion Compensation; Optical Tracking; Targets; Vision; Visual Observation; Head Movement

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*.

20070018153 NASA Glenn Research Center, Cleveland, OH, USA
Intravenous Solutions for Exploration Missions
Miller, Fletcher J.; Niederhaus, Charles; Barlow, Karen; Griffin, DeVon; January 11, 2007; 12 pp.; In English; 45th AIAA Aerospace Sciences Meeting and Exhibit, 8-11 Jan. 2007, Reno, NV, USA
Contract(s)/Grant(s): NCC3-975; WBS 444543.01.02.01
Report No.(s): AIAA Paper-2007-544; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018153

This paper describes the intravenous (IV) fluids requirements being developed for medical care during NASA s future exploration class missions. Previous research on IV solution generation and mixing in space is summarized. The current exploration baseline mission profiles are introduced, potential medical conditions described and evaluated for fluidic needs, and operational issues assessed. We briefly introduce potential methods for generating IV fluids in microgravity. Conclusions on the recommended fluid volume requirements are presented.
Author
Intravenous Procedures; Mission Planning; Microgravity; Aerospace Medicine

20070018169 NASA Johnson Space Center, Houston, TX, USA
The Lunar Environment: Determining the Health Effects of Exposure to Moon Dusts
Khan-Mayberry, Noreen; May 24, 2007; 22 pp.; In English; 16th IAA Symposium, 20-25 May 2007, Beijing, China; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018169

The moon's surface is covered with a thin layer of fine, charged, reactive dust capable of layer of fine, charged, reactive dust capable of capable of entering habitats and vehicle compartments, where it can result in crewmember health problems. NASA formed the Lunar Airborne Dust Toxicity Advisory Group (LADTAG) to study the effects of exposure to Lunar Dust on human health. To date, no scientifically defensible toxicological studies have been performed on lunar dusts, specifically the determination of exposure limits and their affect on human health. The multi-center LADTAG (Lunar Airborne Dust Toxicology center LADTAG (Lunar Airborne Dust Toxicology Advisory Group) was formed in response to the Office of the Chief Health and Medical Office s (OCHMO) request to develop recommendations for defining risk (OCHMO) request to develop recommendations for defining risk defining risk criteria for human lunar dust exposure.
Derived from text
Exposure; Lunar Dust; Selenology; Health Physics; Safety Factors; Health

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*.

20070018272 NASA Johnson Space Center, Houston, TX, USA
International Space Station Temperature and Humidity Control Subsystem Verification for Node 1
Williams, David E.; [2007]; 12 pp.; In English; 37th International Conference on Environmental Systems, 9-12 Jul. 2007, Chicago, IL, USA; Original contains color illustrations
Contract(s)/Grant(s): 401769.06.01.01.01; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018272

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 nominal operation of the Node 1 THC subsystem design. The paper will also provide a discussion of the detailed Element Verification methodologies for nominal operation of the Node 1 THC subsystem operations utilized during the Qualification phase.
Author
International Space Station; Environmental Control; Control Systems Design; Life Support Systems; Controllers

59
MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see *categories 60 through 67*.

20070018085 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Active Learning with Irrelevant Examples
Mazzoni, Dominic; Wagstaff, Kiri L.; Burl, Michael; September 18, 2006; 12 pp.; In English; 17th European Conference on Machine Learning, 18-22 Sep. 2006, Berlin, Germany; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/39889
Active learning algorithms attempt to accelerate the learning process by requesting labels for the most informative items first. In real-world problems, however, there may exist unlabeled items that are irrelevant to the user's classification goals. Queries about these points slow down learning because they provide no information about the problem of interest. We have observed that when irrelevant items are present, active learning can perform worse than random selection, requiring more time (queries) to achieve the same level of accuracy. Therefore, we propose a novel approach, Relevance Bias, in which the active learner combines its default selection heuristic with the output of a simultaneously trained relevance classifier to favor items that are likely to be both informative and relevant. In our experiments on a real-world problem and two benchmark datasets, the Relevance Bias approach significantly improved the learning rate of three different active learning approaches.
Author
Heuristic Methods; Classifications; Bias; Machine Learning; Classifiers; Algorithms

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.

20070018056 NASA Stennis Space Center, Stennis Space Center, MS, USA
Systems Modeling to Implement Integrated System Health Management Capability
Figueroa, Jorge F.; Walker, Mark; Morris, Jonathan; Smith, Harvey; Schmalzel, John; [2007]; 2 pp.; In English; Integrated Systems Health Management, 6-9 Aug. 2007, Cincinnati, OH, USA
Contract(s)/Grant(s): NNS04AB67T
Report No.(s): SSTI-2200-0083; Copyright; Avail.: CASI: A01, Hardcopy
ISHM capability includes: detection of anomalies, diagnosis of causes of anomalies, prediction of future anomalies, and user interfaces that enable integrated awareness (past, present, and future) by users. This is achieved by focused management of data, information and knowledge (DIaK) that will likely be distributed across networks. Management of DIaK implies storage, sharing (timely availability), maintaining, evolving, and processing. Processing of DIaK encapsulates strategies, methodologies, algorithms, etc. focused on achieving high ISHM Functional Capability Level (FCL). High FCL means a high degree of success in detecting anomalies, diagnosing causes, predicting future anomalies, and enabling health integrated awareness by the user. A model that enables ISHM capability, and hence, DIaK management, is denominated the ISHM Model of the System (IMS). We describe aspects of the IMS that focus on processing of DIaK. Strategies, methodologies, and algorithms require proper context. We describe an approach to define and use contexts, implementation in an object-oriented software environment (G2), and validation using actual test data from a methane thruster test program at NASA SSC. Context

is linked to existence of relationships among elements of a system. For example, the context to use a strategy to detect leak is to identify closed subsystems (e.g. bounded by closed valves and by tanks) that include pressure sensors, and check if the pressure is changing. We call these subsystems Pressurizable Subsystems. If pressure changes are detected, then all members of the closed subsystem become suspect of leakage. In this case, the context is defined by identifying a subsystem that is suitable for applying a strategy. Contexts are defined in many ways. Often, a context is defined by relationships of function (e.g. liquid flow, maintaining pressure, etc.), form (e.g. part of the same component, connected to other components, etc.), or space (e.g. physically close, touching the same common element, etc.). The context might be defined dynamically (if conditions for the context appear and disappear dynamically) or statically. Although this approach is akin to case-based reasoning, we are implementing it using a software environment that embodies tools to define and manage relationships (of any nature) among objects in a very intuitive manner. Context for higher level inferences (that use detected anomalies or events), primarily for diagnosis and prognosis, are related to causal relationships. This is useful to develop root-cause analysis trees showing an event linked to its possible causes and effects. The innovation pertaining to RCA trees encompasses use of previously defined subsystems as well as individual elements in the tree. This approach allows more powerful implementations of RCA capability in object-oriented environments. For example, if a pressurizable subsystem is leaking, its root-cause representation within an RCA tree will show that the cause is that all elements of that subsystem are suspect of leak. Such a tree would apply to all instances of leak-events detected and all elements in all pressurizable subsystems in the system. Example subsystems in our environment to build IMS include: Pressurizable Subsystem, Fluid-Fill Subsystem, Flow-Thru-Valve Subsystem, and Fluid Supply Subsystem. The software environment for IMS is designed to potentially allow definition of any relationship suitable to create a context to achieve ISHM capability.
Author
Systems Integration; Systems Health Monitoring; Data Management; Models; Software Engineering

20070018255 NASA Johnson Space Center, Houston, TX, USA
NASA's Software Safety Standard
Ramsay, Christopher M.; [2005]; 5 pp.; In English; 1st International Association for the Advancement of Space Safety (IAASS) Conference, 'Space Safety, A New Beginning', 25-27 Oct. 2005, Nice, France; Original contains black and white illustrations; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018255

NASA (National Aeronautics and Space Administration) relies more and more on software to control, monitor, and verify its safety critical systems, facilities and operations. Since the 1960's there has hardly been a spacecraft (manned or unmanned) launched that did not have a computer on board that provided vital command and control services. Despite this growing dependence on software control and monitoring, there has been no consistent application of software safety practices and methodology to NASA's projects with safety critical software. Led by the NASA Headquarters Office of Safety and Mission Assurance, the NASA Software Safety Standard (STD-18l9.13B) has recently undergone a significant update in an attempt to provide that consistency. This paper will discuss the key features of the new NASA Software Safety Standard. It will start with a brief history of the use and development of software in safety critical applications at NASA. It will then give a brief overview of the NASA Software Working Group and the approach it took to revise the software engineering process across the Agency.
Author
Software Engineering; Computer Programming; Procedures; Safety; NASA Programs

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.

20070018138 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Transforming Space Missions into Service Oriented Architectures
Mandl, Dan; Frye, Stuart; Cappelaere, Pat; September 12, 2006; 14 pp.; In English; GGF18 2006 (Global Grid Forum), 12-14 Sep. 2006, Washington, DC, USA; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

This viewgraph presentation reviews the vision of the sensor web enablement via a Service Oriented Architecture (SOA).

