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Langley Research Center
Scientific and Technical Information Program Office

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NASA STI Program ... in Profile

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

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  Hanover, MD 21076-1320

Introduction

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

STAR includes citations to R&D results reported in:

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

The NASA STI Program

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

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

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

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

NASA STI Availability Information

NASA Center for AeroSpace Information (CASI)

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

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

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National Technical Information Service (NTIS)

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

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

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

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

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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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01
AERONAUTICS (GENERAL)

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

20080008563 NASA Langley Research Center, Hampton, VA, USA

Spatially Developing Secondary Instabilities and Attachment Line Instability in Supersonic Boundary Layers

Li, Fei; Choudhari, Meelan M.; January 07, 2008; 20 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 984754

Report No.(s): AIAA Paper-2008-590; Copyright; Avail.: CASI: A03, Hardcopy

This paper reports on progress towards developing a spatial stability code for compressible shear flows with two inhomogeneous directions, such as crossflow dominated swept-wing boundary layers and attachment line flows. Certain unique aspects of formulating a spatial, two-dimensional eigenvalue problem for the secondary instability of finite amplitude crossflow vortices are discussed. A primary test case used for parameter study corresponds to the low-speed, NLF-0415(b) airfoil configuration as tested in the ASU Unsteady Wind Tunnel, wherein a spanwise periodic array of roughness elements was placed near the leading edge in order to excite stationary crossflow modes with a specified fundamental wavelength. The two classes of flow conditions selected for this analysis include those for which the roughness array spacing corresponds to either the naturally dominant crossflow wavelength, or a subcritical wavelength that serves to reduce the growth of the naturally excited dominant crossflow modes. Numerical predictions are compared with the measured database, both as indirect validation for the spatial instability analysis and to provide a basis for comparison with a higher Reynolds number, supersonic swept-wing configuration. Application of the eigenvalue analysis to the supersonic configuration reveals that a broad spectrum of stationary crossflow modes can sustain sufficiently strong secondary instabilities as to potentially cause transition over this configuration. Implications of this finding for transition control in swept wing boundary layers are examined. Finally, extension of the spatial stability analysis to supersonic attachment line flows is also considered.

Author

Stability; Supersonic Boundary Layers; Computational Fluid Dynamics; Shear Flow; Swept Wings

20080008574 NASA Langley Research Center, Hampton, VA, USA

Bayesian Inference in the Modern Design of Experiments

DeLoach, Richard; January 07, 2008; 26 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 122711.03.09.07.07; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080008574

This paper provides an elementary tutorial overview of Bayesian inference and its potential for application in aerospace experimentation in general and wind tunnel testing in particular. Bayes Theorem is reviewed and examples are provided to illustrate how it can be applied to objectively revise prior knowledge by incorporating insights subsequently obtained from additional observations, resulting in new (posterior) knowledge that combines information from both sources. A logical merger of Bayesian methods and certain aspects of Response Surface Modeling is explored. Specific applications to wind tunnel testing, computational code validation, and instrumentation calibration are discussed.

Author

Bayes Theorem; Experiment Design; Wind Tunnel Tests; Regression Analysis

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.

20080006600 NASA Glenn Research Center, Cleveland, OH, USA

Recent Progress in Aircraft Noise Research

Envia, Edmane; Thomas, Russell; October 16, 2007; 43 pp.; In English; Fundamental Aeronautics Annual Meeting, 30 Oct. - 1 Nov. 2007, New Orleans, LA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.18.03; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080006600

An overview of the acoustics research at NASA under the Subsonic Fixed Wing project is given. The presentation describes the rationale behind the noise reduction goals of the project in the context of the next generation air transportation system, and the emphasis placed on achieving these goals through a combination of the in-house and collaborative efforts with industry, universities and other government agencies. The presentation also describes the in-house research plan which is focused on the development of advanced noise and flow diagnostic techniques, next generation noise prediction tools, and novel noise reduction techniques that are applicable across a wide range of aircraft.

Author

Acoustics; Noise Reduction; Aerodynamic Noise; Aircraft Noise

20080006643 NASA Glenn Research Center, Cleveland, OH, USA

The Potential Benefits of Advanced Casing Treatment for Noise Attenuation in Utra-High Bypass Ratio Turbofan Engines

Elliott, David; December 2007; 17 pp.; In English; 35th International Congress and Exposition on Noise Control Engineering (INTER-NOISE 2006), 3-6 Dec. 2006, Honolulu, HI, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.03.01

Report No.(s): NASA/TM-2007-214812; E-15967; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080006643

In order to increase stall margin in a high-bypass ratio turbofan engine, an advanced casing treatment was developed that extracted a small amount of flow from the casing behind the fan and injected it back in front of the fan. Several different configurations of this casing treatment were designed by varying the distance of the extraction and injection points, as well as varying the amount of flow. These casing treatments were tested on a 55.9 cm (22 in.) scale model of the Pratt & Whitney Advanced Ducted Propulsor in the NASA Glenn 9 by 15 Low Speed Wind Tunnel. While all of the casing treatment configurations showed the expected increase in stall margin, a few of the designs showed a potential noise benefit for certain engine speeds. This paper will show the casing treatments and the results of the testing as well as propose further research in this area. With better prediction and design techniques, future casing treatment configurations could be developed that may result in an optimized casing treatment that could conceivably reduce the noise further.

Author

Injection; Extraction; Ducts; Bypass Ratio; Turbofan Engines; Noise Reduction

20080008345

Aerodynamic Analysis of Simulated Heat Shield Recession for the Orion Command Module

January 07, 2008; 16 pp.; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

The aerodynamic effects of the recession of the ablative thermal protection system for the Orion Command Module of the Crew Exploration Vehicle are important for the vehicle guidance. At the present time, the aerodynamic effects of recession being handled within the Orion aerodynamic database indirectly with an additional safety factor placed on the uncertainty bounds. This study is an initial attempt to quantify the effects for a particular set of recessed geometry shapes, in order to provide more rigorous analysis for managing recession effects within the aerodynamic database. The aerodynamic forces and moments for the baseline and recessed geometries were computed at several trajectory points using multiple CFD codes, both viscous and inviscid. The resulting aerodynamics for the baseline and recessed geometries were compared. The forces (lift, drag) show negligible differences between baseline and recessed geometries. Generally, the moments show a difference between baseline and recessed geometries that correlates with the maximum amount of recession of the geometry. The

difference between the pitching moments for the baseline and recessed geometries increases as Mach number decreases (and the recession is greater), and reach a value of -0.0026 for the lowest Mach number. The change in trim angle of attack increases from approx. 0.5deg at M = 28.7 to approx. 1.3deg at M = 6, and is consistent with a previous analysis with a lower fidelity engineering tool. This correlation of the present results with the engineering tool results supports the continued use of the engineering tool for future work. The present analysis suggests there does not need to be an uncertainty due to recession in the Orion aerodynamic database for the force quantities. The magnitude of the change in pitching moment due to recession is large enough to warrant inclusion in the aerodynamic database. An increment in the uncertainty for pitching moment could be calculated from these results and included in the development of the aerodynamic database uncertainty for pitching moment.

Author

Command Modules; Heat Shielding; Thermal Protection; Aerodynamic Forces; Design Analysis; Aerodynamic Characteristics; Computational Fluid Dynamics

20080008549 American Inst. of Aeronautics and Astronautics, Reston, VA, USA

Breathing New Hope into Hypersonics

Canan, James W.; Aerospace America; November 2007; ISSN 0740-722X, pp. 26-31; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Hypersonics technology development has faced many obstacles not, all of them technical. But interest in the field has increased following successful ground tests of the new NASA/DARPA/Air Force X-5 7A engine. Officials say the program's short-term purpose is only to prove the practicality of hypersonic scramjet propulsion. But they also note that this is an essential first step toward development of a high-speed, long-range missile and, ultimately of an operationally responsive hypersonic space launch vehicle.

Author

Hypersonic Flight; Hypersonics; Supersonic Combustion Ramjet Engines; Hypersonic Aircraft; Research Aircraft

20080008559 NASA Langley Research Center, Hampton, VA, USA

Aerothermodynamic Testing of the Crew Exploration Vehicle in the LaRC 20-Inch Mach 6 and 31-Inch Mach 10 Tunnels

Berger, Karen T.; January 07, 2008; 14 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 732759.07.05; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080008559

An experimental wind tunnel program is being conducted in support of a NASA wide effort to develop a Space Shuttle replacement and to support the Agency s long term objective of returning to the Moon and Mars. This report documents experimental measurements made on several scaled ceramic heat transfer models of the proposed Crew Exploration Vehicle Crew Module. The experimental data highlighted in this test report are to be used to assess numerical tools that will be used to generate the flight aerothermodynamic database. Global heat transfer images and heat transfer distributions were obtained over a range of freestream Reynolds numbers and angles of attack with the phosphor thermography technique. Heat transfer data were measured on the forebody and afterbody and were used to infer the heating on the vehicle as well as the boundary layer state on the forebody surface. Several model support configurations were assessed to minimize potential support interference. In addition, the ability of the global phosphor thermography method to provide quantitative heating measurements in the low temperature environment of the capsule base region was assessed. While naturally fully developed turbulent levels were not obtained on the forebody, the use of boundary layer trips generated fully developed turbulent flow. Laminar and turbulent computational results were shown to be in good agreement with the data. Backshell testing demonstrated the ability to obtain data in the low temperature region as well as demonstrating the lack of significant model support hardware influence on heating.

Author

Aerothermodynamics; Crew Exploration Vehicle; Heat Transfer; Ceramics; Angle of Attack; Reynolds Number; Thermography; Phosphors

20080008561 NASA Langley Research Center, Hampton, VA, USA

Fluorescence Imaging Study of Impinging Underexpanded Jets

Inman, Jennifer A.; Danehy, Paul M.; Nowak, Robert J.; Alderfer, David W.; January 07, 2008; 19 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 014368.09.07.01.08; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080008561

An experiment was designed to create a simplified simulation of the flow through a hole in the surface of a hypersonic aerospace vehicle and the subsequent impingement of the flow on internal structures. In addition to planar laser-induced fluorescence (PLIF) flow visualization, pressure measurements were recorded on the surface of an impingement target. The PLIF images themselves provide quantitative spatial information about structure of the impinging jets. The images also help in the interpretation of impingement surface pressure profiles by highlighting the flow structures corresponding to distinctive features of these pressure profiles. The shape of the pressure distribution along the impingement surface was found to be double-peaked in cases with a sufficiently high jet-exit-to-ambient pressure ratio so as to have a Mach disk, as well as in cases where a flow feature called a recirculation bubble formed at the impingement surface. The formation of a recirculation bubble was in turn found to depend very sensitively upon the jet-exit-to-ambient pressure ratio. The pressure measured at the surface was typically less than half the nozzle plenum pressure at low jet pressure ratios and decreased with increasing jet pressure ratios. Angled impingement cases showed that impingement at a 60deg angle resulted in up to a factor of three increase in maximum pressure at the plate compared to normal incidence.

Author

Laser Induced Fluorescence; Fluorescence; Surface Vehicles; Pressure Measurement; Ambience; Flow Visualization

20080008564 NASA Langley Research Center, Hampton, VA, USA

Initial Experiments and Analysis of Blunt-Edge Vortex Flows

Luckring, James M.; January 07, 2008; 16 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 526282.01.07.04.01

Report No.(s): AIAA Paper-2008-0378; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080008564

A review is presented of the initial experimental results and analysis that formed the basis the Vortex Flow Experiment 2 (VFE-2). The focus of this work was to distinguish the basic effects of Reynolds number, Mach number, angle of attack, and leading edge bluntness on separation-induced leading-edge vortex flows that are common to slender wings. Primary analysis is focused on detailed static surface pressure distributions, and the results demonstrate significant effects regarding the onset and progression of leading-edge vortex separation.

Author

Angle of Attack; Mach Number; Pressure Distribution; Reynolds Number; Slender Wings; Vortices; Wind Tunnel Tests; Blunt Leading Edges

20080008565 NASA Langley Research Center, Hampton, VA, USA

What Was Learned from the New VFE-2 Experiments?

Luckring, James M.; Hummel, Dietrich; January 07, 2008; 19 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 526282.01.07.04.01

Report No.(s): AIAA Paper-2008-0383; Copyright; Avail.: CASI: A03, Hardcopy

In the present paper the main results of the new experiments from Vortex Flow Experiment (VFE-2) are summarized. These include some force and moment results, surface and off-body measurements, as well as steady and fluctuating quantities. Some critical remarks are added, and an outlook for future investigations is given.

Author

Vortices; Delta Wings; Leading Edges; Angle of Attack; Reynolds Number; Wind Tunnel Tests

20080008566 NASA Langley Research Center, Hampton, VA, USA

Grid Quality and Resolution Issues from the Drag Prediction Workshop Series

Mavriplis, Dimitri J.; Vassberg, John C.; Tinoco, Edward N.; Mani, Mori; Brodersen, Olaf P.; Eisfeld, Bernhard; Wahls, Richard A.; Morrison, Joseph H.; Zickuhr, Tom; Levy, David; Murayama, Mitsuhiro; January 07, 2008; 25 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.07.20.03; Copyright; Avail.: CASI: A03, Hardcopy

The drag prediction workshop series (DPW), held over the last six years, and sponsored by the AIAA Applied Aerodynamics Committee, has been extremely useful in providing an assessment of the state-of-the-art in computationally based aerodynamic drag prediction. An emerging consensus from the three workshop series has been the identification of spatial discretization errors as a dominant error source in absolute as well as incremental drag prediction. This paper provides an overview of the collective experience from the workshop series regarding the effect of grid-related issues on overall drag prediction accuracy. Examples based on workshop results are used to illustrate the effect of grid resolution and grid quality on drag prediction, and grid convergence behavior is examined in detail. For fully attached flows, various accurate and successful workshop results are demonstrated, while anomalous behavior is identified for a number of cases involving substantial regions of separated flow. Based on collective workshop experiences, recommendations for improvements in mesh generation technology which have the potential to impact the state-of-the-art of aerodynamic drag prediction are given.
Author

Aerodynamic Drag; Computational Grids; Grid Generation (Mathematics); Computational Fluid Dynamics; Error Analysis; Grid Refinement (Mathematics)

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.

20080006664 Damos Aviation Services, Inc., Gurnee, IL USA

Foundations of Military Pilot Selection Systems: World War I

Damos, Diane L; Sep 2007; 23 pp.; In English

Contract(s)/Grant(s): DASW01-03-D-0016; Proj-A790; Proj-792

Report No.(s): AD-A474611; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes the development of the U.S. Army pilot selection system beginning in World War I. It starts with a review of aviation in the USA up to 1917. The phases of flight training then are described with the associated failure and fatality rates. Some cost estimates for each phase also are provided. Finally, the pilot selection system itself is described. Because the selection system was revised over time, the early system (administered from May, 1917 to February, 1918) is described first, followed by the revised system (administered from March, 1918 to November, 1918). Additions to the initial battery are described, as are the tests that were under development at the time of the Armistice.
DTIC

Military Operations; Personnel Selection; Pilot Selection; Pilots

20080006847 NASA Langley Research Center, Hampton, VA, USA

Multi-Terrain Impact Testing and Simulation of a Composite Energy Absorbing Fuselage Section

Fasanella, Edwin L.; Jackson, Karen E.; Lyle, Karen H.; Sparks, Chad E.; Sareen, Ashish K.; [2007]; 12 pp.; In English; Submitted to the Journal of American Helicopter Society to be published in volume 52, no. 2, pp. 159-168, April 2007; Original contains color and black and white illustrations

Contract(s)/Grant(s): 23-376-70-30-07; Copyright; Avail.: CASI: A03, Hardcopy

Comparisons of the impact performance of a 5-ft diameter crashworthy composite fuselage section were investigated for hard surface, soft soil, and water impacts. The fuselage concept, which was originally designed for impacts onto a hard surface only, consisted of a stiff upper cabin, load bearing floor, and an energy absorbing subfloor. Vertical drop tests were performed at 25-ft/s onto concrete, soft-soil, and water at NASA Langley Research Center. Comparisons of the peak acceleration values, pulse durations, and onset rates were evaluated for each test at specific locations on the fuselage. In addition to comparisons

of the experimental results, dynamic finite element models were developed to simulate each impact condition. Once validated, these models can be used to evaluate the dynamic behavior of subfloor components for improved crash protection for hard surface, soft soil, and water impacts.
Author
Crashworthiness; Fuselages; Impact Tests; Terrain; Aircraft Safety; Impact Resistance; Aircraft Parts; Aircraft Accidents

20080006877 NASA Glenn Research Center, Cleveland, OH, USA
Observations on the Growth of Roughness Elements Into Icing Feathers
Vargas, Mario; Tsao, Jen, Ching; December 2007; 30 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): WBS 645846.02.07.03.04.01
Report No.(s): NASA/TM-2007-214932; AIAA Paper-2007-0900; E-16114; Copyright; Avail.: CASI: A03, Hardcopy

This work presents the results of an experiment conducted in the Icing Research Tunnel at NASA Glenn Research Center to understand the process by which icing feathers are formed in the initial stages of ice accretion formation on swept wings. Close-up photographic data were taken on an aluminum NACA 0012 swept wing tip airfoil. Two types of photographic data were obtained: time sequence close-up photographic data during the run and close-up photographic data of the ice accretion at the end of each run. Icing runs were conducted for short ice accretion times from 10 to 180 sec. The time sequence close-up photographic data was used to study the process frame by frame and to create movies of how the process developed. The movies confirmed that at glaze icing conditions in the attachment line area icing feathers develop from roughness elements. The close-up photographic data at the end of each run showed that roughness elements change into a pointed shape with an upstream facet and join on the side with other elements having the same change to form ridges with pointed shape and upstream facet. The ridges develop into feathers when the upstream facet grows away to form the stem of the feather. The ridges and their growth into feathers were observed to form the initial scallop tips present in complete scallops.
Author
Swept Wings; Ice Formation; Flat Surfaces; Airfoils

20080008287 NASA Dryden Flight Research Center, Edwards, CA, USA
Weather and Flight Testing
Wiley, Scott; December 07, 2007; 68 pp.; In English; Weather and Flight Testing, 7 Dec. 2007, Edwards AFB, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A04, Hardcopy

This viewgraph document reviews some of the weather hazards involved with flight testing. Some of the hazards reviewed are: turbulence, icing, thunderstorms and winds and windshear. Maps, pictures, satellite pictures of the meteorological phenomena and graphs are included. Also included are pictures of damaged aircraft.
CASI
Flight Tests; Meteorological Parameters; Aviation Meteorology; Flight Conditions; Flight Hazards; Aircraft Hazards; Flight Safety

20080008291 NASA Langley Research Center, Hampton, VA, USA
Structural Analysis of the Right Rear Lug of American Airlines Flight 587
Raju, Ivatury S.; Glaessgen, Edward H.; Mason, Brian H.; Krishnamurthy, Thiagarajan; Davila, Carlos G.; November 20, 2006; 21 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 843515.03.01.07.03.01.11; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080008291

A detailed finite element analysis of the right rear lug of the American Airlines Flight 587 - Airbus A300-600R was performed as part of the National Transportation Safety Board s failure investigation of the accident that occurred on November 12, 2001. The loads experienced by the right rear lug are evaluated using global models of the vertical tail, local models near the right rear lug, and a global-local analysis procedure. The right rear lug was analyzed using two modeling approaches. In the first approach, solid-shell type modeling is used, and in the second approach, layered-shell type modeling is used. The solid-shell and the layered-shell modeling approaches were used in progressive failure analyses (PFA) to determine the load, mode, and location of failure in the right rear lug under loading representative of an Airbus certification test conducted in 1985 (the 1985-certification test). Both analyses were in excellent agreement with each other on the predicted failure loads, failure mode, and location of failure. The solid-shell type modeling was then used to analyze both a subcomponent test conducted by Airbus in 2003 (the 2003-subcomponent test) and the accident condition. Excellent

agreement was observed between the analyses and the observed failures in both cases. The moment, Mx (moment about the fuselage longitudinal axis), has significant effect on the failure load of the lugs. Higher absolute values of Mx give lower failure loads. The predicted load, mode, and location of the failure of the 1985- certification test, 2003-subcomponent test, and the accident condition are in very good agreement. This agreement suggests that the 1985-certification and 2003-subcomponent tests represent the accident condition accurately. The failure mode of the right rear lug for the 1985-certification test, 2003-subcomponent test, and the accident load case is identified as a cleavage-type failure. For the accident case, the predicted failure load for the right rear lug from the PFA is greater than 1.98 times the limit load of the lugs.
Author
European Airbus; Structural Analysis; Failure Analysis; Lugs; Finite Element Method; Loads (Forces); Tail Assemblies

20080008309 Industrial Coll. of the Armed Forces, Washington, DC USA
Aircraft Industry
Spicer, John; Al Garni, Fadel M; Bereda, Deborah; Bojarski, Janusz; Braley, Bill; Celigoy, John; Chandler, David; Crawford, Bruce; Goodwin, Brian; Haines, Linda; Jan 2007; 30 pp.; In English
Report No.(s): AD-A475079; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA475079

The aircraft industry plays a critical role in today's global economy. Comprising a wide array of firms supplying various products and services to a diverse and dynamic customer base, this industry represents a compelling case study from three distinct perspectives: a business strategy analysis, a review of the underlying economics, and an overview of national security issues. To provide this perspective, the study provides a description of the major markets comprising the industry followed by an analysis of the issues outlined above. Finally, the report details policy recommendations outlining the proper role of government in maintaining a vibrant industry.
DTIC
Aircraft Industry; Economic Development; Economic Impact

20080008434 NASA Langley Research Center, Hampton, VA, USA
Application of Probability Methods to Assess Crash Modeling Uncertainty
Lyle, Karen H.; Stockwell, Alan E.; Hardy, Robin C.; October 2007; 13 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 728-50-10-01; Copyright; Avail.: CASI: A03, Hardcopy

Full-scale aircraft crash simulations performed with nonlinear, transient dynamic, finite element codes can incorporate structural complexities such as: geometrically accurate models; human occupant models; and advanced material models to include nonlinear stress-strain behaviors, and material failure. Validation of these crash simulations is difficult due to a lack of sufficient information to adequately determine the uncertainty in the experimental data and the appropriateness of modeling assumptions. This paper evaluates probabilistic approaches to quantify the effects of finite element modeling assumptions on the predicted responses. The vertical drop test of a Fokker F28 fuselage section will be the focus of this paper. The results of a probabilistic analysis using finite element simulations will be compared with experimental data.
Author
Fuselages; Probability Theory; Stress-Strain Relationships; Aircraft Accidents

20080008569 RTI International, Research Triangle Park, NC, USA
Documentation for Three Wake Vortex Model Data Sets from Simulation of Flight 587 Wake Vortex Encounter Accident Case
Switzer, George F.; January 2008; 16 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAS1-02057; WBS 305295.02.07.07
Report No.(s): RTI/8438/006-02F; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080008569

This document contains a general description for data sets of a wake vortex system in a turbulent environment. The turbulence and thermal stratification of the environment are representative of the conditions on November 12, 2001 near John F. Kennedy International Airport. The simulation assumes no ambient winds. The full three dimensional simulation of the wake vortex system from a Boeing 747 predicts vortex circulation levels at 80% of their initial value at the time of the proposed vortex encounter. The linked vortex oval orientation showed no twisting, and the oval elevations at the widest point were about 20 meters higher than where the vortex pair joined. Fred Proctor of NASA?s Langley Research Center presented

the results from this work at the NTSB public hearing that started 29 October 2002. This document contains a description of each data set including: variables, coordinate system, data format, and sample plots. Also included are instructions on how to read the data.
Author
Three Dimensional Models; Turbulence; Vortices; Computerized Simulation; Aircraft Wakes; Flight 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.

20080006507 Air Force Research Lab., Wright-Patterson AFB, OH USA
Reduced-Order Modeling of the Random Response of Curved Beams Using Implicit Condensation (Preprint)
Gordon, Robert W; Hollkamp, Joseph J; May 2006; 14 pp.; In English
Contract(s)/Grant(s): Proj-A083
Report No.(s): AD-A475023; AFRL-RB-WP-TP-2007-326; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA475023

Accurate prediction of the response of aircraft skins to acoustic loading is important in the design of future air vehicles. Much work has been reported in recent years on prediction methods which reduce a finite element model to a reduced-order system of nonlinear modal equations. This body of work has shown good results for predicting the random response of flat structures. However, there have been few studies reported on reduced-order methods applied to structures with shallow curvature. Curvature complicates the analysis by introducing linear coupling of transverse and in-plane displacements. The implicit condensation and expansion (ICE) method, which eliminates the need for normal membrane vectors in the modal basis, has been shown to give accurate results for flat structures. This paper presents the results of a numerical study of the ICE method to predict the response of a thin, curved aluminum beam to random distributed loading. Power spectral densities of transverse and in-plane displacement from the ICE method agree very closely with those from direct integration of a full finite element model.
DTIC
Aircraft; Curved Beams; Models; Responses

20080006605 NASA Glenn Research Center, Cleveland, OH, USA
Sensor Selection and Optimization for Health Assessment of Aerospace Systems
Maul, William A.; Kopasakis, George; Santi, Louis M.; Sowers, Thomas S.; Chicatelli, Amy; January 2008; 32 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): WBS 136905.08.05.08.8.01.03; Copyright; Avail.: CASI: A03, Hardcopy

Aerospace systems are developed similarly to other large-scale systems through a series of reviews, where designs are modified as system requirements are refined. For space-based systems few are built and placed into service these research vehicles have limited historical experience to draw from and formidable reliability and safety requirements, due to the remote and severe environment of space. Aeronautical systems have similar reliability and safety requirements, and while these systems may have historical information to access, commercial and military systems require longevity under a range of operational conditions and applied loads. Historically, the design of aerospace systems, particularly the selection of sensors, is based on the requirements for control and performance rather than on health assessment needs. Furthermore, the safety and reliability requirements are met through sensor suite augmentation in an ad hoc, heuristic manner, rather than any systematic approach. A review of the current sensor selection practice within and outside of the aerospace community was conducted and a sensor selection architecture is proposed that will provide a justifiable, defendable sensor suite to address system health assessment requirements.
Author
Aerospace Systems; Sensors; Optimization; Systems Health Monitoring; Systems Integration; Mathematical Models

20080006638 NASA Dryden Flight Research Center, Edwards, CA, USA

The X-43A Six Degree of Freedom Monte Carlo Analysis

Baumann, Ethan; Bahm, Catherine; Strovers, Brian; Beck, Roger; Richard, Michael; December 2007; 50 pp.; In English; Original contains color and black and white illustrations

Report No.(s): NASA/TM-2007-214630; H-2683; Copyright; Avail.: CASI: A03, Hardcopy

This report provides an overview of the Hyper-X research vehicle Monte Carlo analysis conducted with the six-degree-of-freedom simulation. The methodology and model uncertainties used for the Monte Carlo analysis are presented as permitted. In addition, the process used to select hardware validation test cases from the Monte Carlo data is described. The preflight Monte Carlo analysis indicated that the X-43A control system was robust to the preflight uncertainties and provided the Hyper-X project an important indication that the vehicle would likely be successful in accomplishing the mission objectives. The X-43A in-flight performance is compared to the preflight Monte Carlo predictions and shown to exceed the Monte Carlo bounds in several instances. Possible modeling shortfalls are presented that may account for these discrepancies. The flight control laws and guidance algorithms were robust enough as a result of the preflight Monte Carlo analysis that the unexpected in-flight performance did not have undue consequences. Modeling and Monte Carlo analysis lessons learned are presented.

Author

Monte Carlo Method; Research Vehicles; Flight Control; Degrees of Freedom; Preflight Analysis; Control Theory; X-43 Vehicle

20080006639 NASA Dryden Flight Research Center, Edwards, CA, USA

Stability and Controls Analysis and Flight Test Results of a 24-Foot Telescoping Nose Boom on an F-15B Airplane

Moua, Cheng M.; Cox, Timothy H.; McWherter, Shaun C.; January 07, 2008; 24 pp.; In English; AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; Original contains color and black and white illustrations

Report No.(s): AIAA-2008-0126; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080006639

The Quiet Spike(TradeMark) F-15B flight research program investigated supersonic shock reduction using a 24-ft telescoping nose boom on an F-15B airplane. The program goal was to collect flight data for model validation up to 1.8 Mach. In the area of stability and controls, the primary concerns were to assess the potential destabilizing effect of the oversized nose boom on the stability, controllability, and handling qualities of the airplane and to ensure adequate stability margins across the entire research flight envelope. This paper reports on the stability and control analytical methods, flight envelope clearance approach, and flight test results of the F-15B telescoping nose boom configuration. Also discussed are brief pilot commentary on typical piloting tasks and refueling tasks.

Author

F-15 Aircraft; Flight Tests; Stability Tests; Controllability; Mach Number; Flight Envelopes

20080006640 NASA Dryden Flight Research Center, Edwards, CA, USA

The X-43A Six Degree of Freedom Monte Carlo Analysis

Baumann, Ethan; Bahm, Catherine; Strovers, Brian; Beck, Roger; January 07, 2008; 38 pp.; In English; 48th AIAA Aerospace Sciences Meeting and Exhibit, 7 Jan. 2008, Reno, NV, USA; Original contains black and white illustrations

Report No.(s): AIAA Paper-2008-0203; Copyright; Avail.: CASI: A03, Hardcopy

This report provides an overview of the Hyper-X research vehicle Monte Carlo analysis conducted with the six-degree-of-freedom simulation. The methodology and model uncertainties used for the Monte Carlo analysis are presented as permitted. In addition, the process used to select hardware validation test cases from the Monte Carlo data is described. The preflight Monte Carlo analysis indicated that the X-43A control system was robust to the preflight uncertainties and provided the Hyper-X project an important indication that the vehicle would likely be successful in accomplishing the mission objectives. The X-43A inflight performance is compared to the preflight Monte Carlo predictions and shown to exceed the Monte Carlo bounds in several instances. Possible modeling shortfalls are presented that may account for these discrepancies. The flight control laws and guidance algorithms were robust enough as a result of the preflight Monte Carlo analysis that the unexpected in-flight performance did not have undue consequences. Modeling and Monte Carlo analysis lessons learned are presented.

Author

X-43 Vehicle; Research Vehicles; Degrees of Freedom; Flight Control; Preflight Analysis; Monte Carlo Method

20080006646 NASA Glenn Research Center, Cleveland, OH, USA

Flight Testing an Iced Business Jet for Flight Simulation Model Validation

Ratvasky, Thomas P.; Barnhart, Billy P.; Lee, Sam; Cooper, Jon; December 2007; 23 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 457280.02.07.03.02

Report No.(s): NASA/TM-2007-214936; AIAA Paper-2007-0089; E-16113; Copyright; Avail.: CASI: A03, Hardcopy

A flight test of a business jet aircraft with various ice accretions was performed to obtain data to validate flight simulation models developed through wind tunnel tests. Three types of ice accretions were tested: pre-activation roughness, runback shapes that form downstream of the thermal wing ice protection system, and a wing ice protection system failure shape. The high fidelity flight simulation models of this business jet aircraft were validated using a software tool called 'Overdrive.' Through comparisons of flight-extracted aerodynamic forces and moments to simulation-predicted forces and moments, the simulation models were successfully validated. Only minor adjustments in the simulation database were required to obtain adequate match, signifying the process used to develop the simulation models was successful. The simulation models were implemented in the NASA Ice Contamination Effects Flight Training Device (ICEFTD) to enable company pilots to evaluate flight characteristics of the simulation models. By and large, the pilots confirmed good similarities in the flight characteristics when compared to the real airplane. However, pilots noted pitch up tendencies at stall with the flaps extended that were not representative of the airplane and identified some differences in pilot forces. The elevator hinge moment model and implementation of the control forces on the ICEFTD were identified as a driver in the pitch ups and control force issues, and will be an area for future work.

Author

Aircraft Icing; Flight Simulation; Thermal Protection; Surface Roughness; Ice Prevention; Flight Tests; Deicing

20080007530 NASA Dryden Flight Research Center, Edwards, CA, USA

CFD to Flight: Some Recent Success Stories of X-Plane Design to Flight Test at the NASA Dryden Flight Research Center

Cosentino, Gary B.; November 12, 2007; 9 pp.; In English; 2007 ITEA Symposium, 12-15 Nov. 2007, Kaua, HI, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080007530

Several examples from the past decade of success stories involving the design and flight test of three true X-planes will be described: in particular, X-plane design techniques that relied heavily upon computational fluid dynamics (CFD). Three specific examples chosen from the author s personal experience are presented: the X-36 Tailless Fighter Agility Research Aircraft, the X-45A Unmanned Combat Air Vehicle, and, most recently, the X-48B Blended Wing Body Demonstrator Aircraft. An overview will be presented of the uses of CFD analysis, comparisons and contrasts with wind tunnel testing, and information derived from the CFD analysis that directly related to successful flight test. Some lessons learned on the proper application, and misapplication, of CFD are illustrated. Finally, some highlights of the flight-test results of the three example X-planes will be presented. This overview paper will discuss some of the author s experience with taking an aircraft shape from early concept and three-dimensional modeling through CFD analysis, wind tunnel testing, further refined CFD analysis, and, finally, flight. An overview of the key roles in which CFD plays well during this process, and some other roles in which it does not, are discussed. How wind tunnel testing complements, calibrates, and verifies CFD analysis is also covered. Lessons learned on where CFD results can be misleading are also given. Strengths and weaknesses of the various types of flow solvers, including panel methods, Euler, and Navier-Stokes techniques, are discussed. The paper concludes with the three specific examples, including some flight test video footage of the X-36, the X-45A, and the X-48B.

Author

Flight Tests; X-36 Aircraft; Computational Fluid Dynamics; Three Dimensional Models; Blended-Wing-Body Configurations; Fighter Aircraft

20080008289 NASA Dryden Flight Research Center, Edwards, CA, USA

NASA Dryden's UAS Service Capabilities

Bauer, Jeff; January 2007; 3 pp.; In English; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080008289

The vision of NASA s Dryden Flight Research Center is to 'fly what others only imagine.' Its mission is to advance technology and science through flight. Objectives supporting the mission include performing flight research and technology integration to revolutionize aviation and pioneer aerospace technology, validating space exploration concepts, conducting airborne remote sensing and science missions, and supporting operations of the Space Shuttle and the International Space

Station. A significant focus of effort in recent years has been on Unmanned Aircraft Systems (UAS), both in support of the Airborne Science Program and as research vehicles to advance the state of the art in UAS. Additionally, the Center has used its piloted aircraft in support of UAS technology development. In order to facilitate greater access to the UAS expertise that exists at the Center, that expertise has been organized around three major capabilities. The first is access to high-altitude, long-endurance UAS. The second is the establishment of a test range for small UAS. The third is safety case assessment support.
Derived from text
Unmanned Aircraft Systems; Pilotless Aircraft; NASA Programs; Research Aircraft

20080008290 NASA Dryden Flight Research Center, Edwards, CA, USA
Autonomous Soaring
Lin, Victor P.; September 17, 2007; 21 pp.; In English; 2007 SAE AeroTech Congress and Exhibition, 17-20 Sep. 2007, Los Angeles, CA, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy ONLINE: http://hdl.handle.net/2060/20080008290

This viewgraph presentation reviews the autonomous soaring flight of unmanned aerial vehicles (UAV). It reviews energy sources for UAVs, and two examples of UAV's that used alternative energy sources, and thermal currents for soaring. Examples of flight tests, plans, and results are given. Ultimately, the concept of a UAV harvesting energy from the atmosphere has been shown to be feasible with existing technology.
CASI
Autonomy; Pilotless Aircraft; Soaring; Unmanned Aircraft Systems; Gliding; Convective Flow; Air Currents

20080008293 NASA Langley Research Center, Hampton, VA, USA
Interactive Inverse Design Optimization of Fuselage Shape for Low-Boom Supersonic Concepts
Li, Wu; Shields, Elwood; Le, Daniel; January 07, 2008; 27 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA
Contract(s)/Grant(s): WBS 984754.02.07.07.12.03; Copyright; Avail.: CASI: A03, Hardcopy

This paper introduces a tool called BOSS (Boom Optimization using Smoothest Shape modifications). BOSS utilizes interactive inverse design optimization to develop a fuselage shape that yields a low-boom aircraft configuration. A fundamental reason for developing BOSS is the need to generate feasible low-boom conceptual designs that are appropriate for further refinement using computational fluid dynamics (CFD) based preliminary design methods. BOSS was not developed to provide a numerical solution to the inverse design problem. Instead, BOSS was intended to help designers find the right configuration among an infinite number of possible configurations that are equally good using any numerical figure of merit. BOSS uses the smoothest shape modification strategy for modifying the fuselage radius distribution at 100 or more longitudinal locations to find a smooth fuselage shape that reduces the discrepancies between the design and target equivalent area distributions over any specified range of effective distance. For any given supersonic concept (with wing, fuselage, nacelles, tails, and/or canards), a designer can examine the differences between the design and target equivalent areas, decide which part of the design equivalent area curve needs to be modified, choose a desirable rate for the reduction of the discrepancies over the specified range, and select a parameter for smoothness control of the fuselage shape. BOSS will then generate a fuselage shape based on the designer's inputs in a matter of seconds. Using BOSS, within a few hours, a designer can either generate a realistic fuselage shape that yields a supersonic configuration with a low-boom ground signature or quickly eliminate any configuration that cannot achieve low-boom characteristics with fuselage shaping alone. A conceptual design case study is documented to demonstrate how BOSS can be used to develop a low-boom supersonic concept from a low-drag supersonic concept. The paper also contains a study on how perturbations in the equivalent area distribution affect the ground signature shape and how new target area distributions for low-boom signatures can be constructed using superposition of equivalent area distributions derived from the Seebass-George-Darden (SGD) theory.
Author
Sonic Booms; Computational Fluid Dynamics; Aircraft Design; Fuselages; Design Optimization

20080008296 NASA Langley Research Center, Hampton, VA, USA
Aerothermodynamic Testing and Boundary Layer Trip Sizing of the HIFiRE Flight 1 Vehicle
Berger, Karen T.; Greene, Frank A.; Kimmel, Roger; January 07, 2008; 14 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 732759.07.05; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080008296

An experimental wind tunnel test was conducted in the NASA Langley Research Center s 20-Inch Mach 6 Air Tunnel in

support of the Hypersonic International Flight Research Experimentation Program. The information in this report is focused on the Flight 1 configuration, the first in a series of flight experiments. This report documents experimental measurements made over a range of Reynolds numbers and angles of attack on several scaled ceramic heat transfer models of the Flight 1 payload. Global heat transfer was measured using phosphor thermography and the resulting images and heat transfer distributions were used to infer the state of the boundary layer on the vehicle windside and leeside surfaces. Boundary layer trips were used to force the boundary layer turbulent, and a brief study was conducted to determine the effectiveness of the trips with various heights. The experimental data highlighted in this test report were used to size and place the boundary layer trip for the flight test vehicle.
Author
Aerothermodynamics; Wind Tunnel Tests; Reynolds Number; Ceramics; Heat Transfer; Hypersonic Flight; Payloads; Phosphors; Thermography

20080008340 NASA, Washington, DC, USA
X-15: Extending the Frontiers of Flight
Jenkins, Dennis R.; 2007; 705 pp.; In English; Original contains color and black and white illustrations
Report No.(s): NASA/SP-2007-9-001-HQ; No Copyright; Avail.: CASI: C01, CD-ROM: A99, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080008340
A history of the design and achievements of the high-speed, 1950s-era X-15 airplane is presented. The following chapters are included: A New Science; A Hypersonic Research Airplane; Conflict and Innovation; The Million-Horsepower Engine; High Range and Dry Lakes; Preparations; The Flight Program; and the Research Program. Selected biographies, flight logs and physical characteristics of the X-15 Airplane are included in the appendices.
Derived from text
Hypersonics; X-15 Aircraft; Aircraft Design; Aircraft Performance; Histories

20080008496 Air Force Research Lab., Wright-Patterson AFB, OH USA
Air Force Power Requirements
Pfahler, David; Jan 24, 2006; 23 pp.; In English
Report No.(s): AD-A475172; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Briefing on power systems and requirements for Air Force aircraft.
DTIC
Aircraft; Electricity; Requirements

20080008570 NASA Dryden Flight Research Center, Edwards, CA, USA
Results of NASA/DARPA Automatic Probe and Drogue Refueling Flight Test
Schweikhard, Keith; October 11, 2006; 23 pp.; In English; SAE Guidance and Control Subcommittee Meeting, 11-13 Oct. 2006, Williamsburg, VA, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080008570
This viewgraph document reviews the results of the refueling flight test conducted by NASA and DARPA. In this test an F-18 jet used automatic engagement of the probe on the drogue of the F-18 to connect with the B707 Tanker aircraft. The tests demonstrated acquisition and tracking capability of the video tracking subsystem, demonstrated autonomous rendezvous capability, demonstrated the ability to plug in a turn and demonstrated the ability to plug in mild turbulence.
CASI
Autonomy; Flight Tests; Towed Bodies; Flight Operations; Air to Air Refueling

20080008571 NASA Dryden Flight Research Center, Edwards, CA, USA
Results of NASA/DARPA Automatic Probe and Drogue Refueling Flight Test
Schweikhard, Keith; May 08, 2007; 23 pp.; In English; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080008571
The following tasks were completed: 1) Designed, developed and successfully tested a prototype system to autonomously perform probe to drogue refueling; 2) Demonstrated acquisition and tracking capability of the video tracking subsystem; 3)

Demonstrated autonomous rendezvous capability; 4) Demonstrated the ability to plug in a turn; and 5) Demonstrated the ability to plug in mild turbulence.
Derived from text
Flight Tests; Air to Air Refueling; Target Acquisition; Autonomy

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.