An generic example is given of a user finding a service through the Web, and initiating a request for the desired observation. The parts that comprise this system and how they interact are reviewed. The advantages of the use of SOA are reviewed.
CASI
Service Oriented Architecture; Space Missions; Web Services

20070018203 National Inst. of Aerospace, Hampton, VA, USA
Model Checking Abstract PLEXIL Programs with SMART
Siminiceanu, Radu I.; April 2007; 33 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NCC1-02043
Report No.(s): NASA/CR-2007-214542; NIA-Report-No-2007-02; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018203

We describe a method to automatically generate discrete-state models of abstract Plan Execution Interchange Language (PLEXIL) programs that can be analyzed using model checking tools. Starting from a high-level description of a PLEXIL program or a family of programs with common characteristics, the generator lays the framework that models the principles of program execution. The concrete parts of the program are not automatically generated, but require the modeler to introduce them by hand. As a case study, we generate models to verify properties of the PLEXIL macro constructs that are introduced as shorthand notation. After an exhaustive analysis, we conclude that the macro definitions obey the intended semantics and behave as expected, but contingently on a few specific requirements on the timing semantics of micro-steps in the concrete executive implementation.
Author
Semantics; Autonomy; Language Programming; Management Planning; Discretization (Mathematics); Mathematical Models

20070018362 Naval Research Lab., Washington, DC USA
Agent Trustworthiness
Kassab, Lora L; Voas, Jeffrey; Jan 1998; 14 pp.; In English; Original contains color illustrations
Report No.(s): AD-A465142; XB-NRL/MR/5540; No Copyright; Avail.: CASI: A03, Hardcopy

Agent-based technology could revolutionize the manner by which distributed computation is performed. The fact that the information returned by an agent to the agent owner cannot be validated by the owner is impeding the widespread adoption of agent-based computing. Our paper addresses this concern by proposing a new type of software assertion to increase observability by providing agent owner's with agent state 'snap-shots.' These snap-shots provide agent owners with: (1) a means to determine whether its agent's results are trustworthy, (2) information to debug a roving agent, (3) a greater ability to meet real-time constraints, and (4) a means to identify hosts systems that are resource-deficient, grant insufficient access rights, or tamper with agents. We present a methodology and tool for selecting and embedding protective assertions into agent code. We also discuss how the information from the assertions is automatically analyzed. Although our proposed assertions are not foolproof, they make it much harder for an agent to be tampered with in ways that are not detectable by the agent's owner. This knowledge is paramount for the utility of an agent-based system.
DTIC
Computer Information Security; Technology Utilization; Data Processing

20070018365 Naval Research Lab., Washington, DC USA
Covert Channels - Here to Stay
Moskowitz, Ira S; Kang, Myong H; Jul 7, 1994; 11 pp.; In English
Report No.(s): AD-A465048; XB-NRL/ITD/5500; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/100.2/ADA465048

We discuss the difficulties of satisfying high-assurance system requirements without sacrificing system capabilities. To alleviate this problem, we show how trade-offs can be made to reduce the threat of covert channels. We also clarify certain concepts in the theory of covert channels. Traditionally, a covert channel's vulnerability was measured by the capacity. We show why a capacity analysis alone is not sufficient to evaluate the vulnerability and introduce a new metric referred to as the 'small message criterion'
DTIC
Information Theory; Channels (Data Transmission); Interprocessor Communication

20070018366 Naval Research Lab., Washington, DC USA
The Multicast Dissemination Protocol (MDP) Version 1 Framework
Macker, Joseph P; Dang, Winston; Apr 1996; 12 pp.; In English
Report No.(s): AD-A465018; XB-NRL/ITD/5500; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/100.2/ADA465018

This white paper outlines a simple protocol framework that was developed for reliable multicast dissemination of data files. It also provides some historical development and testing history. The general framework described here was originally developed and used by the Image Multicaster (IMM) application within the Internet Mbone for reliable multicast file transfer. This document describes the more general use of the protocol framework as a reliable bulk file transfer technique. We discuss the present operational modes, some performance issues, and the basic application data units (ADUs) used. This is not intended to be a detailed protocol specification document, but rather a broad description of the basic protocol features and a discussion of issues.
DTIC
Protocol (Computers); Data Structures; Specifications

20070018367 Naval Research Lab., Washington, DC USA
Simplified Multicast Forwarding in Mobile Ad Hoc Networks
Macker, Joseph P; Dean, Justin; Chao, William; Jan 2004; 8 pp.; In English; Original contains color illustrations
Report No.(s): AD-A465008; XB-NRL/ITD/5500; No Copyright; Avail.: CASI: A02, Hardcopy

We implemented a working IP multicast forwarding prototype for use in mobile ad hoc networks (MANETs) based upon flooding mechanisms. We present the design of a working experimental prototype and some initial performance results using the NRL mobile network emulation system and various optional flooding approaches within the design framework. In addition, we present supplemental analytical examination of several implemented flooding algorithms for MANET environments and discuss related performance tradeoffs. We conclude by presenting further technical considerations and future work issues.
DTIC
Protocol (Computers); Communication Networks

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*.

20070018284 NASA Marshall Space Flight Center, Huntsville, AL, USA
Lunar Precursor Robotic Program: A Robotic Focus To The Vision
French, Raymond A.; Nall, Mark E.; February 11, 2007; 17 pp.; In English; Space Technology and Applications International Forum 2007, 11-15 Feb. 2007, Albuquerque, NM, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018284

In April 2006, NASA, with help from the commercial and international communities, began developing a global Lunar Exploration Strategy. These activities resulted in themes that expanded on why we should return to the Moon and objectives that identify what we should do when we get there. NASA used these results to develop a Lunar Architecture designed to achieve the subset of the global Lunar Exploration Strategy objectives that fit within NASA's scope. A component of this architecture is the Lunar Precursor Robotic Program. This Program, anticipated to consist of both lunar orbiters and landers, is intended to meet many of NASA's lunar exploration objectives.
Author
Lunar Programs; Robotics; Computer Vision; Lunar Exploration

20070018285 NASA Glenn Research Center, Cleveland, OH, USA
Simulation of Foam Divot Weight on External Tank Utilizing Least Squares and Neural Network Methods
Chamis, Christos C.; Coroneos, Rula M.; May 16, 2007; 7 pp.; In English; 6th International Symposium on Advanced Composites (COMP07), 16-18 May 2007, Corfu, Greece; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 561.581.02.08.03.15.03
Report No.(s): COMP2007-005; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018285

Simulation of divot weight in the insulating foam, associated with the external tank of the U.S. space shuttle, has been evaluated using least squares and neural network concepts. The simulation required models based on fundamental considerations that can be used to predict under what conditions voids form, the size of the voids, and subsequent divot ejection mechanisms. The quadratic neural networks were found to be satisfactory for the simulation of foam divot weight in various tests associated with the external tank. Both linear least squares method and the nonlinear neural network predicted identical results.
Author
Digital to Voice Translators; Least Squares Method; External Tanks; Neural Nets; Computerized Simulation; Mathematical Models

64
NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20070018160 Mississippi State Univ., Starkville, MS, USA
Anisotropic Solution Adaptive Unstructured Grid Generation Using AFLR
Marcum, David L.; March 15, 2007; 55 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNL04AA91G; WBS 23-762-45-CE; No Copyright; Avail.: CASI: A04, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018160

An existing volume grid generation procedure, AFLR3, was successfully modified to generate anisotropic tetrahedral elements using a directional metric transformation defined at source nodes. The procedure can be coupled with a solver and an error estimator as part of an overall anisotropic solution adaptation methodology. It is suitable for use with an error estimator based on an adjoint, optimization, sensitivity derivative, or related approach. This offers many advantages, including more efficient point placement along with robust and efficient error estimation. It also serves as a framework for true grid optimization wherein error estimation and computational resources can be used as cost functions to determine the optimal point distribution. Within AFLR3 the metric transformation is implemented using a set of transformation vectors and associated aspect ratios. The modified overall procedure is presented along with details of the anisotropic transformation implementation. Multiple two-and three-dimensional examples are also presented that demonstrate the capability of the modified AFLR procedure to generate anisotropic elements using a set of source nodes with anisotropic transformation metrics. The example cases presented use moderate levels of anisotropy and result in usable element quality. Future testing with various flow solvers and methods for obtaining transformation metric information is needed to determine practical limits and evaluate the efficacy of the overall approach.
Author
Unstructured Grids (Mathematics); Grid Generation (Mathematics); Anisotropy; Error Analysis; Computational Grids; Computational Fluid Dynamics; Tetrahedrons; Derivation

20070018166 Analytical Mechanics Associates, Inc., Hampton, VA, USA, NASA Langley Research Center, Hampton, VA, USA
CFD Analysis of Tile-Repair Augers for the Shuttle Orbiter Re-Entry Aeroheating
Mazaheri, Ali R.; April 2007; 23 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNL06AC49T; WBS 37781606030308
Report No.(s): NASA/CR-2007-214858; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018166

A three-dimensional aerothermodynamic model of the shuttle orbiter's tile overlay repair (TOR) sub-assembly is presented. This sub-assembly, which is an overlay that covers the damaged tiles, is modeled as a protuberance with a constant thickness. The washers and augers that serve as the overlay fasteners are modeled as cylindrical protuberances with constant thicknesses. Entry aerothermodynamic cases are studied to provide necessary inputs for future thermal analyses and to support the space-shuttle return-to-flight effort. The NASA Langley Aerothermodynamic Upwind Relaxation Algorithm (LAURA) is used to calculate heat transfer rate on the surfaces of the tile overlay repair and augers. Gas flow is modeled as

non-equilibrium, five species air in thermal equilibrium. Heat transfer rate and surface temperatures are analyzed and studied for a shuttle orbiter trajectory point at Mach 17.85. Computational results show that the average heat transfer rate normalized with respect to its value at body point 1800 is about BF=1.9 for the auger head. It is also shown that the average BF for the auger and washer heads is about BF=2.0.
Author
Aerothermodynamics; Computational Fluid Dynamics; Tiles; Space Shuttle Orbiters; Three Dimensional Models; Thermodynamic Equilibrium; Spacecraft Models; Heat Transfer

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20070018023 AI Solutions, Inc., Lanham, MD, USA
Adapting Covariance Propagation to Account for the Presence of Modeled and Unmodeled Maneuvers
Schiff, Conrad; [2006]; 11 pp.; In English; AAS/AIAA Astrodynamics Specialist Conference, 21-24 Aug. 2006, Keystone, CO, USA; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