20080006607 Federal Aviation Administration, Cambridge, MA, USA
Use of Traffic Displays for General Aviation Approach Spacing: A Human Factors Study
Nadler, E.; Yost, A.; Kendra, A.; December 2007; 41 pp.; In English; Original contains black and white illustrations
Report No.(s): DOT/FAA/AM-07/30; No Copyright; Avail.: CASI: A03, Hardcopy

A flight experiment was conducted to assess human factors issues associated with pilot use of traffic displays for approach spacing. Sixteen multi-engine rated pilots participated. Eight flew approaches in a twin-engine Piper Aztec originating in Sanford, ME, and eight flew approaches in the same aircraft originating in Atlantic City, NJ. The spacing target was a Cessna 206. The traffic display was either a Garmin International MX-20TM (the 'Basic' Cockpit Display of Traffic Information, or CDTI) or an MX-20TM modified with features to help the pilot monitor the closing rate, the range and ground speed of the traffic-to-follow, and ownship gound speed (Range Monitor). Two other Equipment conditions were Baseline and Autopilot. Pilots successhlly used the displays to maintain the assigned spacing on visual and instrument approaches. The spacing deviations were significantly lower when using the displays during visual approaches than when attempting to maintain spacing without a traffic display. The mean spacing deviation during the IFR alpproaches was less than 0.10 NM for all three equipment conditions (Basic CDTI, Range Monitor, Autopilot), and these mean spacing deviations did not differ significantly. Range Monitor features appeared to particularly benefit the low-.hour pilots. Wliile the traffic display reduced visual reacquisition times, this effect was only found with pilots whose displays showed addieiond traffic (not only the traffic-to-follow). In general, however, the additional traffic was associated with less time between fixations on the display and higher workload. Subjects appeared to have had difficulty identifying an optimal display range that would simultaneously provide traffic awareness and spacing task performance. The traffic display necessarily requires visual attention and reduces the attention available for scanning the instrument panel and on visual approaches, the outside world. For this reason, even if pilots assume responsibility for spacing when they temporarily lose visual contact with the assigned traffic-to-follow, they should notify ATC of the loss of visual contact so that controllers can assume responsibiIity for separation from other aircraft.
Author
Air Traffic Control; Display Devices; Human Factors Engineering; Human Performance; Workloads (Psychophysiology); Approach Control; Flight Paths; Aircraft Approach Spacing

20080008348 NASA Ames Research Center, Moffett Field, CA USA
Towards Determination of Visual Requirements for Augmented Reality Displays and Virtual Environments for the Airport Tower
Ellis, Stephen R.; Jun 1, 2006; 29 pp.; In English; Original contains color illustrations
Report No.(s): AD-A473306; Copyright; Avail.: CASI: A03, Hardcopy

The visual requirements for augmented reality or virtual environments displays that might be used in real or virtual towers are reviewed with respect to similar displays already used in aircraft. As an example of the type of human performance studies needed to determine the useful specifications of augmented reality displays, an optical see-through display was used in an ATC Tower simulation. Three different binocular fields of view (14 deg, 28 deg, and 47 deg) were examined to determine their effect on subjects# ability to detect aircraft maneuvering and landing. The results suggest that binocular fields of view much greater than 47 deg are unlikely to dramatically improve search performance and that partial binocular overlap is a feasible display technique for augmented reality Tower applications.
Author
Airport Towers; Display Devices; Drone Vehicles; Virtual Reality; Human Performance; Head-Up Displays; Augmentation

20080008577 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Target Tracking, Approach, and Camera Handoff for Automated Instrument Placement

Bajracharya, Max; Diaz-Calderon, Antonio; Robinson, Matthew; Powell, Mark; March 5, 2005; 8 pp.; In English; IEEE Aerospace Conference, Big SKy, MT, USA; Original contains black and white illustrations

Report No.(s): IEEEAC paper 1631; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40605

This paper describes the target designation, tracking, approach, and camera handoff technologies required to achieve accurate, single-command autonomous instrument placement for a planetary rover. It focuses on robust tracking integrated with obstacle avoidance during the approach phase, and image-based camera handoff to allow vision-based instrument placement. It also provides initial results from a complete system combining these technologies with rover base placement to maximize arm manipulability and image-based instrument placement.

Author

Tracking (Position); Image Analysis; Obstacle Avoidance; Roving Vehicles; Cameras

13
ASTRODYNAMICS

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

20080008567 NASA Langley Research Center, Hampton, VA, USA

Stardust Entry Reconstruction

Desai, Prasun N.; Qualls, Garry D.; January 07, 2008; 9 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 439654.02.08

Report No.(s): AIAA Paper-2008-1198; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080008567

An overview of the reconstruction analyses performed for the Stardust capsule entry is described. The results indicate that the actual entry was very close to the pre-entry predictions. The capsule landed 8.1 km north-northwest of the desired target at Utah Test and Training Range. Analyses of infrared video footage and radar range data (obtained from tracking stations) during the descent show that drogue parachute deployment was 4.8 s later than the pre-entry prediction, while main parachute deployment was 19.3 s earlier than the pre-set timer indicating that main deployment was actually triggered by the backup baroswitch. Reconstruction of a best estimated trajectory revealed that the aerodynamic drag experienced by the capsule during hypersonic flight was within 1% of pre-entry predications. Observations of the heatshield support the pre-entry estimates of small hypersonic angles of attack, since there was very little, if any, charring of the shoulder region or the aftbody. Through this investigation, an overall assertion can be made that all the data gathered from the Stardust capsule entry were consistent with flight performance close to nominal pre-entry predictions. Consequently, the design principles and methodologies utilized for the flight dynamics, aerodynamics, and aerothermodynamics analyses have been corroborated.

Author

Aerodynamic Drag; Aerodynamics; Design Analysis; Stardust Mission; Reentry Trajectories; Spacecraft Trajectories; Spacecraft Reentry; Flight Mechanics

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*.

20080006650 NASA Glenn Research Center, Cleveland, OH, USA

Crew Exploration Vehicle Ascent Abort Trajectory Analysis and Optimization

Falck, Robert D.; Gefert, Leon P.; December 2007; 14 pp.; In English; AIAA Guidance, Navigation and Control Conference and Exhibit, 20-23 Aug. 2007, Hilton Head, SC, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 644423.06.32.03.15.03

Report No.(s): NASA/TM-2007-214996; AIAA Paper-2007-6775; E-16199; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080006650

The Orion Crew Exploration Vehicle is the first crewed capsule design to be developed by NASA since Project Apollo.

Unlike Apollo, however, the CEV is being designed for service in both Lunar and International Space Station missions. Ascent aborts pose some issues that were not present for Apollo, due to its launch azimuth, nor Space Shuttle, due to its cross range capability. The requirement that a North Atlantic splashdown following an abort be avoidable, in conjunction with the requirement for overlapping abort modes to maximize crew survivability, drives the thrust level of the service module main engine. This paper summarizes 3DOF analysis conducted by NASA to aid in the determination of the appropriate propulsion system for the service module, and the appropriate propellant loading for ISS missions such that crew survivability is maximized.
Author
Abort Trajectories; Ascent Trajectories; Crew Exploration Vehicle; Trajectory Analysis; NASA Space Programs; Trajectory Optimization

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*.

20080008149 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Spacecraft Sterilization Using Non-Equilibrium Atmospheric Pressure Plasma
Cooper, Moogega; Vaze, Nachiket; Anderson, Shawn; Fridman, Gregory; Vasilets, Victor N.; Gutsol, Alexander; Tsapin, Alexander; Fridman, Alexander; August 26, 2007; 4 pp.; In English; 18th International Symposium on Plasma Chemistry, 26-31 Aug. 2007, Kyoto, Japan; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNH04ZSS001N; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40576

As a solution to chemically and thermally destructive sterilization methods currently used for spacecraft, non-equilibrium atmospheric pressure plasmas are used to treat surfaces inoculated with Bacillus subtilis and Deinococcus radiodurans. Evidence of significant morphological changes and reduction in viability due to plasma exposure will be presented, including a 4-log reduction of B. subtilis after 2 minutes of dielectric barrier discharge treatment.
Author
Spacecraft Sterilization; Plasma Equilibrium; Dielectrics; Atmospheric Pressure; Plasmas (Physics)

20080008292 NASA Langley Research Center, Hampton, VA, USA
Ares-I-X Vehicle Preliminary Range Safety Malfunction Turn Analysis
Beaty, James R.; Starr, Brett R.; Gowan, John W., Jr.; January 07, 2008; 9 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 136905.10.10.20.20; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080008292

Ares-I-X is the designation given to the flight test version of the Ares-I rocket (also known as the Crew Launch Vehicle - CLV) being developed by NASA. As part of the preliminary flight plan approval process for the test vehicle, a range safety malfunction turn analysis was performed to support the launch area risk assessment and vehicle destruct criteria development processes. Several vehicle failure scenarios were identified which could cause the vehicle trajectory to deviate from its normal flight path, and the effects of these failures were evaluated with an Ares-I-X 6 degrees-of-freedom (6-DOF) digital simulation, using the Program to Optimize Simulated Trajectories Version 2 (POST2) simulation framework. The Ares-I-X simulation analysis provides output files containing vehicle state information, which are used by other risk assessment and vehicle debris trajectory simulation tools to determine the risk to personnel and facilities in the vicinity of the launch area at Kennedy Space Center (KSC), and to develop the vehicle destruct criteria used by the flight test range safety officer. The simulation analysis approach used for this study is described, including descriptions of the failure modes which were considered and the underlying assumptions and ground rules of the study, and preliminary results are presented, determined by analysis of the trajectory deviation of the failure cases, compared with the expected vehicle trajectory.
Author
Ares 1 Launch Vehicle; Test Vehicles; Range Safety; Debris; Trajectory Analysis; Failure Modes; Malfunctions; Thrust Vector Control; Solid Propellant Rocket Engines

20080008346

Supersonic/Hypersonic Laminar Heating Correlations for Rectangular and Impact-Induced Open and Closed Cavities

January 07, 2008; 26 pp.; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

Impact and debris damage to the Space Shuttle Orbiter Thermal Protection System tiles is a random phenomenon, occurring at random locations on the vehicle surface, resulting in random geometrical shapes that are exposed to a definable range of surface flow conditions. In response to the 2003 Final Report of the Columbia Accident Investigation Board, wind tunnel aeroheating experiments approximating a wide range of possible damage scenarios covering both open and closed cavity flow conditions were systematically tested in hypersonic ground based facilities. These data were analyzed and engineering assessment tools for damage-induced fully-laminar heating were developed and exercised on orbit. These tools provide bounding approximations for the damaged-surface heating environment. This paper presents a further analysis of the baseline, zero-pressure-gradient, idealized, rectangular-geometry cavity heating data, yielding new laminar correlations for the floor-averaged heating, peak cavity endwall heating, and the downstream decay rate. Correlation parameters are derived in terms of cavity geometry and local flow conditions. Prediction Limit Uncertainty values are provided at the 95%, 99% and 99.9% levels of significance. Non-baseline conditions, including non-rectangular geometries and flows with known pressure gradients, are used to assess the range of applicability of the new correlations. All data variations fall within the 99% Prediction Limit Uncertainty bounds. Importantly, both open-flow and closed-flow cavity heating are combined into a single-curve parameterization of the heating predictions, and provide a concise mathematical model of the laminar cavity heating flow field with known uncertainty.

Author

Impact Damage; Aerodynamic Heating; Surface Properties; Cavity Flow; Laminar Flow; Space Debris; Thermal Protection; Tiles; Accident Investigation; Space Shuttle Orbiters

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*.

20080006791 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Limits on Interconnection Bandwidth for On-Board Processing

Lux, James P.; May 16, 2006; 15 pp.; In English; 17th Annual Workshop Interconnections within High-speed Digital Systems, 16 May 2006, Santa Fe, NM, USA; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40583

This viewgraph presentation reviews the constraints, and concerns of spacecraft design, in particular spacecraft instrumentation design and the issues concerning space communication. The advantages and disadvantages of several communication options are reviewed. Ultimately there will be spacecraft communication not between boxes on spacecraft, but between spacecraft. The future of spacecraft communication is interplanetary networks.

CASI

Bandwidth; Onboard Data Processing; Spacecraft Communication; Spacecraft Instruments; Wireless Communication

20080007091 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Changes in the Deep Space Network to Support the Mars Reconnaissance Orbiter

Berner, Jeff B.; Bhanji, Alaudin M.; Kurtik, Susan C.; June 19, 2006; In English; SpaceOps Earth, Moon, Mars, and Beyond, 19-23 Jun. 2006, Rome, Italy; Copyright; Avail.: Other Sources; Abstract Only

ONLINE: http://hdl.handle.net/2014/40586

In August of 2005, the Mars Reconnaissance Orbiter (MRO) was launched. Its mission is to orbit Mars, performing remote sensing of the planet. Its mission will either introduce new, or greatly expand upon, deep space telecommunication capabilities. To support the MRO requirements, there have been multiple changes implemented in NASA's Deep Space Network. These changes include the first deep space usage of Quadrature Phase Shift Keying (QPSK), high rate turbo coded links (up to 1.6 Mbps), high rate Reed-Solomon coded links (6 Mbps), and characterization and utilization of Ka-band for the downlink, both for telemetry and for navigational purposes. The challenges of implementing these changes are discussed.

Author

Deep Space Network; Mars Reconnaissance Orbiter; Satellite Transmission; Spacecraft Communication

20080007514 NASA Langley Research Center, Hampton, VA, USA

DAWN Mission Bus and Waveguide Venting Analysis Review

Cragg, Clinton H.; Kichak, Robert A.; Sutter, James K.; Holder, Donald; Jeng, Frank; Ruitberg, Arthur; Sank, Victor; October 2007; 41 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 510505.01.07.01.06

Report No.(s): NASA/TM-2007- 215091; NESC-RP-07-49/07-022-E; L-19423; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080007514

A concern was raised regarding the time after launch when the DAWN Mission Communications Subsystem, which contains a 100 Watt X-Band Traveling Wave Tube Amplifier (TWTA) with a high voltage ((approximately 7 Kilo Volt (KV)) Electronic Power Converter (EPC), will be powered on for the first post-launch downlink. This activation is planned to be approximately one hour after launch. Orbital Sciences (the DAWN Mission spacecraft contractor) typically requires a 24-hour wait period prior to high voltage initiation for Earth-orbiting Science and GEO spacecraft. The concern relates to the issue of corona and/or radio frequency (RF) breakdown of the TWTA ((high voltage direct current (DC) and RF)), and of the microwave components (high voltage RF) in the presence of partial atmospheric pressures or outgassing constituents. In particular, generally the diplexer and circulator are susceptible to RF breakdown in the corona region due to the presence of small physical gaps ((~ 2.5 millimeter (mm)) between conductors that carry an RF voltage. The NESC concurred the DAWN Mission communication system is safe for activation.

Author

Traveling Wave Amplifiers; Power Converters; Electric Potential; Microwave Tubes; Millimeter Waves; Radio Frequencies; Superhigh Frequencies; Direct Current

20080008152 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Challenges of Space Mission Interoperability

Martin, Warren L.; Hooke, Adrian J.; October 27, 2007; 23 pp.; In English; Executive Meeting on Space Communications Interoperability, 27 Oct. 2007, Geneva, Switzerland; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40574

This viewgraph presentation reviews some of the international challenges to space mission interoperability. Interoperability is the technical capability of two or more systems or components to exchange information and to use the information that has been exchanged. One of the challenges that is addressed is the problem of spectrum bandwidth, and interference. The key to interoperability is the standardization of space communications services and protocols. Various levels of international cross support are reviewed: harmony, cooperation cross support and confederation cross support. The various international bodies charged with implementing cross support are reviewed. The goal of the Interagency Operations Advisory Group (IOAG) is to achieve plug-and-play operations where all that is required is for each of the systems to use an agreed communications medium, after which the systems configure each other for the purpose of exchanging information and subsequently effect such exchange automatically.

Author

Interoperability; Space Missions; Standardization; Spacecraft Communication; International Cooperation

20080008382 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

An LO Phase Link Using a Commercial Geo-Stationary Satellite

Bardin, Joseph C.; Weinreb, Sander; Bagri, Durgadas S.; January 8, 2005; 19 pp.; In English; National Radio Science Meeting, 5-8 Jan. 2005, Boulder, CO, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40595

This viewgraph presentation reviews an experiment to determine feasibility of achieving 1 ps level time transfer using a satellite link and make use of inexpensive Ku band transmit/receive equipment. It reviews the advantages of Two Way Satellite Time Transfer using a commercial Geo-Stationary Satellite: (1) Commercial satellites are available (2) Significant cost reduction when compared to Hydrogen Masers and (3) Large footprint- entire US (including Hawaii) with just one satellite. CASI

Commercial Spacecraft; Signal Reception; Transmission; Superhigh Frequencies; Satellite Communication

18
SPACECRAFT DESIGN, TESTING AND PERFORMANCE

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

20080007517 NASA Langley Research Center, Hampton, VA, USA
GN&C Engineering Best Practices for Human-Rated Spacecraft Systems
Dennehy, Cornelius J.; Lebsock, Kenneth; West, John; August 20, 2007; 26 pp.; In English; AIAA Guidance, Navigation, and Control Conference and Exhibit, 20-23 Aug. 2007, Hilton Head, SC, USA
Contract(s)/Grant(s): WBS 510505.01.07.01.06
Report No.(s): AIAA Paper-2007-6336; Copyright; Avail.: CASI: A03, Hardcopy

The NASA Engineering and Safety Center (NESC) recently completed an in-depth assessment to identify a comprehensive set of engineering considerations for the Design, Development, Test and Evaluation (DDT&E) of safe and reliable human-rated spacecraft systems. Reliability subject matter experts, discipline experts, and systems engineering experts were brought together to synthesize the current 'best practices' both at the spacecraft system and subsystems levels. The objective of this paper is to summarize, for the larger Community of Practice, the initial set of Guidance, Navigation and Control (GN&C) engineering Best Practices as identified by this NESC assessment process.
Author
Aerospace Engineering; Systems Engineering; Satellite Design; Guidance (Motion); System Effectiveness; Navigation; Reliability

20080007518 NASA Langley Research Center, Hampton, VA, USA
External Tank (ET) Bipod Fitting Bolted Attachment Locking Insert Performance
Larsen, Curtis E.; Wilson, Tim R.; Elliott, Kenny B.; Raju, Ivatury S.; McManamen, John; January 2008; 23 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 510505.01.07.01.06
Report No.(s): NASA/TM-2008-215099; NESC-RP-06-53/06-032-E; L-19439; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080007518

Following STS-107, the External Tank (ET) Project implemented corrective actions and configuration changes at the ET bipod fitting. Among the corrective actions, the existing bolt lock wire which provided resistance to potential bolt rotation was removed. The lock wire removal was because of concerns with creating voids during foam application and potential for lock wire to become debris. The bolts had been previously lubricated to facilitate assembly but, because of elimination of the lock wire, the ET Project wanted to enable the locking feature of the insert. Thus, the lubrication was removed from bolt threads and instead applied to the washer under the bolt head. Lubrication is necessary to maximize joint pre-load while remaining within the bolt torque specification. The locking feature is implemented by thread crimping in at four places in the insert. As the bolt is torqued into the insert the bolt threads its way past the crimped parts of the insert. This provides the locking of the bolt, as torque is required to loosen the joint after clamping.
Author
External Tanks; Torque; Foams; Loads (Forces); Bolts; Clamps; Debris; Space Transportation System

20080008297 NASA Langley Research Center, Hampton, VA, USA
Aerothermodynamic Testing of Protuberances and Penetrations on the NASA Crew Exploration Vehicle Heat Shield in the NASA Langley 20-Inch Mach 6 Air Tunnel
Liechty, Derek S.; January 07, 2008; 12 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 732759.07.05; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080008297

An experimental wind tunnel program is being conducted in support of an Agency wide effort to develop a replacement for the Space Shuttle and to support the NASA s long-term objective of returning to the moon and then on to Mars. This paper documents experimental measurements made on several scaled ceramic heat transfer models of the proposed Crew Exploration Vehicle. Global heat transfer images and heat transfer distributions obtained using phosphor thermography were

used to infer interference heating on the Crew Exploration Vehicle Cycle 1 heat shield from local protuberances and penetrations for both laminar and turbulent heating conditions. Test parametrics included free stream Reynolds numbers of 1.0x10(exp 6)/ft to 7.25x10(exp 6)/ft in Mach 6 air at a fixed angle-of-attack. Single arrays of discrete boundary layer trips were used to trip the boundary layer approaching the protuberances/penetrations to a turbulent state. Also, the effects of three compression pad diameters, two radial locations of compression pad/tension tie location, compression pad geometry, and rotational position of compression pad/tension tie were examined. The experimental data highlighted in this paper are to be used to validate CFD tools that will be used to generate the flight aerothermodynamic database. Heat transfer measurements will also assist in the determination of the most appropriate engineering methods that will be used to assess local flight environments associated with protuberances/penetrations of the CEV thermal protection system.
Author
Aerothermodynamics; Angle of Attack; Wind Tunnel Tests; Ceramics; Heat Transfer; Thermography; Reynolds Number; Heat Shielding

20080008298 NASA Langley Research Center, Hampton, VA, USA
Aeroheating Test of CEV Entry Vehicle at Turbulent Conditions
Hollis, Brian R.; Berger, Karen T.; Horvath, Thomas J.; Coblish, Joseph J.; Norris, Joseph D.; Lillard, Randolph P.; Kirk, Ben; January 07, 2008; 5 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2007; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 732759.07.05
Report No.(s): AIAA-2008-1226; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080008298

An investigation of the aeroheating environment of the Project Orion Crew Entry Vehicle has been performed in the Arnold Engineering Development Center Tunnel 9. Data were measured on a approx. 3.5% scale model (0.1778m/7-inch diam.) of the vehicle using coaxial thermocouples in the Mach 8 and Mach 10 nozzles of Tunnel 9. Runs were performed at free stream Reynolds numbers of 1 106/ft to 20 10(exp 6)/ft in the Mach 10 nozzle and 8 10(exp 6)/ft to 48 10(exp 6)/ft in the Mach 8 nozzle. The test gas in Tunnel 9 is pure N2, which at these operating conditions remains un-dissociated and may be treated as a perfect gas. At these conditions, laminar, transitional, and turbulent flow was produced on the model at Mach 10, and transitional and turbulent conditions were produced on the model at Mach 8. The majority of runs were made on a clean, smooth-surface model configuration and a limited number of runs were made in which inserts with varying boundary-layer trips configurations were used to force the occurrence of transition. Laminar and turbulent predictions were generated for all wind tunnel test conditions and comparisons were performed with the data for the purpose of helping to define uncertainty margins for the computational method. Data from both the wind tunnel test and the computations are presented herein. Figure 1 shows a schematic of the thermocouple locations on the model and figures 2 and 3 show a photo and schematic of the AEDC Hypervelocity Tunnel 9. Figure 4 shows a typical grid used in the computations. From the comparisons shown in figures 5 through 8 it was concluded that for perfect-gas conditions, the computations could predict either fully-laminar or full-turbulent flow to within +/-10% of the experimental data. The experimental data showed that transition began on the leeside of the heatshield at a free stream Reynolds number of 9 10(exp 6)/ft in the Mach 10 nozzle and fully-developed turbulent flow was produced at 20 10(exp 6)/ft. In the Mach 8 nozzle, transition on the leeside of the heat-shield was observed for all test conditions, and full-developed turbulent flow occurred at a free stream Reynolds number of 18 10(exp 6)/ft. On the aftbody of the vehicle no evidence of turbulence was detected at Mach 10 conditions, and at Mach 8 conditions, transition appeared to begin on the windside of the aftbody at free stream Reynolds number of 18x10(exp 6)/ft with fully-developed turbulent flow occurring only at the highest test condition of 48x10(exp 6)/ft.
Author
Aerodynamic Heating; Thermocouples; Reynolds Number; Transition Flow; Turbulent Flow; Laminar Flow; Hypersonic Speed; Boundary Layers; Heat Shielding

20080008343 NASA Langley Research Center, Hampton, VA, USA
Visualization of Flowfield Modification by RCS Jets on a Capsule Entry Vehicle
Danehy, P. M.; Inman, J. A.; Alderfer, D. W.; Buck, G. M.; Schwartz, R.; January 07, 2008; 2 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080008343

Nitric oxide planar laser-induced fluorescence (NO PLIF) has been used to visualize the flow on the aft-body of an entry capsule having an activated RCS jet in NASA Langley Research Center's 31-Inch Mach 10 wind tunnel facility. A capsule

shape representative of the Apollo command module was tested. These tests were performed to demonstrate the ability of the PLIF method to visualize RCS jet flow while providing some preliminary input to NASA's Orion Vehicle design team. Two different RCS nozzle designs - conical and contoured - were tested. The conical and contoured nozzles had area ratios of 13.4 and 22.5 respectively. The conical nozzle had a half-angle of 10 . Low- and high-Reynolds number cases were investigated by changing the tunnel stagnation pressure from 350 psi to 1300 psi, resulting in freestream Reynolds numbers of 0.56 and 1.8 million per foot respectively. For both of these cases, three different jet plenum pressures were tested (nominally 56, 250 and 500 psi). A single angle-of-attack was investigated (24 degrees). NO PLIF uses an ultraviolet laser sheet to interrogate a slice in the flow containing seeded NO; this UV light excites fluorescence from the NO molecules which is detected by a high-speed digital camera. The system has spatial resolution of about 200 microns (2 pixel blurring) and has flow-stopping time resolution (approximately 1 microsecond). NO was seeded into the flow two different ways. First, the RCS jet fluid was seeded with approximately 1-5% NO, with the balance N2. This allowed observation of the shape, structure and trajectory of the RCS jets. Visualizations of both laminar and turbulent flow jet features were obtained. Visualizations were obtained with the tunnel operating at Mach 10 and also with the test section held at a constant pressure similar to the aftbody static pressure (0.04 psi) obtained during tunnel runs. These two conditions are called 'tunnel on' and 'tunnel off' respectively. Second, the forebody flow was seeded with a very low flowrate (<100 standard cubic centimeters per minute) of pure NO. This trace gas was entrained into and allowed visualization of the shear layer forming between the expansion fan on the shoulder of the model and the recirculating separated flow in the wake of the model. This shear layer was observed to be laminar in the absence of the RCS jet operation and turbulent above a certain RCS jet flowrate. Furthermore, the operation of the RCS jet is seen to push the shear layer out away from the model, with a higher jet pressures resulting in larger deflections. Figures show some data from this test, partially processed. In the final paper, these images will be processed and rendered on a three dimensional visualization of the test hardware for clearer visualization and interpretation of the flowfields.
Author
Laser Induced Fluorescence; Nitric Oxide; Nozzle Design; Reynolds Number; Flow Visualization; Spacecraft Reentry; Crew Exploration Vehicle

20080008344 NASA Langley Research Center, Hampton, VA, USA
Using Pressure- and Temperature-Sensitive Paint for Global Surface Pressure and Temperature Measurements on the Aft-Body of a Capsule Reentry Vehicle
Watkins, A. Neal; Buck, Gregory M.; Leighty, Bradley D.; Lipford, William E.; Oglesby, Donald M.; January 07, 2008; 17 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; Original contains color illustrations
Report No.(s): AIAA Paper-2008-1230; Copyright; Avail.: CASI: A03, Hardcopy

Pressure Sensitive Paint (PSP) and Temperature Sensitive Paint (TSP) were used to visualize and quantify the surface interactions of reaction control system (RCS) jets on the aft body of capsule reentry vehicle shapes. The first model tested was an Apollo-like configuration and was used to focus primarily on the effects of the forward facing roll and yaw jets. The second model tested was an early Orion Crew Module configuration blowing only out of its forward-most yaw jet, which was expected to have the most intense aerodynamic heating augmentation on the model surface. This paper will present the results from the experiments, which show that with proper system design, both PSP and TSP are effective tools for studying these types of interaction in hypersonic testing environments.
Author
Pressure Sensitive Paints; Temperature Sensitive Paints; Reentry Vehicles; Pressure Measurement; Surface Reactions; Afterbodies; Temperature Measurement; Aerodynamic Heating

20080008493 NASA Langley Research Center, Hampton, VA, USA
GN&C Engineering Best Practices for Human-Rated Spacecraft System
Dennehy, Cornelius J.; Lebsock, Kenneth; West, John; January 2008; 31 pp.; In English; AIAA Guidance, Navigation and Control Conference and Exhibit, 20-23 Aug. 2007, Hilton Head, SC, USA
Contract(s)/Grant(s): WBS 510505.01.07.01.06
Report No.(s): NASA/TM-2008-215106; L-19446; AIAA 2007-6336; Copyright; Avail.: CASI: A03, Hardcopy

The NASA Engineering and Safety Center (NESC) recently completed an in-depth assessment to identify a comprehensive set of engineering considerations for the Design, Development, Test and Evaluation (DDT&E) of safe and reliable human-rated spacecraft systems. Reliability subject matter experts, discipline experts, and systems engineering experts were brought together to synthesize the current 'best practices' both at the spacecraft system and subsystems levels. The objective of this paper is to summarize, for the larger Community of Practice, the initial set of Guidance, Navigation and

Control (GN&C) engineering Best Practices as identified by this NESC assessment process.
Author
Systems Engineering; Aerospace Engineering; Satellite Design; Product Development; Guidance (Motion); Navigation

20080008558 NASA Langley Research Center, Hampton, VA, USA
Experimental Measurement of RCS Jet Interaction Effects on a Capsule Entry Vehicle
Buck, Gregory M.; Watkins, A. Neal; Danehy, Paul M.; Inman, Jennifer A.; Alderfer, David W.; Dyakonov, Artem A.; January 07, 2008; 15 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 732759.07.05; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080008558

An investigation was made in NASA Langley Research Center s 31-Inch Mach 10 Tunnel to determine the effects of reaction-control system (RCS) jet interactions on the aft-body of a capsule entry vehicle. The test focused on demonstrating and improving advanced measurement techniques that would aid in the rapid measurement and visualization of jet interaction effects for the Orion Crew Exploration Vehicle while providing data useful for developing engineering models or validation of computational tools used to assess actual flight environments. Measurements included global surface imaging with pressure and temperature sensitive paints and three-dimensional flow visualization with a scanning planar laser induced fluorescence technique. The wind tunnel model was fabricated with interchangeable parts for two different aft-body configurations. The first, an Apollo-like configuration, was used to focus primarily on the forward facing roll and yaw jet interactions which are known to have significant aft-body heating augmentation. The second, an early Orion Crew Module configuration (4-cluster jets), was tested blowing only out of the most windward yaw jet, which was expected to have the maximum heating augmentation for that configuration. Jet chamber pressures and tunnel flow conditions were chosen to approximate early Apollo wind tunnel test conditions. Maximum heating augmentation values measured for the Apollo-like configuration (>10 for forward facing roll jet and 4 for yaw jet) using temperature sensitive paint were shown to be similar to earlier experimental results (Jones and Hunt, 1965) using a phase change paint technique, but were acquired with much higher surface resolution. Heating results for the windward yaw jet on the Orion configuration had similar augmentation levels, but affected much less surface area. Numerical modeling for the Apollo-like yaw jet configuration with laminar flow and uniform jet outflow conditions showed similar heating patterns, qualitatively, but also showed significant variation with jet exit divergence angle, with as much as 25 percent variation in heat flux intensity for a 10 degree divergence angle versus parallel outflow. These results along with the fabrication methods and advanced measurement techniques developed will be used in the next phase of testing and evaluation for the updated Orion RCS configuration.
Author
Wind Tunnel Tests; Jet Flow; Laminar Flow; Crew Exploration Vehicle; Three Dimensional Flow; Heat Flux; Yaw

20080008579 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Mars Aeronomy Explorer (MAX): Study Employing Distributed Micro-Spacecraft
Shotwell, Robert F.; Gray, Andrew A.; Illsley, Peter M.; Johnson, M.; Sherwood, Robert L.; Vozoff, M.; Ziemer, John K.; March 5, 2005; 10 pp.; In English; IEEE Aerospace Conference, 5-12 Mar. 2005, Big Sky, MT, USA; Original contains black and white illustrations
Report No.(s): IEEEAC Paper I400; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40603

An overview of a Mars Aeronomy Explorer (MAX) mission design study performed at NASA's Jet Propulsion Laboratory is presented herein. The mission design consists of ten micro-spacecraft orbiters launched on a Delta IV to Mars polar orbit to determine the spatial, diurnal and seasonal variation of the constituents of the Martian upper atmosphere and ionosphere over the course of one Martian year. The spacecraft are designed to allow penetration of the upper atmosphere to at least 90 km. This property coupled with orbit precession will yield knowledge of the nature of the solar wind interaction with Mars, the influence of the Mars crustal magnetic field on ionospheric processes, and the measurement of present thermal and nonthermal escape rates of atmospheric constituents. The mission design incorporates alternative design paradigms that are more appropriate for-and in some cases motivate-distributed micro-spacecraft. These design paradigms are not defined by a simple set of rules, but rather a way of thinking about the function of instruments, mission reliability/risk, and cost in a systemic framework.
Author
Mars Missions; Annual Variations; Aeronomy; Spatial Distribution; Mission Planning; Diurnal Variations; Mars Atmosphere; Plasma Interactions; Polar Orbits

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*.

20080006757 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Key and Driving Requirements for the Juno Payload of Instruments

Dodge, Randy; Boyles, Mark A.; Rasbach, Chuck E.; September 18, 2007; 19 pp.; In English; AIAA Space Conference & Exposition, Long Beach, California, September 18-20, 2007, 18-20 Sep. 2007, Long Beach, CA, USA; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40566

The Juno Mission was selected in the summer of 2005 via NASA's New Frontiers competitive AO process (refer to http://www.nasa.gov/home/hqnews/2005/jun/HQ_05138_New_Frontiers_2.html). The Juno project is led by a Principle Investigator based at Southwest Research Institute [SwRI] in San Antonio, Texas, with project management based at the Jet Propulsion Laboratory [JPL] in Pasadena, California, while the Spacecraft design and Flight System Integration are under contract to Lockheed Martin Space Systems Company [LM-SSC] in Denver, Colorado. the payload suite consists of a large number of instruments covering a wide spectrum of experimentation. The science team includes a lead Co-investigator for each one of the following experiments: A Magnetometer experiment (consisting of both a FluxGate Magnetometer (FGM) built at Goddard Space Flight Center GSFC] and a Scalar Helium Magnetometer (SHM) built at JPL, a MicroWave Radiometer (MWR) also built at JPL, a Gravity Science experiment (GS) implemented via the telecom subsystem, two complementary particle instruments (Jovian Auroral Distribution Experiment, JADE developed by SwRI and Juno Energetic-particle Detector Instrument, JEDI from the Applied Physics Lab (APL)--JEDI and JADE both measure electrons and ions), an Ultraviolet Spectrometer (UVS) also developed at SwRI, and a radio and plasma (WAVES) experiment (from the University of Iowa). In addition, a visible camera (JunoCam) is included in the payload to facilitate education and public outreach (designed & fabricated by Malin Space Science Systems [MSSS]).

Author

Payloads; Project Management; Systems Integration; Payload Integration Plan; Jupiter Probes

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*.

20080006633 NASA Marshall Space Flight Center, Huntsville, AL, USA

Conceptual Trade Study of General Purpose Heat Source Powered Stirling Converter Configurations

Turpin, J. B.; November 2007; 44 pp.; In English; Original contains color and black and white illustrations

Report No.(s): NASA/TM-2007-215132; M-1207; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080006633

This Technical Manual describes a parametric study of general purpose heat source (GPHS) powered Stirling converter configurations. This study was performed in support of MSFC s efforts to establish the capability to perform non-nuclear system level testing and integration of radioisotope power systems. Six different GPHS stack configurations at a total of three different power levels (80, 250, and 500 W(sub e) were analyzed. The thermal profiles of the integrated GPHS modules (for each configuration) were calculated to determine maximum temperatures for comparison to allowable material limits. Temperature profiles for off-nominal power conditions were also assessed in order to better understand how power demands from the Stirling engine impact the performance of a given configuration.

Author

Stirling Engines; Radioisotope Heat Sources; Temperature Profiles; Stirling Cycle; Systems Engineering

20080006642 NASA Glenn Research Center, Cleveland, OH, USA

Cryogenic Fluid Management Technologies for Advanced Green Propulsion Systems

Motil, Susan M.; Meyer, Michael L.; Tucker, Stephen P.; December 2007; 15 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): WBS 253225.04.01.01.03.01

Report No.(s): NASA/TM-2007-214810; AIAA Paper-2007-343; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080006642

In support of the Exploration Vision for returning to the Moon and beyond, NASA and its partners are developing and testing critical cryogenic fluid propellant technologies that will meet the need for high performance propellants on long-term missions. Reliable knowledge of low-gravity cryogenic fluid management behavior is lacking and yet is critical in the areas of tank thermal and pressure control, fluid acquisition, mass gauging, and fluid transfer. Such knowledge can significantly reduce or even eliminate tank fluid boil-off losses for long term missions, reduce propellant launch mass and required on-orbit margins, and simplify vehicle operations. The Propulsion and Cryogenic Advanced Development (PCAD) Project is performing experimental and analytical evaluation of several areas within Cryogenic Fluid Management (CFM) to enable NASA's Exploration Vision. This paper discusses the status of the PCAD CFM technology focus areas relative to the anticipated CFM requirements to enable execution of the Vision for Space Exploration.

Author

Cryogenic Fluids; Propulsion System Configurations; Space Exploration; Propellants; Fluid Management; Mass Transfer

20080006649 NASA Glenn Research Center, Cleveland, OH, USA

Initial Test Results of a Dual Closed-Brayton-Cycle Power Conversion System

Johnson, Paul K.; Mason, Lee S.; December 2007; 14 pp.; In English; Space Nuclear Conference 2007, 24-28 Jun. 2007, Boston, MA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS3-00145; WBS 850661.04.01.03

Report No.(s): NASA/TM-2007-214981; Paper 2057; E-16139; Copyright; Avail.: CASI: A03, Hardcopy

The dual Brayton power conversion system constructed for NASA Glenn Research Center (GRC) was acceptance tested April 2007 at Barber-Nichols, Inc., Arvada, Colorado. This uniquely configured conversion system is built around two modified commercial Capstone C30 microturbines and employs two closed-Brayton-cycle (CBC) converters sharing a common gas inventory and common heat source. Because both CBCs share the gas inventory, behavior of one CBC has an impact on the performance of the other CBC, especially when one CBC is standby or running at a different shaft speed. Testing performed to date includes the CBCs operating at equal and unequal shaft speeds. A test was also conducted where one CBC was capped off and the other was operated as a single CBC converter. The dual Brayton configuration generated 10.6 kWe at 75 krpm and a turbine inlet temperature of 817 K. Single Brayton operation generated 14.8 kWe at 90 krpm and a turbine inlet temperature of 925 K.

Author

Brayton Cycle; Closed Cycles; Energy Conversion; Heat Sources; Gas Turbines; Compressors

20080006654 NASA Glenn Research Center, Cleveland, OH, USA

NEXT Thruster Component Verification Testing

Pinero, Luis R.; Sovey, James S.; December 2007; 16 pp.; In English; 43rd Joint Propulsion Conference, 8-11 Jul. 2007, Cincinatti, OH, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 346620.04.05.03.15

Report No.(s): NASA/TM-2007-215036; AIAA Paper-2007-5276; E-16216; Copyright; Avail.: CASI: A03, Hardcopy

Component testing is a critical part of thruster life validation activities under NASA s Evolutionary Xenon Thruster (NEXT) project testing. The high voltage propellant isolators were selected for design verification testing. Even though they are based on a heritage design, design changes were made because the isolators will be operated under different environmental conditions including temperature, voltage, and pressure. The life test of two NEXT isolators was therefore initiated and has accumulated more than 10,000 hr of operation. Measurements to date indicate only a negligibly small increase in leakage current. The cathode heaters were also selected for verification testing. The technology to fabricate these heaters, developed for the International Space Station plasma contactor hollow cathode assembly, was transferred to Aerojet for the fabrication of the NEXT prototype model ion thrusters. Testing the contractor-fabricated heaters is necessary to validate fabrication processes for high reliability heaters. This paper documents the status of the propellant isolator and cathode heater tests.

Author

Electric Potential; Ion Engines; Electric Propulsion; Proving; High Voltages

20080006655 NASA Glenn Research Center, Cleveland, OH, USA

Performance of the NEXT Engineering Model Power Processing Unit

Pinero, Luis R.; Hopson, Mark; Todd, Philip C.; Wong, Brian; December 2007; 18 pp.; In English; 43rd Joint Propulsion COnference, 8-11 Jul. 2007, Cincinnati, OH, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 346620.04.05.03.13

Report No.(s): NASA/TM-2007-215037; AIAA Paper-2007-5214; E-16217; Copyright; Avail.: CASI: A03, Hardcopy

The NASA s Evolutionary Xenon Thruster (NEXT) project is developing an advanced ion propulsion system for future NASA missions for solar system exploration. An engineering model (EM) power processing unit (PPU) for the NEXT project was designed and fabricated by L-3 Communications under contract with NASA Glenn Research Center (GRC). This modular PPU is capable of processing up from 0.5 to 7.0 kW of output power for the NEXT ion thruster. Its design includes many significant improvements for better performance over the state-of-the-art PPU. The most significant difference is the beam supply which is comprised of six modules and capable of very efficient operation through a wide voltage range because of innovative features like dual controls, module addressing, and a high current mode. The low voltage power supplies are based on elements of the previously validated NASA Solar Electric Propulsion Technology Application Readiness (NSTAR) PPU. The highly modular construction of the PPU resulted in improved manufacturability, simpler scalability, and lower cost. This paper describes the design of the EM PPU and the results of the bench-top performance tests.

Author

Ion Propulsion; Solar Electric Propulsion; Electric Potential; High Current; Performance Tests

20080007512 NASA Langley Research Center, Hampton, VA, USA

Feasibility of Conducting J-2X Engine Testing at the Glenn Research Center Plum Brook Station B-2 Facility

Schafer, Charles F.; Cheston, Derrick J.; Worlund, Armis L.; Brown, James R.; Hooper, William G.; Monk, Jan C.; Winstead, Thomas W.; January 2008; 34 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 510505.01.07.01.06

Report No.(s): NASA/TM-2008-215104; NESC-RP-07-20/06-049-E; L-19421; Copyright; Avail.: CASI: A03, Hardcopy

A trade study of the feasibility of conducting J-2X testing in the Glenn Research Center (GRC) Plum Brook Station (PBS) B-2 facility was initiated in May 2006 with results available in October 2006. The Propulsion Test Integration Group (PTIG) led the study with support from Marshall Space Flight Center (MSFC) and Jacobs Sverdrup Engineering. The primary focus of the trade study was on facility design concepts and their capability to satisfy the J-2X altitude simulation test requirements. The propulsion systems tested in the B-2 facility were in the 30,000-pound (30K) thrust class. The J-2X thrust is approximately 10 times larger. Therefore, concepts significantly different from the current configuration are necessary for the diffuser, spray chamber subsystems, and cooling water. Steam exhaust condensation in the spray chamber is judged to be the key risk consideration relative to acceptable spray chamber pressure. Further assessment via computational fluid dynamics (CFD) and other simulation capabilities (e.g. methodology for anchoring predictions with actual test data and subscale testing to support investigation.

Author

Computational Fluid Dynamics; Propulsion System Configurations; Engine Tests; Aeronautical Engineering; Propulsion System Performance

20080008573 NASA Glenn Research Center, Cleveland, OH, USA

Managing Space Station Solar-Array Electrical Hazards for Sequential Shunt Unit Replacement

Deulleur, Ann M.; Kerslake, Thomas W.; Levy, Robert K.; Journal of Propulsion and Power; January 15, 2008; Volume 22, No. 1, pp. 16-23; In English; International Energy Conversion Engineering Conference, 16-19 Aug. 2004, Providence, RI, USA; Original contains black and white illustrations

Report No.(s): Paper 2004-5500; Copyright; Avail.: CASI: A02, Hardcopy

The U.S. solar-array strings on the International Space Station are connected to a sequential shunt unit. The sequential shunt unit's job is to shunt excess current from the solar array, such that just enough current is provided downstream to maintain the bus voltage while meeting the power load demand. Should a unit fail, its removal and replacement would normally be done with the solar arrays retracted to reduce the voltages and currents at the sequential shunt unit to safe levels. However, an alternate approach was desired to avoid the inherent risks associated with array retraction and redeployment. This approach allowed the replacement to be conducted via astronaut 'space walk' or extra vehicular activity with the solar array still deployed. Removing a sequential shunt unit with the solar array in sunlight could result in substantial hardware damage and/or safety risk to the astronaut due to the voltages that may be present. Replacing the sequential shunt unit during eclipse would seem optimal, except that the maximum eclipse period is only 36 min, which is insufficient time. To guide the

assessment and ameliorate hazards, the authors analyzed array string current and voltage capability during the various operating conditions using System Power Analysis for Capability Evaluation (SPACE), an electrical power system modeling code. This paper discusses six sequential shunt unit remove and replacement options and the associated analysis to develop a workable sequential shunt unit replacement procedure via extravehicular activity.
Author
Circuits; Extravehicular Activity; Hazards; Replacing; Solar Arrays; Space Maintenance

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COMPOSITE MATERIALS

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

20080006509 Air Force Research Lab., Wright-Patterson AFB, OH USA
Characterization of Mode I Properties of Full-Depth Z-Fiber Stubble in Co-Bonded Composites (Preprint)
Clay, Stephen B; Apr 2007; 14 pp.; In English
Contract(s)/Grant(s): Proj-A03M
Report No.(s): AD-A475007; AFRL-RB-WP-TP-2007-325; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA475007

Z-pins are small-diameter carbon rods that are ultrasonically inserted through composite laminates in the z-direction to provide extra resistance to crack growth and delamination. They are normally inserted through co-cured composites, but this paper presents an experimental study on a new z-pin stubble manufacturing technique that is compatible with the co-bonding process. Stubble lengths were 0.125 and 0.250 inch. Double cantilever beam (DCB) specimens were used to characterize the effect of stubble diameter and height on the Mode I crack resistance. It was determined that the new approach using a second ultrasonic step is indeed necessary for stubble heights on the order of 0.125 inch. It was also found that increasing the stubble height from 0.04 inch to 0.125 inch resulted in a much more significant improvement in Mode I properties than increasing the aerial density from 2 % to 4 %. Finally, taking that final step of increasing the stubble height from 0.125 to 0.250 inch did not improve the properties as much as would be expected from previous studies.
DTIC
Composite Materials; Depth

20080006582 Cincinnati Univ., OH USA
Effect of Surface Engineering Processes on the Surface Properties and Adhesive Bonding of Graphite/Epoxy Composites (Preprint)
Boerio, F J; Roby, B; Dillingham, R G; Bossi, R H; Dec 2007; 15 pp.; In English
Contract(s)/Grant(s): F33615-98-3-5103; Proj-2865
Report No.(s): AD-A475187; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The effect of surface engineering processes such as grit-blasting and plasma etching on the surface energy and composition of graphite/epoxy composites that were cured at 177 C was determined. As-tooled composites had about 73% carbon, 20% oxygen, and 5% nitrogen on the surface. Grit-blasting with 80- or 220-grit garnet resulted in an increase of several percent in the carbon concentration and a similar decrease in the oxygen concentration. However, grit-blasting with 220-grit alumina resulted in a decrease in the carbon concentration of a few percent and a similar increase in oxygen concentration. Etching as-tooled composites in O2 plasmas resulted in a decrease in the carbon concentration and an increase in the oxygen concentration of about 10%. Derivatization of the composite surfaces with trifluoroacetic anhydride and pentafluorobenzalde-hyde enabled the relative numbers of hydroxyl and amino groups on the surfaces to be determined and showed that the surface properties of the composites were dominated by the hydroxyl groups. As-tooled composites had a total surface energy of approximately 35 mJ/sq m; the polar components were small, meaning that the surface energies were mostly dispersive. After grit-blasting with 80- or 220-grit garnet or 220-grit alumina, the polar component of the surface energy increased significantly and the total surface energy was approximately 50 mJ/sq m.
DTIC
Adhesive Bonding; Graphite-Epoxy Composites; Grit; Plasma Etching; Surface Finishing; Surface Properties

20080006597 NASA Glenn Research Center, Cleveland, OH, USA

Ceramic Integration Technologies for Aerospace and Energy Systems: Technical Challenges and Opportunities

Singh, Mrityunjay; November 11, 2007; 25 pp.; In English; Plenary Lecture in International PACRIM7 Conference, 11-14 Nov. 2007, Shanghai, China; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC07ZA02A; WBS 561581.02.08.03.16.02; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080006597

Ceramic integration technology has been recognized as an enabling technology for the implementation of advanced ceramic systems in a number of high-temperature applications in aerospace, power generation, nuclear, chemical, and electronic industries. Various ceramic integration technologies (joining, brazing, attachments, repair, etc.) play a role in fabrication and manufacturing of large and complex shaped parts of various functionalities. However, the development of robust and reliable integrated systems with optimum performance requires the understanding of many thermochemical and thermomechanical factors, particularly for high temperature applications. In this presentation, various challenges and opportunities in design, fabrication, and testing of integrated similar (ceramic-ceramic) and dissimilar (ceramic-metal) material systems will be discussed. Experimental results for bonding and integration of SiC based LDI fuel injector, high conductivity C/C composite based heat rejection system, solid oxide fuel cells system, ultra high temperature ceramics for leading edges, and ceramic composites for thermostructural applications will be presented. Potential opportunities and need for the development of innovative design philosophies, approaches, and integrated system testing under simulated application conditions will also be discussed.

Author

Fabrication; High Temperature; Technology Utilization; Ceramic Matrix Composites; Aerospace Systems

20080006599 NASA Glenn Research Center, Cleveland, OH, USA

Fabrication and Characterization of Diffusion Bonds for Silicon Carbide

Halbig, Michael; Singh, Mrityunjay; Martin, Richard E.; Cosgriff, Laura M.; September 16, 2007; 23 pp.; In English; MS^T'07, Materials Science and Technology Conference and Exposition, 16-20 Sep. 2007, Detroit, MI, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.16.02; Copyright; Avail.: CASI: A03, Hardcopy

Diffusion bonds of silicon carbide (SiC) were fabricated using several different types of titanium (Ti) based interlayers between the SiC substrates. The interlayers were an alloyed Ti foil, a pure Ti foil, and a physically vapor deposited (PVD) Ti coating. Microscopy was conducted to evaluate the cross-sections of the resulting bonds. Microprobe analysis identified reaction formed phases in the diffusion bonded region. Uniform and well adhered bonds were formed between the SiC substrates. In the case where the alloyed Ti foil or a thick Ti coating (i.e. 20 micron) was used as the interlayer, microcracks and several phases were present in the diffusion bonds. When a thinner interlayer was used (i.e. 10 micron PVD Ti), no microcracks were observed and only two reaction formed phases were present. The two phases were preferred and fully reacted phases that did not introduce thermal stresses or microcracks during the cool-down stage after processing. Diffusion bonded samples were evaluated with the non-destructive evaluation (NDE) methods of pulsed thermography and immersion ultrasonic testing. Joined SiC substrates that were fully bonded and that had simulated bond flaws in the interlayer were also evaluated using immersion ultrasound. Pull testing was conducted on the bonds to determine the tensile strength. To demonstrate the joining approach for a complex multilayered component for a low NOx injector application, the diffusion bonding approach was used to join three 4' diameter SiC discs that contained complex fuel and air flow channels.

Author

Metal Bonding; Silicon Carbides; Substrates; Titanium; Titanium Alloys; Ceramic Bonding; Cermets; Heat Resistant Alloys; Ceramic Matrix Composites

20080006602 NASA Glenn Research Center, Cleveland, OH, USA

Carbon Nanofiber Incorporated Silica Based Aerogels with Di-Isocyanate Cross-Linking

Vivod, Stephanie L.; Meador, Mary Ann B.; Capadona, Lynn A.; Sullivan, Roy M.; Ghosn, Louis J.; Clark, Nicholas; McCorkle, Linda; [2008]; 3 pp.; In English; ACS National Meeting, 6-10 Apr. 2008, New Orleans, LA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.10.03.06; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080006602

Lightweight materials with excellent thermal insulating properties are highly sought after for a variety of aerospace and aeronautic applications. (1) Silica based aerogels with their high surface area and low relative densities are ideal for applications in extreme environments such as insulators for the Mars Rover battery. (2) However, the fragile nature of aerogel

monoliths prevents their widespread use in more down to earth applications. We have shown that the fragile aerogel network can be cross-linked with a di-isocyanate via amine decorated surfaces to form a conformal coating. (3) This coating reinforces the neck regions between secondary silica particles and significantly strengthens the aerogels with only a small effect on density or porosity. Scheme 1 depicts the cross-linking reaction with the di-isocyanate and exhibits the stages that result in polymer cross-linked aerogel monoliths.
Author
Aerogels; Crosslinking; Isocyanates; Nanocomposites; Carbon; Fibers; Nanostructure (Characteristics)

20080007508 NASA Langley Research Center, Hampton, VA, USA
Nanoscale Subsurface Imaging via Resonant Difference-Frequency Atomic Force Ultrasonic Microscopy
Cantrell, Sean A.; Cantrell, John H.; Lilehei, Peter T.; [2007]; 11 pp.; In English
Contract(s)/Grant(s): WBS 561581.02.08.07; Copyright; Avail.: CASI: A03, Hardcopy

A novel scanning probe microscope methodology has been developed that employs an ultrasonic wave launched from the bottom of a sample while the cantilever of an atomic force microscope, driven at a frequency differing from the ultrasonic frequency by the fundamental resonance frequency of the cantilever, engages the sample top surface. The nonlinear mixing of the oscillating cantilever and the ultrasonic wave in the region defined by the cantilever tip-sample surface interaction force generates difference-frequency oscillations at the cantilever fundamental resonance. The resonance-enhanced difference-frequency signals are used to create images of embedded nanoscale features.
Author
Atomic Force Microscopy; Imaging Techniques; Ultrasonic Radiation; Surface Properties

20080008147 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
High Voltage Breakdown Levels in Various EPC Potting Materials
Komm, David S.; April 25, 2006; 16 pp.; In English; 7th IEEE International Vacuum Electronics Conference (IVEC2006), 25-27 Apr. 2006, Monterey, CA, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40590

This viewgraph presentation reviews exploration activities at JPL into various potting materials. Since high power space-borne microwave transmitters invariably use a vacuum tube as a final power amplifier, and this tube requires high electrode voltages for operation. The associated high voltage insulation typically represents a significant fraction of the mass of the transmitter. Since mass is always a premium resource on board spacecraft, we have been investigating materials with the potential to reduce the mass required for our applications here at JPL. This paper describes electrical breakdown results obtained with various potting materials. Conathane EN-11 (polyurethane) is the traditional HVPS encapsulant at JPL, but due to temperature limitations and durability issues it was deemed inappropriate for the particular application (i.e., CloudSat radar). The choices for the best available materials were epoxies, or silicones. Epoxies are too rigid, and were deemed inadvisable. Two silicones were further investigated (i.e.,ASTM E595- 93e2: GE RTV566(R) and Dow Corning 93-500X(R), another compound was considered (i.e., DC material, Sylgard 184(R)). 'Loading' (adding filler materials) the potting compound will frequently alter the final material properties. Powdered alumina and borosilicate glass known as 'microballoons' were investigated as possible loading materials. The testing of the materials is described. Each of the two loading materials offers advantages and disadvantages. The advantages and disadvantages are described.
CASI
Durability; Electrical Faults; Encapsulating; Fillers; High Voltages; Potting Compounds; Silicones; Polyurethane Resins; Electrical Insulation

25
INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

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

20080006578 Air Force Research Lab., Wright-Patterson AFB, OH USA

Use of Measured Species Class Concentrations with Chemical Kinetic Modeling for the Prediction of Autoxidation and Deposition of Jet Fuels (Postprint)

Kuprowicz, Nicholas J; Zabarnick, Steven; West, Zachary J; Ervin, Jamie S; Feb 2007; 17 pp.; In English

Contract(s)/Grant(s): Proj-3048

Report No.(s): AD-A475189; AFRL-RZ-WP-TP-2007-249; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The production of detrimental carbonaceous deposits in jet aircraft fuel systems results from the involvement of trace heteroatomic species in the autoxidation chain that occurs upon fuel heating. Although it has been known for many years that these sulfur-, nitrogen-, and oxygen-containing species contribute to the tendency of a fuel to form deposits, simple correlations have been unable to predict the oxidation rates or the deposit forming tendencies over a range of fuel samples. In the present work, a chemical kinetic mechanism developed previously is refined to include the roles of key fuel species classes, such as phenols, reactive sulfur species, dissolved metals, and hydroperoxides. The concentrations of these fuel species classes in the unreacted fuel samples are measured experimentally and used as an input to the mechanism. The resulting model is used to simulate autoxidation behavior observed over a range of fuel samples.

DTIC

Deposition; Deposits; Jet Engine Fuels; Oxidation; Reaction Kinetics

20080006612 NASA Langley Research Center, Hampton, VA, USA

Experimental Air-Broadened Line Parameters in the nu2 Band of CH3D

Cross, Adriana Predoi; Brawley-Tremblay, Shannon; Povey, Chad; Smith, Mary Ann H.; [2007]; 33 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 281945.02.43.01.04; Copyright; Avail.: CASI: A03, Hardcopy

In this study we report the first experimental measurements of air-broadening and air-induced pressure-shift coefficients for approximately 378 transitions in the nu2 fundamental band of CH3D. These results were obtained from analysis of 17 room temperature laboratory absorption spectra recorded at 0.0056 cm(exp -1) resolution using the McMath-Pierce Fourier transform spectrometer located on Kitt Peak, Arizona. Three absorption cells with path lengths of 10.2, 25 and 150 cm were used to record the spectra. The total sample pressures ranged from 0.129x10(exp -2) to 52.855x10(exp -2) atm with CH3D volume mixing ratios of approximately 0.0109 in air. The spectra were analyzed using a multispectrum non-linear least-squares fitting technique. We report measurements for air pressure-broadening coefficients for transitions with quantum numbers as high as J' = 20 and K = 15, where K' = K' equivalent to K (for a parallel band). The measured air broadening coefficients range from 0.0205 to 0.0835 cm(exp -1) atm(exp -1) at 296 K. All the measured pressure-shift coefficients are negative and are found to vary from about -0.0005 to -0.0080 cm(exp -1) atm(exp -1) at the temperature of the spectra. We have examined the dependence of the measured broadening and shift parameters on the J' and K quantum numbers and also developed empirical expressions to describe the broadening coefficients in terms of m (m = -J', J' and J' + 1 in the (sup Q)P-(sup Q)Q-, and (sup Q)R-branch, respectively) and K. On average, the empirical expressions reproduce the measured broadening coefficients to within 4.4%.

Author

Absorption Spectra; Line Spectra; Spectroscopy; Planetary Atmospheres; Methane; Deuterium; Pressure Broadening

20080006648 NASA Glenn Research Center, Cleveland, OH, USA

Ultra-Lightweight Hybrid Thin-Film Solar Cells: A Survey of Enabling Technologies for Space Power Applications

Hepp, Aloysius F.; McNatt, Jeremiah S.; Bailey, Sheila G.; Dickman, John E.; Raffaelle, Ryne P.; Landi, Brian J.; Anctil, Annick; DiLeo, Roberta; Jin, Michael H.-C.; Lee, Chung-Young; Friske, Theresa J.; Sun, Sam-S.; Zhang, Cheng; Choi, S.; Ledbetter, Abram; Seo, Kang; Bonner, Carl E.; Banger, Kulbinder K.; Castro, Stephanie L.; Rauh, David; December 2007; 30 pp.; In English; 5th International Energy Conversion Engineering Conference and Exhibit (IECEC), 25-27 Jun. 2007, Saint Louis, MO, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 698671.01.03.23

Report No.(s): NASA/TM-2007-214955; AIAA-2007-4721; E-16170; Copyright; Avail.: CASI: A03, Hardcopy

The development of hybrid inorganic/organic thin-film solar cells on flexible, lightweight, space-qualified, durable substrates provides an attractive solution for fabricating solar arrays with high mass specific power (W/kg). Next generation thin-film technologies may well involve a revolutionary change in materials to organic-based devices. The high-volume, low-cost fabrication potential of organic cells will allow for square miles of solar cell production at one-tenth the cost of conventional inorganic materials. Plastic solar cells take a minimum of storage space and can be inflated or unrolled for deployment. We will explore a cross-section of in-house and sponsored research efforts that aim to provide new hybrid technologies that include both inorganic and polymer materials as active and substrate materials. Research at University of Texas at Arlington focuses on the fabrication and use of poly(isothianaphthene-3,6-diyl) in solar cells. We describe efforts at Norfolk State University to design, synthesize and characterize block copolymers. A collaborative team between EIC Laboratories, Inc. and the University of Florida is investigating multijunction polymer solar cells to more effectively utilize solar radiation. The National Aeronautics and Space Administration (NASA)/Ohio Aerospace Institute (OAI) group has undertaken a thermal analysis of potential metallized substrates as well as production of nanoparticles of CuInS2 and CuInSe2 in good yield at moderate temperatures via decomposition of single-source precursors. Finally, preliminary work at the Rochester Institute of Technology (R.I.T.) to assess the impact on performance of solar cells of temperature and carbon nanotubes is reported. Technologies that must be developed to enable ultra-lightweight solar arrays include: monolithic interconnects, lightweight array structures, and new ultra-light support and deployment mechanisms. For NASA applications, any solar cell or array technology must not only meet weight and AMO efficiency goals, but also must be durable enough to survive launch conditions and space environments.

Author

Block Copolymers; Carbon Nanotubes; Copper Selenides; Solar Cells; Quantum Dots

20080006653 NASA Glenn Research Center, Cleveland, OH, USA

Feasibility Study of Vapor-Mist Phase Reaction Lubrication Using a Thioether Liquid

Morales, Wilfredo; Handschuh, Robert F.; Krantz, Timothy L.; December 2007; 15 pp.; In English; 2007 Annual STLE Conference, 6-10 May 2007, Philadelphia, PA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 877868.02.07.03.01.01

Report No.(s): NASA/TM-2007-215035; E-16223; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080006653

A primary technology barrier preventing the operation of gas turbine engines and aircraft gearboxes at higher temperatures is the inability of currently used liquid lubricants to survive at the desired operating conditions over an extended time period. Current state-of-the-art organic liquid lubricants rapidly degrade at temperatures above 300 C; hence, another form of lubrication is necessary. Vapor or mist phase reaction lubrication is a unique, alternative technology for high temperature lubrication. The majority of past studies have employed a liquid phosphate ester that was vaporized or misted, and delivered to bearings or gears where the phosphate ester reacted with the metal surfaces generating a solid lubricious film. This method resulted in acceptable operating temperatures suggesting some good lubrication properties, but the continuous reaction between the phosphate ester and the iron surfaces led to wear rates unacceptable for gas turbine engine or aircraft gearbox applications. In this study, an alternative non-phosphate liquid was used to mist phase lubricate a spur gearbox rig operating at 10,000 rpm under highly loaded conditions. After 21 million shaft revolutions of operation the gears exhibited only minor wear.

Author

Feasibility Analysis; Mist; Vapors; Ethers; Vapor Phase Lubrication; Organic Liquids; Gas Turbine Engines; Chemical Reactions; Thiols

26
METALS AND METALLIC MATERIALS

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

20080006601 NASA Glenn Research Center, Cleveland, OH, USA
Effects of Stoichiometry on Transformation Temperatures and Actuator-Type Performance of NiTiPd and NiTiPdX High-Temperature Shape Memory Alloys
Bigelow, Glen S.; Gaydosh, Darrell; Garg, Anita; Padula, Santo A., II; Noebe, Ronald D.; December 03, 2007; 28 pp.; In English; International Conference on Shape Memory and Superelastic Technologies, 3-5 Dec. 2007, Tsukuba, Japan; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 561581.02.08.03.15.02; Copyright; Avail.: CASI: A03, Hardcopy

High-temperature shape memory NiTiPd and NiTiPdX (X=Au, Pt, Hf) alloys were produced with titanium equivalent (Ti+Hf) compositions of 50.5, 50.0, 49.5, and 49.0 at.%. Thermo-mechanical testing in compression was used to evaluate the transformation temperatures, transformation strain, work output, and permanent deformation behavior of each alloy to study the effects of quaternary alloying and stoichiometry on high-temperature shape memory alloy behavior. Microstructural evaluation showed the presence of second phases for all alloy compositions. No load transformation temperatures in the stoichiometric alloys were relatively unchanged by Au and Pt substitutions, while the substitution of Hf for Ti causes a drop in transformation temperatures. The NiTiPd, NiTiPdAu and NiTiPdHf alloys exhibited transformation temperatures that were highest in the Ti-rich compositions, slightly lower at stoichiometry, and significantly reduced when the Ti equivalent composition was less than 50 at.%. For the NiTiPdPt alloy, transformation temperatures were highest for the Ti-rich compositions, lowest at stoichiometry, and slightly higher in the Ni-rich composition. When thermally cycled under constant stresses of up to 300 MPa, all of the alloys had transformation strains, and therefore work outputs, which increased with increasing stress. In each series of alloys, the transformation strain and thus work output was highest for stoichiometric or Ti-rich compositions while permanent strain associated with the constant-load thermal cycling was lowest for alloys with Ni-equivalent-rich compositions. Based on these results, basic rules for optimizing the composition of NiTiPd alloys for actuator performance will be discussed.
Author
Heat Resistant Alloys; High Temperature; Shape Memory Alloys; Stoichiometry; Titanium Alloys; Nickel Alloys

20080006645 NASA Glenn Research Center, Cleveland, OH, USA
The Grain Size-Temperature Response of Advanced Nickel-Base Disk Superalloys During Solution Heat Treatments
Gabb, Timothy P.; Gayda, John; Kantzos, Peter; December 2007; 22 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 984754.02.07.03.11.03
Report No.(s): NASA/TM-2007-214912; E-16075; Copyright; Avail.: CASI: A03, Hardcopy

The grain size-temperature response was measured for a series of experimental disk superalloys. The responses were compared and related to the chemistries of these alloys.
Author
Nickel Alloys; Heat Resistant Alloys; Grain Size

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*.

20080006833 American Ceramic Society, OH, USA
Global Roadmap for Ceramics and Glass Technology
Freiman, Stephen, Editor; Cook, Robert, Editor; Coyle, Thomas, Editor; Fischman, Gary, Editor; Hellmann, John, Editor; Green, Martin, Editor; Hobbs, Linn, Editor; Logan, Kathryn, Editor; Sideridis, Costa, Editor; Singh, Mrityunjay, Editor; Smith, Jeffrey, Editor; January 2007; 9 pp.; In English
Contract(s)/Grant(s): NNC07ZA02A; WBS 561581.02.08.03.16.02; Copyright; Avail.: Other Sources

This is a global roadmap that identifies the technical and manufacturing challenges associated with the development and expansion of commercial markets for ceramics and glass. Featuring presentations by industry leaders at the 1st International

Congress on Ceramics (ICC) held in 2006, it suggests positive, proactive ways to address these challenges. The ICC Global Roadmap contains the following content: 1) Summary papers prepared by the invited speakers before the meeting 2) A detailed account of the presentation of each invited speaker written by an editor who attends the presentation 3) A summary account and future recommendations for the industry on each topic covered written by the board and the president of this meeting, Dr. Stephen Freiman (National Institutes of Standards and Technology) 4) The CDRom accompanying the book contains all of the above as well as PDFs of the presentations for non-invited speakers, including posters presented and discussed.
CASI
Ceramics; Glass; Industries; Manufacturing; Technologies; Technology Assessment; Technology Utilization

20080006835 Ohio Aerospace Inst., Cleveland, OH, USA
Tensile Creep and Fatigue of Sylramic-iBN Melt-Infiltrated SiC Matrix Composites: Retained Properties, Damage Development, and Failure Mechanisms
Morscher, Gregory N.; Ojard, Greg; Miller, Robert; Gowayed, Yasser; Santhosh, Unni; Ahmed, Jalees; John, Reji; November 26, 2007; 31 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): F33615-01-C-5234; F33615-03-D-2354-D004; NNC06ZA03A; WBS 599489.02.07.03.02.02.02; Copyright; Avail.: Other Sources

An understanding of the elevated temperature tensile creep, fatigue, rupture, and retained properties of ceramic matrix composites (CMC) envisioned for use in gas turbine engine applications are essential for component design and life-prediction. In order to quantify the effect of stress, time, temperature, and oxidation for a state-of-the-art composite system, a wide variety of tensile creep, dwell fatigue, and cyclic fatigue experiments were performed in air at 1204 C for the SiC/SiC CMC system consisting of Sylramic-iBN SiC fibers, BN fiber interphase coating, and slurry-cast melt-infiltrated (MI) SiC-based matrix. Tests were either taken to failure or interrupted. Interrupted tests were then mechanically tested at room temperature to determine the residual properties. The retained properties of most of the composites subjected to tensile creep or fatigue were usually within 20% of the as-produced strength and 10% of the as-produced elastic modulus. It was observed that during creep, residual stresses in the composite are altered to some extent which results in an increased compressive stress in the matrix upon cooling and a subsequent increased stress required to form matrix cracks. Microscopy of polished sections and the fracture surfaces of specimens which failed during stressed-oxidation or after the room-temperature retained property test was performed on some of the specimens in order to quantify the nature and extent of damage accumulation that occurred during the test. It was discovered that the distribution of stress-dependent matrix cracking at 1204 C was similar to the as-produced composites at room temperature; however, matrix crack growth occurred over time and typically did not appear to propagate through thickness except at final failure crack. Failure of the composites was due to either oxidation-induced unbridged crack growth, which dominated the higher stress regime (>= 179 MPa) or controlled by degradation of the fibers, probably caused by intrinsic creep-induced flaw growth of the fibers or internal attack of the fibers via Si diffusion through the CVI SiC and/or microcracks at the lower stress regime (<= 165 MPa).
Author
Ceramic Matrix Composites; Creep Properties; Tensile Creep; Silicon Carbides; Fatigue (Materials); Crack Propagation

20080008306 Air Force Research Lab., Wright-Patterson AFB, OH USA
Hybrid Organic-Inorganic Photorefractives (Preprint)
Evans, D R; Cook, G; Carns, J L; Saleh, M A; Aug 2006; 22 pp.; In English
Contract(s)/Grant(s): Proj-4347
Report No.(s): AD-A474897; AFRL-ML-WP-TP-2007-520; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Surface space charge field modulates the local liquid crystal alignment. Liquid crystals amplify the refractive index modulation. Highlights the opportunity of exploiting the electric field sensitivity and large birefringence of liquid crystals.
DTIC
Organic Materials; Inorganic Materials; Photorefractivity

28
PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power*; and *44 Energy Production and Conversion*.

20080006506 Royal Aircraft Establishment, Farnborough, UK
Exploratory Work With Pre-Mixing Injectors for Nitric Acid-Kerosene Rocket Motors
Frauenberger, H; Jessen, F C; Meier, K; Wheeler, W E; Mar 1952; 38 pp.; In English
Report No.(s): AD-A475104; RAE-TN-R.P.D.62; U.D.C.-621.455-41; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA475104
No abstract available
Fuel Injection; Injectors; Kerosene; Nitric Acid; Rocket Engines

31
ENGINEERING (GENERAL)

Includes general research topics related to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see *categories 32 through 39*.

20080006660 Stottler Henke Associates, Inc., San Mateo, CA USA
An Agent Populated Testbed for C2 Experimentation
Davis, Alex; Fu, Dan; Rushing, John; Oct 2007; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-05-C-0208; Proj-558B
Report No.(s): AD-A474586; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Recent concepts in the field of command and control (C2), such as Power to the Edge and Network-Centric Warfare, have indicated the need for a testbed for experimentation. We describe a gaming testbed, populated by realistic synthetic agents for modeling the complex human interactions comprising C2 structures, and for exploring the effectiveness of C2 concepts in a variety of tactical circumstances.
DTIC
Command and Control; Test Stands

20080006674 National Science and Technology Council, Washington, DC USA
Charting the Course for Ocean Science in the USA for the Next Decade: An Ocean Research Priorities Plan and Implementation Strategy
Jan 26, 2007; 101 pp.; In English; Original contains color illustrations
Report No.(s): AD-A474708; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Proper stewardship of the ocean is critical to the long-term vitality of the USA. Despite its vast extent, the ocean is finite and cannot indefinitely absorb all the stresses being placed on it; thus, the USA must commit to protecting the ocean through responsible stewardship and sensible management. Understanding society's impact on the ocean and the ocean's impact on society forms the basis for ensuring a clean, healthy, and stable ocean environment that can be responsibly used and enjoyed for generations to come. The goal of this document is to provide the guidance to build the scientific foundation to improve society's stewardship and use of, and interaction with, the ocean. Three central elements of science and technology will provide the USA with the knowledge and means to redefine its relationship with the ocean. 1) The capability to forecast key ocean and ocean-influenced processes and phenomena will change how society takes action in the future, much like weather forecasts do today. 2) Providing the scientific support for ecosystem-based management will allow resources to be managed in ways that account for the complex interactions between those resources and other parts of the marine environment, including humans. 3) Deploying an ocean-observing system that can accurately describe the state of the ocean will revolutionize the access to and view of the ocean and increase the pace, efficiency, and scope of ocean research. In turn, this observing capability will enable ocean forecasting and ecosystem-based management. This document's final section details an implementation strategy. The implementation strategy describes characteristics of implementation, roles of various sectors,

mechanisms for collaboration, the need for an infrastructure assessment, mechanisms for research translation, strategies for assessment and evaluation, and mechanisms for budget and plan updates.
DTIC
Charts; Oceans; Policies; United States

20080007104 NASA Glenn Research Center, Cleveland, OH, USA
High Specific Power Motors in LN2 and LH2
Brown, Gerald V.; Jansen, Ralph H.; Trudell, Jeffrey J.; December 2007; 18 pp.; In English; 2007 Cryogenic Engineering Conference and International Cryogenic Materials Conference (CEC-ICMC 2007), 16-20 Jul. 2007, Chattanoga, TN, USA; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 561581.02.08.03.15.02
Report No.(s): NASA/TM-2007-215002; Paper C4-C-05; E-16171-1; Copyright; Avail.: CASI: A03, Hardcopy

A switched reluctance motor has been operated in liquid nitrogen (LN2) with a power density as high as that reported for any motor or generator. The high performance stems from the low resistivity of Cu at LN2 temperature and from the geometry of the windings, the combination of which permits steady-state rms current density up to 7000 A/sq cm, about 10 times that possible in coils cooled by natural convection at room temperature. The Joule heating in the coils is conducted to the end turns for rejection to the LN2 bath. Minimal heat rejection occurs in the motor slots, preserving that region for conductor. In the end turns, the conductor layers are spaced to form a heat-exchanger-like structure that permits nucleate boiling over a large surface area. Although tests were performed in LN2 for convenience, this motor was designed as a prototype for use with liquid hydrogen (LH2) as the coolant. End-cooled coils would perform even better in LH2 because of further increases in copper electrical and thermal conductivities. Thermal analyses comparing LN2 and LH2 cooling are presented verifying that end-cooled coils in LH2 could be either much longer or could operate at higher current density without thermal runaway than in LN2.
Author
Electric Motors; Cryogenics; Electrical Resistivity; Current Density; Liquid Nitrogen; Liquid Hydrogen; Heat Exchangers; Resistance Heating

20080008299 NASA Langley Research Center, Hampton, VA, USA
Unbalanced and Minimal Point Equivalent Estimation Second-Order Split-Plot Designs
Parker, Peter A.; Kowalski, Scott M.; Vining, G. Geoffrey; October 2007; 30 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): 23-90-21-TE
Report No.(s): 23-090-21-TE; Copyright; Avail.: CASI: A03, Hardcopy

Restricting the randomization of hard-to-change factors in industrial experiments is often performed by employing a split-plot design structure. From an economic perspective, these designs minimize the experimental cost by reducing the number of resets of the hard-to- change factors. In this paper, unbalanced designs are considered for cases where the subplots are relatively expensive and the experimental apparatus accommodates an unequal number of runs per whole-plot. We provide construction methods for unbalanced second-order split- plot designs that possess the equivalence estimation optimality property, providing best linear unbiased estimates of the parameters; independent of the variance components. Unbalanced versions of the central composite and Box-Behnken designs are developed. For cases where the subplot cost approaches the whole-plot cost, minimal point designs are proposed and illustrated with a split-plot Notz design.
Author
Estimates; Design Analysis; Experiment Design; Structural Design; Costs; Construction; Economics

20080008301 NASA, Washington, DC, USA
NASA Systems Engineering Handbook
December 2007; 360 pp.; In English; Original contains color illustrations
Report No.(s): NASA/SP-2007-6105 Rev1; No Copyright; Avail.: CASI: A16, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080008301

This handbook is intended to provide general guidance and information on systems engineering that will be useful to the NASA community. It provides a generic description of Systems Engineering (SE) as it should be applied throughout NASA. A goal of the handbook is to increase awareness and consistency across the Agency and advance the practice of SE. This handbook provides perspectives relevant to NASA and data particular to NASA. The coverage in this handbook is limited to

general concepts and generic descriptions of processes, tools, and techniques. It provides information on systems engineering best practices and pitfalls to avoid. There are many Center-specific handbooks and directives as well as textbooks that can be consulted for in-depth tutorials. This handbook describes systems engineering as it should be applied to the development and implementation of large and small NASA programs and projects. NASA has defined different life cycles that specifically address the major project categories, or product lines, which are: Flight Systems and Ground Support (FS&GS), Research and Technology (R&T), Construction of Facilities (CoF), and Environmental Compliance and Restoration (ECR). The technical content of the handbook provides systems engineering best practices that should be incorporated into all NASA product lines. (Check the NASA On-Line Directives Information System (NODIS) electronic document library for applicable NASA directives on topics such as product lines.) For simplicity this handbook uses the FS&GS product line as an example. The specifics of FS&GS can be seen in the description of the life cycle and the details of the milestone reviews. Each product line will vary in these two areas; therefore, the reader should refer to the applicable NASA procedural requirements for the specific requirements for their life cycle and reviews. The engineering of NASA systems requires a systematic and disciplined set of processes that are applied recursively and iteratively for the design, development, operation, maintenance, and closeout of systems throughout the life cycle of the programs and projects.
Derived from text
Systems Engineering; Handbooks; NASA Programs; Information Systems; Procedures; Life (Durability)