This paper explores techniques that can be used to adapt the standard linearized propagation of an orbital covariance matrix to the case where there is a maneuver and an associated execution uncertainty. A Monte Carlo technique is used to construct a final orbital covariance matrix for a 'prop-burn-prop' process that takes into account initial state uncertainty and execution uncertainties in the maneuver magnitude. This final orbital covariance matrix is regarded as 'truth' and comparisons are made with three methods using modified linearized covariance propagation. The first method accounts for the maneuver by modeling its nominal effect within the state transition matrix but excludes the execution uncertainty by omitting a process noise matrix from the computation. The second method does not model the maneuver but includes a process noise matrix to account for the uncertainty in its magnitude. The third method, which is essentially a hybrid of the first two, includes the nominal portion of the maneuver via the state transition matrix and uses a process noise matrix to account for the magnitude uncertainty. The first method is unable to produce the final orbit covariance except in the case of zero maneuver uncertainty. The second method yields good accuracy for the final covariance matrix but fails to model the final orbital state accurately. Agreement between the simulated covariance data produced by this method and the Monte Carlo truth data fell within 0.5-2.5 percent over a range of maneuver sizes that span two orders of magnitude (0.1-20 m/s). The third method, which yields a combination of good accuracy in the computation of the final covariance matrix and correct accounting for the presence of the maneuver in the nominal orbit, is the best method for applications involving the computation of times of closest approach and the corresponding probability of collision, PC. However, applications for the two other methods exist and are briefly discussed. Although the process model ('prop-burn-prop') that was studied is very simple - point-mass gravitational effects due to the Earth combined with an impulsive delta-V in the velocity direction for the maneuver - generalizations to more complex scenarios, including high fidelity force models, finite duration maneuvers, and maneuver pointing errors, are straightforward and are discussed in the conclusion.
Author
Probability Theory; Collisions; Covariance; Gravitational Effects; Monte Carlo Method; Risk

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20070018029 Analex Corp., Cleveland, OH, USA
Comparison of Analytical Predictions and Experimental Results for a Dual Brayton Power System
Johnson, Paul; February 14, 2007; 18 pp.; In English; 24th Space Technology and Applications International Forum(STAIF-2006), 12-16 Feb. 2006, Albuquerque, NM, USA; Original contains color illustrations
Contract(s)/Grant(s): NNC06E089T; WBS 997180.10.03.01; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018029

NASA Glenn Research Center (GRC) contracted Barber- Nichols, Arvada, CO to construct a dual Brayton power conversion system for use as a hardware proof of concept and to validate results from a computational code known as the Closed Cycle System Simulation (CCSS). Initial checkout tests were performed at Barber- Nichols to ready the system for delivery to GRC. This presentation describes the system hardware components and lists the types of checkout tests performed along with a couple issues encountered while conducting the tests. A description of the CCSS model is also presented. The checkout tests did not focus on generating data, therefore, no test data or model analyses are presented.
Author
Brayton Cycle; Computer Programs; Data Processing; Prediction Analysis Techniques; Closed Cycles; Data Reduction

20070018257 NASA Johnson Space Center, Houston, TX, USA
Situation Awareness of Onboard System Autonomy
Schreckenghost, Debra; Thronesbery, Carroll; Hudson, Mary Beth; September 05, 2005; 8 pp.; In English; ISAIRAS 2005 (ESA SP-604), 5-9 Sep. 2005, Munich, Germany; Original contains black and white illustrations
Contract(s)/Grant(s): NAS9-02060; Copyright; Avail.: CASI: A02, Hardcopy

We have developed intelligent agent software for onboard system autonomy. Our approach is to provide control agents that automate crew and vehicle systems, and operations assistants that aid humans in working with these autonomous systems. We use the 3 Tier control architecture to develop the control agent software that automates system reconfiguration and routine fault management. We use the Distributed Collaboration and Interaction (DCI) System to develop the operations assistants that provide human services, including situation summarization, event notification, activity management, and support for manual commanding of autonomous system. In this paper we describe how the operations assistants aid situation awareness of the autonomous control agents. We also describe our evaluation of the DCI System to support control engineers during a ground test at Johnson Space Center (JSC) of the Post Processing System (PPS) for regenerative water recovery.
Author
Automatic Control; Autonomy; Situational Awareness

70
PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see *categories 71 through 77*. For related instrumentation see *35 Instrumentation and Photography*; for geophysics, astrophysics, or solar physics see *46 Geophysics, 90 Astrophysics*, or *92 Solar Physics*.

20070018014 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Dissipation Mechanism in Collisionless Magnetic Reconnection
Hesse, Michael; Kuznetsova, M.; Birn, J.; Schindler, K.; [2006]; 1 pp.; In English; 2006 AGU Fall Meeting, 11-15 Dec. 2006, San Francisco, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

The dissipation mechanism of magnetic reconnection remains a subject of intense scientific interest. On one hand, one set of recent studies have shown that particle inertia-based processes, which include thermal and bulk inertial effects, provide the reconnection electric field in the diffusion region. On the other hand, a second set of studies emphasizes the role of wave-particle interactions in providing anomalous resistivity in the diffusion region. In this presentation, we present analytical theory results, as well as PIC simulations of guide-field magnetic reconnection. We will show that the thermal electron inertia-based dissipation mechanism, expressed through nongyrotropic electron pressure tensors, remains viable in three dimensions. We will demonstrate the thermal inertia effect through studies of electron distribution functions. Furthermore, we will show that the reconnection electric field provides a transient acceleration on particles traversing the inner reconnection region. This inertial effect can be described as a diffusion-like term of the current density, which matches key features of electron distribution functions.
Author
Magnetic Field Reconnection; Distribution Functions; Electric Fields; Semiconductors (Materials); Electron Distribution; Current Density; Electrical Resistivity

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*.

20070018236 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Results from SIM's Thermo-Opto-Mechanical (TOM3) Testbed
Goullioud, Renaud; Lindensmith, C. A.; Hahn, I.; May 24, 2006; 16 pp.; In English; SPIE Astronomical Telescopes 2006, Advances in Stellar Interferometry, 24 May 2006; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/39863

Future space-based optical interferometers, such as the Space Interferometer Mission Planet Quest (ESA), require thermal stability of the optical wavefront to the level of picometers in order to produce astrometric data at the micro-arc-second level. In SIM, the internal path of the interferometer will be measured with a small metrology beam whereas the starlight fringe position is estimated from a large concentric annular beam. To achieve the micro-arc-second observation goal for SIM, it is necessary to maintain the optical path difference between the central and the outer annulus portions of the wavefront of the front-end telescope optics to a few tens of picometers. The Thermo-Opto-Mechanical testbed (TOM3) was developed at the Jet Propulsion Laboratory to measure thermally induced optical deformations of a full-size flight-like beam compressor and siderostat, the two largest optics on SIM, in flight-like thermal environments. A Common Path Heterodyne Interferometer (COPHI) developed at JPL was used for the fine optical path difference measurement as the metrology sensor. The system was integrated inside a large vacuum chamber in order to mitigate the atmospheric and thermal disturbances. The siderostat was installed in a temperature-controlled thermal shroud inside the vacuum chamber, creating a flight-like thermal environment. Detailed thermal and structural models of the test articles (siderostat and compressor) were also developed for model prediction and correlation of the thermal deformations. Experimental data shows ESA required thermal stability of the test articles and good agreement with the model predictions.
Author
Interferometers; Metrology; Thermal Stability; Interferometry; Wave Fronts

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*.

20070018213 NASA Goddard Space Flight Center, Greenbelt, MD, USA
SpaceFibre Discussion
Rakow, Glenn; January 19, 2007; 5 pp.; In English; SpaceWire Working Group, 17-19 Jan. 2007, Noordwijk, Netherlands; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018213

This viewgraph presentation discusses the future use of SpaceFibre, a high speed optical extension to the SpaceWire, for NASA and DOD missions. NASA, and US industries would like to work with the European developers currently working on this standard.
CASI
NASA Programs; European Space Agency; Product Development

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20070018086 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Experiences using Visualization Techniques to Present Requirements, Risks to Them, and Options for Risk Mitigation
Feather, Martin S.; Cornford, Steven L.; Kiper, James D.; Menzies, Tim; September 9, 2006; 10 pp.; In English; Workshop on Requirements Engineering Visualization, 9 Sep. 2006, Saint Paul, MN, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/39890

For several years we have been employing a risk-based decision process to guide development and application of advanced technologies, and for research and technology portfolio planning. The process is supported by custom software, in which visualization plays an important role. During requirements gathering, visualization is used to help scrutinize the status (completeness, extent) of the information. During decision making based on the gathered information, visualization is used to help decisionmakers understand the space of options and their consequences. In this paper we summarize the visualization capabilities that we have employed, indicating when and how they have proven useful.
Author
Decision Making; Technological Forecasting; Planning

20070018232 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Quality Interaction Between Mission Assurance and Project Team Members
Kwong-Fu, Helenann H.; Wilson, Robert K.; May 25, 2006; 23 pp.; In English; SPIE Observatory Operations: Strategies, Processes, and Systems, 25 May 206, Orlando, FL, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/39880

This viewgraph presentation demonstrates the importance of value added Mission Assurance to flight operations in order to assure mission success and the Health and Safety of the mission, (i.e., the Spitzer space Telescope.)
CASI
Quality Control; Communication; Project Management; Mission Planning; Project Planning

82
DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer program documentation see *61 Computer Programming and Software*.