20080008363 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
Journal of the Chinese Institute of Engineers: Vol. 30, No. 5
Chen, Shi-Shuenn, Editor; Tsai, Hsien-Lung, Editor; Chern, ing-Jyh, Editor; Lee, Liang-Sun, Editor; Young, Der-Liang, Editor; Pan, Ching-Tsai, Editor; Chen, Jean-Lien; Shieh, Ce-Kuen; Chao, Ching-Kong, Editor; Chang, Kai, Editor, et al.; July 2007; ISSN 0253-3839; 172 pp.; In English; See also 20080008364 - 20080008381; Original contains color illustrations; Copyright; Avail.: Other Sources

Articles in this issue include: Evaluation of the Interference Rejection Capability of a Uniform Circular Array, On-Line ATC Estimator Using Hybrid Principal Component Analysis Network, Experimental Evaluation of a Real-Time Kinematic GPS Positioning Technique, A Genetic Algorithm Based Recurrent Fuzzy Neural Network for Linear Induction Motor Servo Drive, DSP-Based Adaptive Fuzzy Velocity/Pressure Control of Injection Molding Machines, The Design of an Intelligent Real-Time Autonomous Vehicle, Taiwan iTS-1, Log-Scale Method with Equivalent Circuit Model in Semiconductor Device Simulations, On the Reverse Short-channel Effect and Threshold Voltage Roll-Off Controls for 90 nm Node MOSFETs, Adaptive Control of Electrically-Driven Robot without Computation of Regressor Matrix, An Extended Surface Fitting Algorithm for Random Data, On the Development of a Hole Filling Algorithm for Triangular Meshes, Influence of Jig Design on Biomechanical Evaluation of Spinal Construct Stability, Mechanism and Risk Factors of Adjacent Vertebral Failure Post Percutaneous Vertebroplasty--A Strain Energy Density Approach, Dynamic Finite Element Modeling for the Conventional Spinning Process, Singularity Analysis and Path Planning for a MDOF Manipulator, Implementation of Power-Aided Control for a Virtual Reality Exercise Bike, Constructing a New Fuzzy Classifier Based on Hierarchical Fuzzy Entropy, The Effect of Transformer Magnetizing Inductance on a Forward Converter with Current Mode Control
Derived from text
Algorithms; Engineers; Finite Element Method; Genetic Algorithms; Global Positioning System; Mathematical Models; Metal Oxide Semiconductors; Principal Components Analysis; Real Time Operation; Robots

20080008364 National Central Univ., Jung-Li, Taiwan, Province of China
An Extended Surface Fitting Algorithm for Random Data
Chen, Kuo-Jen; Lai, Jiing-Hih; Ueng, Wen-Der; Journal of the Chinese Institute of Engineers: Vol. 30, No. 5; July 2007, pp. 863-876; In English; See also 20080008363; Copyright; Avail.: Other Sources

There are various surface fitting techniques to convert cloud points into surface models in reverse engineering. One type of technique is to reconstruct a surface that can be trimmed with other surfaces. A necessary and sufficient condition for two surfaces to be trimmed is that they should intersect each other. We developed an extended surface fitting to allow the surface boundary to be adjusted freely, while maintaining the accuracy and fairness of the fitted surface. The proposed method determined a base plane from the cloud points, used for the initialization of the parametric values and the determination of the surface boundary. An objective function composed of an error function and an energy function was then proposed. An iterative algorithm incorporating the Gaussian elimination and Newton's method was provided also to optimize the control points and the parametric values. Successf~ll examples were presented to demonstrate the feasibility of the proposed method. Author
Algorithms; Fitting; Reverse Engineering; Gaussian Elimination

20080008365 National Central Univ., Jung-Li, Taiwan, Province of China

On the Development of a Hole Filling Algorithm for Triangular Meshes

Lai, Jiing-Yih; Hsu, Sheng-Han; Journal of the Chinese Institute of Engineers: Vol. 30, No. 5; July 2007, pp. 877-889; In English; See also 20080008363; Copyright; Avail.: Other Sources

Hole-filling is a process to repair the holes in a triangular model and to keep the topology accurate and preserve the smoothness of the original surface as new meshes are added. We propose a hole-filling algorithm by fitting the vertices in the vicinity of a hole into a B-spline surface and plan new vertices on the u-v domain corresponding to such a surface. The main advantage of such a method is that the LL-vp lane. instead of a 3D plane conventionally used, can better be used for the planning of new vertices distributed appropriately on the hole, especially for curved holes with steep slopes. The points on the u-v plane are mapped onto the B-spline surface to yield 3D vertices. Since the surface does not pass through the boundary vertices of the hole completely, a modification algorithm based on the local moving least squares method is proposed to modify the 3D vertices. Successful examples are presented to illustrate the feasibility of the proposed algorithm.
Author

Topology; Least Squares Method; Boundaries; Algorithms

20080008366 Chung Yuan Christian Univ., Chung-Li, Taiwan, Province of China

ON-Line ATC Estimator Using Hybrid Principal Component Analysis Network

Hong, Ying-Yi; Hsaio, Chien-Yang; Journal of the Chinese Institute of Engineers: Vol. 30, No. 5; July 2007, pp. 781-789; In English; See also 20080008363; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Deregulation has had a great impact on the electric power industry in many countries. The independent system operator (ISO), responsible for ensuring the secure, economic, and efficient dispatches, has to calculate the Available Transfer Capability (ATC) for bilateral contract customers. However, a large number of calculation^^ using the power flow approach is required to calculate the ATC. In this paper, a method involving the hybrid Principal Component Analysis and multi-layer feedforward neural networks is used to estimate the ATC. The simulation results obtained from a six-bus and the IEEE 30-bus system show the applicability of the proposed method for on-line use. Key Words: available transfer capability, deregulation, principal component analysis. multi-layer feedforward neural network
Author

On-Line Systems; Principal Components Analysis; Network Analysis; Feedforward Control; Neural Nets

20080008368 National Chiao Tung Univ., Hsinchu, Taiwan, Province of China

The Design of an Intelligent Real-Time Autonomous Vehicle, Taiwan iTS-1

Wu, Bing-Fei; Chen, Chao-Jung; Chiang, Hsin-Han; Peng, Hsin-Yuan; Perng, Jau-Woei; Ma, Li-Shian; Lee, Tsu-Tian; Journal of the Chinese Institute of Engineers: Vol. 30, No. 5; July 2007, pp. 829-842; In English; See also 20080008363
Contract(s)/Grant(s): NSC 95-2572-E-009-012-PAE; MOE-95W803E; Copyright; Avail.: Other Sources

Developed at National Chiao Tung University, TAIWAN iTS-1 is the first smart car with active safety systems and comfortable autonomous driving in Taiwan. An adaptive vision-based lane detection algorithm was proposed to help the lateral control unit to keep the car in its lane safely. It also carries a DSP system to generate warning signals for unintentional roadway departures. A laser radar measures the distance between the preceding car and TAIWAN iTS-1. With this information.. the longitudinal control unit performs intelligent cruise control and stop-and-go functions. The remote control function is realized on TAIWAN iTS-1 for safety testing and military applications. Unlike most smart car studies, this paper considers not only driving safety demands but also non-driving security. An active mobile surveillance system will inform the car owner when the car is illegally broken into, anytime and anyvvherc. For drivers and passengers, the perception of comfort is achieved by intelligent vehicle dynamic control. All functions integrated into TAIWAN iTS-1 have been tested repeatedly on National Highway 3 and Expressway 68 in the Hsinchu area and the system's robustness has been successfully demonstrated in these real-road experiments.
Author

Autonomy; Control Equipment; Remote Control; Automobiles; Real Time Operation; Optical Radar

20080008369 National Taiwan Univ. of Science and Technology, Taipei, Taiwan, Province of China

Adaptive Control of Electrically-Driven Robot without Computation of Regressor Matrix

Chien, Ming-Chih; Huang, An-Chyau; Journal of the Chinese Institute of Engineers: Vol. 30, No. 5; July 2007, pp. 855-862; In English; See also 20080008363; Copyright; Avail.: Other Sources

By using the function approximation technique (FAT), the adaptive control of rigid-link electrically-driven(RLED) robots

is addressed in the presence of time-varying uncertain parameters. Unlike the conventional adaptive control of robot manipulators, the regressor matrix does not need to be calculated in the proposed controller. Rigorous proof of the closed-loop stability and the convergence of the output tracking error are derived by using Lyapunov-like theory. Simulation studies are given to illustrate the tracking performance with the proposed control schemes.
Author
Adaptive Control; Robot Control; Approximation; Robots; Manipulators; Feedback Control; Robot Arms

20080008370 National Chung Hsing Univ., Taichung, Taiwan, Province of China
Singularity Analysis and Path Planning for a MDOF Manipulator
Lin, Chun-Liang; Lin, Jr-Rong; Jan, Horn-Yong; Journal of the Chinese Institute of Engineers: Vol. 30, No. 5; July 2007, pp. 917-922; In English; See also 20080008363; Original contains black and white illustrations
Contract(s)/Grant(s): NSC 93-2212-E-005-005; Copyright; Avail.: Other Sources

This paper presents singularity characterization and path planning design for a newly developed 3 leg 6 degree-of-freedom (DOFs) parallel manipulator. Special emphasis is placed on characterizing the platform singularity and singularity avoidance of path planning based on genetic algorithms. The path planning scheme proposed uses a real-coded genetic algorithm including a modified crossover and a \wap mutation for searching out the shortest moving path in the available workspace. Key Words: parallel manipulator, kinematics, singularity, genetic algorithms, path planning.
Author
Degrees of Freedom; Singularity (Mathematics); Kinematics; Trajectory Planning; Genetic Algorithms

20080008373 National Cheng Kung Univ., Tainan, Taiwan, Province of China
Implementation of Power-Aided Control for a Virtual Reality Exercise Bike
Tsai, Mi-Ching; Hu, Jia-Sheng; Journal of the Chinese Institute of Engineers: Vol. 30, No. 5; July 2007, pp. 923-929; In English; See also 20080008363; Original contains black and white illustrations; Copyright; Avail.: Other Sources

This paper investigates the designs and applications of a virtual reality exercise bike system utilizing active power control. An impedance control which employs a state filter to simplify certain circuits such as torque sensors, is presented for executing functions required by these machines. This approach can be used to improve the indoor exercise experience and assist in physical rehabilitation. Moreover, this method, as opposed to passive techniques, gives patients more options in their endeavors to recover. An experimental setup is given to evaluate control performance in real time and also to demonstrate some practical uses.
Author
Virtual Reality; Physical Exercise; Active Control; Torque

20080008374 National Changhua Univ. of Education, Changhua, Taiwan, Province of China
The Effect of Transformer Magnetizing Inductance on a Forward Converter with Current Mode Control
Chen, Shen-Yuar; Huang, Kunsong; Chen, Jin-Jia; Journal of the Chinese Institute of Engineers: Vol. 30, No. 5; July 2007, pp. 937-940; In English; See also 20080008363; Original contains black and white illustrations; Copyright; Avail.: Other Sources

The small-signal model for a forward converter with current-mode control is derived which includes the magnetizing inductance of the main power transformer. It is found that the feedforward gain is modified by magnetizing inductance and so are the transfer functions of current loop gain, control to output and audio susceptibility. Simulation and experimental results show that the effect of the magnetizing inductance is similar to an external ramp which can stabilize the converter system.
Author
Transformers; Magnetization; Inductance; Feedforward Control

20080008377 Ching Yun Univ., Chung-Li, Taiwan, Province of China
Dynamic Finite Element Modeling for the Conventional Spinning Process
Liu, Chun-Ho; Journal of the Chinese Institute of Engineers: Vol. 30, No. 5; July 2007, pp. 911-916; In English; See also 20080008363; Copyright; Avail.: Other Sources

The process of spin forming is frequently used for manufacturing the axial symmetric products. The spinning process is a transient dynamic contact problem, and is difficult to solve by the quasi-static theory. It is also found that the literature contains few studies of spinning simulation modeling. The present study deals with the dynamic FEM code, LS-DYNA, to

simulate the conventional spinning processes based on the updated Lagrangian formulation. The applications of the mass scaling technique and contact algorithm between the roller and sheet are modeled. The modeling also considers the elasto-plastic material and Coulomb friction conditions. With the differences being variations in the rotation speed of the mandrel, the feed rate of the roller, and the material density. The predicted load-deformation relationships, the strain energy distributions, the full history of deformation states, and the influence and usage of the mass scaling factor are assessed. Some defects in the simulations are observed, and proper solution models are suggested. Besides, some results of the die-less spinning process using a cylindrical mandrel are compared with the conventional spinning process. The proposed models and techniques are helpful for the analysis of the spinning process, and will be a good approach for industrial metal forming simulation. Key Words: dynamic FEM, conventional spinning, mass factor, die-less.
Author
Finite Element Method; Dynamic Models; Loads (Forces); Deformation; Strain Distribution; Energy Distribution; Lagrangian Function

20080008378 National Taiwan Univ., Taiwan, Province of China
Mechanism and Risk Factors of Adjacent Vertebral Failure Post Percutaneous Vertebroplasty: A Strain Energy Density Approach
Wang, Jaw--Lin; Chiang, Chun-Kai; Yang, Been-Der; Wang, Yao-Hung; Lin, Jinn; Journal of the Chinese Institute of Engineers: Vol. 30, No. 5; July 2007, pp. 899-909; In English; See also 20080008363
Contract(s)/Grant(s): NHRI-Ex-94-525EI; NHRI-Ex-95-9425EI; Copyright; Avail.: Other Sources

Percutaneous vertebroplasty (PV) is an effective treatment procedure for compression fracture of osteoporotic vertebra; however, adjacent vertebral fail~tre(AVF) is a frequently observed complication of PV. The mechanism and risk factors of AVF are not yet clear and this problem has attracted a lot of research effort in the medical community. The purpose of this study is to analyze the mechanism and risk factors of AVF post cement augmentation using a strain energy density (SED) approach. Fre5h porcine spine specimens (L1-L5) were used. The effect of cement augmentation on the SED of vertebral bodies (VB), including the damaged VB and both adjacent cranial and caudal VBs, was analyzed. The result showed that the SED of the adjacent VBs did not increase after cement augmentation; however, the accumulated energy in the VBs of the whole spine motion segment decreased significantly after cement augmentation. This globally reduced energy is speculated to be absorbed by thc dl\c between VBs. It is reasonable to believe that AVF may be initiated from the stressed disc. This study also suggests that poor bone quality and flexion compression are the two risk factors for AVF. Key Words: strain energy density, percutaneous vertebroplasty, adjacent vertebral failure, bone quality
Author
Risk; Vertebrae; Flux Density; Complexity; Failure; Fracturing

20080008379 Chaoyang Univ. of Technology, Taichung, Taiwan, Province of China
Constructing a New Fuzzy Classifier Based on Hierarchical Fuzzy Entropy
Lin, Cheng-Jian; Lee, Chi-Yung; Hong, Shang-Jin; Journal of the Chinese Institute of Engineers: Vol. 30, No. 5; July 2007, pp. 931-936; In English; See also 20080008363; Original contains black and white illustrations
Contract(s)/Grant(s): NSC95-2221-E-324-028; Copyright; Avail.: Other Sources

In an earlier work, Lee et al. (Lee et al., 2001) presented a simple and fast fuzzy classifier that employed fuzzy entropy to evaluate pattern distribution information in a pattern space. In this paper, we extend his work to propose a new fuzzy classifier based on hierarchical fuzzy entropy (FC-HFE). We retained the main parts of the original structure and modified some methods (e.g., methods for deciding the number of intervals in each dimension and for assigning class labels). In addition, the hierarchical fuzzy entropy is proposed for partitioning the decision region. The proposed FC-HFE improves classification accuracy and overcomes some of the drawbacks in the Lee et al method (Lee et al., 2001). The simulation results show that the classification rate of the proposed FC-HFE is better than earlier methods.
Author
Fuzzy Systems; Classifications; Entropy; Accuracy

20080008380 Tamaulipas Univ., Tamulipas, Mexico
Evaluation of the Interference Rejection Capability of a Uniform Circular Array
Panduro, Marco A.; Andrade, Angel G.; Covarrubias, David H.; Mendez, Aldo L.; Dominguez, Rene; Romero, Gerardo; Journal of the Chinese Institute of Engineers: Vol. 30, No. 5; July 2007, pp. 775-780; In English; See also 20080008363; Original contains black and white illustrations
Contract(s)/Grant(s): J50B39-Y; Copyright; Avail.: Other Sources

This paper deals with the interference rejection capability of circular antenna arrays, as base stations of wireless

communications systems. In general. this figure of merit depends strongly on the array configuration and is a function of the direction of arrival of the desired signal, the number of antenna elements, and their spacing. The main goal and contribution of this paper is to provide a detailed presentation of the behavior of the interference rejection capability of uniform circular arrays. The effect of varying the number of elements and inter-element spacing on the SIR (signal-to-interference ratio) performance is considered. In addition, the effect of mutual coupling is taken into account. Analytical results, for the total average of spatial interference suppression coefficient for circular arrays, as a function of inter-element spacing when mutual coupling is known and without mutual coupling are provided. Key Words: uniform circular array, interference rejection capability, radiation pattern
Author
Antenna Arrays; Dipole Antennas; Wireless Communication; Antenna Radiation Patterns; Antenna Components

20080008381 National Central Univ., Taoyuan, Taiwan, Province of China
Influence of Jig Design on Biomechanical Evaluation of Spinal Construct Stability
Lin, Shang-Chih; Lee, Wei-Shiun; Ma, Ju-Lung; Shih, Kao-Shang; Mudgal, Chaitanya S.; Journal of the Chinese Institute of Engineers: Vol. 30, No. 5; July 2007, pp. 891-898; In English; See also 20080008363; Copyright; Avail.: Other Sources

The biomechanical evaluation of spinal construct stability is of clinical importance as the results of such an evaluation provide information about the implant's performance in vivo in stabilizing the spine. The flexion/extension test is critical for the evaluation of spinal stability. However, it is more technically demanding to flex the spinal construct with the more structurally complex jig assembly than the assembly used in the compressive or twisting stability tests. A review of the literature shows that a variety of jig assemblies have been used to investigate the mechanical and kinematic behaviors of spinal constructs. However, there is little consensus about the influence of jig design on the investigated behaviors. The current study used the elastic beam-column theory to predict the load and deformation of the spinal construct among four possible jig assemblies. The suitability of these four jig assemblies for the short- and long-segment spinal construct was evaluated in detail with three indices: lateral deflection, loading condition, and failures at the bone-screw interfaces. Among the four assemblies, the jig assembly that generates the distally increasing flexion moment and free cephalic motion was suitable for short-segment fixation. The jig assembly that generates the constant flexion moment seemed to be more appropriate for long-segmentation cases with physiologically acceptable deflection. This study aims to provide an insight into what jig-related factors are associated with physiologically reliable outcomes of the flexion stability test for lumbar implants.
Author
Implantation; Biodynamics; In Vivo Methods and Tests; Stability Tests; Spine; Twisting; Lumbar Region; Jigs

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COMMUNICATIONS AND RADAR

Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and *17 Space Communications, Spacecraft Communications, Command and Tracking*; for search and rescue, see *03 Air Transportation and Safety*; and *16 Space Transportation and Safety*.

20080007492 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
A Cassegrain Offset-Fed Dual-Band Reflectarray
Huang, John; Han, Chulmin; Chang, Kai; July 9, 2006; 4 pp.; In English; IEEE Antennas and Propagation Symposium, 9-14 Jul. 2006, Albuquerque, NM, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40593

An X/Ka dual-band microstrip reflectarray with circular polarization (CP) has been constructed using thin membranes and Cassegrain offset-fed configuration. It is believed that this is the first Cassegrain reflectarray ever been developed. This antenna has a 75-cm-diameter aperture and uses metallic subreflector and angular-rotated annular ring elements. It achieved a measured -3dB-gain bandwidth of 700 MHz at X-band and 1.5 GHz at Ka-band, as well as a CP bandwidth (3dB axial ratio) of more than 700 MHz at X-band and more than 2 GHz at Ka-band. The measured peak efficiencies are 49.8% at X-band and 48.2% at Ka-band.
Author
Antenna Arrays; Cassegrain Optics; Reflector Antennas; Subreflectors; Bandwidth

20080007519 NASA Langley Research Center, Hampton, VA, USA

International Space Station (ISS) S-Band Corona Discharge Anomaly Consultation

Kichak, Robert A.; Leidecker, Henning; Battel, Steven; Ruitberg, Arthur; Sank, Victor; January 2008; 31 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 510505.06.07.03.99

Report No.(s): NASA/TM-2008-215100; NESC-RP-06-115/06-028-E; L-19440; Copyright; Avail.: CASI: A03, Hardcopy

The Assembly and Contingency Radio Frequency Group (ACRFG) onboard the International Space Station (ISS) is used for command and control communications and transmits (45 dBm or 32 watts) and receives at S-band. The system is nominally pressurized with gaseous helium (He) and nitrogen (N2) at 8 pounds per square inch absolute (psia). MacDonald, Dettwiler and Associates Ltd. (MDA) was engaged to analyze the operational characteristics of this unit in an effort to determine if the anomalous behavior was a result of a corona event. Based on this analysis, MDA did not recommend continued use of this ACRFG. The NESC was requested to provide expert support in the area of high-voltage corona and multipactoring in an S-Band RF system and to assess the probability of corona occurring in the ACRFG during the planned EVA. The NESC recommended minimal continued use of S/N 002 ACRFG until a replacement unit can be installed. Following replacement, S/N 002 will be subjected to destructive failure analysis in an effort to determine the proximate and root cause(s) of the anomalous behavior.

Author

Radio Frequencies; Extravehicular Activity; International Space Station; Command and Control; Helium; Nitrogen; High Voltages; Electric Corona

20080007525 NASA Dryden Flight Research Center, Edwards, CA, USA

Hyper-X (X-43A) Flight Test Range Operations Overview

January 2008; 17 pp.; In English; Original contains black and white illustrations

Report No.(s): NASA/TM-2008-214626; H-2740; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080007525

The Hyper-X program flew X-43A research vehicles to hypersonic speeds over the Pacific Ocean in March and November 2004 from the Western Aeronautical Test Range, NASA Dryden Flight Research Center. The program required multiple telemetry ground stations to provide continuous coverage of the captive carry, launch, boost, experiment, and descent phases of these missions. An overview is provided of vehicle telemetry and distributed assets that supported telemetry acquisition, best source selection, radar tracking, video tracking, flight termination systems, and voice communications. Real-time data display and processing are discussed, and postflight analysis and comparison of the acquired data are presented.

Author

Flight Tests; Telemetry; Hypersonic Speed; Ground Stations; Launching; Descent

20080008155 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Effects of Multiple Scattering for Millimeter-Wavelength Weather Radars

Kobayashi, Satoru; Tanelli, Simone; Im, Eastwood; August 23, 2004; 4 pp.; In English; International Radiation Symposium, 23-27 Aug. 2004, Busan, Korea, Republic of; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40570

Effects of multiple scattering on the reflectivity measurement for millimeter-wavelength weather radars are studied, in which backscattering enhancement may play an important role. In the previous works, the backscattering enhancement has been studied for plane wave injection, the reflection of which is received at the infinite distance. In this paper, a finite beam width of a Gaussian antenna pattern along with spherical wave is taken into account. A time-independent second order theory is derived for a single layer of clouds of a uniform density. The ordinary second-order scattering (ladder term) and the second-order backscattering enhancement (cross term) are derived for both the copolarized and cross-polarized waves.

Author

Millimeter Waves; Backscattering; Antenna Radiation Patterns; Cross Polarization; Radiation Distribution

20080008157 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Very Long Microstrip Array Feeds of a Membrane Reflector for the Advanced Precipitation Radar

Huang, John; Rahmat-Samii, Yahya; Durden, Stephen L.; Im, Eastwood; July 5, 2005; 4 pp.; In English; IEEE Antennas and

Propagation Symposium, 5-9 Jul. 2005, Washington, DC, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40596

Very long microstrip arrays have been developed at the Ku- and Ka-band frequencies. Each array having an electrical length of about 110 free-space wavelengths is used to feed a deployable thin-membrane cylindrical reflector for a spaceborne precipitation radar application. These arrays, designed for 0(deg) and 30(deg) beam directions, achieved peak sidelobes of -20 dB and average sidelobes below -30 dB with peak cross-pol levels below -20 dB. Several unique challenges were encountered during the development of these very long arrays, such as the strong coupling between very long power divider lines, the strong leakage radiation from the lengthy transmission lines, and the lack of computer analysis capability of these electrically large arrays.
Author
Meteorological Radar; Precipitation (Meteorology); Reflectors; Antenna Arrays; Cylindrical Bodies

20080008408 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Terahertz Schottky Multiplier Sources
Schlecht, Erich T.; June 2, 2007; 19 pp.; In English; AGED STAR on Compact Terahertz Sources, 28 Feb. - 2 Mar. 2007, Long Beach, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40569

This viewgraph presentation reviews the multiplier source technologies and the status/Performance of THz multiplier sources. An example of a THz application is imaging radar. The presentation reviews areas of requirements for THz sources: (1) Figures of merit, (i.e., Frequency Terahertz for high resolution Bandwidth of at least 15 GHz for high range resolution Efficiency (i.e., minimize power supply requirements) (2) Output power: (i.e., Milliwatts below 800 GHz, 10s of microwatts above 1 THz, 1-2 microwatts near 2 THz (3) Mechanical--stability, compact, low mass (4) Environmental -- radiation, vibration, thermal. Several sources for 0.3 - 2 THz are reviewed: FIR lasers, quantum cascade lasers (QCL), backward-wave oscillator (BWO), and Multiplier sources. The current state of the art (SoA) is shown as Substrateless Technology. It also shows where the SoA is for devices beyond 1 THz. The presentation concludes by reviewing the options for future development, and 2 technology roadmaps
CASI
Multipliers; Superhigh Frequencies; Sources

20080008580 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
A Range Compensating Feed Motion Concept for Spaceborne Radar
Pogorzelski, Ronald J.; Rahmat-Samii, Yahya; Durden, Stephen L.; Im, Eastwood; July 3, 2005; 8 pp.; In English; IEEE International Symposium on Antennas and Propagation, 3 Jul. 2005, Washington, DC, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40604

Tropical cyclones can cause major loss of both life and property, so that improvements in forecasting motion, intensity, and rainfall are needed. Such forecasting requires accurate measurements of the current state of the cyclone. Ground-based Doppler radars have long been used as an effective means of monitoring severe precipitating storms. Because of the oceanic nature of tropical cyclones, remote monitoring from space is desirable. Recently, the Precipitation Radar (PR) [1] aboard the Tropical Rainfall Measuring Mission (TRMM) [2] satellite has demonstrated an unprecedented capacity for 3-D imaging of precipitating storms. Nonetheless, due to the relatively long TRMM return cycle (less than once per day) the value of PR data has primarily been limited to the understanding of climatological properties of tropical cyclones [3]. The return cycle can be substantially reduced by sensing from a geostationary platform.
Author
Meteorological Radar; Tropical Storms; Climatology; Geosynchronous Orbits; Precipitation (Meteorology); Storms (Meteorology); Cyclones

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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*.

20080006603 NASA Glenn Research Center, Cleveland, OH, USA

Test Results from a Simulated High Voltage Lunar Power Transmission Line

Birchenough, Arthur; Hervol, David; [2008]; 9 pp.; In English; Space Technology and Applications International Forum (STAIF2008), 10-14 Feb. 2008, Albuquerque, NM, USA; Original contains color illustrations

Contract(s)/Grant(s): NNC06BA07B; WBS 463169.04.03; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080006603

The Alternator Test Unit (ATU) in the Lunar Power System Facility (LPSF) located at the NASA Glenn Research Center (GRC) in Cleveland, OH was modified to simulate high voltage transmission capability. The testbed simulated a 1 km transmission cable length from the ATU to the LPSF using resistors and inductors installed between the distribution transformers. Power factor correction circuitry was used to compensate for the reactance of the distribution system to improve the overall power factor. This test demonstrated that a permanent magnet alternator can successfully provide high frequency AC power to a lunar facility located at a distance.

Author

High Frequencies; High Voltages; Permanent Magnets; Transmission Lines; Lunar Based Equipment

20080006656 NASA Glenn Research Center, Cleveland, OH, USA

The Effect of Variable End of Charge Battery Management on Small-Cell Batteries

Neubauer, Jeremy S.; Bennetti, Andrea; Pearson, Chris; Simmons, Nick; Reid, Concha; Manzo, Michelle; December 2007; 16 pp.; In English; 5th International Energy Conversion Engineering Conference (IECEC), 25-27 Jun. 2007, Hilton Head, SC, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 038957.04.01.02.03

Report No.(s): NASA/TM-2007-215044; AIAA Paper-2007-4789; E-16243; Copyright; Avail.: CASI: A03, Hardcopy

Batteries are critical components for spacecraft, supplying power to all electrical systems during solar eclipse. These components must be lightweight due to launch vehicle limitations and the desire to fly heavier, more capable payloads, and must show excellent capacity retention with age to support the ever growing durations of space missions. ABSL's heritage Lithium Ion cell, the ABSL 18650HC, is an excellent low mass solution to this problem that has been proven capable of supporting long mission durations. The NASA Glenn Research Center recently proposed and initiated a test to study the effects of reduced end of charge voltage on aging of the ABSL 18650HC and other Lithium Ion cells. This paper presents the testing details, a method to analyze and compare capacity fade between the different cases, and a preliminary analysis of the to-date performance of ABSL s cells. This initial analysis indicates that employing reduced end of charge techniques could double the life capabilities of the ABSL 18650HC cell. Accordingly, continued investigation is recommended, particularly at higher depths of discharge to better assess the method s potential mass savings for short duration missions.

Author

Electric Batteries; Electric Power Supplies; Spacecraft Power Supplies; Space Missions; Solar Eclipses

20080007494 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

324GHz CMOS VCO Using Linear Superimposition Technique

Daquan, Huang; LaRocca, Tim R.; Samoska, Lorene A; Fung, Andy; Chang, Frank; February 8, 2007; 9 pp.; In English; International Solid State Circuits Conference, 8 Feb. 2007, San Francisco, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40578

Terahertz (frequencies ranged from 300GHz to 3THz) imaging and spectroscopic systems have drawn increasing attention recently due to their unique capabilities in detecting and possibly analyzing concealed objects. The generation of terahertz signals is nonetheless nontrivial and traditionally accomplished by using either free-electron radiation, optical lasers, Gunn diodes or fundamental oscillation by using III-V based HBT/HEMT technology[1-3]... We have substantially extended the operation range of deep-scaled CMOS by using a linear superimposition method, in which we have realized a 324GHz VCO in 90nm digital CMOS with 4GHz tuning range under 1V supply voltage. This may also pave the way for ultra-high data rate

wireless communications beyond that of IEEE 802.15.3c and reach data rates comparable to that of fiber optical communications, such as OC768 (40Gbps) and beyond.
Author
Bipolar Transistors; High Electron Mobility Transistors; Voltage Controlled Oscillators; Optical Communication; Heterojunction Devices; CMOS

20080008313 Carnegie-Mellon Univ., Pittsburgh, PA USA
Synthesis of Biofluidic Microsystems (SYNBIOSYS)
Mukherjee, Tamal; Hauan, Steinar; Hoburg, James F; Lin, Qiao; Oct 2007; 121 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-01-2-0587; DARPA ORDER-K900-08; Proj-E117
Report No.(s): AD-A474864; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes approaches to system-level design tools and methodologies. It incorporates significant advances in a behavioral modeling and simulation methodology for Lab-on-a-chip (LoC) design. This modeling and simulation methodology was developed with optimization for design synthesis in mind, enabling rapid automated design of highly complex biofluidic microsystems. This behavioral modeling methodology involves decomposing a complex LoC system into a small set of elements. Each of the elements is associated with a parameterized behavioral model that describes its electric and biofluidic behavior.
DTIC
Microelectronics; Complex Systems

20080008405 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
The use of Electrolyte Additives to Improve the High Temperature Resilience of Li-Ion Cells
Smart, Marshall C.; Lucht, B. L.; Ratnakumar, Bugga V.; October 11, 2007; 24 pp.; In English; 212th Meeting of the Electrochemical Society, 7-12 Oct. 2007, Washington, DC, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40567

This viewgraph presentation reviews the use of electrolyte additves to improve the resillience of Lithium ion cells. The objective of this work is to identify lithium-ion electrolytes, which will lead to Li-ion cells with a wide operational temperature range (+60 to -60 C), and to develop Li-ion electrolytes which result in cells that display improved high temperature resilience. Significant improvement in the high temperature resilience of Li-ion cells containing these additives was observed, with the most dramatic benefit being displayed by addition of DMAc. When the electrochemical properties of the individual electrodes were analyzed, the degradation of the anode kinetics was slowed most dramatically by the incorporation of DMAc into the electrolytes. Whereas, the greatest retention in the cathode kinetics was observed in the cell containing the electrolyte with VC added.
CASI
Electrolytes; High Temperature; Metal Ions; Lithium Batteries; Lithium; Electrochemistry

20080008516 Army Research Lab., Adelphi, MD USA
Characterization of Transparent Organic Light-Emitting Device (TOLED)
Chin, David Y; Blomquist, Steven M; Forsythe, Eric; Shi, Jianmin; Morton, David; Nov 2007; 34 pp.; In English; Original contains color illustrations
Report No.(s): AD-A474589; ARL-TR-4322; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Typical OLEDs are constructed in a bottom-emitting configuration where active organic layers are deposited on top of a transparent electrode, such as indium-tin-oxide (ITO), and then a non-transparent low function metal cathode, such as Mg, Ca, Li, is deposited as the top electrode. When appropriate current and voltage are applied to the electrodes, the organic layers are activated, and light is produced which can be seen at the transparent ITO side. Recently there has been increasing interest in the fabrication of OLEDs that are capable of emitting light from the top surface or from both the top and bottom surfaces by using transparent electrodes on both sides. These transparent OLEDs (TOLEDs) offer some unique features that are applicable to both the military and the commercial world. Examples of which include helmet mounted see-through head-up displays, windshield or window displays, stacked organic light-emitting devices (SOLED) for improved resolution and enhanced full-color capability, etc. This report describes a study performed on TOLEDs by using Mg:Ag and ZnS/Ag/ZnS as the transparent cathodes, a standard OLED device structure, and transparent ITO anode on a glass substrate to investigate and

characterize the device performance as function of the transparent layer thickness; specifically at Mg:Ag layer thickness of 75 Angstroms, 150 Angstroms, 100 Angstroms, and 200 Angstroms.
DTIC
Transparence; Light Emitting Diodes; Electrodes

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FLUID MECHANICS AND THERMODYNAMICS

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

20080006598 NASA Glenn Research Center, Cleveland, OH, USA
TBCC Inlet Experiments and Analysis
Saunders, Dave; Slater, John; Dippold, Vance; Lee, Jinho; Sanders, Bobby; Weir, Lois; October 31, 2007; 29 pp.; In English; FAP Annual Review, 30 Oct. - 1 Nov. 2007, New Orleans, LA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAS3-03110; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080006598

A research plan is being implemented at NASA to investigate inlet mode transition for turbine-based combined-cycle (TBCC) propulsion for the hypersonic community. Unresolved issues have remained on how to design an inlet system to supply both a turbine engine and a ram/scramjet flowpath that operate with both high performance and stability. The current plan is aimed at characterizing the design, performance and operability of TBCC inlets through a series of experiments and analyses. A TBCC inlet has been designed that is capable of high performance (near MIL-E-5008B recovery) with smooth transitioning characteristics. Traditional design techniques were used in an innovative approach to balance the aerodynamic and mechanical constraints to create a new TBCC inlet concept. The inlet was designed for top-end Mach 7 scramjet speeds with an over/under turbine that becomes cocooned beyond its Mach 4 peak design point. Conceptually, this propulsion system was picked to meet the needs of the first stage of a two-stage to orbit vehicle. A series of increasing fidelity CFD-based tools are being used throughout this effort. A small-scale inlet experiment is on-going in the GRC 1'x1' Supersonic Wind Tunnel (SWT). Initial results from both the CFD analyses and test are discussed showing that high performance and smooth mode transitions are possible. The effort validates the design and is contributing to a large-scale inlet/propulsion test being planned for the GRC 10' x10' SWT. This large-scale effort provide the basis for a Combined Cycle Engine Testbed, (CCET), that will be able to address integrated propulsion system and controls objectives.
Author
Computational Fluid Dynamics; Turbine Engines; Engine Inlets; Wind Tunnel Tests; Supersonic Wind Tunnels; Supersonic Combustion Ramjet Engines; Engine Design

20080006635 NASA Marshall Space Flight Center, Huntsville, AL, USA
Heat Transfer and Pressure Drop in Concentric Annular Flows of Binary Inert Gas Mixtures
Reid, R. S.; Martin, J. J.; Yocum, D. J.; Stewart, E. T.; November 2007; 84 pp.; In English; Original contains color and black and white illustrations
Report No.(s): NASA/TM-2007-215135; M-1210; Copyright; Avail.: CASI: A05, Hardcopy

Studies of heat transfer and pressure drop of binary inert gas mixtures flowing through smooth concentric circular annuli, tubes with fully developed velocity profiles, and constant heating rate are described. There is a general lack of agreement among the constant property heat transfer correlations for such mixtures. No inert gas mixture data exist for annular channels. The intent of this study was to develop highly accurate and benchmarked pressure drop and heat transfer correlations that can be used to size heat exchangers and cores for direct gas Brayton nuclear power plants. The inside surface of the annular channel is heated while the outer surface of the channel is insulated. Annulus ratios range $0.5 < r^* < 0.83$. These smooth tube data may serve as a reference to the heat transfer and pressure drop performance in annuli, tubes, and channels having helixes or spacer ribs, or other surfaces.
Author
Heat Transfer; Gas Mixtures; Annular Flow; Binary Mixtures; Circular Tubes; Velocity Distribution; Heat Exchangers; Brayton Cycle

20080006647 NASA Glenn Research Center, Cleveland, OH, USA

Single-Shot Scalar-Triplet Measurements in High-Pressure Swirl-Stabilized Flames for Combustion Code Validation

Kojima, Jun; Nguyen, Quang-Viet; October 30, 2007; 16 pp.; In English; NASA Fundamental Aeronautics 1st Annual Meeting, 30 Oct. - 1 Nov. 2007, New Orleans, LA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.19.03; Copyright; Avail.: CASI: A03, Hardcopy

In support of NASA ARMD's code validation project, we have made significant progress by providing the first quantitative single-shot multi-scalar data from a turbulent elevated-pressure (5 atm), swirl-stabilized, lean direct injection (LDI) type research burner operating on CH4-air using a spatially-resolved pulsed-laser spontaneous Raman diagnostic technique. The Raman diagnostics apparatus and data analysis that we present here were developed over the past 6 years at Glenn Research Center. From the Raman scattering data, we produce spatially-mapped probability density functions (PDFs) of the instantaneous temperature, determined using a newly developed low-resolution effective rotational bandwidth (ERB) technique. The measured 3-scalar (triplet) correlations, between temperature, CH4, and O2 concentrations, as well as their PDF s, also provide a high-level of detail into the nature and extent of the turbulent mixing process and its impact on chemical reactions in a realistic gas turbine injector flame at elevated pressures. The multi-scalar triplet data set presented here provides a good validation case for CFD combustion codes to simulate by providing both average and statistical values for the 3 measured scalars.