20070018137 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Data Integration Support for Data Served in the OPeNDAP and OGC Environments
McDonald, Kenneth R.; Wharton, Stephen W., Technical Monitor; [2006]; 1 pp.; In English; American Geophysical Union 2006 Fall Meeting, 10-16 Dec. 2006, San Francisco, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

NASA is coordinating a technology development project to construct a gateway between system components built upon the Open-source Project for a Network Data AcceSs Protocol (OPeNDAP) and those made available made available via interfaces specified by the Open Geospatial Consortium (OGC). This project is funded though the Advanced Collaborative Connections for Earth-Sun System Science (ACCESS) Program and is a NASA contribution to the Committee on Earth Satellites (CEOS) Working Group on Information Systems and Services (WGISS). The motivation for the project is the set of data integration needs that have been expressed by the Coordinated Enhanced Observing Period (CEOP), an international program that is addressing the study of the global water cycle. CEOP is assembling a large collection in situ and satellite data and mode1 results from a wide variety of sources covering 35 sites around the globe. The data are provided by systems based on either the OPeNDAP or OGC protocols but the research community desires access to the full range of data and associated services from a single client. This presentation will discuss the current status of the OPeNDAP/OGC Gateway Project. The project is building upon an early prototype that illustrated the feasibility of such a gateway and which was demonstrated to the CEOP science community. In its first year as an ACCESS project, the effort has been has focused on the design of the catalog and data services that will be provided by the gateway and the mappings between the metadata and services provided in the two environments.
Author
Data Integration; Protocol (Computers); Information Systems; Earth Sciences; Metadata; Communication Networks

20070018350 Executive Office of the President, Washington, DC USA
Federal Plan for High-End Computing. Report of the High-End Computing Revitalization Task Force (HECRTF)
Jul. 2004; 75 pp.; In English; Original contains color illustrations
Report No.(s): AD-A465007; No Copyright; Avail.: CASI: A04, Hardcopy

Since the World War II era, when scientists, mathematicians, and engineers began using revolutionary electronic machinery that could rapidly perform complex calculations in support of the war effort, pioneering computing capabilities have been a principal foundation of the nation's technological and economic strength. Today, solving many of our most

important scientific and engineering problems requires high-end computers. They are used, for example, for modeling weather and climate patterns; designing highly complex physical systems such as aircraft, ships, and automobiles; and conducting advanced image and signal processing and cryptanalysis. Moreover, U.S. capability in science and engineering is increasingly being called on to address urgent challenges in national and homeland security, economic competitiveness, health care, and environmental protection.
DTIC
Computers; Research Management; Technology Assessment

85
TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION

Includes aerospace technology transfer; urban technology; surface and mass transportation. For related information see also *03 Air Transportation and Safety, 16 Space Transportation and Safety*, and *44 Energy Production and Conversion*. For specific technology transfer applications see also the category where the subject is treated.

20070018189 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Overview of Mars Technology Program
Hayati, Samad A.; July 9, 2006; 23 pp.; In English; 42nd AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 9-12 Jul. 2006, Sacramento, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/39882

This viewgraph presentation reviews the development of a technology program leading to Mars missions. The presentation includes: the goals of technology program, elements of technology program, program metrics, major accomplishments, examples and Information about the Mars Technology Program.
CASI
Mars Missions; Research and Development; Technologies; NASA Programs; Technology Assessment; Technology Utilization; Research Management

88
SPACE SCIENCES (GENERAL)

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through\f93*.

20070018054 NASA Johnson Space Center, Houston, TX, USA
Extravehicular Activity (EVA) 101: Constellation EVA Systems
Jordan, Nicole C.; April 10, 2007; 39 pp.; In English; Engineering Symposium, 10 Apr. 2007, GA, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018054

A viewgraph presentation on Extravehicular Activity (EVA) Systems is shown. The topics include: 1) Why do we need space suits? 2) Protection From the Environment; 3) Primary Life Support System (PLSS); 4) Thermal Control; 5) Communications; 6) Helmet and Extravehicular Visor Assy; 7) Hard Upper Torso (HUT) and Arm Assy; 8) Display and Controls Module (DCM); 9) Gloves; 10) Lower Torso Assembly (LTA); 11) What Size Do You Need?; 12) Boot and Sizing Insert; 13) Boot Heel Clip and Foot Restraint; 14) Advanced and Crew Escape Suit; 15) Nominal & Off-Nominal Landing; 16) Gemini Program (mid-1960s); 17) Apollo EVA on Service Module; 18) A Bold Vision for Space Exploration, Authorized by Congress; 19) EVA System Missions; 20) Configurations; 21) Reduced Gravity Program; and 22) Other Opportunities.
CASI
Extravehicular Activity; Space Suits; NASA Programs; Microgravity

20070018083 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Analysis of Calibration Errors for Both Short and Long Stroke White Light Experiments
Pan, Xaiopei; May 24, 2006; 8 pp.; In English; SPIE Astronomical Telescopes and Instrumentation, 24-31 May 2006, Orlando, FL, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/39884

This work will analyze focusing and tilt variations introduced by thermal changes in calibration processes. In particular the accuracy limits are presented for common short- and long-stroke experiments. A new, simple, practical calibration scheme is proposed and analyzed based on the ESA PlanetQuest's Micro-Arcsecond Metrology (MAM) testbed experiments.
Author
Error Analysis; Calibrating; Accuracy; Attitude (Inclination); Astrophysics

20070018088 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
The Benefits of Virtual Presence in Space (VPS) to Deep Space Missions
De Jong, Eric M.; McGuffie, Barbara A; Levoe, Steven R.; Suzuki, Shigeru; Gorjian, Zareh; Leung, Chris; Cordell, Christopher; Loaiza, Frank; Baldwin, Robert; Craig, Jason; Kuramura, Koji; Stetson, Michael; June 12, 2006; 23 pp.; In English; AIAA 9th International Conference on Spacecraft Operations (SpaceOps), 19-24 Jun. 2006, Rome, Italy; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/39866

Understanding our place in the Universe is one of mankind's greatest scientific and technological challenges and achievements. The invention of the telescope, the Copernican Revolution, the development of Newtonian mechanics, and the Space Age exploration of our solar system; provided us with a deeper understanding of our place in the Universe; based on better observations and models. As we approach the end of the first decade of the new millennium, the same quest, to understand our place in the Universe, remains a great challenge. New technologies will enable us to construct and interact with a 'Virtual Universe' based on remote and in situ observations of other worlds. As we continue the exploration that began in the last century, we will experience a 'Virtual Presence in Space (VPS)' in this century. This paper describes VPS technology, the mechanisms for VPS product distribution and display, the benefits of this technology, and future plans. Deep space mission stereo observations and frames from stereo High Definition Television (HDTV) mission animations are used to illustrate the effectiveness of VPS technology.
Author
Space Missions; Deep Space; Space Exploration; Solar System

20070018089 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Silicon Nanotips Antireflection Surface for Micro Sun Sensor
Bae, Sam Y.; Lee, Choonsup; Mobasser, Sohrab; Manohara, Harish; July 17, 2006; 4 pp.; In English; IEEE Nano Conference, 17-20 Jul. 2006, Cincinnati, OH, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/39867

We have developed a new technique to fabricate antireflection surface using silicon nano-tips for use on a micro sun sensor for Mars rovers. We have achieved randomly distributed nano-tips of radius spanning from 20 nm to 100 nm and aspect ratio of ~200 using a two-step dry etching process. The 30(deg) specular reflectance at the target wavelength of 1 (mu)m is only about 0.09 %, nearly three orders of magnitude lower than that of bare silicon, and the hemispherical reflectance is ~ 8%. By changing the density and aspect ratio of these nanotips, the change in reflectance is demonstrated. Using surfaces covered with these nano-tips, the critical problem of ghost images that are caused by multiple internal reflections in a micro sun sensor was solved.
Author
Antireflection Coatings; Silicon; Solar Sensors; Fabrication; Roving Vehicles; Mars Surface

20070018271 NASA Johnson Space Center, Houston, TX, USA
Progress in Spacecraft Environment Interactions: International Space Station (ISS) Development and Operations
Koontz, Steve; Suggs, Robb; Schneider, Todd; Minow, Joe; Alred, John; Cooke, Bill; Mikatarian, Ron; Kramer, Leonard; Boeder, paul; Soares, Carlos; [2007]; 1 pp.; In English; ISCD 2007, 25-28 May 2007, Dallas, TX, USA
Contract(s)/Grant(s): 401769.06.03.06.02.17; No Copyright; Avail.: Other Sources; Abstract Only

The set of spacecraft interactions with the space flight environment that have produced the largest impacts on the design, verification, and operation of the International Space Station (ISS) Program during the May 2000 to May 2007 time frame are the focus of this paper. In-flight data, flight crew observations, and the results of ground-based test and analysis directly supporting programmatic and operational decision-making are reported as are the analysis and simulation efforts that have led to new knowledge and capabilities supporting current and future space explorations programs. The specific spacecraft-environment interactions that have had the greatest impact on ISS Program activities during the first several years of flight are:

1) spacecraft charging, 2) micrometeoroids and orbital debris effects, 3) ionizing radiation (both total dose to materials and single event effects [SEE] on avionics), 4) hypergolic rocket engine plume impingement effects, 5) venting/dumping of liquids, 6) spacecraft contamination effects, 7) neutral atmosphere and atomic oxygen effects, 8) satellite drag effects, and 9) solar ultraviolet effects. Orbital inclination (51.6deg) and altitude (nominally between 350 km and 460 km) determine the set of natural environment factors affecting the performance and reliability of materials and systems on ISS. ISS operates in the F2 region of Earth s ionosphere in well-defined fluxes of atomic oxygen, other ionospheric plasma species, solar UV, VUV, and x-ray radiation as well as galactic cosmic rays, trapped radiation, and solar cosmic rays. The micrometeoroid and orbital debris environment is an important determinant of spacecraft design and operations in any orbital inclination. The induced environment results from ISS interactions with the natural environment as well as environmental factors produced by ISS itself and visiting vehicles. Examples include ram-wake effects, hypergolic thruster plume impingement, materials out-gassing, venting and dumping of fluids, and specific photovoltaic (PV) power system interactions with the ionospheric plasma. Vehicle size (L) and velocity (v), combined with the magnitude and direction of the geomagnetic field (B) produce operationally significant magnetic induction voltages (VxB.L) in ISS conducting structure during high latitude flight (\g+/- 45deg) during each orbit. In addition, ISS is a large vehicle and produces a deep wake structure from which both ionospheric plasma and neutrals species are largely excluded. ISS must fly in a very limited number of approved flight attitudes, so that exposure of a particular material or system to environmental factors depends upon: 1) location on ISS, 2) ISS flight configuration, 3) ISS flight attitude, and 4) variation of solar exposure (Beta angle), and hence thermal environment, with time. Finally, an induced ionizing radiation environment is produced by trapped radiation and solar/cosmic ray interactions with the relatively massive ISS structural shielding.