Author

High Pressure; Turbulent Mixing; Pulsed Lasers; Raman Spectra; Chemical Reactions; Burners; Computational Fluid Dynamics; Injectors

20080006651 NASA Glenn Research Center, Cleveland, OH, USA

A Microfabricated Segmented-Involute-Foil Regenerator for Enhancing Reliability and Performance of Stirling Engines

Ibrahim, Mounir; Danila, Daniel; Simon, Terrence; Mantell, Susan; Sun, Liyong; Gadeon, David; Qiu, Songgang; Wood, Gary; Kelly, Kevin; McLean, Jeffrey; December 2007; 181 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS3-03124; WBS 138494.04.01.01

Report No.(s): NASA/CR-2007-215006; E-16191; Copyright; Avail.: CASI: A09, Hardcopy

An actual-size microfabricated regenerator comprised of a stack of 42 disks, 19 mm diameter and 0.25 mm thick, with layers of microscopic, segmented, involute-shaped flow channels was fabricated and tested. The geometry resembles layers of uniformly-spaced segmented-parallel-plates, except the plates are curved. Each disk was made from electro-plated nickel using the LiGA process. This regenerator had feature sizes close to those required for an actual Stirling engine but the overall regenerator dimensions were sized for the NASA/Sunpower oscillating-flow regenerator test rig. Testing in the oscillating-flow test rig showed the regenerator performed extremely well, significantly better than currently used random-fiber material, producing the highest figures of merit ever recorded for any regenerator tested in that rig over its approximately 20 years of use.

Author

Fabrication; Regenerators; Reliability; Segments; Stirling Engines; Computational Fluid Dynamics; Energy Conversion; Radioisotope Heat Sources

20080006726 NASA Glenn Research Center, Cleveland, OH, USA

Hydrodynamic Force on a Cylinder Oscillating at Low Frequency

Berg, Robert F.; Yao, Minwu; Panzarella, Charles H.; December 2007; 47 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NASA Order C-32067-J; WBS 253225.04.01.02.05.03.03

Report No.(s): NASA/CR-2007-215050; E-16266; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080006726

The hydrodynamic force on a cylinder oscillating transversely to its axis is a nonlinear function of the displacement amplitude x0. We report measurements and numerical calculations of the force at frequencies low enough that delta > R, where delta is the viscous penetration length and R is the cylinder radius. For small amplitudes, the numerically calculated Fourier transform of the force per unit length, F(sub small), agrees with Stokes' analytical calculation. For larger amplitudes, the force per unit length found by both calculation and measurement is F = F(sub small)C (x(sub 0)/delta,R/delta). The complex function C depends only weakly on R/delta, indicating that x0/delta is more appropriate as a scaling variable than the Keulegan-Carpenter number KC = pi*x(sub 0)/R. The measurements used a torsion oscillator driven at frequencies from 1 to

12 Hz while immersed in dense xenon. The oscillator comprised cylinders with an effective radius of R = 13.4 micron and oscillation amplitudes as large as x(sub 0)/delta = 4 (corresponding to KC as large as 71). The calculations used similar conditions except that the amplitudes were as large as x0/delta = 28.
Author
Low Frequencies; Oscillating Cylinders; Hydrodynamics; Oscillations; Finite Element Method; Computational Fluid Dynamics

20080006845 NASA Langley Research Center, Hampton, VA, USA
Analyzing the Influence of Compressibility on the Rapid Pressure-Strain Rate Correlation in Turbulent Shear Flows
Thacker, W. D.; Sarkar, S.; Gatski, T. B.; [2007]; 30 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 23-065-30-35; Copyright; Avail.: Other Sources

The influence of compressibility on the rapid pressure-strain rate tensor is investigated using the Green's function for the wave equation governing pressure fluctuations in compressible homogeneous shear flow. The solution for the Green's function is obtained as a combination of parabolic cylinder functions; it is oscillatory with monotonically increasing frequency and decreasing amplitude at large times, and anisotropic in wave-vector space. The Green's function depends explicitly on the turbulent Mach number M(sub t), given by the root mean square turbulent velocity fluctuations divided by the speed of sound, and the gradient Mach number M(sub g), which is the mean shear rate times an integral scale of the turbulence divided by the speed of sound. Assuming a form for the temporal decorrelation of velocity fluctuations brought about by the turbulence, the rapid pressure-strain rate tensor is expressed exactly in terms of the energy spectrum tensor and the time integral of the Green's function times a decaying exponential. A model for the energy spectrum tensor linear in Reynolds stress anisotropies and in mean shear is assumed for closure. The expression for the rapid pressure-strain correlation is evaluated using parameters applicable to a mixing layer and a boundary layer. It is found that, for the same range of M(sub t), there is a large reduction of the pressure-strain correlation in the mixing layer but not in the boundary layer. Implications for compressible turbulence modeling are also explored.
Author
Compressibility; Compressible Flow; Green's Functions; Mach Number; Shear Flow; Turbulence; Turbulent Flow

20080006846 NASA Langley Research Center, Hampton, VA, USA
Role of Turbulent Prandtl Number on Heat Flux at Hypersonic Mach Numbers
Xiao, X.; Edwards, J. R.; Hassan, H. A.; Gaffney, R. L., Jr.; [2007]; 21 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): FA9101-04-C-0015; NAG1-03030; 23R-065-50-9177-01
Report No.(s): AIAA Paper 2005-1098; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080006846

A new turbulence model suited for calculating the turbulent Prandtl number as part of the solution is presented. The model is based on a set of two equations: one governing the variance of the enthalpy and the other governing its dissipation rate. These equations were derived from the exact energy equation and thus take into consideration compressibility and dissipation terms. The model is used to study two cases involving shock wave/boundary layer interaction at Mach 9.22 and Mach 5.0. In general, heat transfer prediction showed great improvement over traditional turbulence models where the turbulent Prandtl number is assumed constant. It is concluded that using a model that calculates the turbulent Prandtl number as part of the solution is the key to bridging the gap between theory and experiment for flows dominated by shock wave/boundary layer interactions.
Author
Heat Transfer; Hypersonic Speed; Mach Number; Prandtl Number; Turbulence Models; Turbulent Flow; Computational Fluid Dynamics

20080007111 NASA Langley Research Center, Hampton, VA, USA; NASA Langley Research Center, Hampton, VA, USA
Dual-Pump CARS Temperature and Species Concentration Measurements in a Supersonic Combustor
O'Byrne, S.; Danehy, P. M.; Tedder, S. A.; Cutler, A. D.; [2007]; 31 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 599489.02.07.07; Copyright; Avail.: CASI: A03, Hardcopy

The dual-pump coherent anti-Stokes Raman scattering (CARS) method was used to measure temperature and the mole fractions of N2 and O2 in a supersonic combustor. Experiments were conducted in NASA Langley Research Center s Direct

Connect Supersonic Combustion Test Facility. In this facility, H2 and oxygen-enriched air burn to increase the enthalpy of the simulated air test gas. This gas is expanded through a Mach 2 nozzle and into a combustor model consisting of a short constant-area section followed by a small rearward-facing step and another constant-area section. At the end of this straight section, H2 fuel is injected at Mach 2 and at a 30 angle with respect to the freestream. One wall of the duct then expands at a 3 angle for over 1 meter. The ensuing combustion is probed optically through ports in the side of the combustor. Dual-pump CARS measurements were performed at the facility nozzle exit and at four planes downstream of fuel injection. Maps are presented of the mean temperature, as well as N2 and O2 mean mole fraction fields. Correlations between fluctuations of the different measured parameters are also presented.
Author
Raman Spectra; Coherent Scattering; Supersonic Combustion; Fuel Injection; Free Flow; Oxygen; Nitrogen

20080007193 NASA Langley Research Center, Hampton, VA, USA
Small Scale Response and Modeling of Periodically Forced Turbulence
Bos, Wouter; Clark, Timothy T.; Rubinstein, Robert; [2007]; 23 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 561581.02.08; Copyright; Avail.: CASI: A03, Hardcopy

The response of the small scales of isotropic turbulence to periodic large scale forcing is studied using two-point closures. The frequency response of the turbulent kinetic energy and dissipation rate, and the phase shifts between production, energy and dissipation are determined as functions of Reynolds number. It is observed that the amplitude and phase of the dissipation exhibit nontrivial frequency and Reynolds number dependence that reveals a filtering effect of the energy cascade. Perturbation analysis is applied to understand this behavior which is shown to depend on distant interactions between widely separated scales of motion. Finally, the extent to which finite dimensional models (standard two-equation models and various generalizations) can reproduce the observed behavior is discussed.
Author
Isotropic Turbulence; Reynolds Number; Fluid Dynamics; Turbulent Flow; Turbulence Models

20080007495 NASA Glenn Research Center, Cleveland, OH, USA
The alpha(3) Scheme - A Fourth-Order Neutrally Stable CESE Solver
Chang, Sin-Chung; June 27, 2007; 36 pp.; In English; 18th AIAA Computational Fluid Dynamics Conference, 25-28 Ju. 2007, Miami, FL, USA; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 599489.02.07.03.04.03.01
Report No.(s): AIAA 2007-4321; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080007495

The conservation element and solution element (CESE) development is driven by a belief that a solver should (i) enforce conservation laws in both space and time, and (ii) be built from a non-dissipative (i.e., neutrally stable) core scheme so that the numerical dissipation can be controlled effectively. To provide a solid foundation for a systematic CESE development of high order schemes, in this paper we describe a new 4th-order neutrally stable CESE solver of the advection equation Theta u/Theta + alpha Theta u/Theta x = 0. The space-time stencil of this two-level explicit scheme is formed by one point at the upper time level and three points at the lower time level. Because it is associated with three independent mesh variables u(sup n) (sub j), (u(sub x))(sup n) (sub j) , and (uxz)(sup n) (sub j) (the numerical analogues of u, Theta u/Theta x, and Theta(exp 2)u/Theta x(exp 2), respectively) and four equations per mesh point, the new scheme is referred to as the alpha(3) scheme. As in the case of other similar CESE neutrally stable solvers, the alpha(3) scheme enforces conservation laws in space-time locally and globally, and it has the basic, forward marching, and backward marching forms. These forms are equivalent and satisfy a space-time inversion (STI) invariant property which is shared by the advection equation. Based on the concept of STI invariance, a set of algebraic relations is developed and used to prove that the alpha(3) scheme must be neutrally stable when it is stable. Moreover it is proved rigorously that all three amplification factors of the alpha(3) scheme are of unit magnitude for all phase angles if |v| <= 1/2 (v = alpha delta t/delta x). This theoretical result is consistent with the numerical stability condition |v| <= 1/2. Through numerical experiments, it is established that the alpha(3) scheme generally is (i) 4th-order accurate for the mesh variables u(sup n) (sub j) and (ux)(sup n) (sub j); and 2nd-order accurate for (uxx)(sup n) (sub j). However, in some exceptional cases, the scheme can achieve perfect accuracy aside from round-off errors.
Author
Space-Time CE/SE Method; Computational Fluid Dynamics; Flow Equations; Conservation Laws; Conservation Equations

20080007516 NASA Langley Research Center, Hampton, VA, USA

Inspection of the Math Model Tools for On-Orbit Assessment of Impact Damage Report

Harris, Charles E.; Raju, Ivatury S.; Piascik, Robert S>; KramerWhite, Julie A.; KramerWhite, Julie A.; Labbe, Steve G.; Rotter, Hank A.; December 2007; 159 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WU 104-08-40

Report No.(s): NASA/TM-2005-213928/Version 1.1/Rev1; NESC-RP-05-104/05-011-E; L-19436/Version 1.1/Rev1; No Copyright; Avail.: CASI: A08, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080007516

In Spring of 2005, the NASA Engineering Safety Center (NESC) was engaged by the Space Shuttle Program (SSP) to peer review the suite of analytical tools being developed to support the determination of impact and damage tolerance of the Orbiter Thermal Protection Systems (TPS). The NESC formed an independent review team with the core disciplines of materials, flight sciences, structures, mechanical analysis and thermal analysis. The Math Model Tools reviewed included damage prediction and stress analysis, aeroheating analysis, and thermal analysis tools. Some tools are physics-based and other tools are empirically-derived. Each tool was created for a specific use and timeframe, including certification, real-time pre-launch assessments. In addition, the tools are used together in an integrated strategy for assessing the ramifications of impact damage to tile and RCC. The NESC teams conducted a peer review of the engineering data package for each Math Model Tool. This report contains the summary of the team observations and recommendations from these reviews.
Author

Mathematical Models; Impact Damage; Damage Assessment; Tiles; Stress Analysis; Thermal Protection; Flight Mechanics

20080008300 NASA Glenn Research Center, Cleveland, OH, USA

Evaluation of Modified Two-Equation Turbulence Models for Jet Flow Predictions

Georgiadis, Nicholas J.; Yoder, Dennis A.; Engblom, William A.; AIAA Journal; December 2006; Volume 44, No. 12, pp. 3107-3114; In English; AIAA Aerospace Sciences Meeting and Exhibit, 9-12 Jan 2006, Reno, NV, USA; Original contains black and white illustrations

Report No.(s): AIAA Paper-2006-0490; Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://dx.doi.org/10.2514/1.22650

Three two-equation turbulence models developed specifically to improve prediction of jet flowfields are investigated. These models are the Tam-Ganesan k-epsilon formulation, a standard k-epsilon model with modification for heated jets referred to as the PAB temperature correction, and a standard k-epsilon model employing variable diffusion for the k and epsilon equations. Two standard two-equation models are also investigated for comparison with the modified formulations. The standard models are the Chien k-epsilon and Menter shear stress transport formulations. All of the models were investigated for a reference nozzle producing heated and unheated jets at a low acoustic Mach number of 0.5 to avoid complications of large compressibility effects. The primary deficiency of the standard models was the delayed initial jet mixing rate. All of the modified turbulence model formulations provided improved mean flow predictions relative to the standard models. The improved mixing rate enabled by the Tam-Ganesan model and the variable diffusion correction resulted from increased turbulent diffusion enabled by both models. The Tam-Ganesan model and PAB temperature correction improved predictions of mean axial velocities for the heated jet, but did not improve prediction of the calculated turbulent kinetic energy fields.
Author

Flow Distribution; Turbulent Diffusion; K-Epsilon Turbulence Model; Kinetic Energy; Jet Flow; Fluid Jets; Flow Equations

20080008385 NASA Langley Research Center, Hampton, VA, USA

Constraint Force Equation Methodology for Modeling Multi-Body Stage Separation Dynamics

Toniolo, Matthew D.; Tartabini, Paul V.; Pamadi, Bandu N.; Hotchko, Nathaniel; January 07, 2008; 22 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

This paper discusses a generalized approach to the multi-body separation problems in a launch vehicle staging environment based on constraint force methodology and its implementation into the Program to Optimize Simulated Trajectories II (POST2), a widely used trajectory design and optimization tool. This development facilitates the inclusion of stage separation analysis into POST2 for seamless end-to-end simulations of launch vehicle trajectories, thus simplifying the overall implementation and providing a range of modeling and optimization capabilities that are standard features in POST2.

Analysis and results are presented for two test cases that validate the constraint force equation methodology in a stand-alone mode and its implementation in POST2.
Author
Simulation; Trajectory Optimization; Stage Separation; Mathematical Models

20080008439 NASA Langley Research Center, Hampton, VA, USA
Apparent Transition Behavior of Widely-Used Turbulence Models
Rumsey, Christopher L.; December 2007; 34 pp.; In English
Contract(s)/Grant(s): WBS 561581.02.08; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080008439

The Spalart-Allmaras and the Menter SST k-omega turbulence models are shown to have the undesirable characteristic that, for fully turbulent computations, a transition region can occur whose extent varies with grid density. Extremely fine two-dimensional grids over the front portion of an airfoil are used to demonstrate the effect. As the grid density is increased, the laminar region near the nose becomes larger. In the Spalart-Allmaras model this behavior is due to convergence to a laminar-behavior fixed point that occurs in practice when freestream turbulence is below some threshold. It is the result of a feature purposefully added to the original model in conjunction with a special trip function. This degenerate fixed point can also cause non-uniqueness regarding where transition initiates on a given grid. Consistent fully turbulent results can easily be achieved by either using a higher freestream turbulence level or by making a simple change to one of the model constants. Two-equation k-omega models, including the SST model, exhibit strong sensitivity to numerical resolution near the area where turbulence initiates. Thus, inconsistent apparent transition behavior with grid refinement in this case does not appear to stem from the presence of a degenerate fixed point. Rather, it is a fundamental property of the k-omega model itself, and is not easily remedied.
Author
Convergence; Turbulence; Turbulence Models; K-Omega Turbulence Model; Computational Fluid Dynamics; Shear Stress; Turbulent Boundary Layer; Turbulent Flow

20080008560 NASA Langley Research Center, Hampton, VA, USA
Implementation of a Blowing Boundary Condition in the LAURA Code
Thompson, Richard a.; Gnoffo, Peter A.; January 07, 2008; 11 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 732759.07.05; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080008560

Preliminary steps toward modeling a coupled ablation problem using a finite-volume Navier-Stokes code (LAURA) are presented in this paper. Implementation of a surface boundary condition with mass transfer (blowing) is described followed by verification and validation through comparisons with analytic results and experimental data. Application of the code to a carbon-nosetip ablation problem is demonstrated and the results are compared with previously published data. It is concluded that the code and coupled procedure are suitable to support further ablation analyses and studies.
Author
Boundary Conditions; Blowing; Navier-Stokes Equation; Finite Volume Method; Mass Transfer

20080008572 NASA Glenn Research Center, Cleveland, OH, USA
Turbulence Modeling Effects on Calculation of Lobed Nozzle Flowfields
Georgiadis, Nicholas J.; Rumsey, Christopher L.; Yoder, Dennis A.; Zaman, Khairul B. M. Q.; Journal of Propulsion and Power; May-June 2006; Volume 22, No. 3, pp. 567-575; In English; AIAA 41st Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A02, Hardcopy

Two Reynolds-averaged Navier-Stokes solvers, CFL3D and WIND, are applied to the subsonic turbulent jet flowfield originating from a six-lobed nozzle, with emphasis placed on turbulence modeling effects. The turbulence models investigated include linear one-equation and two-equation models and nonlinear two-equation explicit algebraic stress model (EASM) formulations. Two nozzle operating points are investigated, corresponding to exit Mach numbers of 0.30 and 0.94. Comparisons of calculated mean axial velocities and turbulence intensities are made with experimental data. A11 of the turbulence models were deficient in predicting the initial mixing rate exhibited by the experimental data. The one-equation model provided the best agreement with experimental data in the near field of the jet. The linear two-equation models and a modified EASM provided better agreement with data in the farfield. The Mach 0.30 k-w EASM calculation required a

time-accurate calculation because of significant unsteadiness in the initial jet region, which is believed to be characteristic of the nozzle flow under consideration.
Author
Flow Distribution; Mathematical Models; Navier-Stokes Equation; Nozzle Flow; Reynolds Averaging; Turbulence Models; Computational Fluid Dynamics

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INSTRUMENTATION AND PHOTOGRAPHY

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

20080006567 CAE Professional Services, Ottawa, Ontario Canada
Advanced Integrated Multi-Sensor Surveillance (AIMS. Operator Machine Interface (OMI) Definition Study
Baker, Kevin; Youngson, Gord; Feb 2007; 142 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DRDC; ATLANTIC CR 2006-242
Report No.(s): AD-A475282; No Copyright; Avail.: Defense Technical Information Center (DTIC)

To enhance the capability of airborne search and rescue (SAR) and surveillance, particularly at night and in poor weather, a multi sensor electro optical imaging system, the Advanced Integrated Multi sensor Surveillance (AIMS) system, is being developed by Defence Research & Development Canada. The AIMS system is advanced through active gated capability and the integration of five sensors into a single gimbal. As such, the system will support a myriad of missions for both the CP 140 and FWSAR communities including timely SAR response and ground surveillance in aid of the Land Forces (LF). To ensure optimal performance the AIMS system requires an appropriate interface and controls, the design of which must realize the interaction between technological capability and operator performance. This document, prepared by CAE Professional Services on behalf of Defence Research and Establishment Canada, presents preliminary design concepts and associated rationale for the AIMS Operator Machine Interface (OMI). The intent is to provide a framework for the future evolution of the AIMS OMI as well as identify areas for investigation.
DTIC
Human Factors Engineering; Multisensor Applications; Multisensor Fusion; Patrols; Rescue Operations; Surveillance

20080006573 CAE Professional Services, Ottawa, Ontario Canada
AIMSsim Version 2.2.1, System Manual
Schoenborn, Oliver; Mar 2007; 50 pp.; In English; Original contains color illustrations
Report No.(s): AD-A475272; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This system manual provides an overview of software developed to support the empirical investigation of a simulated user interface for an Advanced Integrated Multi-sensor Surveillance (AIMS) system (formerly known as the Enhanced Low Light Level Visible and Infrared Surveillance System ELVISS). The AIMS system is an electro-optical imaging system being developed by the Defence Research and Development Canada (DRDC)-Valcartier to enhance the capability of search and rescue (SAR) crews to operate effectively at night and in degraded weather conditions. In order to ensure that a SAR operator would be able to use the system effectively and with a minimal amount of training, a prototype human machine interface (HMI) was developed to evaluate design concepts. The latest development phase added important tracking and motion related functionality (amongst other things) to the system and gave it a new name AIMSsim.
DTIC
Computerized Simulation; Infrared Radiation; Multisensor Applications; Software Development Tools; Surveillance

20080006575 Kachemak Research Development, Inc., Homer, AK USA
Sensor Feasibility Report: Survey of the Capabilities and Limitations of Chemical, Biological, Radiological, Nuclear and Explosive (CBRNE) Sensor Technologies Relevant to Vehicle Inspection Systems
Riley, Larry E; Oct 2007; 20 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA4819-06-C-0012; Proj-GOVT
Report No.(s): AD-A475258; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report provides a summary of KRD's research on existing Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) sensor technologies and possible incorporation into Under Vehicle Inspection Systems (UVIS) platforms,

as provided in the sensor integration plan. Sections two through five discuss how KRD could potentially integrate these technologies into its Under-Vehicle Inspection System (UVIS) platforms, thereby enhancing their threat detection capabilities. These sections also focus on the practical implications of each sensor technology, including capabilities, limitation, operational considerations, and integration with UVIS platforms. Detailed information on the theory and principal of operation for each sensor technology can be found in the references. Section six presents a sensor integration plan for incorporating sensor capabilities into KRD's UVIS platforms for large vehicles. This plan summarizes the practical considerations in selecting a CBRNE sensor. Additionally, it discusses the advantage of selecting a 'weigh-in-motion' capability as the first sensor technology that KRD will use in conjunction with its UVIS platforms.
DTIC
Inspection; Radiology; Raman Spectroscopy; Surveys

20080006629 Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA
Standardized UXO Technology Demonstration Site Blind Grid Scoring Record No. 831
Teefy, Dennis; Oct 2007; 55 pp.; In English
Contract(s)/Grant(s): Proj-8-CO-160-UXO-021
Report No.(s): AD-A475097; ATC-9514; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA475097

This Scoring Record documents the efforts of NAEVA Geophysics, Inc., to detect and discriminate inert unexploded ordnance (UXO) utilizing the APG Standardized UXO Technology Demonstration Site Blind Grid. This Scoring Record was coordinated by Dennis Teefy and the Standardized UXO Technology Demonstration Site Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Command, and the U.S. Army Aberdeen Test Center.
DTIC
Ammunition; Evaluation; Ordnance; Scoring; Standardization; System Effectiveness

20080006631 Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA
Standardized UXO Technology Demonstration Site Blind Grid Scoring Record No. 830
Teefy, Dennis; Oct 1, 2007; 57 pp.; In English
Contract(s)/Grant(s): Proj-8-CO-160-UXO-021
Report No.(s): AD-A475096; ATC-9513; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA475096

This Scoring Record documents the efforts of NAEVA Geophysics, Inc., to detect and discriminate inert unexploded ordnance (UXO) utilizing the APG Standardized UXO Technology Demonstration Site Blind Grid. This Scoring Record was coordinated by Dennis Teefy and the Standardized UXO Technology Demonstration Site Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Command, and the U.S. Army Aberdeen Test Center.
DTIC
Ammunition; Evaluation; Ordnance; Scoring; Standardization; System Effectiveness

20080007196 NASA Glenn Research Center, Cleveland, OH, USA
In Situ Multi-Species (O2, N2, Fuel, Other) Fiber Optic Sensor for Fuel Tank Ullage
Nguyen, Quang-Viet; October 29, 2007; 23 pp.; In English; International Fire and Cabin Saety Research Conference, 29 Oct. - 1 Nov. 2007, Atlantic City, NJ, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 561581.02.08.03.05.01; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080007196

A rugged and compact fiber optic sensor system for in situ real-time measurement of nitrogen (N2), oxygen (O2), hydrocarbon (HC) fuel vapors, and other gases has been developed over the past several years at Glenn Research Center. The intrinsically-safe, solid-state fiber optic sensor system provides a 1% precision measurement (by volume) of multiple gases in a 5-sec time window. The sensor has no consumable parts to wear out and requires less than 25 W of electrical power to operate. The sensor head is rugged and compact and is ideal for use in harsh environments such as inside an aircraft fuel tank, or as a feedback sensor in the vent-box of an on-board inert gas generation system (OBIGGS). Multiple sensor heads can be

monitored with a single optical detection unit for a cost-effective multi-point sensor system. The present sensor technology is unique in its ability to measure N2 concentration directly, and in its ability to differentiate different types of HC fuels. The present sensor system provides value-added aircraft safety information by simultaneously and directly measuring the nitrogen-oxygen-fuel triplet, which provides the following advantages: (1) information regarding the extent of inerting by N2, (2) information regarding the chemical equivalence ratio, (3) information regarding the composition of the aircraft fuel, and (4) by providing a self-consistent calibration by utilizing a singular sensor for all species. Using the extra information made available by this sensor permits the ignitability of a fuel-oxidizer mixture to be more accurately characterized, which may permit a reduction in the amount of inerting required on a real-time basis, and yet still maintain a fire-safe fuel tank. This translates to an increase in fuel tank fire-safety through a better understanding of the physics of fuel ignition, and at the same time, a reduction in compressed bleed air usage and concomitant aircraft operational costs over the long-run. The present fiber optic sensor can also be used as a false-alarm-free engine/hidden/cargo space fire detector (by measuring increased CO2 and CO, and decreased O2), a multi-point in situ measurement and certification system for halogenated-compound fire protection systems, and for the testing and certification of other aircraft safety sensor systems. The technology (LEW-17826-1) developed in the present sensor system is patent pending.
Author
Chemical Composition; Fiber Optics; Fuel Tanks; Hydrocarbon Fuels; Nitrogen; Optical Measurement; Oxygen; Chemical Detection; Gas Detectors; Gas Composition

20080008156 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
1024x1024 Pixel MWIR and LWIR QWIP Focal Plane Arrays and 320x256 MWIR:LWIR Pixel Colocated Simultaneous Dualband QWIP Focal Plane Arrays
Gunapala, Sarath D.; Bandara, Sumith V.; Liu, John K.; Hill, Cory J.; Rafol, S. B.; Mumolo, Jason M.; Trinh, Joseph T.; Tidrow, M. Z.; Le Van, P. D.; March 28, 2005; 15 pp.; In English; 31st SPIE Infrared Technology and Applications, 28 Mar. - Apr. 2005, Orlando, FL, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40597

Mid-wavelength infrared (MWIR) and long-wavelength infrared (LWIR) 1024x1024 pixel quantum well infrared photodetector (QWIP) focal planes have been demonstrated with excellent imaging performance. The MWIR QWIP detector array has demonstrated a noise equivalent differential temperature (NE(Delta)T) of 17 mK at a 95K operating temperature with f/2.5 optics at 300K background and the LWIR detector array has demonstrated a NE(Delta)T of 13 mK at a 70K operating temperature with the same optical and background conditions as the MWIR detector array after the subtraction of system noise. Both MWIR and LWIR focal planes have shown background limited performance (BLIP) at 90K and 70K operating-temperatures respectively, with similar optical and background conditions. In addition, we are in the process of developing MWIR and LWIR pixel collocated simultaneously readable dualband QWIP focal plane arrays.
Author
Focal Plane Devices; Quantum Well Infrared Photodetectors; Infrared Imagery; Quantum Wells; Imaging Techniques; Infrared Radiation; Wavelengths

20080008404 NASA Langley Research Center, Hampton, VA, USA
Direct-View Multi-Point Two-Component Interferometric Rayleigh Scattering Velocimeter
Vivolaru, Daniel; Danehy, Paul M.; Gaffney, Richard L., Jr.; Cutler, Andrew D.; January 07, 2008; 14 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Renov, NV, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 644423.05; Copyright; Avail.: CASI: A03, Hardcopy

This paper describes an instantaneous velocity measurement system based on the Doppler shift of elastically scattered laser light from gas molecules (Rayleigh scattering) relative to an incident laser. The system uses a pulsed laser as the light source, direct-viewing optics to collect the scattered light, an interferometer to analyze spectrally the scattered light mixed with the incident laser light, and a CCD camera to capture the resulting interferogram. The system is capable of simultaneous, spatially (approximately 0.2 mm(exp 3)) and temporally (approximately 40 ns) resolved, multiple point measurements of two orthogonal components of flow velocity in the presence of background scattered light, acoustic noise and vibrations, and flow particulates. Measurements in a large-scale axi-symmetric Mach 1.6 H2-air combustion-heated jet running at a flow sensible enthalpy specific to Mach 5.5 hypersonic flight are performed to demonstrate the technique. The measurements are compared with CFD calculations using a finite-volume discretization of the Favre-averaged Navier-Stokes equations (VULCAN code).
Author
CCD Cameras; Hypersonic Speed; Interferometry; Rayleigh Scattering; Velocity Measurement

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*.

20080008562 NASA Langley Research Center, Hampton, VA, USA
Tm:germanate Fiber Laser: Tuning And Q-switching
Barnes, Norman P.; Walsh, Brian M.; Reichle, Donald J.; DeYoung, R. J.; Jiang, Shibin; November 2007; 14 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 953033.01.07.18; Copyright; Avail.: CASI: A03, Hardcopy

A Tm:germanate fiber laser produced >0.25 mJ/pulse in a 45 ns pulse. It is capable of producing multiple Q-switched pulses from a single pump pulse. With the addition of a diffraction grating, Tm:germanate fiber lasers produced a wide, but length dependent, tuning range. By selecting the fiber length, the tuning range extends from 1.88 to 2.04 ?m. These traits make Tm:germanate lasers suitable for remote sensing of water vapor.
Author
Fiber Lasers; Pulsed Lasers; Q Switched Lasers; Tuning; Thulium; Tunable Lasers

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*.

20080008367 Southern Taiwan Univ. of Technology, Tainan, Taiwan, Province of China
DSP-Based Adaptive Fuzzy Velocity/Pressure Control of Injection Molding Machines
Wang, Ming-Shyan; Chang, Chia-Ming; Journal of the Chinese Institute of Engineers: Vol. 30, No. 5; July 2007, pp. 819-827; In English; See also 20080008363
Contract(s)/Grant(s): NSC 92-2622-E-218-015-CC3; Copyright; Avail.: Other Sources

The design and implementation of a low-cost DSP-based fully digital velocity1 pressure (V/P) controller for hydraulic injection molding machines is proposed. This system includes an analog potentiometer to sense position signal and a fixed-point 16-bit DSP with built-in 10-bit ADCs. An in-parallel interlaced sample-and-hold structure is proposed to improve the accuracy of computing low velocities due to noise contamination and using low-resolution ADCs. PI control is employed in V/P control loops to provide compatibility with commercial cards. An adaptive fuzzy control is adopted to overcome the pressure drop at the V/P transfer point. Finally. simulated and experimental results validate the proposed algorithms.
Author
Controllers; Injection Molding; Pressure Regulators; Velocity; Control Systems Design

38
QUALITY ASSURANCE AND RELIABILITY

Includes approaches to, and methods for reliability analysis and control, quality control, inspection, maintainability, and standardization.

20080007093 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Threads of Mission Success
Gavin, Thomas R.; April 18, 2006; 11 pp.; In English; JPL's 8th Briefing for Industry, 18 Apr. 2006, Pasadena, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40587

This viewgraph presentation reviews the many parts of the JPL mission planning process that the project manager has to work with. Some of them are: NASA & JPL's institutional requirements, the mission systems design requirements, the science interactions, the technical interactions, financial requirements, verification and validation, safety and mission assurance, and independent assessment, review and reporting.
CASI
Mission Planning; Systems Engineering; Management Planning; Project Management

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*.

20080006848 NASA Langley Research Center, Hampton, VA, USA

Stress Analysis of Composite Cylindrical Shells with an Elliptical Cutout

Oterkus, E.; Madenci, E.; Nemeth, M. P.; [2007]; 63 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): 732759.07.11; Copyright; Avail.: CASI: A04, Hardcopy

A special-purpose, semi-analytical solution method for determining the stress and deformation fields in a thin laminated-composite cylindrical shell with an elliptical cutout is presented. The analysis includes the effects of cutout size, shape, and orientation; non-uniform wall thickness; oval-cross-section eccentricity; and loading conditions. The loading conditions include uniform tension, uniform torsion, and pure bending. The analysis approach is based on the principle of stationary potential energy and uses Lagrange multipliers to relax the kinematic admissibility requirements on the displacement representations through the use of idealized elastic edge restraints. Specifying appropriate stiffness values for the elastic extensional and rotational edge restraints (springs) allows the imposition of the kinematic boundary conditions in an indirect manner, which enables the use of a broader set of functions for representing the displacement fields. Selected results of parametric studies are presented for several geometric parameters that demonstrate that analysis approach is a powerful means for developing design criteria for laminated-composite shells.

Author

Composite Structures; Cylindrical Shells; Deformation; Design Analysis; Stress Analysis; Stress Distribution; Ellipticity; Openings

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*.

20080006784 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

The Orbiting Carbon Observatory: Sampling Approach and Anticipated Data Products

Crisp, David; May 9, 2006; 19 pp.; In English; Carbon Fusion Workshop, 9-11 May 2006, Edinburgh, UK; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40580

This viewgraph presentation reviews the mission and the architecture of NASA's Orbiting Carbon Observatory (OCO). It also discusses the method of making precise measurements of CO2 from space. Due to be launched in September of 2008, the OCO will fly 12 minutes ahead of the EOS Aqua platform in the Earth Observing System (EOS) Afternoon Constellation (A-Train). The OCO's mission is to identify the sources and sinks for atmospheric CO2.

CASI

Carbon Dioxide; Carbon Dioxide Concentration; Sampling; Sinks; Remote Sensing; Earth Observations (From Space); Spacecraft Instruments

20080007107 NASA Langley Research Center, Hampton, VA, USA

Bulk Scattering Properties for the Remote Sensing of Ice Clouds. 3. High Resolution Spectral Models from 100 to 3250 cm(exp -1)

Baum, Bryan A.; Yang, Ping; Nasiri, Shaima; Heidinger, Andrew K.; Heymsfield, Andrew; Li, Jun; [2007]; 27 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNG04GL24G; NSF ATM-0239605; WBS 921266.04.07.06; Copyright; Avail.: Other Sources

This study reports on the development of bulk single-scattering models for ice clouds that are appropriate for use in hyperspectral radiative transfer cloud modeling over the spectral range from 100 to 3250 / cm. The models are developed in a manner similar to that recently reported for the Moderate Resolution Imaging Spectroradiometer (MODIS), so these models result in a consistent set of scattering properties from visible to far-infrared wavelengths. The models incorporate a new

database of individual ice particle scattering properties that includes droxtals, 3D bullet rosettes, hexagonal solid and hollow columns, aggregates, and plates. The database provides scattering properties for each habit in 45 size bins ranging from 2 to 9500 m, at a spectral resolution of 1 / cm obtained from a spline interpolation based on data sets at 49 wavenumbers. Bulk models are developed by integrating various properties over both particle habit and size distributions. A total of 1117 particle size distributions are used in the analyses, and are taken from analysis of FIRE-I, FIRE-II, ARM-IOP, TRMM-KWAJEX, and CRYSTAL-FACE data. The models include microphysical and scattering properties such as median mass diameter, effective diameter, single-scatter albedo, asymmetry factor, and scattering phase function. The spectral models are appropriate for use by infrared spectrometers such as the Atmospheric InfraRed Sounder (AIRS) on the NASA Aqua satellite and the Cross-track Infrared Sounder (CrIS) on the upcoming National Polar Orbiting Environmental Satellite System (NPOESS) platforms.
Author
High Resolution; Ice Clouds; Remote Sensing; Scattering; Spectral Resolution

44
ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power*; and *28 Propellants and Fuels*.