Author

International Space Station; Spacecraft Charging; Micrometeoroids; Ionizing Radiation; Rocket Engines; Plumes; Liquids; Venting; Spacecraft Environments

89
ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20070018016 NASA Ames Research Center, Moffett Field, CA, USA

Zeta Pegasi: An SPB Variable Star

Goebel, John H.; January 2007; 40 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WU 415113-04-01-01

Report No.(s): NASA/TP-2007-213492; A-0600011; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070018016

Broadband photometric observations of the bright star Zeta Pegasi are presented that display brightness variability of 488.2 +/- 6.6 micromag (ppm) range with a period of 22.952 +/- 0.804 hr (f approx. equals 1.04566 c/d). The variation is monosinusoidal, so the star is recommended for membership in the class of small-amplitude Slowly Pulsating B-Stars (SPB) variables oscillating in a non-radial g-mode.

Author

Variable Stars; B Stars; Brightness; Photometry; Oscillations

20070018184 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The New Era of Swift Observations

Gehrels, Neil; [2007]; 1 pp.; In English; Supernova Workshop, 20-23 Feb. 2007, Aspen, CO, USA; No Copyright; Avail.: Other Sources; Abstract Only

Swift was launched in November 2004 and is performing observations of 100 GRBs per year. For each burst, arcsec positions are determined and optical/ultraviolet/gamma-ray spectrophotometry performed. Information is rapidly sent to the ground to a team of more than 50 observers at telescopes around the world. The observatory contributes in several ways to supernova research. The first is in detecting nearby GRBs that may be coincident with supernovae. The prompt Swift trigger

and rapid repointing enables observations of the supernova from the time of core collapse. The observations of SN 2006aj in conjunction with GRB 060218 is an example of this capability. Swift is also performing optical, ultraviolet and X-ray observations of approx. 15 supernovae of all types per year. The talk will give an overview of the new results and discuss future prospects for Swift observations.
Author
Gamma Ray Bursts; Swift Observatory; Telescopes; Supernovae

20070018185 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Gamma Ray Burst Observations with Swift and GLAST
Gehrels, Neil; [2007]; 1 pp.; In English; GLAST Symposium, 4-9 Feb. 2007, Stanford, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

The Swift and GLAST missions promise a great increase in our understanding of the gamma-ray universe. Swift was launched in November 2004 with a primary objective to study gamma-ray bursts. All instruments are performing well and more than 200 GRBs have been studied in detail. Major advances have already been made in the areas of short bursts, high redshift events and afterglow physics. The GLAST mission is scheduled for launch in fall 2007. It features a large newtechnology instrument for high energy gamma-ray observations. Hundreds of gamma-ray bursts will be detected by the LAT and GBM instruments. The talk will discuss the GRB science available with GLAST and the opportunities for joint Swift and GLAST observations of bursts.
Author
Gamma Ray Bursts; Swift Observatory; Gamma Ray Telescopes; Gamma Ray Astronomy

20070018221 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Multiwavelength Observations of Blazars
Sambruna, Rita; [2007]; 1 pp.; In English; Fifth Stromlo Symposium: Disks, Winds, and Jets: from planets to quasars, 3-9 Dec. 2006, Canberra, Australia; No Copyright; Avail.: Other Sources; Abstract Only

The last decade has seen formidable progress in our understanding of blazar jets, thanks to the advent of several higher-sensitivity observatories. I will review the status of the art for blazar jets focusing especially on the latest multiwavelength campaigns.
Author
Blazars; Wavelengths; Astronomy

20070018222 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Does the Blazar Gamma-ray Spectrum Harden with Increasing Flux? - Analysis of Nine Years of EGRET Data
Nandikotkur, Giridhar; Jahoda, Keith M.; Hartman, R. C.; Mukherjee, R.; Sreekumar, P.; Boettcher, M.; [2207]; 9 pp.; In English; Copyright; Avail.: CASI: A02, Hardcopy

The Energetic Gamma Ray Experiment Telescope (EGRET) on the Compton Gamma Ray Observatory (CGRO) discovered gamma-ray emission from more than 67 blazars during its nine-year lifetime. We conducted an exhaustive search of the EGRET archives and selected all the blazars that were observed multiple times and were bright enough to enable a spectral analysis using standard powerlaw models. The sample consists of 18 flat-spectrum radio quasars (FSRQs), 6 low-frequency-peaked BL Lacs (LBLs) and 2 high-frequency-peaked BL Lacs (HBLs). We do not detect any clear pattern in'the variation of spectral index with flux. Some of the blazars do not show any statistical evidence for spectral variability. The spectrum hardens with increasing flux in a few cases. There is also evidence for a flux-hardness anticorrelation at lo\v fluxes in five blazars. The well observed blazars (3C 279,3C 273, PKS 0528-i-134, PKS 1622-297, PKS 0208- 512) do not show any overall trend in the long-term spectral dependence on flux, but the sample shows a mixture of hard and soft states. We observed spectral hysteresis at weekly timescales in all the three FSRQs for which data from flares lasting for 3 approx. 4 weeks were available. All three sources show a counterclockwise rotation despite the widely different flux profiles. Hysteresis in the spectral index vs. flux space has never been observed in FSRQs in gamma-rays at weekly timescales. itre analyze the observed spectral behavior in the context of various inverse-Compton mechanisms believed to be responsible for emission in the EGRET energy range. Our analysis uses the EGRET skymaps that were regenerated to include the changes in performance during the mission.
Author
Gamma Ray Telescopes; Gamma Ray Observatory; Spectrum Analysis; Blazars; Quasars; Gamma Rays

20070018230 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Neutron Stars

Cottam, J.; January 08, 2007; 1 pp.; In English; MIT Presentation, 21 Nov. 2006, Cambridge, MA, USA; No Copyright; Avail.: Other Sources; Abstract Only

Neutron stars were discovered almost 40 years ago, and yet many of their most fundamental properties remain mysteries. There have been many attempts to measure the mass and radius of a neutron star and thereby constrain the equation of state of the dense nuclear matter at their cores. These have been complicated by unknown parameters such as the source distance and burning fractions. A clean, straightforward way to access the neutron star parameters is with high-resolution spectroscopy. I will present the results of searches for gravitationally red-shifted absorption lines from the neutron star atmosphere using XMM-Newton and Chandra.

Author

Neutron Stars; Radii; Equations of State; Spectroscopy; Matter (Physics)

20070018254 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Gamma-Ray Pulsar Candidates for GLAST

Thompson, David J.; Smith, D. A.; Dumora, D.; Guillemot, L.; Parent, D.; Reposeur, T.; Grove, E.; Romani, R. W.; Thorsett, S. E.; [2007]; 1 pp.; In English; AAS Meeting, 8-9 Jan. 2007, Seattle, WA, USA; Copyright; Avail.: Other Sources; Abstract Only

The Gamma-ray Large Area Space Telescope (GLAST) will be launched less than a year from now, and its Large Area Telescope (LAT) is expected to discover scores to hundreds of gamma-ray pulsars. This poster discusses which of the over 1700 known pulsars, mostly visible only at radio Erequencies, are likely to emit greater than l00 MeV gamma rays with intensities detectable by the LAT. The main figure of merit used to select gamma-ray pulsar candidates is sqrt(E-dot)/d^2, where E-dot is the energy loss due to rotational spindown, and d is the distance to the pulsar. The figure of merit incorporates spin-down flux at earth (proportional to E-dot/d^2) times efficiency, assumed proportional to 1/sqrt(E-dot). A few individual objects are cited to illustrate the issues. Since large E-dot pulsars also tend to have large timing noise and occasional glitches, their ephemerides can become inaccurate in weeks to months. To detect and study the gamma-ray emission the photons must be accurately tagged with the pulse phase. With hours to days between gamma-ray photon arrival times from a pulsar and months to years of LAT exposure needed for good detections, GLAST will need timing measurements throughout the continuous gamma-ray observations. The poster will describe efforts to coordinate pulsar timing of the candidate gamma-ray pulsars.

Author

Gamma Ray Telescopes; Pulsars; Photons; Gamma Ray Astronomy

20070018281 NASA Marshall Space Flight Center, Huntsville, AL, USA

Constraints on an Optical Afterglow and on Supernova Light Following the Short Burst GRB 050813

Ferrero, P.; Sanchez, S. F.; Kann, D. A.; Klose, S.; Greiner, J.; Gorosabel, J.; Hartmann, D. H.; Henden, A. A.; Moller, P.; Palazzi, E.; Rau, A.; Stecklum, B.; Castro-Tirado, A. J.; Fynbok J. P. U.; Hjorth, J.; Jakobsson, P.; Kouveliotou, C.; Masetti, N.; Pian, E.; Tanvir, N. R.; Wijers, R. A. M. J.; [2006]; 23 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

We report early follow-up observations of the error box of the short burst 050813 using the telescopes at Calar Alto and at Observatorio Sierra Nevada (OSN), followed by deep VLT/FORS2 I-band observations obtained under very good seeing conditions 5.7 and 11.7 days after the event. No evidence for a GRB afterglow was found in our Calar Alto and OSN data, no rising supernova component was detected in our FORS2 images. A potential host galaxy can be identified in our FORS2 images, even though we cannot state with certainty its association with GRB 050813. IN any case, the optical afterglow of GRB 050813 was very faint, well in agreement with what is known so far about the optical properties of afterglows of short bursts. We conclude that all optical data are not in conflict with the interpretation that GRB 050813 was a short burst.