20080006795 NASA Glenn Research Center, Cleveland, OH, USA
Investigating Sonoluminescence as a Means of Energy Harvesting
Wrbanek, John D.; Gralic, Gustave C.; Wrbanek, Susan Y.; Hall, Nancy R.; [2008]; 29 pp.; In English; Frontiers of Propulsion Science; Original contains black and white illustrations; No Copyright; Avail.: Other Sources

SONOLUMINESCENCE has risen to be a source of interest to those outside of the ultrasonic community over the last decade. The processes of understanding the effect lead to the challenge of utilizing some of its more interesting properties in practical applications. The sonoluminescence phenomena is defined as the generation of light from sound waves, first discovered in the 1930s as a by-product of early work on sonar. The report in 1992 of the ultrasonic trapping of a single glowing bubble in a flask of water generated a cascade of research. The glow from the bubble was found to be generated in bubbles compressed to at least 150 kPa in an extremely short duration flash (<12 picoseconds), and had temperatures of at least 25,000 K for the single bubble. Bubbles of noble gases were seen to flash brighter, but the nature of the liquid was also seen as playing a large role in the flashes as well. Shortly after experimental results on trapped single bubbles were published, models were developed to explain these measurements. Simple shock calculations showed that peak temperatures inside the sonoluminescent bubbles could reach 3 x 10(exp 8) K based on the collapse of an ideal spherical gas bubble. Assuming a non-spherical collapse, the high-speed jet striking the opposite side of the bubble gave rise to the possibility of the water being fractured on the molecular scale and generating light as fracto-luminescence. The extremely rapid collapse of the bubble led to the theoretical examination of sonoluminescence as an effect of quantum vacuum radiation. The lack of an after-glow suggested a cooperative optical emission, like that of an optical laser or superradiance. A model of the flash resulting from a two-component plasma in the bubble (containing a low density halo and high density core) was developed to explain the measured properties. The actual process may be a combination of any of the above. A simplified schematic of the current model of the process is shown in accompanying figure. Even as these theories are being explored, applications for the effect are taking shape, from fusion containment to thin film deposition systems and other useful applications. Recently, claims put forward for the generation of fusion reactions has caused controversy in the scholarly and popular media. However, if realized, harnessing the high energy release in safe, emission-free ultrasonic processes would lead to the development of revolutionary power systems for in-flight use for both aircraft and spacecraft. The benefits of an on-board fusion power system will be in reduced fuel consumption, lower emissions and reduced noise for many types of aircraft. A practical fusion power source would replace the conventional gas turbine auxiliary power units and electrical generators in aircraft, and fuel cells and batteries in spacecraft, improving flight and mission capability. Longer-term use of the power source will have both an environmental benefit and act as a positive contributor to the country s energy diversification, as well as enable new missions for both air and space.
Author
Sonoluminescence; Auxiliary Power Sources; Bubbles; Light Emission; Energy Technology

20080008151 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Fluorinated Ester Co-Solvents for Low-Temperature Li-Ion Cells
Smith, Kiah A.; Smart, Marshall C.; Prakash, G. K. Surya; Ratnakumar, B. V.; FROM; October 7, 2007; 32 pp.; In English;

212th Meeting of the Electrochemical Society, 7-12 Oct. 2007, Washington, DC, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40568

This viewgraph presentation reviews the development of co-solvents for Li-ion cells. The future planned NASA Missions to explore Mars, the Moon, and the outer planets require rechargeable batteries that can operate at low temperatures. The applications for these batteries include landers, rovers and penetraters. This presentation reviews the work on optimizing the ester-based electrolyte formulations, with the intent of providing the best performance at temperatures ranging from -60 to +60 C.
CASI
Low Temperature; Electrolytes; Lithium; Solvents; Electrochemistry; Lithium Batteries; Esters; Electrochemical Cells; Fluorination

45
ENVIRONMENT POLLUTION

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

20080007115 NASA Langley Research Center, Hampton, VA, USA
Chemical Data Assimilation Estimates of Continental US Ozone and Nitrogen Budgets during INTEX-A
Pierce, Robert B.; Schaack, Todd K.; Al-Saadi, Jassim A.; Fairlie, T. Duncan; Kittaka, Chieko; Lingenfelser, Gretchen; Natarajan, Murali; Olson, Jennifer; Soja, Amber; Zapotocny, Tom; Lenzen, Allen; Stobie, James; Johnson, Donald; Avery, Melody A.; Sachse, Glen W.; Thompson, Anne; Cohen, Ron; Dibb, Jack E.; Crawford, James H.; Rault, Didier F.; Martin, Randall; Szykman, James J.; Fishman, Jack; [2007]; 66 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 281945.02.37.01.15; Copyright; Avail.: CASI: A04, Hardcopy

Global ozone analyses, based on assimilation of stratospheric profile and ozone column measurements, and NOy predictions from the Real-time Air Quality Modeling System (RAQMS) are used to estimate the ozone and NOy budget over the Continental US during the July-August 2004 Intercontinental Chemical Transport Experiment-North America (INTEX-A). Comparison with aircraft, satellite, surface, and ozonesonde measurements collected during the INTEX-A show that RAQMS captures the main features of the global and Continental US distribution of tropospheric ozone, carbon monoxide, and NOy with reasonable fidelity. Assimilation of stratospheric profile and column ozone measurements is shown to have a positive impact on the RAQMS upper tropospheric/lower stratosphere ozone analyses, particularly during the period when SAGE III limb scattering measurements were available. Eulerian ozone and NOy budgets during INTEX-A show that the majority of the Continental US export occurs in the upper troposphere/lower stratosphere poleward of the tropopause break, a consequence of convergence of tropospheric and stratospheric air in this region. Continental US photochemically produced ozone was found to be a minor component of the total ozone export, which was dominated by stratospheric ozone during INTEX-A. The unusually low photochemical ozone export is attributed to anomalously cold surface temperatures during the latter half of the INTEX-A mission, which resulted in net ozone loss during the first 2 weeks of August. Eulerian NOy budgets are shown to be very consistent with previously published estimates. The NOy export efficiency was estimated to be 24 percent, with NOx+PAN accounting for 54 percent of the total NOy export during INTEX-A.
Author
Nitrogen; Ozone; Atmospheric Composition; Air Quality; Troposphere; Environment Models; Stratosphere

20080007143 Centre National de la Recherche Scientifique, Paris, France
Processes Influencing Ozone Levels in Alaskan Forest Fires Plumes during Long-Range Transport over the North Atlantic
Real, E.; Law, K. S.; Wienzierl, B.; Fiebig, M.; Petzold, A.; Wild, O.; Methven, J.; Arnold, S.; Stohl, A.; Huntrieser, H.; Roiger, A.; Schlager, H.; Stewart, D.; Avery, M.; Sachse, G.; Browell, E.; Ferrare, R.; Blake, D.; [2006]; 56 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A04, Hardcopy

A case of long-range transport of a biomass burning plume from Alaska to Europe is analyzed using a Lagrangian approach. This plume was sampled several times in the free troposphere over North America, the North Atlantic and Europe by 3 different aircraft during the IGAC Lagrangian 2K4 experiment which was part of the ICARTT/ITOP measurement intensive in summer 2004. Measurements in the plume showed enhanced values of CO, VOCs and NOy, mainly in form of PAN. Observed O3 levels increased by 17 ppbv over 5 days. A photochemical trajectory model, CiTTyCAT, is used to examine

processes responsible for the chemical evolution of the plume. The model was initialized with upwind data, and compared with downwind measurements. The influence of high aerosol loading on photolysis rates in the plume is investigated using in-situ aerosol measurements in the plume and lidar retrievals of optical depth as input into a photolysis code (Fast-J), run in the model. Significant impacts on photochemistry are found with a decrease of 18 percent in O3 production and 24 percent in O3 destruction over 5 days when including aerosols. The plume is found to be chemically active with large O3 increases attributed primarily to PAN decomposition during descent of the plume towards Europe. The predicted O3 changes are very dependent on temperature changes during transport, and also, on water vapor levels in the lower troposphere which can lead to O3 destruction. Simulation of mixing/dilution was necessary to reproduce observed pollutants level in the plume. Mixing was simulated using background concentrations from measurements in air masses in close proximity to the plume, and mixing timescales (averaging 6.25 days) were derived from CO changes. Observed and simulated O3/CO correlations in the plume are also compared in order to evaluate the photochemistry in the model. Observed slopes changed from negative to positive over 5 days. This change, which can be attributed largely to photochemistry, is well reproduced by multiple model runs even if slope values are slightly underestimated suggesting small underestimation of photochemical processes. The possible impact of this biomass burning plume on O3 levels in the Europe boundary layer is also examined by running the model for a further 5 days, and comparing with data collected at surface sites, such as Jungfraujoch, which showed small O3 increases and elevated CO levels. The model predicts significant changes in O3 over this 10 days due to photochemistry but the signal is largely lost due to the effects of dilution. However, measurement in several others BB plumes over Europe show that O3 impact of Alaskan fires can be punctually significant over Europe.
Author
Forest Fires; Alaska; Europe; Atlantic Ocean; Aerosols; North America; Plumes; Trajectories; Wind Direction; Contaminants; In Situ Measurement

20080007505 NASA Langley Research Center, Hampton, VA, USA
Evaluation of the MOCAGE Chemistry Transport Model during the ICARTT/ITOP Experiment
Bousserez, N.; Attie, J. L.; Peuch, V. H.; Michou, M.; Pfister, G.; Edwards, D.; Emmons, L.; Arnold, S.; Heckel, A.; Richter, A.; Shlager, H.; Lewis A.; Avery, M.; Sachse, G.; Browell, E.; Ferrare, R.; [2007]; 43 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): WBS 281945.02.39.01.04; Copyright; Avail.: CASI: A03, Hardcopy

We evaluate the Meteo-France global chemistry transport 3D model MOCAGE (MOdele de Chimie Atmospherique a Grande Echelle) using the important set of aircraft measurements collected during the ICARRT/ITOP experiment. This experiment took place between US and Europe during summer 2004 (July 15-August 15). Four aircraft were involved in this experiment providing a wealth of chemical data in a large area including the North East of US and western Europe. The model outputs are compared to the following species of which concentration is measured by the aircraft: OH, H2O2, CO, NO, NO2, PAN, HNO3, isoprene, ethane, HCHO and O3. Moreover, to complete this evaluation at larger scale, we used also satellite data such as SCIAMACHY NO2 and MOPITT CO. Interestingly, the comprehensive dataset allowed us to evaluate separately the model representation of emissions, transport and chemical processes. Using a daily emission source of biomass burning, we obtain a very good agreement for CO while the evaluation of NO2 points out incertainties resulting from inaccurate ratio of emission factors of NOx/CO. Moreover, the chemical behavior of O3 is satisfactory as discussed in the paper.
Author
Ozone; Atmospheric Chemistry; Atmospheric Models; Three Dimensional Models; Air Pollution; Atmospheric Composition; Carbon Monoxide; Hydroxyl Radicals; Hydrogen Peroxide; Hydrocarbons; Nitrogen Compounds; Pollution Transport

20080008148 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Study Pollution Impacts on Upper-Tropospheric Clouds with Aura, CloudSat, and CALIPSO Data
Wu, Dong; June 11, 2007; 11 pp.; In English; CloudSat/CALIPSO Science Meeting, 11-14 Jun. 2007, San Francisco, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40577

This viewgraph presentation reviews the impact of pollution on clouds in the Upper Troposphere. Using the data from the Aura Microwave Limb Sounder (MLS), CloudSat, CALIPSO the presentation shows signatures of pollution impacts on clouds in the upper troposphere. The presentation demonstrates the complementary sensitivities of MLS , CloudSat and CALIPSO to upper tropospheric clouds. It also calls for careful analysis required to sort out microphysical changes from dynamical changes.
CASI
Troposphere; Microwave Sounding; Air Pollution; Pollution Monitoring; Clouds (Meteorology); Remote Sensing; Multisensor Fusion

20080008341 Cambridge Univ., UK; NASA Ames Research Center, Moffett Field, CA, USA; NASA Langley Research Center, Hampton, VA, USA

Forest Fire Plumes over the North Atlantic: p-TOMCAT Model Simulations with Aircraft and Satellite Measurements from the ITOP/ICARTT Campaign

Cook, Peter A.; Savage, Nicholas; Turquety, Solene; Carver, Glenn D.; OConnor, Fiona M.; Heckel, Andreas; Stewart, David; Whalley, Lisa K.; Parker, Alex E.; Schlager, Hans; Singh, Hanwant B.; Avery, Melody A.; Sachse, Glen W.; Brune, William; Richter, Andreas; Burrows, John P.; Purvis, Ruth; Lewis, Alastair C.; Reeves, Claire E.; Monks, Paul S.; Levine, James G.; Pyle, John A.; [2007]; 59 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ITOP (Intercontinental Transport of Ozone and Precursors), part of ICARTT (International Consortium for Atmospheric Research on Transport and Transformation), was an intense research effort to measure the long range transport of pollution across the North Atlantic and its impact on O3 production. During the aircraft campaign in July and August 2004, plumes were encountered containing large concentrations of CO plus other tracers and aerosols emitted from forest fires in Alaska and Canada. Here a chemical transport model, p-TOMCAT, and new inventories of the biomass-burning emissions during May to August 2004 have been used to study both the long-range transport of the fire emissions and their impact on the O3 budget across large regions of the troposphere. The structure of the fire plume is modeled well by the transport model until it encounters convection over Europe. The CO values within the simulated plumes closely match the measurements from aircraft flying near North America and over the Atlantic and there is also good agreement with the CO data from MOPITT. Values of O3 and NO(x) were initially too great in the model plumes. However, by including additional vertical mixing of O3 into the troposphere above the fires, and using a lower NO2/CO emission ratio (0.008) for boreal fires, O3 concentrations in the simulated plumes are reduced closer to aircraft measurements, with NO2 closer to data from the SCIAMACHY satellite instrument. Too little PAN is produced within the simulated plumes and the simplicity of our VOC scheme may be another reason for model-data discrepancies for O3 and NO(x). In the p-TOMCAT simulations the fire emissions lead to increased O3 in the troposphere over much of North America, the north Atlantic, and western Europe from photochemical production and transport. The increased O3 over the northern hemisphere in the model simulations reaches a peak in July 2004 in the range 2.0 to 6.2 Tg over a baseline of 150 Tg.
Author

Pollution Transport; Ozone; Air Pollution; Plumes; Atmospheric Models; Northern Hemisphere; Environment Simulation

20080008342 NASA Langley Research Center, Hampton, VA, USA

Surface and Lightning Sources of Nitrogen Oxides over the USA: Magnitudes, Chemical Evolution, and Outflow

Hudman, Rynda C.; Jacob, Daniel J.; Turquety, Solene; Leinbensperger, E. M.; Murray, L. T.; Wu, Samuel; Gilliland, A. B.; Avery, Melody A.; Bertram, Timothy H.; Brune, W. H.; Cohen, Ronald C.; Dibb, Jack E.; Flocke, F. M.; Fried, Alan; Holloway, J.; Neuman, J. A.; Orville, R.; Perring, Anne; Ren, Xinrong; Ryerson, T. B.; Sachse, Glen W.; Singh, H. B.; Swanson, Aaron; Wooldridge, Paul J.; [2007]; 29 pp.; In English

Contract(s)/Grant(s): WBS 281945.02.39.01.04; Copyright; Avail.: CASI: A03, Hardcopy

We use observations from two aircraft during the International Consortium for Atmospheric Research on Transport and Transformation (ICARTT) campaign over the eastern USA and North Atlantic during summer 2004, interpreted with a global 3-D model of tropospheric chemistry (GEOS-Chem) to test current understanding of the regional sources, chemical evolution, and export of nitrogen oxides. The boundary layer NO(x) data provide top-down verification of a 50% decrease in power plant and industry NO(x) emissions over the eastern USA between 1999 and 2004. Observed 8-12 8 km NO(x) concentrations in ICARTT were 0.55 +/- 36 ppbv, much larger than in previous USA aircraft campaigns (ELCHEM, SUCCESS, SONEX). We show that regional lightning was the dominant source of this NO(x) and increased upper tropospheric ozone by 10 ppbv. Simulating the ICARTT upper tropospheric NO(x) observations with GEOS-Chem require a factor of 4 increase in the model NO(x) yield per flash (to 500 mol/flash). Observed OH concentrations were a factor of 2 lower than can be explained from current photochemical models, and if correct would imply a broader lightning influence in the upper troposphere than presently thought.An NO(y)-CO correlation analysis of the fraction f of North American NO(x) emissions vented to the free troposphere as NO(y) (sum of NO(x) and its oxidation products PAN and HNO3) s shows observed f=16+/-10 percent and modeled f=14 +/- 8 percent, consistent with previous studies. Export to the lower free troposphere is mostly HNO3 but at higher altitudes is mostly PAN. The model successfully simulates NO(y) export efficiency and speciation, supporting previous model estimates of a large U.S. contribution to tropospheric ozone through NO(x) and PAN export.
Author

Nitrogen Oxides; Air Pollution; Photochemical Reactions; Pollution Transport; Atmospheric Composition; Lightning

20080008383 NASA Langley Research Center, Hampton, VA, USA

Summertime Influence of Asian Pollution in the Free Troposphere over North America

Liang, Q.; Jaegle, Lyatt; Hudman, Rynda C.; Turquety, Solene; Jacob, Daniel J.; Avery, Melody A.; Blake, Donald R.; Browell, Edward V.; Sachse, Glen W.; Brune, W. H.; Ren, Xinrong; Clarke, A.; Cohen, R.; Dibb, Jack; Fried, Alan; Fuelberg, Henry; Porter, M.; Heikes, Brian; Huey, Greg; Singh, H. B.; Wennberg, Paul; [2007]; 48 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NSF ATM 0238530; WBS 281945.02.39.01.04; Copyright; Avail.: CASI: A03, Hardcopy

We analyze aircraft observations obtained during INTEX-A (1 July 14 - August 2004) to examine the summertime influence of Asian pollution in the free troposphere over North America. By applying correlation analysis and Principal Component Analysis (PCA) to the observations between 6-12 km, we find dominant influences from recent convection and lightning (13 percent of observations), Asia (7 percent), the lower stratosphere (7 percent), and boreal forest fires (2 percent), with the remaining 71 percent assigned to background. Asian airmasses are marked by high levels of CO, O3, HCN, PAN, acetylene, benzene, methanol, and SO4(2-). The partitioning of reactive nitrogen species in the Asian plumes is dominated by peroxyacetyl nitrate (PAN) (approximately 600 pptv), with varying NO(x)/HNO3 ratios in individual plumes consistent with different plumes ages ranging from 3 to 9 days. Export of Asian pollution in warm conveyor belts of mid-latitude cyclones, deep convection, and lifting in typhoons all contributed to the five major Asian pollution plumes. Compared to past measurement campaigns of Asian outflow during spring, INTEX-A observations display unique characteristics: lower levels of anthropogenic pollutants (CO, propane, ethane, benzene) due to their shorter summer lifetimes; higher levels of biogenic tracers (methanol and acetone) because of a more active biosphere; as well as higher levels of PAN, NO(x), HNO3, and O3 (more active photochemistry possibly enhanced by injection of lightning NO(x)). The high delta O3/delta CO ratio (0.76 mol mol(exp -1)) of Asian plumes during INTEX-A is due to a combination of strong photochemical production and mixing with stratospheric air along isentropic surfaces. The GEOS-Chem global chemical transport model captures the timing and location of the Asian plumes remarkably well. However, it significantly underestimates the magnitude of the enhancements.
Author

Summer; Air Pollution; Atmospheric Circulation; Photochemical Reactions; Pollution Transport; Environment Pollution; Atmospheric Models; Plumes

20080008474 NASA Langley Research Center, Hampton, VA, USA

3D Air Quality and the Clean Air Interstate Rule: Lagrangian Sampling of CMAQ Model Results to Aid Regional Accountability Metrics

Fairlie, T. D.; Szykman, Jim; Pierce, Robert B.; Gilliland, A. B.; Engel-Cox, Jill; Weber, Stephanie; Kittaka, Chieko; Al-Saadi, Jassim A.; Scheffe, Rich; Dimmick, Fred; Tikvart, Joe; January 20, 2008; 33 pp.; In English; 88th AMS Annual Meeting, 20-24 Jan. 2008, New Orleans, LA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 389018.02.13.01.46

Report No.(s): J5.4; Copyright; Avail.: CASI: A03, Hardcopy

The Clean Air Interstate Rule (CAIR) is expected to reduce transport of air pollutants (e.g. fine sulfate particles) in nonattainment areas in the Eastern USA. CAIR highlights the need for an integrated air quality observational and modeling system to understand sulfate as it moves in multiple dimensions, both spatially and temporally. Here, we demonstrate how results from an air quality model can be combined with a 3d monitoring network to provide decision makers with a tool to help quantify the impact of CAIR reductions in SO2 emissions on regional transport contributions to sulfate concentrations at surface monitors in the Baltimore, MD area, and help improve decision making for strategic implementation plans (SIPs). We sample results from the Community Multiscale Air Quality (CMAQ) model using ensemble back trajectories computed with the NASA Langley Research Center trajectory model to provide Lagrangian time series and vertical profile information, that can be compared with NASA satellite (MODIS), EPA surface, and lidar measurements. Results are used to assess the regional transport contribution to surface SO4 measurements in the Baltimore MSA, and to characterize the dominant source regions for low, medium, and high SO4 episodes.
Author

Air Pollution; Air Quality; Air Sampling; Lagrangian Function; Pollution Transport; Satellite Observation; Sulfur Dioxides; Three Dimensional Models

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*.

20080006595 Geophysical Inst. of Israel, Holon, Israel

Seismic Energy Generation and Partitioning into Various Regional Phases from Different Seismic Sources in the Middle East Region

Gitterman, Yefim; Pinsky, Vladimir; Hofstetter, Rami; Sep 20, 2007; 85 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F19628-03-C-0124; Proj-1010

Report No.(s): AD-A475170; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The project was focused on studying, experimentally, features of seismic energy generation and partitioning of P and S waves from different explosive seismic sources, at near-source and regional distances, in the time and spectral domain. An extensive database of Ground Truth single-fired explosions was created. The explosions selected contain a broad variety of design features (buried and surface sources, tamped and decoupled shots, large diameter 0.5-0.8m borehole and near-spherical cavity charges), charge weight (100-32500kg), depth (14 62m), scaled burial depth (1.0-3.9m/kg1/3), emplacement rocks (alluvium, basalts, marls) and geological settings. The highlight of this project was the source phenomenology experiments: Decoupling and Depth-of-Burial (DOB) explosion series at the phosphate quarry Oron, Negev. A special technology was used for creation of large cavities (up to 3.5 m) at different depths, to accommodate large near-spherical ANFO charges. Extensive observations in the near-source zone (100-800 m) and remotely (up to 350 km) demonstrated signal characteristics and energy generation features; decoupling factors were estimated. The design and configuration of the Oron DOB experiment were preferable in design to the previous Balapan DOB experiment (1997): media homogeneity, small aspect ratio (~1), full containment and small separation (~200 m) of the shots. The crossover point of spectral dominance at ~10 Hz for different depth shots, observed at ranges 0.2-230 km, was remarkably consistent with the Mueller/Murphy source model predictions. DTIC

Decoupling; Explosions; Middle East; Seismic Energy; Seismic Waves

20080006611 NASA Langley Research Center, Hampton, VA, USA

Direct Measurements of the Convective Recycling of the Upper Troposphere

Bertram, Timothy H.; Perring, Anne E.; Wooldridge, Paul J.; Crounse, John D.; Kwan, Alan J.; Wennberg, Paul O.; Scheuer, Eric; Dibb, Jack; Avery, Melody; Sachse, Glen; Vay, Stephanie A.; Crawford, James H.; McNaughton, Cameron S.; Clarke, Antony; Pickering, Kenneth E.; Fuelberg, Henry; Huey, Greg; Blake, Donald R.; Singh, Hanwant B.; Hall, Samuel R.; Shetter, Richard E.; Fried, Alan; Heikes, Brian G.; Cohen, Ronald C.; [2007]; 41 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 281945.02.39.01.04; Copyright; Avail.: CASI: A03, Hardcopy

We present a statistical representation of the aggregate effects of deep convection on the chemistry and dynamics of the Upper Troposphere (UT) based on direct aircraft observations of the chemical composition of the UT over the Eastern USA and Canada during summer. These measurements provide new and unique observational constraints on the chemistry occurring downwind of convection and the rate at which air in the UT is recycled, previously only the province of model analyses. These results provide quantitative measures that can be used to evaluate global climate and chemistry models. Author

Chemical Composition; Recycling; Troposphere; Mathematical Models; Climate Models; Convective Flow

20080007137 NASA Langley Research Center, Hampton, VA, USA

A Link between Variability of the Semidiurnal Tide and Planetary Waves in the Opposite Hemisphere

Smith, Anne K.; Pancheva, Dora V.; Mitchell, Nicholas J.; Marsh, Daniel R.; Russell, James M., III; Mlynczak, Martin G.; [2007]; 19 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 370544.04.12; Copyright; Avail.: CASI: A03, Hardcopy

Horizontal wind observations over four years from the meteor radar at Esrange (68 deg N) are analyzed to determine the variability of the semidiurnal tide. Simultaneous global observations of temperature and geopotential from the SABER satellite instrument are used to construct time series of planetary wave amplitudes and geostrophic mean zonal wind. During NH summer and fall, the temporal variability of the semidiurnal tide at Esrange is found to be well correlated with the amplitude of planetary wavenumber 1 in the stratosphere in high southern latitudes (i.e., in the opposite hemisphere). The correlations indicate that a significant part of the tidal variations at Esrange is due to dynamical interactions in the Southern

Hemisphere. Other times of the year do not indicate a corresponding robust correlation pattern for the Esrange tides over multiple years.
Author
Wind (Meteorology); Tides; Time Series Analysis; Diurnal Variations; Summer

20080008421 Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA
Accuracy of High-Rate GPS for Seismology
Elosegui, P.; Davis, J. L.; Oberlander, D.; Baena, R.; Ekstrom, G.; Geophysical Research Letters; June 13, 2006; ISSN 0094-8276; Volume 33; 4 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAG5-13748; ESP2004-00218; CGL2004-2 1479-E; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1029/2006GL026065

We built a device for translating a GPS antenna on a positioning table to simulate the ground motions caused by an earthquake. The earthquake simulator is accurate to better than 0.1 mm in position, and provides the 'ground truth' displacements for assessing the technique of high-rate GPS. We found that the root-mean-square error of the 1-Hz GPS position estimates over the 15-min duration of the simulated seismic event was 2.5 mm, with approximately 96% of the observations in error by less than 5 mm, and is independent of GPS antenna motion. The error spectrum of the GPS estimates is approximately flicker noise, with a 50% decorrelation time for the position error of approx.1.6 s. We that, for the particular event simulated, the spectrum of dependent error in the GPS measurements. surface deformations exceeds the GPS error spectrum within a finite band. More studies are required to determine whether a generally optimal bandwidth exists for a target group of seismic events.
Author
Global Positioning System; Seismology; Accuracy; Earthquakes; Ground Truth; Position Errors; Displacement

20080008426 Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA
Global Distortion of GPS Networks Associated with Satellite Antenna Model Errors
Cardellach, E.; Elosequi, P.; Davis, J. L.; July 10, 2007; ISSN 0148-0227; 13 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAG5-13748; NNG04GF09G; NNG04GL69G; ESP2004--00218; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1029/2006JB004675

Recent studies of the GPS satellite phase center offsets (PCOs) suggest that these have been in error by approx.1 m. Previous studies had shown that PCO errors are absorbed mainly by parameters representing satellite clock and the radial components of site position. On the basis of the assumption that the radial errors are equal, PCO errors will therefore introduce an error in network scale. However, PCO errors also introduce distortions, or apparent deformations, within the network, primarily in the radial (vertical) component of site position that cannot be corrected via a Helmert transformation. Using numerical simulations to quantify the effects of PC0 errors, we found that these PCO errors lead to a vertical network distortion of 6-12 mm per meter of PCO error. The network distortion depends on the minimum elevation angle used in the analysis of the GPS phase observables, becoming larger as the minimum elevation angle increases. The steady evolution of the GPS constellation as new satellites are launched, age, and are decommissioned, leads to the effects of PCO errors varying with time that introduce an apparent global-scale rate change. We demonstrate here that current estimates for PCO errors result in a geographically variable error in the vertical rate at the 1-2 mm/yr level, which will impact high-precision crustal deformation studies.
Author
Global Positioning System; Deformation; Navigation Satellites; Satellite Antennas; Crustal Fractures; Distortion; Errors

20080008445 NASA Langley Research Center, Hampton, VA, USA
Radiative Heating Methodology for the Huygens Probe
Johnston, Christopher O.; Hollis, Brian R.; Sutton, Kenneth; October 2007; 36 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

The radiative heating environment for the Huygens probe near peak heating conditions for Titan entry is investigated in this paper. The task of calculating the radiation-coupled flowfield, accounting for non-Boltzmann and non-optically thin radiation, is simplified to a rapid yet accurate calculation. This is achieved by using the viscous-shock layer (VSL) technique for the stagnation-line flowfield calculation and a modified smeared rotational band (SRB) model for the radiation calculation. These two methods provide a computationally efficient alternative to a Navier-Stokes flowfield and line-by-line radiation

calculation. The results of the VSL technique are shown to provide an excellent comparison with the Navier-Stokes results of previous studies. It is shown that a conventional SRB approach is inadequate for the partially optically-thick conditions present in the Huygens shock-layer around the peak heating trajectory points. A simple modification is proposed to the SRB model that improves its accuracy in these partially optically-thick conditions. This modified approach, labeled herein as SRBC, is compared throughout this study with a detailed line-by-line (LBL) calculation and is shown to compare within 5% in all cases. The SRBC method requires many orders-of-magnitude less computational time than the LBL method, which makes it ideal for coupling to the flowfield. The application of a collisional-radiative (CR) model for determining the population of the CN electronic states, which govern the radiation for Huygens entry, is discussed and applied. The non-local absorption term in the CR model is formulated in terms of an escape factor, which is then curve-fit with temperature. Although the curve-fit is an approximation, it is shown to compare well with the exact escape factor calculation, which requires a computationally intensive iteration procedure.
Author
Huygens Probe; Radiative Heat Transfer; Flow Distribution; Shock Layers; Navier-Stokes Equation; Electron States

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20080006610 NASA Langley Research Center, Hampton, VA, USA
Ice Cloud Properties in Ice-Over-Water Cloud Systems Using TRMM VIRS and TMI Data
Minnis, Patrick; Huang, Jianping; Lin, Bing; Yi, Yuhong; Arduini, Robert F.; Fan, Tai-Fang; Ayers, J. Kirk; Mace, Gerald G.; [2007]; 55 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): DE-AI02-97ER62341; DE-AI02-02ER63319; WBS 389018.02.04.01.01; Copyright; Avail.: CASI: A04, Hardcopy

A multi-layered cloud retrieval system (MCRS) is updated and used to estimate ice water path in maritime ice-over-water clouds using Visible and Infrared Scanner (VIRS) and TRMM Microwave Imager (TMI) measurements from the Tropical Rainfall Measuring Mission spacecraft between January and August 1998. Lookup tables of top-of-atmosphere 0.65- m reflectance are developed for ice-over-water cloud systems using radiative transfer calculations with various combinations of ice-over-water cloud layers. The liquid and ice water paths, LWP and IWP, respectively, are determined with the MCRS using these lookup tables with a combination of microwave (MW), visible (VIS), and infrared (IR) data. LWP, determined directly from the TMI MW data, is used to define the lower-level cloud properties to select the proper lookup table. The properties of the upper-level ice clouds, such as optical depth and effective size, are then derived using the Visible Infrared Solar-infrared Split-window Technique (VISST), which matches the VIRS IR, 3.9- m, and VIS data to the multilayer-cloud lookup table reflectances and a set of emittance parameterizations. Initial comparisons with surface-based radar retrievals suggest that this enhanced MCRS can significantly improve the accuracy and decrease the IWP in overlapped clouds by 42% and 13% compared to using the single-layer VISST and an earlier simplified MW-VIS-IR (MVI) differencing method, respectively, for ice-over-water cloud systems. The tropical distribution of ice-over-water clouds is the same as derived earlier from combined TMI and VIRS data, but the new values of IWP and optical depth are slightly larger than the older MVI values, and exceed those of single-layered layered clouds by 7% and 11%, respectively. The mean IWP from the MCRS is 8-14% greater than that retrieved from radar retrievals of overlapped clouds over two surface sites and the standard deviations of the differences are similar to those for single-layered clouds. Examples of a method for applying the MCRS over land without microwave data yield similar differences with the surface retrievals. By combining the MCRS with other techniques that focus primarily on optically thin cirrus over low water clouds, it will be possible to more fully assess the IWP in all conditions over ocean except for precipitating systems.
Author
Cloud Physics; Cirrus Clouds; TRMM Satellite; Microwave Imagery; Ice Clouds; Cloud Cover

20080006613 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Importance of Rain Evaporation and Continental Convection in the Tropical Water Cycle

Worden, John; Noone, David; Bowman, Kevin; Beer, R.; Eldering, A.; Fisher, B.; Gunson, M.; Goldman, Aaron; Kulawik, S. S.; Lampel, Michael; Osterman, Gregory; Rinsland, Curtis P.; Rogders, Clive; Sander, Stanley; Shepard, Mark; Webster, Christopher R.; Worden, H. M.; Nature; February 2007; Volume 445, pp. 528-532; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 281945.02.44.01.04; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1038/nature05508

Atmospheric moisture cycling is an important aspect of the Earth's climate system, yet the processes determining atmospheric humidity are poorly understood. For example, direct evaporation of rain contributes significantly to the heat and moisture budgets of clouds, but few observations of these processes are available. Similarly, the relative contributions to atmospheric moisture over land from local evaporation and humidity from oceanic sources are uncertain. Lighter isotopes of water vapour preferentially evaporate whereas heavier isotopes preferentially condense and the isotopic composition of ocean water is known. Here we use this information combined with global measurements of the isotopic composition of tropospheric water vapour from the Tropospheric Emission Spectrometer (TES) aboard the Aura spacecraft, to investigate aspects of the atmospheric hydrological cycle that are not well constrained by observations of precipitation or atmospheric vapour content. Our measurements of the isotopic composition of water vapour near tropical clouds suggest that rainfall evaporation contributes significantly to lower troposphere humidity, with typically 20% and up to 50% of rainfall evaporating near convective clouds. Over the tropical continents the isotopic signature of tropospheric water vapour differs significantly from that of precipitation, suggesting that convection of vapour from both oceanic sources and evapotranspiration are the dominant moisture sources. Our measurements allow an assessment of the intensity of the present hydrological cycle and will help identify any future changes as they occur.

Author

Hydrological Cycle; Rain; Tropical Regions; Convection; Climatology; Evaporation

20080006657 NASA Langley Research Center, Hampton, VA, USA

Nitric Acid Particles in Cold Thick Ice Clouds Observed at Global Scale: Link with Lightning, Temperature, and Upper Tropospheric Water Vapor

Chepfer, H.; Minnis, P.; Dubuisson, P.; Chiriaco, M.; Sun-Mack, S.; Riviere, E. D.; [2007]; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): 23-621-35-96; Copyright; Avail.: CASI: A03, Hardcopy

Signatures of nitric acid particles (NAP) in cold thick ice clouds have been derived from satellite observations. Most NAP are detected in the Tropics (9 to 20% of clouds with T less than 202.5 K). Higher occurrences were found in the rare mid-latitudes very cold clouds. NAP occurrence increases as cloud temperature decreases and NAP are more numerous in January than July. Comparisons of NAP and lightning distributions show that lightning is the main source of the NOx, which forms NAP in cold clouds. Qualitative comparisons of NAP with upper tropospheric humidity distributions suggest that NAP play a role in the dehydration of the upper troposphere when the tropopause is colder than 195K.

Author

Ice Clouds; Lightning; Nitric Acid; Tropical Regions; Troposphere; Water Vapor; Atmospheric Temperature; Cold Weather; Remote Sensing

20080007106 NASA Langley Research Center, Hampton, VA, USA

A Reanalysis for the Seasonal and Longer-Period Cycles and the Trends in Middle Atmosphere Temperature from the HALOE

Remsberg, Ellis E.; [207]; 55 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): 584635.04.02.01; No Copyright; Avail.: CASI: A04, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080007106

Previously published analyses for the seasonal and longer-period cycles in middle atmosphere temperature versus pressure (or T(p)) from the Halogen Occultation Experiment (HALOE) are extended to just over 14 years and updated to properly account for the effects of autocorrelation in its time series of zonally-averaged data. The updated seasonal terms and annual averages are provided, and they can be used to generate temperature distributions that are representative of the period 1991-2005. QBO-like terms have also been resolved and are provided, and they exhibit good consistency across the range of latitudes and pressure-altitudes. Further, exploratory analyses of the residuals from each of the 221 time series have yielded significant 11-yr solar cycle (or SC-like) and linear trend terms at a number of latitudes and levels. The amplitudes of the

SC-like terms for the upper mesosphere agree reasonably with calculations of the direct solar radiative effects for T(p). Those SC amplitudes increase by about a factor of 2 from the lower to the upper mesosphere and are also larger at the middle than at the low latitudes. The diagnosed cooling trends for the subtropical latitudes are in the range, -0.5 to -1.0 K/decade, which is in good agreement with the findings from models of the radiative effects on pressure surfaces due to known increases in atmospheric CO2. The diagnosed trends are somewhat larger than predicted with models for the upper mesosphere of the northern hemisphere middle latitudes.
Author
Halogen Occultation Experiment; Middle Atmosphere; Annual Variations; Solar Cycles; Atmospheric Composition; Atmospheric Temperature

20080007122 NASA Langley Research Center, Hampton, VA, USA
Climate-Induced Boreal Forest Change: Predictions versus Current Observations
Soja, Amber J.; Tchebakova, Nadezda M.; French, Nancy H. F.; Flannigan, Michael D.; Shugart, Herman H.; Stocks, Brian J.; Sukhinin, Anatoly I.; Parfenova, E. I.; Chapin, F. Stuart, III; Stackhouse, Paul W., Jr.; [2007]; 58 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): RFBS-06-05-65127; WBS 920476.07.07; Copyright; Avail.: CASI: A04, Hardcopy

For about three decades, there have been many predictions of the potential ecological response in boreal regions to the currently warmer conditions. In essence, a widespread, naturally occurring experiment has been conducted over time. In this paper, we describe previously modeled predictions of ecological change in boreal Alaska, Canada and Russia, and then we investigate potential evidence of current climate-induced change. For instance, ecological models have suggested that warming will induce the northern and upslope migration of the treeline and an alteration in the current mosaic structure of boreal forests. We present evidence of the migration of keystone ecosystems in the upland and lowland treeline of mountainous regions across southern Siberia. Ecological models have also predicted a moisture-stress-related dieback in white spruce trees in Alaska, and current investigations show that as temperatures increase, white spruce tree growth is declining. Additionally, it was suggested that increases in infestation and wildfire disturbance would be catalysts that precipitate the alteration of the current mosaic forest composition. In Siberia, five of the last seven years have resulted in extreme fire seasons, and extreme fire years have also been more frequent in both Alaska and Canada. In addition, Alaska has experienced extreme and geographically expansive multi-year outbreaks of the spruce beetle, which had been previously limited by the cold, moist environment. We suggest that there is substantial evidence throughout the circumboreal region to conclude that the biosphere within the boreal terrestrial environment has already responded to the transient effects of climate change. Additionally, temperature increases and warming-induced change are progressing faster than had been predicted in some regions, suggesting a potential non-linear rapid response to changes in climate, as opposed to the predicted slow linear response to climate change.
Author
Forests; Timberline; Timber Vigor; Climate Change; Ecosystems; Conifers; Seasons

20080007123 NASA Langley Research Center, Hampton, VA, USA
An EOF Iteration Approach for Obtaining Homogeneous Radiative Fluxes from Satellites Observations
Zhang, Banglin; Pinker, Rachel T.; Stackhouse, Paul W., Jr.; [2007]; 30 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAGW-4740; NAG5-6667; WBS 509496.02.01.01.13; Copyright; Avail.: CASI: A03, Hardcopy

Conventional observations of climate parameters are sparse in space and/or in time and the representativeness of such information needs to be optimized. Observations from satellites provide improved spatial coverage than point observations however they pose new challenges for obtaining homogeneous coverage. Surface radiative fluxes, the forcing functions of the hydrologic cycle and biogeophysical processes, are now becoming available from global scale satellite observations. They are derived from independent satellite platforms and sensors that differ in temporal and spatial resolution and in the size of the footprint from which information is derived. Data gaps, degraded spatial resolution near boundaries of geostationary satellites, and different viewing geometries in areas of satellite overlap, could result in biased estimates of radiative fluxes. In this study, discussed will be issues related to the sources of inhomogeneity in surface radiative fluxes as derived from satellites; development of an approach to obtain homogeneous data sets; and application of the methodology to the widely used International Satellite Cloud Climatology Project (ISCCP) data that currently serve as a source of information for deriving estimates of surface and top of the atmosphere radiative fluxes. Introduced is an Empirical Orthogonal Function (EOF) iteration scheme for homogenizing the fluxes. The scheme is evaluated in several ways including comparison of the inferred

radiative fluxes against ground observations, both before and after the EOF approach is applied. On the average, the latter reduces the rms error by about 2-3 W/m2.
Author
Satellite Observation; Clouds (Meteorology); Radiative Heat Transfer; Photosynthetically Active Radiation; Climatology

20080007146 NASA Langley Research Center, Hampton, VA, USA
Reactive Nitrogen Distribution and Partitioning in the North American Troposphere and Lowermost Stratosphere
Singh, H. B.; Salas, L.; Herlth, D.; Kolyer, R.; Czech, E.; Avery, M.; Crawford, J. H.; Pierce, B.; Sachse, G. W.; Blake, D. R.; Cohen, R. C.; Dibb, J.; Huey, G.; Hudman, R. C.; Turquety, S.; Emmons, L. K.; FLocke, F.; Tang, Y.; Carmichael, G. R.; Horowitz, L. W.; [2007]; 35 pp.; In English; Submitted to the Journal of Geophysical Research to be published in volume 112, pp. 1-15, April 2007; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 281945.02.39.01.04; Copyright; Avail.: CASI: A03, Hardcopy

A comprehensive group of reactive nitrogen species (NO, NO2, HNO3, HO2NO2, PANs, alkyl nitrates, and aerosol-NO3) were measured in the troposphere and lowermost stratosphere over North America and the Atlantic during July/August 2004 (INTEX-A) from the NASA DC-8 platform (0.1-12 km). Less reactive nitrogen species (HCN and CH3CN), that are also unique tracers of biomass combustion, were also measured along with a host of other gaseous (CO, VOC, OVOC, halocarbon) and aerosol tracers. Clean background air as well as air with influences from biogenic emissions, anthropogenic pollution, biomass combustion, and stratosphere was sampled both over continental U. S., Atlantic and Pacific. The North American upper troposphere was found to be greatly influenced by both lightning NO(x) and surface pollution lofted via convection and contained elevated concentrations of PAN, ozone, hydrocarbons, and NO(x). Under polluted conditions PAN was a dominant carrier of reactive nitrogen in the upper troposphere while nitric acid dominated in the lower troposphere. Peroxynitric acid (HO2NO2) was present in sizable concentrations always peaking at around 8 km. Aerosol nitrate appeared to be mostly contained in large soil based particles in the lower troposphere. Plumes from Alaskan fires contained large amounts of PAN and very little enhancement in ozone. Observational data suggest that lightning was a far greater contributor to NO(x) in the upper troposphere than previously believed. NO(x) and NO(y) reservoir appeared to be in steady state only in the middle troposphere where NO(x)/NO(y) was independent of air mass age. A first comparison of observed data with simulations from four 3-D models shows significant differences between observations and models as well as among models. These uncertainties likely propagate themselves in satellites derived NOx data. Observed data are interpreted to suggest that soil sinks of HCN/CH3CN are at best very small. We investigate the partitioning and interplay of the reactive nitrogen species within characteristic air masses and further examine their role in ozone formation.
Author
Stratosphere; Troposphere; Nitrogen Oxides; Nitrogen; Hydrocarbons; Air Masses; Air Quality; Pollution; Reactivity

20080007166 NASA Langley Research Center, Hampton, VA, USA
Cloudy Sounding and Cloud-Top Height Retrieval From AIRS Alone Single Field-of-View Radiance Measurements
Weisz, Elisabeth; Li, Jun; Li, Jinlong; Zhou, Daniel K.; Huang, Hung-Lung; Goldberg, Mitchell D.; Yang, Ping; [2007]; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): WBS 5341730207943802; Copyright; Avail.: CASI: A03, Hardcopy

High-spectral resolution measurements from the Atmospheric Infrared Sounder (AIRS) onboard the EOS (Earth Observing System) Aqua satellite provide unique information about atmospheric state, surface and cloud properties. This paper presents an AIRS alone single field-of-view (SFOV) retrieval algorithm to simultaneously retrieve temperature, humidity and ozone profiles under all weather conditions, as well as cloud top pressure (CTP) and cloud optical thickness (COT) under cloudy skies. For optically thick cloud conditions the above-cloud soundings are derived, whereas for clear skies and optically thin cloud conditions the profiles are retrieved from 0.005 hPa down to the earth's surface. Initial validation has been conducted by using the operational MODIS (Moderate Resolution Imaging Spectroradiometer) product, ECMWF (European Center of Medium range Weather Forecasts) analysis fields and radiosonde observations (RAOBs). These inter-comparisons clearly demonstrate the potential of this algorithm to process data from 38 high-spectral infrared (IR) sounder instruments.
Author
Cloud Height Indicators; Weather Forecasting; Meteorological Parameters; Field of View; Infrared Instruments; Atmospheric Composition; Cloud Physics

20080007187 NASA Langley Research Center, Hampton, VA, USA

Ionospheric E-Region Response to Solar-Geomagnetic Storms Observed by TIMED/SABER and Application to IRI Storm-Model Development

Mertens, Christopher J.; Mast, Jeffrey C.; Winick, Jeremy R.; Russell, James M., III; Mlynczak, Martin G.; Evans, David S.; [2007]; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 23-370-16-02; Copyright; Avail.: CASI: A03, Hardcopy

The large thermospheric infrared radiance enhancements observed from the TIMED/SABER experiment during recent solar storms provide an exciting opportunity to study the influence of solar-geomagnetic disturbances on the upper atmosphere and ionosphere. In particular, nighttime enhancements of 4.3 um emission, due to vibrational excitation and radiative emission by NO+, provide an excellent proxy to study and analyze the response of the ionospheric E-region to auroral electron dosing and storm-time enhancements to the E-region electron density. In this paper we give a status report of on-going work on model and data analysis methodologies of deriving NO+ 4.3 um volume emission rates, a proxy for the storm-time E-region response, and the approach for deriving an empirical storm-time correction to International Reference Ionosphere (IRI) E-region NO+ and electron densities.