Author

Afterglows; Supernovae; Gamma Ray Bursts; Galaxies; Optical Properties; Constraints

20070018282 NASA Marshall Space Flight Center, Huntsville, AL, USA

Gamma-Ray Burst Afterglows as Probes of Environment and Blastwave Physics, 1, Absorption by Host Galaxy Gas and Dust

Starling, R. L. C.; Wijers, R. A. M. J.; Wiersema, K.; Rol, E.; Curran, P. A.; Kouveliotou, C.; vanderHorst, A. J.; Heemskerk, M. H. M.; Dec. 18, 2006; 25 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): CT-2002-00294

Report No.(s): astro-ph/0610899v2; Copyright; Avail.: CASI: A03, Hardcopy

We use a new approach to obtain limits on the absorbing columns towards an initial sample of 10 long Gamma-Ray Bursts observed with BeppoSAX and selected on the basis of their good optical and nIR coverage, from simultaneous fits to nIR, optical and X-ray afterglow data, in count space and including the effects of metallicity. In no cases is a MIV-like ext,inction preferred, when testing MW, LMC and SMC extinction laws. The 2175A bump would in principle be detectable in all these afterglows, but is not present in the data. An SMC-like gas-to-dust ratio or lower value can be ruled out for 4 of the hosts analysed here (assuming Sh4C metallicity and extinction law) whilst the remainder of the sample have too large an error to discriminate. We provide a more accurate estimate of the line-of-sight extinction and improve upon the uncertainties for the majority of the extinction measurements made in previous studies of this sample. We discuss this method to determine extinction values in comparison with the most commonly employed existing methods.

Author

Gamma Ray Bursts; Metallicity; Cosmic Dust; Line of Sight; Afterglows; Extinction

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ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20070018103 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Causes of Extremely Fast CMEs

Feynman, Joan; Ruzmaikin, Alexander; March 31, 2006; In English; Solar Activity and its Magnetic Origin (IAU Symposium No. 233), 31 Mar. - 4 Apr. 2006, Cario, Egypt; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/39873

We study CMEs observed by LASCO to have plane of the sky velocities exceeding 1500 km/sec. We find that these extremely fast CMEs are typically associated with flares accompanied by erupting prominences. Our results are consistent with a single CME initiation process that consists of three stages. The initial stage is brought about by the emergence of new magnetic flux, which interacts with the pre-existing magnetic configuration and results in a slow rise of the magnetic structure. The second stage is a fast reconnection phase with flaring, filament eruption and a sudden increase of the rise velocity of the magnetic structure (CME). The third stage consists of propagation in the corona. We discuss the sources of these CMEs and the need for improved understanding of the first and third stages.

Author

Coronal Mass Ejection; Magnetic Flux; Coronas; Magnetic Field Configurations; Magnetic Field Reconnection

20070018146 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Predictable Glitches in PSR J0537-6910

Marshall, Francis; [2006]; 1 pp.; In English; AAS Conference, 8-12 Jan. 2006, Washington, DC, USA; No Copyright; Avail.: Other Sources; Abstract Only

We report the accumulated results of more than six and a half years of monitoring of J0537-6910, the 16 ms pulsar in the Large Magellanic Cloud, using data acquired with the Rossi X-ray Timing Explorer. During this campaign the pulsar experienced some 20 sudden increases in frequency (‘glitches’) of at least one μHz, amounting to a gain of six parts per million of rotation frequency superposed on its normal spindown of $\sim-1.99 \times 10(exp -10)$ Hz/s. The time interval from one glitch to the next obeys a strong linear correlation to the amplitude of the first glitch, with a mean slope of about 120 days per 0.3 parts per million. As a result, the time of the next glitch can usually be predicted to an accuracy of a few days. The magnitude of the pulsar spindown continues to increase, and thus its timing age ($-\nu/2\dot\nu$) continues to decrease at a rate of about one year for every two year interval. The implications of these observations are discussed.

Author

Magellanic Clouds; Pulsars; X Ray Timing Explorer; Frequencies; Rotation

20070018208 NASA Goddard Space Flight Center, Greenbelt, MD, USA
GLAST Large Area Telescope Multiwavelength Planning
Reimer, O.; Michelson, P. F.; Cameron, R. A.; Digel, S. W.; Thompson, D. J.; Wood, K. S.; [2007]; 4 pp.; In English; Copyright; Avail.: CASI: A01, Hardcopy

Gamma-ray astrophysics depends in many ways on multiwavelength studies. The Gamma-ray Large Area Space Telescope (GLAST) Large Area Telescope (LAT) Collaboration has started multiwavelength planning well before the scheduled 2007 launch of the observatory. Some of the high-priority multiwavelength needs include: (1) availability of contemporaneous radio and X-ray timing of pulsars; (2) expansion of blazar catalogs, including redshift measurements; (3) improved observations of molecular clouds, especially at high galactic latitudes; (4) simultaneous broad-spectrum blazar monitoring; (5) characterization of gamma-ray transients, including gamma ray bursts; (6) radio, optical, X-ray and TeV counterpart searches for reliable and effective sources identification and characterization. Several of these activities are needed to be in place before launch.
Author
Gamma Ray Telescopes; Wavelengths; Astrophysics; Mission Planning; Milky Way Galaxy

20070018227 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The EPIC-MOS Particle-Induced Background Spectrum
Kuntz, K. D.; Snowden, S. L.; November 13, 2006; 28 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

We have developed a method for constructing a spectrum of the particle-induced instrumental background of the XMM-Newton EPIC MOS detectors that can be used for observations of the diffuse background and extended sources that fill a significant fraction of the instrument field of view. The strength and spectrum of the particle-induced background, that is, the background due to the interaction of particles with the detector and the detector surroundings, is temporally variable as well as spatially variable over individual chips. Our method uses a combination of the filter-wheel-closed data and a database of unexposed-region data to construct a spectrum of the 'quiescent' background. We show that, using this method of background subtraction, the differences between independent observations of the same region of 'blank sky' are consistent with the statistical uncertainties except when there is clear evidence of solar wind charge exchange emission. We use the blank sky observations to show that contamination by SWCX emission is a strong function of the solar wind proton flux, and that observations through the flanks of the magnetosheath appear to be contaminated only at much higher solar wind fluxes. We have also developed a spectral model of the residual soft proton flares, which allows their effects to be removed to a substantial degree during spectral fitting.
Author
Metal Oxide Semiconductors; Spectral Theory; Chips (Electronics); Detectors; Background Radiation

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LUNAR AND PLANETARY SCIENCE AND EXPLORATION

Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance*.

20070018024 NASA Johnson Space Center, Houston, TX, USA
Conditions on Early Mars Might Have Fostered Rapid and Early Development of Life
Gibson, Everett K.; McKay, David S.; Thomas-Keprta, Kathie L.; Clemett, Simon J.; Wentworth, Susan J.; [2007]; 4 pp.; In English; 7th Mars Conference, 9-13 Jul. 2007, Pasadena, CA, USA; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018024

The exploration of Mars during the past decades has begun to unveil the history of the planet. The combinations of remote sensing, in situ geochemical compositional measurements and photographic observations from both above and on the surface have shown Mars to have a dynamic and active geologic evolution. Mars geologic evolution clearly had conditions that were suitable for supporting life. For a planet to be able to be habitable, it must have water, carbon sources, energy sources and a dynamic geologic past. Mars meets all of these requirements. The first 600 My of Martian history were ripe for life to develop because of the abundance of (i) Water-carved canyons and oceans or lakes with the early presence of near surface water shown by precipitated carbonates in ALH84001 well-dated at approx.3.9 Gy., (ii) Energy from the original accretional processes, a molten core which generated a strong magnetic field leaving a permanent record in the early crust, early active volcanism continuing throughout Martian history, and, and continuing impact processes, (iii) Carbon and water from possibly extensive

volcanic outgassing (i.e. H2O, CO2, CH4, CO, O2, N2, H2S, SO2, etc.) and (iv) some crustal tectonics as revealed by faulting and possible plate movement reflected by the magnetic pattern in the crust. The question arises: 'Why would life not evolve from these favorable conditions on early Mars in its first 600 My?' During this period, it seems likely that environmental near-surface conditions on Mars were more favorable to life than at any later time. Standing bodies of water, precipitation and flowing surface water, and possibly abundant hydrothermal energy would all favor the formation of early life. Even if life developed elsewhere (on Earth, Venus, or on other solar systems) and was transported to Mars, the surface conditions were likely very hospitable for that introduced life to multiply and evolve.
Author
Mars Environment; Planetary Geology; Surface Properties; Tectonics; Mars (Planet); Carbon Dioxide; Geochemistry; Habitability

20070018025 NASA Johnson Space Center, Houston, TX, USA
Extraterrestrial Moessbauer Spectroscopy: More than Three Years of Mars Exploration and Developments for Future Missions
Schroeder, Christian; Klingelhoefer, Goestar; Morris, Richard V.; Rodionov, Daniel S.; Fleischer, Iris; Blumers, Mathias; 2007; 1 pp.; In English; International Conference on the Application of the Mossbauer Effect, 14-19 Oct. 2007, Kanpur, India; Copyright; Avail.: CASI: A01, Hardcopy

The NASA Mars Exploration Rovers (MER), Spirit and Opportunity, landed on the Red Planet in January 2004. Both rovers are equipped with a miniaturized Moessbauer spectrometer MIMOS II. Designed for a three months mission, both rovers and both Moessbauer instruments are still working after more than three years of exploring the Martian surface. At the beginning of the mission, with a landed intensity of the Moessbauer source of 150 mCi, a 30 minute touch and go measurement produced scientifically valuable data while a good quality Moessbauer spectrum was obtained after approximately eight hours. Now, after about five halflives of the sources have passed, Moessbauer integrations are routinely planned to last approx.48 hours. Because of this and other age-related hardware degradations of the two rover systems, measurements now occur less frequently, but are still of outstanding quality and scientific importance. Summarizing important Moessbauer results, Spirit has traversed the plains from her landing site in Gusev crater and is now, for the greater part of the mission, investigating the stratigraphically older Columbia Hills. Olivine in rocks and soils in the plains suggests that physical rather than chemical processes are currently active.
Author
Roving Vehicles; Mars Landing Sites; Mars Exploration; Mars Craters; Mars Surface; Miniaturization

20070018151 NASA Glenn Research Center, Cleveland, OH, USA
Calculation of Excavation Force for ISRU on Lunar Surface
Zeng, Xiangwu (David); Burnoski, Louis; Agui, Juan H.; Wilkinson, Allen; January 8, 2007; 11 pp.; In English; 45th AIAA Aerospace Sciences Meeting Exhibit, 8-11 Jan. 2007, Reno, NV, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNC06AA31A; WBS 387498.04.01.01.01.03; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018151

Accurately predicting the excavation force that will be encountered by digging tools on the lunar surface is a crucial element of in-situ resource utilization (ISRU). Based on principles of soil mechanics, this paper develops an analytical model that is relatively simple to apply and uses soil parameters that can be determined by traditional soil strength tests. The influence of important parameters on the excavation force is investigated. The results are compared with that predicted by other available theories. Results of preliminary soil tests on lunar stimulant are also reported.
Author
In Situ Resource Utilization; Lunar Surface; Excavation; Soil Science; Mathematical Models

20070018168 LZ Technology, Inc., Alvin, TX, USA
Determining Desirable Cursor Control Device Characteristics for NASA Exploration Missions
Sandor, Aniko; Holden, Kritina; May 4, 2007; 2 pp.; In English; Human Factors and Ergonomics Society, 4 May 2007, Houston, TX, USA; Copyright; Avail.: Other Sources; Abstract Only

The Crew Exploration Vehicle (CEV) that will travel to the moon and Mars, and all future Exploration vehicles and habitats will be highly computerized, necessitating an accurate method of interaction with the computers. The design of a cursor control device will have to take into consideration g-forces, vibration, gloved operations, and the specific types of tasks

to be performed. The study described here is being undertaken to begin identifying characteristics of cursor control devices that will work well for the unique Exploration mission environments. The objective of the study is not to identify a particular device, but to begin identifying design characteristics that are usable and desirable for space missions. Most cursor control devices have strengths and weaknesses; they are more appropriate for some tasks and less suitable for others. The purpose of this study is to collect some initial usability data on a large number of commercially available and proprietary cursor control devices. A software test battery was developed for this purpose. Once data has been collected using these low-level, basic point/click/drag tasks, higher fidelity, scenario-driven evaluations will be conducted with a reduced set of devices. The standard tasks used for testing cursor control devices are based on a model of human movement known as Fitts law. Fitts law predicts that the time to acquire a target is logarithmically related to the distance over the target size. To gather data for analysis with this law, fundamental, low-level tasks are used such as dragging or pointing at various targets of different sizes from various distances. The first four core tasks for the study were based on the ISO 9241-9:(2000) document from the International Organization for Standardization that contains the requirements for non-keyboard input devices. These include two pointing tasks, one dragging and one tracking task. The fifth task from ISO 9241-9, the circular tracking task was not used because it is a movement that is not applicable to most of the applications used on aviation displays. Additionally, we opted to add a multi-size and multi-distance pointing task, and two ecologically more valid tasks which included text selection, and interaction with drop down menus, sliders, and checkboxes. The Visual Basic test battery tracks the task and trial numbers, measures the pointing, tracking or dragging time, as well as the number and types of errors. The testing session includes a practice set for each input device, then the randomized 7 tasks, and finally a questionnaire about the device. This is repeated for all the devices tested within a session. The experiment is a within-subjects design, with participants returning for multiple sessions to test additional devices. The input devices will be compared based on objective performance data from the tasks, as well as subjective feedback and ratings on the questionnaire.
Author
Control Equipment; Mars Exploration; NASA Space Programs; Crew Exploration Vehicle; Space Missions

20070018187 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Mars Science Laboratory Entry, Descent and Landing Overview
Umland, Jeffrey W.; June 29, 2006; 8 pp.; In English; 4th International Planetary Probe Workshop, 27-30 Jun. 2006, Pasadena, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/39871

This viewgraph presents an overview of the Mars Science Laboratory. It shows the instruments on the lander, the comparative size to a very small automobile. The presentation also shows the planned method of landing the vessel on the Mars surface.
CASI
Mars Landing; Mars Missions; Mars Probes; Mars Roving Vehicles; Trajectory Planning; Mission Planning

20070018188 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Cassini Engineering Operations at Saturn
Standley, Shaun; June 19, 2006; 10 pp.; In English; AIAA 9th International Conference on Spacecraft Operations (SpaceOps), 16-24 Jun. 2006, Rome, Italy; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/39872

These presentation viewgraphs shows the engineering operations that have contributed to the unprecedented scientific success of the Cassini and Huygens missions, and how engineering operations are planned and implemented in concert with the required sequence of science observations. Frequent Orbit Trim Maneuvers (OTM) keep Cassini on the correct trajectory to complete the planned Saturn Tour. Considerable effort has been invested in detailed planning of the complete set of science observations associated with this Tour, so a robust OTM strategy is necessary to protect this investment by ensuring the spacecraft keeps to the planned trajectory.
Author (revised)
Cassini Mission; Interplanetary Trajectories; Orbital Maneuvers; Titan; Trajectory Planning; Mission Planning

20070018206 NASA Johnson Space Center, Houston, TX, USA
Possible Evidence for Iron Sulfates, Iron Sulfides, and Elemental Sulfur at Gusev Crater, Mars, from Mer, Crism, and Analog Data
Morris, R. V.; Ming, D. W.; Yen, A.; Arvidson, R. E.; Gruener, J.; Humm, D.; Klingelhoefer, G.; Murchie, S.; Schroeder, C.; Seelos, F., IV; Squyres, S.; Wiseman, S.; Wolff, M.; July 9, 2007; 4 pp.; In English; Seventh International Conference on

Mars, 9-13 Jul. 2007, Pasadena, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The Mossbauer (MB) spectrometers on the Mars Exploration Rovers (MER) Spirit (Gusev crater) and Opportunity (Meridiani Planum) have detected 14 Fe-bearing phases, and mineralogical assignments have been made for all except 3. Identified Fe2+-bearing phases are olivine, pyroxene, ilmenite, and troilite. Magnetite and chromite are present as mixed Fe(2+) and Fe(3+) phases. Identified Fe(3+) phase are jarosite, hematite, goethite, and nanophase ferric oxide (npOx). Fe(sup 0) (iron metal) is present as kamacite. Nanophase ferric oxide (npOx) is a generic name for octahedrally coordinated Fe(3+) alteration products that cannot be otherwise mineralogically assigned on the basis of MER data. On the Earth, npOx would include ferrihydrite, iddingsite, schwertmannite, akaganeite, and superparamagnetic hematite and goethite. The Mars Reconnaissance Orbiter CRISM instrument, a visible, near-IR hyperspectral imager (approximately 0.35 to 4 micron) enables mineralogical examination of Mars with a tool that is sensitive to H2O and to M-OH (M = Al, Si, Fe, Mg, etc.) at spatial resolution of about 20 m/pixel. We examined a CRISM image of the MER region of Gusev crater (Columbia Hills and plains to the west), looking for spectral evidence of the aqueous process apparent from the MER analyses. We also searched for spectral constraints for the mineralogical composition of our unidentified Fe-bearing phases and the forms of npOx present on Mars. We also consider evidence from analogue samples that the precursor for the goethite detected by MB in Clovis Class rocks is an iron sulfide. We suggest that there is some indirect evidence that elemental sulfur might be present to different extents in Clovis Class rocks, the Fe3Sulfate-rich soils, and perhaps even typical (Laguna Class) surface soils.
Derived from text

Iron; Mars Surface; Mineralogy; Sulfides; Sulfur; Planetary Composition; Mars (Planet)

20070018211 NASA Johnson Space Center, Houston, TX, USA

Experimental Shock Decomposition of Siderite and the Origin of Magnetite in Martian Meteorite ALH84001

Bell, Mary Sue; [2007]; 39 pp.; In English; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070018211

Shock recovery experiments to determine whether magnetite could be produced by the decomposition of iron-carbonate were initiated. Naturally occurring siderite was first characterized by electron microprobe (EMP), transmission electron microscopy (TEM), Mossbauer spectroscopy, and magnetic susceptibility measurements to be sure that the starting material did not contain detectable magnetite. Samples were shocked in tungsten-alloy holders (W=90%, Ni=6%, Cu=4%) to further insure that any iron phases in the shock products were contributed by the siderite rather than the sample holder. Each sample was shocked to a specific pressure between 30 to 49 GPa. Previously reported results of TEM analyses on 49 GPa experiments indicated the presence of nano-phase spinel-structured iron oxide. Transformation of siderite to magnetite as characterized by TEM was found in the 49 GPa shock experiment. Compositions of most magnetites are greater than 50% Fe sup(+2) in the octahedral site of the inverse spinel structure. Magnetites produced in shock experiments display the same range of single-domain, superparamagnetic sizes (approx. 50 100 nm), compositions (100% magnetite to 80% magnetite-20% magnesioferrite), and morphologies (equant, elongated, euhedral to subhedral) as magnetites synthesized by Golden et al. (2001) or magnetites grown naturally by MV1 magnetotactic bacteria, and as the magnetites in Martian meteorite ALH84001. Fritz et al. (2005) previously concluded that ALH84001 experienced approx. 32 GPa pressure and a resultant thermal pulse of approx. 100 - 110 C. However, ALH84001 contains evidence of local temperature excursions high enough to 1 melt feldspar, pyroxene, and a silica-rich phase. This 49 GPa experiment demonstrates that magnetite can be produced by the shock decomposition of siderite as a result of local heating to greater than 470 C. Therefore, magnetite in the rims of carbonates in Martian meteorite ALH84001 could be a product of shock devolatilization of siderite as well.
Author

Decomposition; Magnetite; Siderites; SNC Meteorites

20070018263 NASA Marshall Space Flight Center, Huntsville, AL, USA

Process Demonstration For Lunar In Situ Resource Utilization-Molten Oxide Electrolysis (MSFC Independent Research and Development Project No. 5-81)

Curreri, P. A.; Ethridge, E. C.; Hudson, S. B.; Miller, T. Y.; Grugel, R. N.; Sen, S.; Sadoway, D. R.; August 2006; 36 pp.; In English

Report No.(s): NASA/TM-2006-214600; M-1169; Copyright; Avail.: CASI: A03, Hardcopy

The purpose of this Focus Area Independent Research and Development project was to conduct, at Marshall Space Flight Center, an experimental demonstration of the processing of simulated lunar resources by the molten oxide electrolysis process to produce oxygen and metal. In essence, the vision was to develop two key technologies, the first to produce materials