Author

E Region; Earth Ionosphere; Geomagnetism; Magnetic Storms; Solar Storms; Thermosphere; Solar Terrestrial Interactions

20080008314 Air Force Research Lab., Hanscom AFB, MA USA

A Space-Based Proxy for the Dst Index

Rich, F J; Bono, J M; Burke, W J; Gentile, L C; May 18, 2007; 8 pp.; In English

Contract(s)/Grant(s): F19628-02-C-0012; Proj-2311

Report No.(s): AD-A474975; AFRL-RV-HA-TR-2007-1114; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA474975

The Dst index was created to monitor and quantify disturbances in the inner magnetosphere using ground-based, magnetic field measurements. The phases and strengths of geomagnetic storms are usually defined by the evolution of Dst. The standard Dst database is computed and maintained at the World Data Center for Geomagnetism, Kyoto. We demonstrate that the Dst index can also be approximated using magnetometers on spacecraft in near-Earth orbit. Measurements used in the demonstration were obtained from boom-mounted sensors on two spacecraft of the Defense Meteorological Satellite Program. The extraction technique can be applied to magnetic field data retrieved by magnetometers on any spacecraft in low Earth orbit. This alternate method for computing a Dst-like index can be used to (1) supplement the standard Dst index in near-real-time space weather applications and (2) replace the 'prompt' Dst index during periods of unavailability.

DTIC

Magnetometers; Geomagnetism; Space Weather; Magnetic Storms; Space Platforms; Earth Magnetosphere; Satellite Observation

20080008444 NASA Langley Research Center, Hampton, VA, USA

The Seasonal Heat Budgets of the Red and Black Seas

Matsoukas, C.; Banks, A. C.; Pavlakis, K. G.; Hatzianastassiou, N.; Hatzidimitriou, D.; Drakakis, E.; Stackhouse, Paul W.; Vardavas, I.; October 2007; 44 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 509496.02.01.01.13; Copyright; Avail.: Other Sources

In this study we calculate the monthly heat budget of the Red and Black Seas and its components: the net solar and net terrestrial fluxes, the sensible and latent heat fluxes, and the monthly heat content change. A radiation transfer model is employed for the estimation of the net solar and terrestrial energy fluxes, instead of commonly used parameterizations. The agreement with radiation fluxes measured at surface stations is within 10 W/sq m. The Red Sea net solar flux estimate is lower than past studies. The monthly heat content of both Seas is estimated from water temperature and salinity profiles and is found to dominate the seasonal energy exchange between the water and the atmosphere, as for the Mediterranean Sea. The latent heat flux is calculated using two methodologies: the bulk aerodynamic and the energy balance method. Our annual results for the Red and Black Seas show solar heating of 238 and 139 W/sq m, respectively. The evaporation rates are 2120 and 960 mm/yr, respectively. The annual aerosol direct forcing on the net solar flux is -10 W/sq m and -3 W/sq m.

Author

Energy Budgets; Heat Budget; Heat Flux; Red Sea; Solar Flux; Temperature Profiles; Latent Heat; Radiative Transfer; Solar Energy

20080008460 NASA Langley Research Center, Hampton, VA, USA

Creating User-Friendly Tools for Data Analysis and Visualization in K-12 Classrooms: A Fortran Dinosaur Meets Generation Y

Chambers, L. H.; Chaudhury, S.; Page, M. T.; Lankey, A. J.; Doughty, J.; Kern, Steven; Rogerson, Tina M.; January 20, 2008; 6 pp.; In English; 88th AMS Annual Meeting, 20-24 Jan. 2008, New Orleans, LA, USA; Original contains color illustrations

Contract(s)/Grant(s): NNG06GH31G; WBS 333217.02.01.01.06; Copyright; Avail.: CASI: A02, Hardcopy

During the summer of 2007, as part of the second year of a NASA-funded project in partnership with Christopher Newport University called SPHERE (Students as Professionals Helping Educators Research the Earth), a group of undergraduate students spent 8 weeks in a research internship at or near NASA Langley Research Center. Three students from this group formed the Clouds group along with a NASA mentor (Chambers), and the brief addition of a local high school student fulfilling a mentorship requirement. The Clouds group was given the task of exploring and analyzing ground-based cloud observations obtained by K-12 students as part of the Students' Cloud Observations On-Line (S'COOL) Project, and the corresponding satellite data. This project began in 1997. The primary analysis tools developed for it were in FORTRAN, a computer language none of the students were familiar with. While they persevered through computer challenges and picky syntax, it eventually became obvious that this was not the most fruitful approach for a project aimed at motivating K-12 students to do their own data analysis. Thus, about halfway through the summer the group shifted its focus to more modern data analysis and visualization tools, namely spreadsheets and Google(tm) Earth. The result of their efforts, so far, is two different Excel spreadsheets and a Google(tm) Earth file. The spreadsheets are set up to allow participating classrooms to paste in a particular dataset of interest, using the standard S'COOL format, and easily perform a variety of analyses and comparisons of the ground cloud observation reports and their correspondence with the satellite data. This includes summarizing cloud occurrence and cloud cover statistics, and comparing cloud cover measurements from the two points of view. A visual classification tool is also provided to compare the cloud levels reported from the two viewpoints. This provides a statistical counterpart to the existing S'COOL data visualization tool, which is used for individual ground-to-satellite correspondences. The Google(tm) Earth file contains a set of placemarks and ground overlays to show participating students the area around their school that the satellite is measuring. This approach will be automated and made interactive by the S'COOL database expert and will also be used to help refine the latitude/longitude location of the participating schools. Once complete, these new data analysis tools will be posted on the S'COOL website for use by the project participants in schools around the US and the world.

Author

Cloud Cover; Clouds (Meteorology); Scientific Visualization; Students; Earth Radiation Budget; Earth Observations (From Space); Cloud Physics

20080008470 NASA Langley Research Center, Hampton, VA, USA

Integration of Satellite-Derived Cloud Phase, Cloud Top Height, and Liquid Water Path into an Operational Aircraft Icing Nowcasting System

Haggerty, Julie; McDonough, Frank; Black, Jennifer; Landott, Scott; Wolff, Cory; Mueller, Steven; Minnis, Patrick; Smith, William, Jr.; January 20, 2008; 8 pp.; In English; AMS 13th Conf Aviation, Range, and Aerospace Meteorology, 20-24 Jan. 2008, New Orleans, LA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 389018.02.13.01.60; Copyright; Avail.: CASI: A02, Hardcopy

Operational products used by the U.S. Federal Aviation Administration to alert pilots of hazardous icing provide nowcast and short-term forecast estimates of the potential for the presence of supercooled liquid water and supercooled large droplets. The Current Icing Product (CIP) system employs basic satellite-derived information, including a cloud mask and cloud top temperature estimates, together with multiple other data sources to produce a gridded, three-dimensional, hourly depiction of icing probability and severity. Advanced satellite-derived cloud products developed at the NASA Langley Research Center (LaRC) provide a more detailed description of cloud properties (primarily at cloud top) compared to the basic satellite-derived information used currently in CIP. Cloud hydrometeor phase, liquid water path, cloud effective temperature, and cloud top height as estimated by the LaRC algorithms are into the CIP fuzzy logic scheme and a confidence value is determined. Examples of CIP products before and after the integration of the LaRC satellite-derived products will be presented at the conference.

Author

Aircraft Icing; Cloud Height Indicators; Satellite Observation; Clouds (Meteorology); Flight Conditions; Atmospheric Moisture; Aviation Meteorology; Algorithms

20080008476 NASA Langley Research Center, Hampton, VA, USA

Seasonal Trends in Stratospheric Water Vapor as Derived from SAGE II Data

Roell, Marilee M.; Fu, Rong; January 20, 2008; 1 pp.; In English; 88th AMS Annual Meeting, 20-24 Jan. 2008, New Orleans, LA, USA

Contract(s)/Grant(s): WBS 526282.01.07.02

Report No.(s): P1.76; Copyright; Avail.: Other Sources; Abstract Only

Published analysis of HALOE and Boulder balloon measurements of water vapor have shown conflicting trends in stratospheric water vapor for the periods of 1981 through 2005. Analysis of the SAGE II monthly mean water vapor data filtered for large aerosol events for time periods from 1985-1991, 1995-1999, and 2000-2005 have shown a globally decreasing water vapor trend at 17.5km. Seasonal analysis for these three time periods show a decreasing trend in water vapor at 17.5km for the winter and spring seasons. The summer and autumn seasonal analysis show a decreasing trend from 1985-2005, however, there is a increasing trend in water vapor at 17.5km for these seasons during 1995-2005. Latitude vs height seasonal analysis show a decreasing trend in the lower stratosphere between 20S - 20N for the autumn season, while at the latitudes of 30-50S and 30-50N there is an increasing trend in water vapor at heights up to 15km for that season. Comparison with regions of monsoon activity (Asian and North American) show that the Asian monsoon region had some effect on the lower stratospheric moistening in 1995-1999, however, for the time period of 2000-2005, there was no change in the global trend analysis due to either monsoon region. This may be due to the limitations of the SAGE II data from 2000-2005.

Author

Water Vapor; Stratosphere; Aerosols; Trend Analysis; Halogen Occultation Experiment

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*.

20080006576 Texas Univ. Health Science Center, San Antonio, TX USA

Characterization of the Effects of Fatigue on the Central Nervous System (CNS) and Drug Therapies

Mery, Laura; Nov 2007; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-2313

Report No.(s): AD-A475248; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study aimed to establish a rat fatigue model to test fatigue countermeasures. The model focused on central fatigue. Central fatigue associated with sleep disruption may precede peripheral fatigue, and therefore may predict impaired performance earlier than peripheral fatigue. The modified flower pot method of sleep disruption was used to induce fatigue. This study utilized hippocampal dependant tasks, the radial arm maze and the Barnes maze, to characterize the effects of sleep disruption fatigue. In addition, EEG recordings were taken to detect different sleep state changes associated with 12 hours of light phase sleep disruption. Modafinil given before sleep disruption, and at least 6 hours after the beginning of the light phase during the sleep disruption tended to improve performance in the radial arm maze. Orexin receptor antagonist SB 344867 was administered at the same time points as modafinil for a total dose of 30 mg/kg in a 12 hour sleep disruption time period. SB 344867 had an effect on Barnes maze performance. In this modified flower pot method for sleep disruption, corticosterone increased significantly during the 12 hours of sleep disruption and returned to basal levels at the end of the light phase. Elevated corticosterone leads to dendritic changes in the hippocampus, which is associated with radial arm maze and Barnes maze performance.

DTIC

Central Nervous System; Chemotherapy; Sleep Deprivation

20080008522 Creighton Univ., Omaha, NE USA

Prion Transport to Secondary Lymphoreticular System Tissues

Bartz, Jason C; Jun 2007; 9 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0319

Report No.(s): AD-A474582; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The long-term objective of this proposal is to identify mechanisms of prion transport to secondary lymphoreticular system

(LRS) tissues. The hypothesis to be tested is that following peripheral exposure to prions; host proteins (e.g. complement) bind prions allowing for trapping by cells in the spleen and enhancing uptake by macrophages, which are cells that are responsible for destruction of foreign proteins. To investigate this hypothesis we will examine the disease development of a prion strain (DY TME) that does not replicate in the spleen of hamsters. This system will provide details into the host factor(s) involved in transport of prions to cells in the LRS. We have shown the susceptibility of HY and DY TME to phagocytosis and degradation by a murine macrophage cell line. We are currently studying the effects of prion infection on phagocytic ability and cell viability. We have shown differences in the spatial and temporal spread of the HY and DY TME agents in LRS tissues following intraperitoneal inoculation. We have shown gender specific responses to intraperitoneal DY TME inoculation.
DTIC
Cells (Biology); Infectious Diseases; Tissues (Biology); Lymphatic System; Pathogens

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*.

20080006841 NASA Glenn Research Center, Cleveland, OH, USA
Zero-Gravity Locomotion Simulators: New Ground-Based Analogs for Microgravity Exercise Simulation
Perusek, Gail P.; DeWitt, John K.; Cavanagh, Peter R.; Grodsinsky, Carlos M.; Gilkey, Kelly M.; December 10, 2007; 27 pp.; In English; ESA Symposium: Technology for Artificial Gravity and Microgravity Simulation, 10-12 Dec. 2007, Noordwijk, Netherlands; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 516724.02.02.03; Copyright; Avail.: CASI: A03, Hardcopy

Maintaining health and fitness in crewmembers during space missions is essential for preserving performance for mission-critical tasks. NASA's Exercise Countermeasures Project (ECP) provides space exploration exercise hardware and monitoring requirements that lead to devices that are reliable, meet medical, vehicle, and habitat constraints, and use minimal vehicle and crew resources. ECP will also develop and validate efficient exercise prescriptions that minimize daily time needed for completion of exercise yet maximize performance for mission activities. In meeting these mission goals, NASA Glenn Research Center (Cleveland, OH, USA), in collaboration with the Cleveland Clinic (Cleveland, Ohio, USA), has developed a suite of zero-gravity locomotion simulators and associated technologies to address the need for ground-based test analog capability for simulating in-flight (microgravity) and surface (partial-gravity) exercise to advance the health and safety of astronaut crews and the next generation of space explorers. Various research areas can be explored. These include improving crew comfort during exercise, and understanding joint kinematics and muscle activation pattern differences relative to external loading mechanisms. In addition, exercise protocol and hardware optimization can be investigated, along with characterizing system dynamic response and the physiological demand associated with advanced exercise device concepts and performance of critical mission tasks for Exploration class missions. Three zero-gravity locomotion simulators are currently in use and the research focus for each will be presented. All of the devices are based on a supine subject suspension system, which simulates a reduced gravity environment by completely or partially offloading the weight of the exercising test subject s body. A platform for mounting treadmill is positioned perpendicularly to the test subject. The Cleveland Clinic Zero-g Locomotion Simulator (ZLS) utilizes a pneumatic subject load device to apply a near constant gravity-replacement load to the test subject during exercise, and is currently used in conjunction with the General Clinical Research Center for evaluating exercise protocols using a bedrest analog. The enhanced ZLS (eZLS) at NASA Glenn Research Center features an offloaded treadmill that floats on a thin film of air and interfaces to a force reaction frame via variably-compliant isolators, or vibration isolation system. The isolators can be configured to simulate compliant interfaces to the vehicle, which affects mechanical loading to crewmembers during exercise, and has been used to validate system dynamic models for new countermeasures equipment designs, such as the second International Space Station treadmill slated for use in 2010. In the eZLS, the test subject and exercise device can be pitched at the appropriate angle for partial gravity simulations, such as lunar gravity (1/6th earth gravity). On both the eZLS and the NASA-Johnson Space Center standalone ZLS installed at the University of Texas Medical Branch in Galveston, Texas, USA, the subject's body weight relative to the treadmill is controlled via a linear motor subject load device (LM-SLD). The LM-SLD employs a force-feedback closed-loop control system to provide a relatively constant force to the test subject during locomotion, and is set and verified for subject safety prior to each session. Locomotion data were collected during parabolic flight and on the eZLS. The purpose was to determine the similarities and differences between locomotion in actual and simulated microgravity. Subjects attained greater amounts of hip flexion during walking and running during parabolic flight.

During running, subjects had greater hip range of motion. Trunk motion was significantly less on the eZLS than during parabolic flight. Peak impact forces, loading rate, and impulse were greater on the eZLS than during parabolic while walking with a low external load (EL) and rning with a high EL. Activation timing differences existed between locations in all muscles except for the rectus femoris. The tibialis anterior and gluteus maximus were active for longer durations on the eZLS than in parabolic flight during walking. Ground reaction forces were greater with the LM-SLD than with bungees during eZLS locomotion. While the eZLS serves as a ground-based analog, researchers should be aware that subtle, but measurable, differences in kinematics and leg musculature activities exist between the environments. Aside from space applications, zero-gravity locomotion simulators may help medical researchers in the future with development of rehabilitative or therapeutic protocols for injured or ill patients. Zero-gravity locomotion simulators may be used as a ground-based test bed to support future missions for space exploration, and eventually may be used to simulate planetary locomotion in partial gravity environments, including the Moon and Mars. Figure: Zero-gravity Locomotion Simulator at the Cleveland Clinic, Cleveland, Ohio, USA

Author

Weightlessness; Locomotion; Gravitation; Countermeasures; Loads (Forces); Physical Exercise; Treadmills; Simulators

20080008161 Institute of Space Medico-Engineering, Beijing, China

Space Medicine and Medical Engineering, Volume 20, No. 3

Chen, Shan-guang, Editor; Wang, Xian-min, Editor; Bai, Jing, Editor; Bai, Yan-qiang, Editor; Sun, Xi-qing, Editor; Hong, Feng, Editor; Su, Hong-yu, Editor; Wang, Zhi-kui, Editor; Lu, Yao-feng, Editor; Sun, Meng-jie, Editor; Li, Jian-hui, Editor; Su, Hong-yu, Editor; June 2007; ISSN 1002-0837; 84 pp.; In English; See also 20080008162 - 20080008177; Original contains black and white illustrations

Report No.(s): CN 11-2774/R; Copyright; Avail.: Other Sources

Topics in this issue include: Changes of Cardiac Pump Function in Push-pull Effect Simulated by Tilt Table Effects of Beer and Ethanol on Gamma-Ray-induced Chromosome Aberration in Mouse Bone Marrow Cells Development of a Ground-based Micro-algae Photo-bioreactor Experimental Facility for Using in Space Design of a Novel Quartz Temperature Sensor Used for Temperature Monitoring in Manned Space Flight Effects of Dorsal Periaqueductal Gray Stimulation and Reperfusion on Cerebral Ischemic Injury in Rats The Influence of Circadian Gene Period2 on NIH3T3 Cell Damaged by Ultraviolet Screening the Interacting Proteins of hPerl Experimental Study of Expression of PAL Gene and HSP60 Gene of Legionella Pneumophila in NIH3T3 Cell Atrial Arrhythmia Recognition Based on Grey Correlation and K-nearest Neighbour Speckle Reduction for Ultrasound Images with Anisotropic Diffusion Based on EM Parameter Estimation Algorithm Edge Detection of Ultrasound Medical Image Using Mean Curvature Vector Flow Deformable Models Oxygenated Hemoglobin Responses in Prefrontal Area during Visual Search Tasks Measured with Near-infrared Spectroscopy Image Distance Transform as Used for Studying Distribution of Ca2+ Concentration in Cardiac Myocyte Simulation Study of Eddy Current Problem in Magnetic Induction Tomography by Using Finite Element Method A Contact Mechanics Characteristic Analysis of Artificial Acetabulum by Finite Element Method Experimental Technologies for Imposing Mechanical Force on Cells

CASI

Aerospace Medicine; Physiological Responses; Gravitational Physiology; Gravitational Effects; Cells (Biology); Radiation Effects

20080008162 Institute of Space Medico-Engineering, Beijing, China

Simulation Study of Eddy Current Problem in Magnetic Induction Tomography by Using Finite Element Method

Wang, Cong; Dong, Xiu-zhen; Liu, Rui-gang; Shi, Xue-tao; Fu, Feng; You, Fu-sheng; Space Medicine and Medical Engineering, Volume 20, No. 3; June 2007, pp. 219-222; In Chinese; See also 20080008161; Copyright; Avail.: Other Sources

Objective: To solve the eddy current problem or the forward problem in magnetic induction tomography(M1T). Methods: Differential equation and its boundary condition of eddy current problem in MIT were presented; finite element method was used to calculate the magnetic vector potential of perturbations with different conductivities or positions. Results: The simulation results agreed well with the measured ones from a single receiving coil MIT system. Conclusion: The good agreement of the simulated data with the measured ones demonstrates the applicability of the finite element method for biomedical applications and a solution of the forward problem in MIT, a more sophisticated simulation model may further improve the calculation accuracy. Key words: magnetic induction tomography; forward problem ; finite element method ; eddy currents

Author

Magnetic Induction; Eddy Currents; Tomography; Finite Element Method; Simulation; Boundary Conditions

20080008163 Institute of Space Medico-Engineering, Beijing, China

Image Distance Transform as Used for Studying Distribution of Ca2+ Concentration in Cardiac Myocyte

Li, Xian-wei; Luo, Dai-sheng; Xie, Ming; Gan, Ke; Hu, Huo-zhen; Zhang, Yong-gang; Space Medicine and Medical Engineering, Volume 20, No. 3; June 2007, pp. 213-218; In Chinese; See also 20080008161; Copyright; Avail.: Other Sources

To study the spatial distribution and the time distribution of Ca2+ concentrations in a cardiac myocyte in order to get the parameters for mathematically modeling the excitation-contraction of the cardiac myocyte and to assist pathological and pharmacological researches of cardiac diseases in cell level. The images of a cardiac myocyte were first segmented by image segmentation. Then a distance transform was used to divide the cardiac myocyte into layers of shells from the membrane towards inside. Ca2+ concentrations were detected for each layer. According to the Ca2+ concentrations of each shell in serial time,spatial distribution and time distribution of the Ca2+ concentrations in the cardiac myocyte was calculated. Conclusion The distribution of Ca2+ (and the other ions) concentrations in an elastically beating cardiac myocyte can be analyzed fast and correctly by applying the distance transform method to the cardiac myocyte images. This method can also be applied to analyze the measurements of other elastically moving objects.

Author

Heart; Calcium; Ions; Muscle Cells

20080008164 Institute of Space Medico-Engineering, Beijing, China

Experimental Technologies for Imposing Mechanical Force on Cells

Zeng, Ye; Liu, Xiao-heng; Space Medicine and Medical Engineering, Volume 20, No. 3; June 2007, pp. 227-234; In Chinese; See also 20080008161; Copyright; Avail.: Other Sources

Most of the experimental technologies for imposing force on cells mimic only one in vivo or in vitro mechanical environment. According to the different source of forces, the loading methods can be divided into two types: modeling the force in vivo mainly to simulate fluid shear stress, liquid hydrostatic pressure, circumferential strain and substrate stretch stress; and modeling mechanics in vitro mainly including microgravity culture system, centrifugal field culture system, air hydrostatic pressurization, ultrasound stimulus and microbeam irradiation. In addition, the main experimental technologies for single cell exposed to force are listed as Micropipette aspiration technique, atomic force microscope cantilevers deflection stimulus, magnetic twisting method, and force generated by a laser tweezers trap. These main experimental technologies are discussed in this paper. Key words: cellular mechanics ; mechanobiology ; experimental technology; loading methods ; instruments and equipments

Author

In Vitro Methods and Tests; In Vivo Methods and Tests; Shear Stress; Hydrostatic Pressure; Microgravity; Centrifugal Force; Ultrasonics; Microbeams

20080008165 Institute of Space Medico-Engineering, Beijing, China

A Contact Mechanics Characteristic Analysis of Artificial Acetabulum by Finite Element Method

Ge, Shi-rong; Jiang, Hai-bo; Space Medicine and Medical Engineering, Volume 20, No. 3; June 2007, pp. 223-226; In Chinese; See also 20080008161; Copyright; Avail.: Other Sources

Objective: To investigate the contact mechanical characteristics of artificial acetabulum made of ultra-high molecule polyethylene (UHMWPE). Methods: An acetabulum model was developed and meshed with free pattern. The contact pairs between acetabulum and femur head were built and the mechanical characteristics were analyzed under different conditions by finite element method (FEM). Results: The magnitude of compress deformation decreased with the increase of friction coefficient and acetabulum diameter. Long-term stability of the hip joint was affected by contact layer thickness and contact area that have different characteristics under various thicknesses of the acetabulum. Conclusion The calculations show that acetabula with 7-9 mm thicknesses have better contact mechanical characteristics.

Author

Finite Element Method; Polyethylenes; Joints (Anatomy); Mechanical Properties; Deformation; Coefficient of Friction

20080008166 Institute of Space Medico-Engineering, Beijing, China

The Influence of Circadian Gene Period2 on NIH3T3 Cell Damaged by Ultraviolet

Shi, Xiu-bo; Liu, Yan-you; Wang, Hong-bo; Zhu, Bin; Ye, Qing; Li, Bao-quo; Wang, Zheng-rong; Space Medicine and

Medical Engineering, Volume 20, No. 3; June 2007, pp. 180-183; In Chinese; See also 20080008161; Copyright; Avail.: Other Sources

Objective: To investigate the effect of circadian gene Period2(Per2) on NIH3T3 cell damaged by ultraviolet. Methods: The Per2 expressing vector (pcDNA 3.1-Per2) was transfected into NIH3T3 cells(pcDNA 3.1-Per2 transfected with pcDNA 3.1-Per2, and pcDNA 3.1-vector transfected with pcDNA 3.1-vector) by liposome. They were irradiated with ultraviolet light. Expression of Per2 in the NIH3T3 cells was tested by immunohistochemistry and flow cytometry,while proliferation and apoptosis were examined by colony formation assay and flowcytometry. Single cell gel electrophoresis (SCGE) was used to test the damage and repair pattern of DNA. Results: As compared with the control cells, NIH3T3 cells transfected with pcDNA 3.1-Per2 showed high proliferation and low apoptosis after ultraviolet irradiation. SCGE test also showed that the rate of comet cell and the length of DNA migration was lower in pcDNA 3.1-Per2 transfected cells than that in control cells, though all groups exhibited apparent damage of DNA. Conclusion: Per2 may have protective effect against ultraviolet damage to DNA. The mechanism may be related to the enhancement of DNA repair by Per2. Key words: circardine gene ; Per2 ; DNA damage ;single cell gel electrophoresis ; ultraviolet radiation

Author

Circadian Rhythms; Deoxyribonucleic Acid; Damage; Ultraviolet Radiation; Electrophoresis

20080008167 Institute of Space Medico-Engineering, Beijing, China

Atrial Arrhythmia Recognition Based on Grey Correlation and K-nearest Neighbor

Sun, Rong-rong; Wang, Yuan-yuan; Fang, Zu-xiang; Space Medicine and Medical Engineering, Volume 20, No. 3; June 2007, pp. 193-197; In Chinese; See also 20080008161; Copyright; Avail.: Other Sources

Objective: To study the method combining the grey correlation of the grey theory and the k-nearest neighbor to recognize sinus rhythm (SR) , atrial flutter (AFL) and atrial fibrillation (AF). Methods: The electrocardiograms were divided into training data and testing data. Firstly, signals were transformed into time-frequency domain using multi-scale wavelet. Then singular values were extracted from the wavelet coefficient matrix as feature vectors of the signals. With feature vectors of all the training data as normal template, grey correlation coefficients between feature vectors of the testing data and the normal template were calculated. Finally recognition was made using the k-nearest neighbor. Sensitivity (SE) , specificity(SP) and accuracy (AC) of the method were evaluated for atrial arrhythmia recognition with two databases, the MIT-BIH arrhythmia database and the canine endocardial database. Results: Experimental results demonstrated that the proposed method achieved higher recognition performance for SR, AFL or AF with a higher computation speed compared with the traditional grey correlation, the traditional k-nearest neighbor or the back propagation (BP) neural network. Conclusion: The proposed method can recognize SR ,AFL and AF accurately with a simple computation and small training samples. It is expected to be used in implantable devices for therapy of atrial arrythmias. Key words: atrial arrhythmia; wavelet transform; singular value decomposition; grey correlation; k-nearest neighbor

Author

Arrhythmia; Correlation Coefficients; Wavelet Analysis; Decomposition; Electrocardiography; Neural Nets

20080008168 Institute of Space Medico-Engineering, Beijing, China

Edge Detection of Ultrasound Medical Image Using Mean Curvature Vector Flow Deformable Models

Yang, Liu; Wang, Tian-fu; Lin, Jiang-li; Li, De-yu; Space Medicine and Medical Engineering, Volume 20, No. 3; June 2007, pp. 205-208; In Chinese; See also 20080008161; Copyright; Avail.: Other Sources

Objective: To promote stability and accuracy of gradient vector flow (GVF) deformable models by improving external potential force field of ultrasound images under speckle noisy environments. Methods: A new external force field was generated by using corner and gradient weigh function to control the mean curvature vector flow (MCVF) and anisotropic diffusion, then the deformable model was guided to achieve edge detection. Results: According to the test on noise binary images and ultrasound images, it was proved that in this case the capture range was larger than that of GVF, and it was more insensitive to noise. Conclusion: The results showed that the new method has the advantages of robustness, and large capture range. It reduces noise and at the same time preserves edges and sharp corner points in ultrasound images. It proves to be an effective method for edge detection of ultrasound images. Key words: ultrasound images ; edge detection ; deformable model ; anisotropic diffusion ; mean curvature vector flow

Author

Edge Detection; Gradients; Ultrasonics; Field Theory (Physics); Curvature; Deformation

20080008169 Institute of Space Medico-Engineering, Beijing, China

Changes of Cardiac Pump Function in Push-pull Effect Simulated by Tilt Table

Geng, Jie; Sun, Xi-qing; Yang, Chang-bin; Wang, Yong-chun; Wu, Yan-hong; Wang, Hai-song; Space Medicine and Medical Engineering, Volume 20, No. 3; June 2007, pp. 157-160; In Chinese; See also 20080008161; Copyright; Avail.: Other Sources

Objective: To assess push-pull effect (PPE) on detailed cardiac pump function responses with a tilt table. Methods: Eight healthy male volunteers were exposed to 3 times transition of body position of +90deg head-up tilt (HUT) for 30s approaches head-down tilt (HDT) for 15s in randomized sequences, the angle of HDT are 0deg, -30deg and -90deg. Results: 1) Z(sub 0) decreased with HDT(-Gz) level in the 'push' and 'pull' phases; 2) SV and CO increased with HDT (-Gz) in the 'push' and 'pull' phases; 3) HR decreased in the 'push' phase, but it recovered in the 'pull' phase with HDT (-Gz). Conclusions: In the 'pull' phase of PPE, SV and CO increases while HR decreases with the amplitude of the negative acceleration. This suggests that the vasoconstriction or vasodilatation of peripheral arterial vessels plays an important role in the mechanism of PPE. Author

Cardiac Output; Heart Function; Heart Rate; Hypokinesia; Physiological Responses; Stroke Volume

20080008171 Institute of Space Medico-Engineering, Beijing, China

Effects of Dorsal Periaqueductal Gray Stimulation and Reperfusion on Cerebral Ischemic Injury in Rats

Lei, ting; Huang, Hui-ming; Jin, Ying-xiong; Yang, Zhuo; Zhang, Tao.; Space Medicine and Medical Engineering, Volume 20, No. 3; June 2007, pp. 174-179; In Chinese; See also 20080008161; Copyright; Avail.: Other Sources

Objective: To investigate the effects of dorsal periaqueductal gray (dPAG) stimulation or reperfusion on neural injury and autonomic dysfunction after cerebral ischemia in rats. Methods: Twenty-four male Spague-Dawley rats were randomly divided into three groups: ischemia for 5 h group, ischemia for 2 h plus reperfusion for 3 h group, ischemia for 2 h plus stimulation of dPAG for 1 h group. Cerebral ischemia was induced by intraluminal occlusion of middle cerebral artery. Blood pressure, electrocardiograph and renal sympathetic nerve activity were collected during experiments. Heart rate variability and renal sympathetic nerve activity signals were estimated by power spectral analysis. And infarction volume was measured as well. Results: Stimulation of dPAG reduced infarction volume after cerebral ischemia and increased total power of autonomic system and parasympathetic nerve activity. Reperfusion increased infarction volume after cerebral ischemia and increased sympathetic and parasympathetic nerve activities. Conclusion: Reperfusion has ascendancy in long-dated effects. Electrical stimulation could be beneficial for early injury after cerebral ischemia and may be an accessorial therapy of reperfusion. Key words: electrical stimulation ; reperfusion ; cerebral ischemia ; autonomic dysfunction

Author

Autonomic Nervous System; Ischemia; Cerebrum; Arteries; Blood Pressure; Electrocardiography; Sympathetic Nervous System

20080008172 Institute of Space Medico-Engineering, Beijing, China

Oxygenated Hemoglobin Responses in Prefrontal Area during Visual Search Tasks Measured with Near-infrared Spectroscopy

Yang, Hong-yu; Zhou, Zhen-yu; Ruan, Zong-cai; Gong, Hui; Luo, Qing-ming; Lu, Zu-hong; Space Medicine and Medical Engineering, Volume 20, No. 3; June 2007, pp. 209-212; In Chinese; See also 20080008161; Copyright; Avail.: Other Sources

Objective: To observe concentration changes of oxygenated hemoglobin (HbO2) in prefrontal area during visual search tasks. Methods: Twenty-five healthy college students were asked to do two levels of visual search tasks during which changes of concentration of HbO, were measured. Results: 1) HbO2 increased during the task of detecting a target letter from eight non-target letters as compared with that during the task of detecting a target letter from 2 non-target letters. 2) The enhancement of HbO2 measured by NIRS on prefrontal cortex was negatively correlated with performance of the tasks. Conclusion: The HbO2 response of prefrontal area is consistent with the behavioral result of visual search tasks, suggesting that higher hemodynamic response may reduce the response time of visual search task. Key works : prefrontal cortex ; near-infrared spectroscopy ; visual search

Author

Oxygenation; Hemoglobin; Hemodynamic Responses; Visual Tasks

20080008173 Institute of Space Medico-Engineering, Beijing, China

Screening the Interacting Proteins of hPerl

Ji, Zhi-hong; Jiang, Zhou; Wang, Yu-hui; Lu, Fang; Liu, Yan-you; Gao, Mei; Wang, Zheng-rong; Space Medicine and Medical Engineering, Volume 20, No. 3; June 2007, pp. 184-187; In Chinese; See also 20080008161; Copyright; Avail.: Other Sources

To find a new method for identifying interacting proteins of human Per1 in the blood. Using bHLH-PAS domain of hPerl as bait, a human blood cDNA library was screened and the proteins interacting with hPerl were searched. The positive clones were sequenced and analyzed by bioinformatics methods. Forty-six colonies were selected by the yeast two-hybrid system. LSMD1 protein was obtained after verification. It is proved that Perl can interact with LSMD1 by yeast two-hybrid system. Author

Proteins; Interactions

20080008174 Institute of Space Medico-Engineering, Beijing, China

Design of a Novel Quartz Temperature Sensor Used for Temperature Monitoring in Manned Space Flight

Chen, Zhao-yang; Hao, Hong-wei; Li, Lu-ming; Space Medicine and Medical Engineering, Volume 20, No. 3; June 2007, pp. 170-173; In Chinese; See also 20080008161; Copyright; Avail.: Other Sources

Objective: To design a new digital temperature sensor with quartz crystal for manned space flight. Methods: Based on the piezoelectric resonance principles, the mechanics of quartz tuning-fork flexural vibration frequency was analyzed to determine the first order frequency-temperature characteristics. ZYtw cut mode was designed for the novel tuning-fork temperature sensor. Results: Static and dynamic experiments showed that the nominal frequency of the quartz temperature sensor was 31.530 kHz; the resolution reached 0.03deg C/Hz; and the respond time was less than 4.5 s. Conclusion: The accuracy and effectiveness of the method for designing the new quartz temperature sensor is confirmed to be suitable for manned space flight. Key words: manned space flight; quartz temperature sensor; frequency-temperature characteristics ; flexural vibration ;double cuts type

Author

Temperature Sensors; Quartz Crystals; Frequency Distribution; Accuracy; Piezoelectricity

20080008175 Institute of Space Medico-Engineering, Beijing, China

Experimental Study of Expression of PAL Gene and HSP60 Gene of Legionella Pneumophila in NIH3T3 Cell

Tian, Yu; Chen, Jian-ping; Zhang, Jian-guo; Yang, Chun-lei; Liu, Ming-jie; Space Medicine and Medical Engineering, Volume 20, No. 3; June 2007, pp. 188-192; In Chinese; See also 20080008161; Copyright; Avail.: Other Sources

To study the expression of PAL,HSP60 gene of Legionella pneumophila in NIH3T3 cell ,in order to provide experimental data for development of DNA vaccine against legionnaires' disease. Recombinant plasmid pcDNA3.1-PAL and pcDNA3.1-HSP60 were transfected into the eukaryotic cell NIH3T3 respectively with lipofection strategy. Furthermore, mixed pcDNA3.1- PAL and pcDNA3. 1-HSP60 were also transfected into NIH3T3. Their expression were detected by immunofluorescent staining and RT-PCR. Immunofluorescent staining and RT-PCR detection showed that the recombinant plasmid pcDNA3.1-PAL and pcDNA3.1-HSP60 could express PAL protein and HSP60 protein in the eukaryotic cell NIH3T3 respectively, and mixed pcDNA3. 1-PAL and pcDNA3.1-HSP60 could express PAL protein and HSP60 protein respectively in the eukaryotic cell NIH3T3. These evidences could be the basis for developing new genetic vaccine against Legionnaires ' disease.