(oxygen, metals, and silicon) from lunar resources and the second to produce energy by photocell production on the Moon using these materials. Together, these two technologies have the potential to greatly reduce the costs and risks of NASA s human exploration program. Further, it is believed that these technologies are the key first step toward harvesting abundant materials and energy independent of Earth s resources.
Author
Lunar Resources; Electrolysis; Metals; In Situ Resource Utilization; Photoelectric Cells; Earth Resources

20070018342 NASA Langley Research Center, Hampton, VA, USA
A Method to have Multi-Layer Thermal Insulation Provide Damage Detection
Woodward, Stanley E.; Taylor, Bryant D.; Jones, Thomas W.; Shams, Qamar A.; Lyons, Frankel; Henderson, Donald; [2007]; 23 pp.; In English; 48th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 23-26 Apr. 2007, Waikiki, HI, USA; Original contains color illustrations
Report No.(s): AIAA 2007-1847; LAR-17295; LAR-17294; Copyright; Avail.: CASI: A03, Hardcopy

Design and testing of a multi-layer thermal insulation system that also provides debris and micrometeorite damage detection is presented. One layer of the insulation is designed as an array of passive open-circuit electrically conductive spiral trace sensors. The sensors are a new class of sensors that are electrically open-circuits that have no electrical connections thereby eliminating one cause of failure to circuits. The sensors are powered using external oscillating magnetic fields. Once electrically active, they produce their own harmonic magnetic fields. The responding field frequency changes if any sensor is damaged. When the sensors are used together in close proximity, the inductive coupling between sensors provides a means of telemetry. The spiral trace design using reflective electrically conductive material provides sufficient area coverage for the sensor array to serves as a layer of thermal insulation. The other insulation layers are designed to allow the sensor s magnetic field to permeate the insulation layers while having total reflective surface area to reduce thermal energy transfer. Results of characterizing individual sensors and the sensor array s response to punctures are presented. Results of hypervelocity impact testing using projectiles of 1-3.6 millimeter diameter having speeds ranging from 6.7-7.1 kilometers per second are also presented.
Author
Detection; Multilayer Insulation; Thermal Insulation; Micrometeorites; Meteoritic Damage

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SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20070018209 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Roles of Flares and Shocks in determining SEP Abundances
Cane, H. V.; Mewaldt, R. A.; Cohen, C. M. S.; vonRosenvinge, T. T.; [2007]; ISSN 0148-0227; 19 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

We examine solar energetic particle (SEP) event-averaged abundances of Fe relative to O and intensity versus time profiles at energies above 25 MeV/nucleon using the SIS instrument on ACE. These data are compared with solar wind conditions during each event and with estimates of the strength of the associated shock based on average travel times to 1 AU. We find that the majority of events with an Fe to 0 abundance ratio greater than two times the average 5-12 MeV/nuc value for large SEP events (0.134) occur in the western hemisphere. Furthermore, in most of these Fe-rich events the profiles peak within 12 hours of the associated flare, suggesting that some of the observed interplanetary particles are accelerated in these flares. The vast majority of events with Fe/O below 0.134 are influenced by interplanetary shock acceleration. We suggest that variations in elemental composition in SEP events mainly arise from the combination of flare particles and shock acceleration of these particles and/or the ambient medium.
Author
Abundance; Energetic Particles; Solar Corpuscular Radiation; Solar Flares; Interplanetary Shock Waves

20070018224 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Solar Forced Dansgaard/Oeschger Events?
Muscheler, R.; Beer, J.; Geophysical Research Letters; Oct. 27, 2006; ISSN 0094-8276; Volume 33; 5 pp.; In English; Copyright; Avail.: Other Sources

Climate records for the last ice age (which ended 11,500 years ago) show enormous climate fluctuations in the North

Atlantic region - the so-called Dansgaard/Oeschger events. During these events air temperatures in Greenland changed on the order of 10 degrees Celsius within a few decades. These changes were attributed to shifts in ocean circulation which influences the warm water supply from lower latitudes to the North Atlantic region. Interestingly, the rapid warmings tend to recur approximately every 1500 years or multiples thereof. This has led researchers to speculate about an external cause for these changes with the variable Sun being one possible candidate. Support for this hypothesis came from climate reconstructions, which suggested that the Sun influenced the climate in the North Atlantic region on these time scales during the last approximately 12,000 years of relatively stable Holocene climate. However, Be-10 measurements in ice cores do not indicate that the Sun caused or triggered the Dansgaard/Oeschger events. Depending on the solar magnetic shielding more or less Be-10 is produced in the Earth's atmosphere. Therefore, 10Be can be used as a proxy for solar activity changes. Since Be-10 can be measured in ice cores, it is possible to compare the variable solar forcing directly with the climate record from the same ice core. This removes any uncertainties in the relative dating, and the solar-climate link can be reliably studied. Notwithstanding that some Dansgaard/Oeschger warmings could be related to increased solar activity, there is no indication that this is the case for all of the Dansgaard/Oeschger events. Therefore, during the last ice age the Be-10 and ice core climate data do not indicate a persistent solar influence on North Atlantic climate.
Author
Solar Activity; Geophysics; Climatology; Solar Physics

20070018264 NASA Marshall Space Flight Center, Huntsville, AL, USA
On the Relationship Between Spotless Days and the Sunspot Cycle: A Supplement
Wilson, Robert M.; Hathaway, David H.; August 2006; 68 pp.; In English
Report No.(s): NASA/TP-2006-214601; M-1170; No Copyright; Avail.: CASI: A04, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070018264

This study provides supplemental material to an earlier study concerning the relationship between spotless days and the sunspot cycle. Our previous study, Technical Publication (TP)-2005-213608 determined the timing and size of sunspot minimum and maximum for the new sunspot cycle, relative to the occurrence of the first spotless day during the declining phase of the old sunspot cycle and the last spotless day during the rising portion of the new cycle. Because the number of spotless days (NSD) rapidly increases as the cycle nears sunspot minimum and rapidly decreases thereafter, the size and timing of sunspot minimum and maximum might be more accurately determined using a higher threshold for comparison, rather than using the first and last spotless day occurrences. It is this aspect that is investigated more thoroughly in this TP.
Author
Sunspot Cycle; Sunspots; Sun; Predictions

20070018278 NASA Marshall Space Flight Center, Huntsville, AL, USA
Solar Rossby Wave 'Hills' Identified As Supergranules
Williams, P. E.; Hathaway, David H.; Cuntz, M.; [2007]; 12 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

We explore the nature of 'hills' observed on the solar surface which had previously been attributed to Rossby waves. We investigate the solar hills phenomenon by analyzing the output from a synthetic model based solely on the observed solar photospheric convection spectrum. We show that the characteristics of these hills can be explained by the corrugation of the surface produced by the radial flows of the convection. The hills in our simulations are dominated by supergranules, a well-known component of solar convection. Rossby waves have been predicted to exist within the Sun and may play an important role in the dynamics of the solar interior, including the Sun's differential rotation and magnetic dynamo. Our study suggests, however, that the hills observed at the solar limb do not confirm the existence of solar Rossby waves.
Author
Planetary Waves; Sun; Solar Limb; Simulation; Convection

20070018313 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Scheme for finding the Front Boundary of an Interplanetary Magnetic Cloud
Lepping, Ronald P.; Narock, Thomas W.; Wu, Chin-Chun; [2006]; 1 pp.; In English; 2006 AGU Fall Meeting, 10-15 Dec. 2006, San Francisco, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

We developed a scheme for finding the front boundary of an interplanetary magnetic cloud (MC) based on criteria that depend on the possible existence of any one or all of six specific solar wind features. The features that the program looks for, within +/- 2 hours of a preliminarily determined time for the front boundary, estimated either by visual inspection or by an

automatic MC identification scheme, are: (1) a sufficiently large directional discontinuity in the interplanetary magnetic field (IMF), (2) existence of a magnetic hole, (3) a significant proton plasma beta drop, (4) a significant proton temperature drop, (5) a marked increase in the IMF's intensity, and (6) a significant decrease in a normalized root-mean-square deviation (RMS)of the magnetic field - where the scheme was tested using 5, 10, 15, and 20 minute averages of the relevant physical quantities, in order to find the optimum average (and RMS) to use. Other criteria, besides these six, were examined and dismissed as not reliable, e.g., plasma speed. The scheme was developed specifically for aiding in forecasting the strength and timing of a geomagnetic storm due to the passage of an interplanetary MC in real-time, but can be used in post ground-data collection for imposition of consistency in choosing a MC's front boundary. The scheme has been extensively tested, first using 80 bona fide MCs over about 9 years of WIND data, and also for 121 MC-like structures as defined by a program that automatically identifies such structures over the same period. Optimum limits for various parameters in the scheme were found by statistical studies of the WIND MCs. The resulting limits can be user-adjusted for other data sets, if desired. Final testing of the 80 MCs showed that for 50 percent of the events the boundary estimates occurred within +/-10 minutes of visually determined times, 80 percent occurred within +/-30 minutes, and 91 percent occur within +/-60 minutes, and three or more individual boundary tests were passed for 88 percent of the total MCs. The scheme and its testing will be described.
Author

Boundaries; Interplanetary Magnetic Fields; Magnetic Clouds; Solar Wind; Solar Magnetic Field; Magnetic Field Configurations

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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*.

20070018244 NASA Johnson Space Center, Houston, TX, USA

The Ionizing Radiation Environment on the International Space Station: Performance vs. Expectations for Avionics and Materials

Koontz, Steven L.; Boeder, Paul A.; Pankop, Courtney; Reddell, Brandon; [2005]; 7 pp.; In English; 2005 IEEE NSREC, 11-15 Jul. 2005, Seattle, WA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A02, Hardcopy

The role of structural shielding mass in the design, verification, and in-flight performance of International Space Station (ISS), in both the natural and induced orbital ionizing radiation (IR) environments, is reported.
Author

Ionizing Radiation; International Space Station; Shielding; Avionics

Subject Term Index

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