Author

Deoxyribonucleic Acid; Genetics; Infectious Diseases; Viruses

20080008176 Institute of Space Medico-Engineering, Beijing, China

Effects of Beer and Ethanol on Gamma-Ray-induced Chromosome Aberration in Mouse Bone Marrow Cells

Lv, Dui-cai; Zhao, Ya-li; Wang, Gen-liang; Liang, Hong; Guo, Yao-yu; Space Medicine and Medical Engineering, Volume 20, No. 3; June 2007, pp. 161-164; In Chinese; See also 20080008161; Copyright; Avail.: Other Sources

Objective: To observe effects of beer and ethanol on chromosome aberrations of mouse bone marrow cells induced by various doses of gamma-ray irradiation. Methods: Healthy male BALB/c mice were arranged into control group, beer group and diluted ethanol group. One ml of saline, beer(ethano1 content, 4.5 v/v) or diluted ethanol (4.5 v/v) were administered orally to the three groups respectively. Thirty minutes later, the animals were given whole-body irradiation with various doses of gamma-ray. The animals were sacrificed by cervical dislocation 24 h after irradiation. (4 micro-g/g colchicine was administered to the experimental animals intraperiteonally 4 h before killing). According to routine methods,chromosome

slides were made with bone marrow from both femurs. Five mice were used for each dose and 100 metaphases for each animal were observed under microscope. Results: When irradiation dose was up to 0. 5 Gy, chromosome aberrations induced by irradiation in both beer and ethanol groups decreased obviously($P < 0.05$ or $P < 0.01$) ,and more significant effect was found in beer group. Conclusion Beside ethanol, other antioxidant substances ,such as phenolic compounds ,may account for beer's activity of reducing chromosome aberrations induced by irradiation.
Author
Ethyl Alcohol; Gamma Rays; Bone Marrow; Cells (Biology); Chromosome Aberrations

20080008177 Institute of Space Medico-Engineering, Beijing, China
Development of a Ground-based Micro-algae Photo-bioreactor Experimental Facility for Using in Space
Al, Wei-dang; Guo, Shuang-sheng; Qin, Li-feng; Tang, Yong-kang; Space Medicine and Medical Engineering, Volume 20, No. 3; June 2007, pp. 165-169; In Chinese; See also 20080008161; Copyright; Avail.: Other Sources

Objective: To develop a ground-based micro-algae photo-bioreactor experimental facility for using in space. Methods: Project planning, design drafting, manufacture and debugs were conducted basing on demand of using in space. Finally, a demonstration test for producing algae was done. Results: The facility comprises nine subsystems, including a reactor, a light unit, a CO2 supplying unit and an O2 removing unit. A new type of reactor was adopted, where the micro-algae grew. A membrane module was introduced to develop a CO2 supplying unit. By this way, capacity of algae absorbing and utilizing CO2 was improved. An O2 removing unit was manufactured by applying the membrane technique, it not only removed the dissolved oxygen immediately and gave it to the human, but also alleviated the load of separating gas from liquid in weightlessness condition. The experimental test results demonstrated that the density of algae in the photo-bioreactor increased from 0.174 g (DW)/L to 4.064 g (DW)/L after 7 d growing. Its productivity for the microalgae was up to 11.1 g (DW)/d. Conclusion The facility has reasonable technical indexes, and smooth and reliable performances. The micro-algae can grow normally in the bioreactor. The principle of the bioreactor of providing CO2 for algae and taking O2 from the culture medium is suitable for the demand under space conditions.
Author
Bioreactors; Microorganisms; Algae; Carbon Dioxide; Oxygen; Membranes; Project Planning; Weightlessness

20080008526 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
The Validation of Vapor Phase Hydrogen Peroxide Microbial Reduction for Planetary Protection and a Proposed Vacuum Process Specification
Chung, Shirley; Barengoltz, Jack; Kern, Roger; Koukol, Robert; Cash, Howard; October 2006; 47 pp.; In English; Original contains color and black and white illustrations
Report No.(s): JPL Publication 06-6; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40601

The Jet Propulsion Laboratory, in conjunction with the NASA Planetary Protection Officer, has selected the vapor phase hydrogen peroxide sterilization process for continued development as a NASA approved sterilization technique for spacecraft subsystems and systems. The goal is to include this technique, with an appropriate specification, in NPR 8020.12C as a low temperature complementary technique to the dry heat sterilization process.To meet microbial reduction requirements for all Mars in-situ life detection and sample return missions, various planetary spacecraft subsystems will have to be exposed to a qualified sterilization process. This process could be the elevated temperature dry heat sterilization process (~115 C for 40 hours) which was used to sterilize the Viking lander spacecraft. However, with utilization of such elements as highly sophisticated electronics and sensors in modern spacecraft, this process presents significant materials challenges and is thus an undesirable bioburden reduction method to design engineers. The objective of this work is to introduce vapor hydrogen peroxide (VHP) as an alternative to dry heat microbial reduction to meet planetary protection requirements.The VHP process is widely used by the medical industry to sterilize surgical instruments and biomedical devices, but high doses of VHP may degrade the performance of flight hardware, or compromise material properties. Our goal for this study was to determine the minimum VHP process conditions to achieve microbial reduction levels acceptable for planetary protection.
Author
Hydrogen Peroxide; Vapor Phases; Vacuum; Sterilization; Bioinstrumentation; Dry Heat; Surgical Instruments

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*.

20080006569 Applied Research Associates, Inc., Tyndall AFB, FL USA
Air Force Research Laboratory Fire Research (Postprint)
Hawk, John R; Apr 5, 2007; 15 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA4819-07-D-0001; Proj-4915
Report No.(s): AD-A475279; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Representatives from the National Institute of Standards and Technology (NIST) requested that the AFRL Fire Research Group prepare a non-technical brief of current areas of research and development at AFRL/MLQD to be presented at NIST's Annual Fire Conference, 4-6 April 2007. The presentation outlines the major areas of research at the AFRL Fire Research Facility at Tyndall Air Force Base, Florida in 2007.
DTIC
Fire Fighting; Fire Prevention; Fires; Military Technology; Nonflammable Materials; Research and Development

20080008553 NASA Langley Research Center, Hampton, VA, USA
Spatial Awareness in Synthetic Vision Systems: Using Spatial and Temporal Judgments to Evaluate Texture and Field of View
Bolton, Matthew L.; Bass, Ellen J.; Comstock, James Raymond, Jr.; [2007]; 35 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 609866.02.07.07.03; Copyright; Avail.: Other Sources

This work introduced judgment-based measures of spatial awareness and used them to evaluate terrain textures and fields of view (FOVs) in Synthetic Vision Systems (SVS) displays. SVS are cockpit technologies which depict computer generated views of terrain surrounding an aircraft. In the assessment of textures and FOVs for SVS, no studies have directly measured the 3 levels of spatial awareness with respect to terrain: 1) identification of terrain, 2) its relative spatial location, and 3) its relative temporal location. Eighteen pilots made 4 judgments (relative azimuth angle, distance, height, and abeam time) regarding the location of terrain points displayed in 112 5-second, non-interactive simulations of a SVS head down display. There were 2 between subject variables (texture order and FOV order) and 5 within subject variables (the relative azimuth angle, distance, and height of the terrain point, texture, and FOV). Texture produced significant main and interaction effects for the magnitude of error in the relative angle, distance, height, and abeam time judgments. FOV interaction effects were significant for the directional magnitude of error in the relative distance, height, and abeam time judgments. Spatial awareness was best facilitated by the Elevation Fishnet (EF), Photo Fishnet (PF), and Photo Elevation Fishnet (PEF) textures. This study recommends that the EF, PF, and PEF textures be further evaluated in future SVS experiments. Additionally, the judgment-based spatial awareness measures used in this experiment could be used to evaluate other display parameters and depth cues in SVS.
Author
Field of View; Enhanced Vision; Spatial Dependencies; Situational Awareness; Display Devices; Flight Control

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*.

20080008294 NASA Langley Research Center, Hampton, VA, USA
Parallel Anisotropic Tetrahedral Adaptation
Park, Michael A.; Darmofal, David L.; January 07, 2008; 17 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 561581; Copyright; Avail.: CASI: A03, Hardcopy

An adaptive method that robustly produces high aspect ratio tetrahedra to a general 3D metric specification without introducing hybrid semi-structured regions is presented. The elemental operators and higher-level logic is described with their respective domain-decomposed parallelizations. An anisotropic tetrahedral grid adaptation scheme is demonstrated for 1000-1

stretching for a simple cube geometry. This form of adaptation is applicable to more complex domain boundaries via a cut-cell approach as demonstrated by a parallel 3D supersonic simulation of a complex fighter aircraft. To avoid the assumptions and approximations required to form a metric to specify adaptation, an approach is introduced that directly evaluates interpolation error. The grid is adapted to reduce and equidistribute this interpolation error calculation without the use of an intervening anisotropic metric. Direct interpolation error adaptation is illustrated for 1D and 3D domains.
Author
Tetrahedrons; High Aspect Ratio; Computational Grids; Domains; Simulation; Interpolation

20080008295 NASA Langley Research Center, Hampton, VA, USA
Towards Verification of Unstructured-Grid Solvers
Thomas, James L.; Diskin, Boris; Rumsey, Christopher L.; January 07, 2008; 30 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NCC1-02043; WBS 599489; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080008295

New methodology for verification of computational methods using unstructured grids is presented. The discretization order properties are studied in computational windows, easily constructed within a collection of grids or a single grid. The windows can be adjusted to isolate the interior discretization, the boundary discretization, or singularities. A major component of the methodology is the downscaling test, introduced previously for studying the convergence rates of truncation and discretization errors of finite-volume discretization schemes on general unstructured grids. Demonstrations of the method are shown, including a comparative accuracy assessment of commonly-used schemes on general mixed grids and the identification of local accuracy deterioration at intersections of tangency and inflow/outflow boundaries. Recommendations for the use of the methodology in large-scale computational simulations are given.
Author
Unstructured Grids (Mathematics); Convergence; Singularity (Mathematics); Boundaries; Accuracy; Truncation Errors

20080008435 NASA Langley Research Center, Hampton, VA, USA
Mesh Deformation Based on Fully Stressed Design: The Method and Two-Dimensional Examples
Hsu, Su-Yuen; Chang, Chau-Lyan; October 2007; 25 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 599489.02.07.07.01; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080008435

Mesh deformation in response to redefined boundary geometry is a frequently encountered task in shape optimization and analysis of fluid-structure interaction. We propose a simple and concise method for deforming meshes defined with three-node triangular or four-node tetrahedral elements. The mesh deformation method is suitable for large boundary movement. The approach requires two consecutive linear elastic finite-element analyses of an isotropic continuum using a prescribed displacement at the mesh boundaries. The first analysis is performed with homogeneous elastic property and the second with inhomogeneous elastic property. The fully stressed design is employed with a vanishing Poisson s ratio and a proposed form of equivalent strain (modified Tresca equivalent strain) to calculate, from the strain result of the first analysis, the element-specific Young s modulus for the second analysis. The theoretical aspect of the proposed method, its convenient numerical implementation using a typical linear elastic finite-element code in conjunction with very minor extra coding for data processing, and results for examples of large deformation of two-dimensional meshes are presented in this paper. KEY WORDS: Mesh deformation, shape optimization, fluid-structure interaction, fully stressed design, finite-element analysis, linear elasticity, strain failure, equivalent strain, Tresca failure criterion
Author
Shape Optimization; Deformation; Elastic Properties; Finite Element Method; Modulus of Elasticity; Boundaries; Computational Grids

20080008524 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
LMI-Based Generation of Feedback Laws for a Robust Model Predictive Control Algorithm
Acikmese, Behcet; Carson, John M., III; September 17, 2007; 6 pp.; In English
Report No.(s): JPL D-40295; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40622

This technical note provides a mathematical proof of Corollary 1 from the paper ‘A Nonlinear Model Predictive Control Algorithm with Proven Robustness and Resolvability’ that appeared in the 2006 Proceedings of the American Control

Conference. The proof was omitted for brevity in the publication. The paper was based on algorithms developed for the FY2005 R&TD (Research and Technology Development) project for Small-body Guidance, Navigation, and Control [2].The framework established by the Corollary is for a robustly stabilizing MPC (model predictive control) algorithm for uncertain nonlinear systems that guarantees the resolvability of the associated nite-horizon optimal control problem in a receding-horizon implementation. Additional details of the framework are available in the publication.
Author
Optimal Control; Robustness (Mathematics); Algorithms; Feedback; Uncertain Systems; Nonlinear Systems; Laws; Guidance (Motion)

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.

20080006593 Army Research Inst. for the Behavioral and Social Sciences, Orlando, FL USA
Effects of Spatial and Non-Spatial Multi-Modal Cues on Orienting of Visual-Spatial Attention in an Augmented Environment
Jerome, Christian J; Nov 2007; 67 pp.; In English
Contract(s)/Grant(s): Proj-A790
Report No.(s): AD-A475115; ARI-TR-1215; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Visual search tasks are known to be cognitive capacity demanding and therefore may be improved by training in an augmented reality (AR) environment. During the experimental task, 64 participants searched for enemies (while cued from visual, auditory, tactile, combinations of two, or all three modality cues) and tried to shoot them while avoiding shooting the civilians (fratricide) for two 2-minute low-workload scenarios, and two 2-minute high-workload scenarios. The results showed significant benefits of attentional cueing on visual search task performance. These benefits were revealed by improved performance in reaction time and accuracy from the haptic cues alone, auditory cues alone, and the combination of the visual and haptic cues together. Fratricide occurrence was shown to be amplified by the presence of the audio cues. The two levels of workload produced differences within individual's task performance for accuracy and reaction time. Accuracy and reaction time were significancy better with the medium cues than all the other cue * specificities and the control condition during low workload and marginally better during high workload. Cue specificity generally resulted in better accuracy and reaction time with the medium cues.
DTIC
Computer Programs; Cues; Education; Virtual Reality

20080006790 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Auto-Coding UML Statecharts for Flight Software
Benowitz, Edward G; Clark, Ken; Watney, Garth J.; July 21, 2006; 6 pp.; In English; Space Mission Challenges for Information Technology, 21 Jul. 2006, Pasadena, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40582

Statecharts have been used as a means to communicate behaviors in a precise manner between system engineers and software engineers. Hand-translating a statechart to code, as done on some previous space missions, introduces the possibility of errors in the transformation from chart to code. To improve auto-coding, we have developed a process that generates flight code from UML statecharts. Our process is being used for the flight software on the Space Interferometer Mission (ESA).
Author
Applications Programs (Computers); Charts; Software Development Tools; Computer Programming; Software Engineering

20080006849 Notre Dame Univ., IN USA
Resource-Efficient Digital Communications: Research and Testbed Development in Support of Future Force Warrior and Joint Tactical Radio Systems
Fuja, Thomas; Collins, Oliver; Costello, Daniel; Huang, Yih-Fang; Nov 2007; 34 pp.; In English
Contract(s)/Grant(s): DAAD16-02-C-0057
Report No.(s): AD-A474493; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes the design and simulation of a bandwidth-efficient waveform suitable for the SLICE radio developed

by ITT Aerospace/Communications; this waveform uses quadrature amplitude modulation (QAM) and low-complexity turbo codes developed at Notre Dame. The result is compared with another using continuous phase modulation (CPM). It is shown that the amplifier backoff required for QAM puts it at a disadvantage to CPM at spectral efficiencies where both are feasible - below 2.0 bits/sec/Hz. However, signal processing techniques (e.g. pre-distortion filtering) for QAM can reduce that disadvantage; moreover, at higher spectral efficiencies, QAM may be the only feasible solution. Other topics include low-density parity check (LDPC) convolutional codes, new techniques to reduce the peak to average power ratio (PAPR) for QPSK signals, and analysis of systems employing adaptive modulation and orthogonal frequency division multiplexing (OFDM).
DTIC
Telecommunication; Radio Equipment; Pulse Communication

20080008356 Cornell Univ., Ithaca, NY USA
Language-Based Security for Malicious Mobile Code
Schneider, Fred B; Sep 30, 2007; 19 pp.; In English
Contract(s)/Grant(s): N00014-01-1-0968
Report No.(s): AD-A475288; CU-CSD-39545; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Classical operating system architecture provides support for only a limited class of coarse-grained security policies. Furthermore, system software has grown too large and complicated to be considered trustworthy. To address these shortcomings, we have explored the application of programming language technology, including advanced type-systems, proof systems, analyses, and compilers for realizing new classes of security policies and for reducing or relocating the trusted computing base.
DTIC
Software Engineering; Computer Programming; Computer Security; Computer Viruses; Computer Systems Design; Program Verification (Computers)

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.

20080006568 Communications Research Centre, Ottawa, Ontario Canada
Comparison of Two Hierarchical Routing Protocols for Heterogeneous MANET
Yang, Maoyu; Ge, Ying; Lamont, Louise; Oct 2007; 78 pp.; In English; Original contains color illustrations
Report No.(s): AD-A475287; DRDC OTTAWA TM 2007-201; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this report, a study on hierarchical routing protocols for heterogeneous mobile Ad Hoc wireless networks is presented. The main thrust of the investigation is to identify a potential hierarchical routing scheme that is best suited for a heterogeneous tactical Mobile Ad Hoc Network (MANET). Such networks consist of mobile nodes that are characterized by different communications capabilities, such as multiple radio interfaces. The report highlights the benefits and issues of the different routing protocols, namely the H-OLSR and H-LANMAR, as they pertain to a military tactical scenario. We first discuss the context for the use of a hierarchical routing strategy by describing a typical military scenario where a number of platforms are used each supporting link types of varying capabilities. We then discuss the rational for selecting a proactive hierarchical routing scheme for typical tactical MANETs. We discuss in detail the routing algorithms of the two protocols under investigation. Finally we conduct an experimental comparison study between the two routing protocols. Our experiments reveal that H-OLSR outperforms H-LANMAR for most of the group mobility scenarios that can potentially be used in the operation of a tactical MANET.
DTIC
Heterogeneity; Protocol (Computers); Topology; Wireless Communication

20080006594 Military Academy, West Point, NY USA

IkeNet: Social Network Analysis of E-mail Traffic in the Eisenhower Leadership Development Program

McCulloh, Ian; Garcia, Grace; Tardieu, Kelsey; MacGibbon, Jennifer; Dye, Heather; Moores, Kerry; Graham, John; Horn, Daniel B; Nov 2007; 51 pp.; In English

Contract(s)/Grant(s): Proj-B74F

Report No.(s): AD-A475135; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Social network analysis (SNA) has become an important analytic tool for analyzing terrorist networks, friendly command and control structures, and a wide variety of other applications. In this project we collect social network data from a group of 24 Army officers in a one-year graduate program at Columbia University. In this report we discuss methodological issues associated with collecting e-mail social networks and include source code for an add-in to Microsoft Outlook to aid in this process. These data were investigated for patterns and trends in mutual, asymmetric, and null dyads. Behavioral changes in the group resulting from awareness of one's position in social network were also studied. Additionally, comparisons were made between SNA data derived from e-mail traffic and from questionnaires. The differences between these two types of networks are important concerns when considering the implementation of SNA as a command and control tool for friendly forces.

DTIC

Electronic Mail; Group Dynamics; Leadership; Network Analysis; Traffic

20080006662 Colorado State Univ., Fort Collins, CO USA

Monitoring Tools for Domain Name System (DNS) Security Deployment

Massey, Daniel F; Oct 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-02-2-0205; Proj-DHSA

Report No.(s): AD-A474596; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Domain Name System (DNS) converts names such as www.afrl.mil into IP addresses that can be used for communication. It is an essential part of almost every Internet application, but lacks authentication mechanisms. The DNS Security Extensions address this problem and add origin authentication into the system. Deployment of the security extensions is now beginning and this project monitors that early deployment. The project provides real-time deployment tracking and identifies several operational challenges and barriers that must be overcome for this system to succeed.

DTIC

Deployment; Direct Numerical Simulation; Internets; Security

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*.

20080006778 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Using Planning, Scheduling and Execution for Autonomous Mars Rover Operations

Estlin, Tara A.; Gaines, Daniel M.; Chouinard, Caroline M.; Fisher, Forest W.; Castano, Rebecca; Judd, Michele J.; Nesnas, Issa A.; June 6, 2006; 10 pp.; In English; International Conference on Automated Planning and Scheduling, 6-7 Jun. 2006, Windermere, UK; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40588

With each new rover mission to Mars, rovers are traveling significantly longer distances. This distance increase raises not only the opportunities for science data collection, but also amplifies the amount of environment and rover state uncertainty that must be handled in rover operations. This paper describes how planning, scheduling and execution techniques can be used onboard a rover to autonomously generate and execute rover activities and in particular to handle new science opportunities that have been identified dynamically. We also discuss some of the particular challenges we face in supporting autonomous rover decision-making. These include interaction with rover navigation and path-planning software and handling large amounts of uncertainty in state and resource estimations. Finally, we describe our experiences in testing this work using several Mars rover prototypes in a realistic environment.

Author

Autonomy; Decision Making; Mars Missions; Scheduling; Task Planning (Robotics); Mars Roving Vehicles; Robotics; Roving Vehicles

20080008154 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Enabling Autonomous Rover Science through Dynamic Planning and Scheduling

Estlin, Tara A.; Gaines, Daniel; Chouinard, Caroline; Fisher, Forest; Castano, Rebecca; Judd, Michele; Nesnas, Issa; March 5, 2005; 11 pp.; In English; IEEE Aerospace Conference, 5-12 Mar. 2005, Big Sky, MT, USA; Original contains color illustrations

Report No.(s): IEEEAC Paper-1405, Version 3; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40571

This paper describes how dynamic planning and scheduling techniques can be used onboard a rover to autonomously adjust rover activities in support of science goals. These goals could be identified by scientists on the ground or could be identified by onboard data-analysis software. Several different types of dynamic decisions are described, including the handling of opportunistic science goals identified during rover traverses, preserving high priority science targets when resources, such as power, are unexpectedly over-subscribed, and dynamically adding additional, ground-specified science targets when rover actions are executed more quickly than expected. After describing our specific system approach, we discuss some of the particular challenges we have examined to support autonomous rover decision-making. These include interaction with rover navigation and path-planning software and handling large amounts of uncertainty in state and resource estimations. Author

Scheduling; Roving Vehicles; Autonomy; Trajectory Planning; Decision Making

20080008372 National Dong Hwa Univ., Hualien, Taiwan, Province of China

A Genetic Algorithm Based Recurrent Fuzzy Neural Network for Linear Induction Motor Servo Drive

Lin. Faa-Jen; Huang, Po-Kai; Lin, F. J.; Chou, Wen-Der; Journal of the Chinese Institute of Engineers: Vol. 30, No. 5; July 2007, pp. 801-817; In English; See also 20080008363; Copyright; Avail.: Other Sources

A genetic algorithm (GA) based recurrent fuzzy neural network (RFNN) is proposed to control the mover of a linear induction motor (LIM) servo drive for periodic motion in this paper. The GA is developed to search the optimal weights between the membership layer and the rule layer of RFNN. First, the dynamic model of am indirect field-oriented LIM servo drive is derived. Then, an on-line training RFNN with backpropagation algorithm is introduced as the tracking controller. Moreover, to guarantee the global convergence of tracking error, analytical methods based on a discrete- type Lyapunov function are proposed to determine the varied learning rates of the RFNN. In addition, a real-time GA is developed to search the optimal weights between the membership layer and the rule layer of RFNN on-line. The theoretical analyses for the proposed GA-based RFNN controller are described in detail. Finally, simulated and experimental results show that the proposed controller provides good control performance dynamic characteristics and is robust with regard to plant parameter variations and external load disturbance.

Author

Genetic Algorithms; Induction Motors; Mechanical Drives; Neural Nets; Servomechanisms

64
NUMERICAL ANALYSIS

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

20080006702 Air Force Research Lab., Rome, NY USA

Development and Evaluation of Fusion Techniques

Alford, Mark G; Scalzo, Maria L; Bubalo, Adnan; Jones, Eric C; Oct 2007; 94 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-459E

Report No.(s): AD-A474630; AFRL-RI-RS-TR-2007-215; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this effort was to investigate and develop promising innovative technologies that hold promise for improvements in the Air Force target tracking and fusion capabilities. The problem statement is that Nonlinear Non-Gaussian Processes (NNGP) present a major challenge in all types of military problems. This is because the real-world is nonlinear and non-Gaussian, despite assumptions made in most conventional fusion algorithms. This in-house program addressed this problem by researching and developing tracking filters that do not presume a linear Gaussian world. The most famous of these is the Particle Filter (PF). Progress made includes development of a MATLAB PF simulation capability for in-house analysis/testing and preliminary investigation of PF capabilities. Prior to this effort AFRL/IF had no capability in this area and

PF were not being investigated. DEFT developed a two-dimensional PF and performed Monte Carlo simulation runs to test the performance of the PF as compared to the Extended Kalman Filter (EKF) for multiple bearings only sensors (ESM sensors). Results showed that in certain cases, the Monte Carlo averaged tracking error variance of the PF was much better than that of the EKF, but with ten times the computational cost. Under these same conditions (50 particles, 100 Monte Carlo runs, two bearings only sensors), the EKF lost track 28% of the time whereas the PF did not lose track at all. This effort established future directions for research. There is a need to do more nonlinear filtering analysis, development and enhancements under realistic scenarios with varying degrees of nonlinearity. Considerable study is needed to fully determine the conditions under which these techniques will lead to improved performance. It is possible that a system could be developed employing multiple nonlinear filters.
DTIC
Multisensor Fusion; Targets; Tracking Filters

20080008310 North Carolina State Univ., Raleigh, NC USA
Inverse Problems, Control and Modeling in the Presence of Uncertainty
Banks, H T; Ito, K; Oct 30, 2007; 41 pp.; In English
Contract(s)/Grant(s): FA9550-04-1-0220; Proj-2304
Report No.(s): AD-A474995; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA474995

We report progress on the development of methods in a number of specific areas of application including static, non-cooperative games related to counter- and counter-counter-electromagnetic interrogation of targets, modeling of complex viscoelastic polymeric materials, stochastic and deterministic models for complex networks and development of inverse problem methodologies (generalized sensitivity functions; asymptotic standard errors) for estimation of infinite dimensional functional parameters including probability measures and temporal/spatial dependent functions in complex nonlinear dynamical systems. These efforts are part of our fundamental research in a modeling, estimation and control methodology (theoretical, statistical and computational) for systems in the presence of major model and observation uncertainties.
DTIC
Models; Game Theory

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

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

20080007181 NASA Langley Research Center, Hampton, VA, USA
Magnetic Field Response Measurement Acquisition System
Woodard, Stanley E.; Taylor,Bryant D.; Shams, Qamar A.; Fox, Robert L.; [2007]; 35 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 23-762-65-AT; Copyright; Avail.: CASI: A03, Hardcopy

This paper presents a measurement acquisition method that alleviates many shortcomings of traditional measurement systems. The shortcomings are a finite number of measurement channels, weight penalty associated with measurements, electrical arcing, wire degradations due to wear or chemical decay and the logistics needed to add new sensors. Wire degradation has resulted in aircraft fatalities and critical space launches being delayed. The key to this method is the use of sensors designed as passive inductor-capacitor circuits that produce magnetic field responses. The response attributes correspond to states of physical properties for which the sensors measure. Power is wirelessly provided to the sensing element by using Faraday induction. A radio frequency antenna produces a time-varying magnetic field used to power the sensor and receive the magnetic field response of the sensor. An interrogation system for discerning changes in the sensor response frequency, resistance and amplitude has been developed and is presented herein. Multiple sensors can be interrogated using this method. The method eliminates the need for a data acquisition channel dedicated to each sensor. The method does not require the sensors to be near the acquisition hardware. Methods of developing magnetic field response sensors and the influence of key parameters on measurement acquisition are discussed. Examples of magnetic field response sensors and the respective measurement characterizations are presented. Implementation of this method on an aerospace system is discussed.
Author
Magnetic Fields; Data Acquisition; Radio Frequencies; Aerospace Systems; Detection; Capacitors; Degradation

20080007490 Carnegie-Mellon Univ., Pittsburgh, PA USA
CMMI (Trademark) for Acquisition, Version 1.2
Nov 2007; 442 pp.; In English
Contract(s)/Grant(s): FA8721-05-C-0003
Report No.(s): AD-A474820; CMU/SEI-2007-TR-017; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The CMMI-ACQ, V1.2 model is a collection of best practices that is generated from the CMMI V1.2 Architecture and Framework. This collection includes acquisition best practices from government and industry. CMMI-ACQ is based on the CMMI Model Foundation or CMF (i.e., model components common to all CMMI models and constellations), the CMMI Acquisition Module [Bernard 2005], and the Software Acquisition Capability Maturity Model (SA-CMM) [SEI 2002]. CMMI-ACQ also incorporates work by several acquisition organizations to adapt the Development constellation for use in an acquisition organization.
DTIC
Software Development Tools; Procedures

20080008358 Center for Naval Analyses, Alexandria, VA USA
Wargaming and Analysis. Presentation for MORS Special Meeting
Perla, Peter; McGrady, Ed; Oct 2007; 28 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-05-D-0500; Proj-R0148
Report No.(s): AD-A475206; CAB-D0016966.A1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Our starting point, of course, has to be wargaming itself. What is it? Too often, people in this business use the term loosely, to describe everything from the activity of thousands of real troops and vehicles maneuvering across hundreds of square miles, to the largely intellectual activity of a couple of guys crouched over a paper map and pushing around tiny cardboard squares. What I am going to be talking about here are REAL wargames, not field exercises, analytical models, or computer simulations without players (what I call cazwhips). Real wargames involve human beings making decisions and dealing with the consequences of those decisions, but not the action of actual forces.
DTIC
War Games; Decision Making; Military Operations

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*.

20080006577 Naval Health Research Center, Brooks AFB, TX USA
Effects of Facial Topography and Eyewear on the 94 GHz Beam
Hatcher, Donald; Marchello, Donald; Cox, Duane; D'Andrea, John; Ziriax, John; Johnson, Leland; Kuhnel, Charles; Nov 2005; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-7757
Report No.(s): AD-A475216; DEBL-2005-03; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Recently, a millimeter wave (MMW) hardware system, called Active Denial System (ADS) has been developed for use as a non-lethal weapon system. The ADS system is capable of generating high power MMWs and is to be used for, but not limited to, crowd management and denying access to restricted areas. ADS achieves this end by using a 94 GHz MMW beam to produce rapid skin heating to a temperature that causes intense discomfort in a very short period of time, normally in just a matter of seconds. The intensity of the discomforting sensation rapidly decreases when the power to the transmitter is turned off or the individual moves out of the MMW beam. The primary effect of the ADS is heating of skin and absorption of the 94GHz millimeter waves in the eye. Recently the effects that eyewear may have on the absorption of 94 GHz MMWs on the face have been questioned. To fully understand the effects of ADS through eyewear, exposure data must be collected while the targeted subject is wearing various types of eyewear, such as, eyeglasses, night vision goggles (NVG) and binoculars, that may be encountered when subjects are be exposed to the system. This investigation was conducted to evaluate the effects that

various types of eyewear may have on absorption of the 94 GHz beam and especially the production of hotspots generated by reflections or focusing of the beam on the surface of the face.
DTIC
Millimeter Waves; Particle Beams; Personnel; Topography

71
ACOUSTICS

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution*. For aircraft noise see also *02 Aerodynamics* and *07 Aircraft Propulsion and Power*.

20080006652 NASA Glenn Research Center, Cleveland, OH, USA
Evaluation of a Low-Noise Formate Spiral-Bevel Gear Set
Lewicki, David g.; Woods, Ron L.; Litvin, Faydor L.; Fuentes, Alfonso; December 2007; 23 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NCC2-9019
Report No.(s): NASA/TM-2007-215032; ARL-TR-4135; E-16204; ARL-TR-4125; Copyright; Avail.: CASI: A03, Hardcopy

Studies to evaluate low-noise Formate spiral-bevel gears were performed. Experimental tests were performed on the OH-58D helicopter main-rotor transmission in the NASA Glenn 500-hp Helicopter Transmission Test Stand. Low-noise Formate spiral-bevel gears were compared to the baseline OH-58D spiral-bevel gear design, a high-strength design, and previously tested low-noise designs (including an original low-noise design and an improved-bearing-contact low-noise design). Noise, vibration, and tooth strain tests were performed. The Formate design showed a decrease in noise and vibration compared to the baseline OH-58D design, and was similar to that of the previously tested improved-bearing contact low-noise design. The pinion tooth stresses for the Formate design significantly decreased in comparison to the baseline OH-58D design. Also similar to that of the improved bearing-contact low-noise design, the maximum stresses of the Formate design shifted toward the heel, compared to the center of the face width for the baseline, high-strength, and previously tested low-noise designs.
Author
Low Noise; Spiral Bevel Gears; Transmissions (Machine Elements); Test Stands; OH-58 Helicopter; Rotary Wings

20080008146 NASA Glenn Research Center, Cleveland, OH, USA
Overview of Aircraft Noise Prediction Tools Assessment
Dahl, Milo D.; December 04, 2007; 46 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 984754.02.07.03.17.02; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080008146

The acoustic assessment task for both the Subsonic Fixed Wing and the Supersonic projects under NASA s Fundamental Aeronautics Program was designed to assess the current state-of-the-art in noise prediction capability and to establish baselines for gauging future progress. The documentation of our current capabilities included quantifying the differences between predictions of noise from computer codes and measurements of noise from experimental tests. Quantifying the accuracy of both the computed and experimental results further enhanced the credibility of the assessment. This presentation gives sample results from codes representative of NASA s capabilities in aircraft noise prediction at the system level and at the component level. These include semi-empirical, statistical, analytical, and numerical codes. An example of system level results is shown for an aircraft. Component level results are shown for airframe flaps and landing gear, for jet noise from a variety of nozzles, and for broadband fan noise. Additional results are shown for modeling of the acoustic behavior of duct acoustic lining and the attenuation of sound in lined ducts with flow.
Author
Noise Prediction; Aerodynamic Noise; Noise Measurement; Prediction Analysis Techniques; Fixed Wings; Jet Aircraft Noise

20080008170 Institute of Space Medico-Engineering, Beijing, China
Speckle Reduction for Ultrasound Images with Anisotropic Diffusion Based on EM Parameter Estimation Algorithm
Yu, Jin-hua; Wang, Yuan-yuan; Shi, Xin-ling; Space Medicine and Medical Engineering, Volume 20, No. 3; June 2007, pp. 198-204; In Chinese; See also 20080008161; Copyright; Avail.: Other Sources

To improve the flexibility and stability of the filter in speckle reduction of ultrasound images. The gray distribution of an

ultrasound image was modeled by a mixture of one Rayleigh and one Gaussian distribution. The mixture distribution was decomposed using the expectation maximization(EM) algorithm. The homogeneous region of the image was then estimated according to the decomposition results of the mixture distribution. Finally, the diffusion threshold was obtained by analyzing the statistical features of the homogeneous region. By comparing the results with other two improved parameter estimation methods for the anisotropic diffusion, the method based on the EM algorithm could estimate the diffusion threshold more accurately. The balance between speckle removal and edge preservation could also be obtained in the diffusion result. The anisotropic diffusion based on EM parameter estimation is an effective method for suppressing speckle in ultrasound images. Author

Anisotropy; Diffusion; Parameter Identification; Ultrasonics; Image Enhancement

20080008494 NASA Glenn Research Center, Cleveland, OH, USA

Jet Screech Noise Computation

Loh, Ching Y.; Hultgren, Lennart S.; AIAA Journal; May 2006; Volume 44, No. 5, pp. 992-998; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A02, Hardcopy

The near-field screech-tone noise of a typical underexpanded circular jet issuing from a sonic nozzle is simulated numerically. The self-sustained feedback loop is automatically established in the simulation. The computed shock-cell structure, acoustic wave length, screech-tone frequencies, and sound pressure levels in the near field are in good agreement with existing experimental results.

Author

Jet Aircraft Noise; Screech Tones; Computation; Sound Waves; Sonic Nozzles; Sound Pressure

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*.

20080007169 NASA Langley Research Center, Hampton, VA, USA

Focal-Plane Imaging of Crossed Beams in Nonlinear Optics Experiments

Bivolaru, Daniel; Herring, G. C.; [2007]; 3 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 984754.02.07.07.14.02; Copyright; Avail.: CASI: A01, Hardcopy

An application of focal-plane imaging that can be used as a real time diagnostic of beam crossing in various optical techniques is reported. We discuss two specific versions and demonstrate the capability of maximizing system performance with an example in a combined dual-pump coherent anti-Stokes Raman scattering interferometric Rayleigh scattering experiment (CARS-IRS). We find that this imaging diagnostic significantly reduces beam alignment time and loss of CARS-IRS signals due to inadvertent misalignments.

Author

Optical Measuring Instruments; Rayleigh Scattering; Nonlinear Optics; Coherent Scattering; Interferometry; Real Time Operation; Raman Spectra

20080007507 Research and Technology Organization, Neuilly-sur-Seine, France

Flight Testing of Night Vision Systems in Rotorcraft

July 2007; 82 pp.; In English; Original contains color illustrations; CD-ROM contains full text document in PDF format

Report No.(s): AC/323(SCI-089)TP/89; RTO-AG-SCI-089; Copyright; Avail.: CASI: C01, CD-ROM: A05, Hardcopy

This AGARDograph presents a general summary of suggested Night Vision Goggle (NVG) testing methods and should be used as a framework for developing airborne and laboratory based experiments to evaluate equipment. The objective of this document is to provide an inventory of rules, standards, procedures, methods and means needed to test and evaluate night vision systems. In order to meet its objective, the scope of this AGARDograph is limited to the testing of night vision devices based on image intensification technology for use in rotorcraft. This AGARDograph includes sections covering the basic theory of the systems in use today, human vision and its relationship to the technology, general flight test methodology and an inventory of flight test techniques from NATO countries.

Author

Night Vision; Goggles; Rotary Wing Aircraft; Image Intensifiers; Flight Tests

20080008397 NASA Goddard Space Flight Center, Greenbelt, MD, USA
TRL-6 for JWST Wavefront Sensing and Control
Feinberg, Lee; Dean, Bruce; Smith, Scott; Aronstein, David; Shiri, Ron; Lyon, Rick; Hayden, Bill; Bowers, Chuck; Acton, D. Scott; Shields, Duncan; Sabatke, Erin; Schwenker, John; Towell, Tim; Carey, Larkin; Contos, Adam; Shi, Fang; Mesa, Luis; August 26, 2007; 1 pp.; In English; SPIE Optics and Photonics, 26-30 Aug. 2007, San Diego, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

NASA's Technology Readiness Level (TRL)-6 is documented for the James Webb Space Telescope (JWST) Wavefront Sensing and Control (WFSC) subsystem. The WFSC subsystem is needed to align the Optical Telescope Element (OTE) after all deployments have occurred, and achieves that requirement through a robust commissioning sequence consisting of unique commissioning algorithms, all of which are part of the WFSC algorithm suite. This paper identifies the technology need, algorithm heritage, describes the finished TRL-6 design platform, and summarizes the TRL-6 test results and compliance. Author
James Webb Space Telescope; Controllers; Detection; Wave Fronts; Control Systems Design; Algorithms

20080008528 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Estimation of Cyclic Error Due to Scattering in the Internal OPD Metrology of the Space Interferometry Mission
Tang, Hong; Zhao, Feng; February 14, 2005; 9 pp.; In English; 8th International Sypmosium on Laser Metrology, 14-18 Feb. 2005, Merida, Yucatan, Mexico; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40602

A common-path laser heterodyne interferometer capable of measuring the internal optical path difference (OPD) with accuracy of the order of 10 pm was demonstrated at JPL. To achieve this accuracy, the relative power received by the detector that is contributed by the scattering of light at the optical surfaces should be less than -97 dB. A method has been developed to estimate the cyclic error caused by the scattering of the optical surfaces. The result of the analysis is presented. Author
Interferometry; Space Missions; Error Analysis; Laser Applications; Optical Paths; Heterodyning

20080008554 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Photon Counting Techniques for the Bandlimited Optical Channel
Lee, Clement G.; Gray, Andrew A.; March 5, 2005; 7 pp.; In English; IEEE Aerospace Conference, Big Sky, Montana, March 5-12, 2005, 5-12 Mar. 2005, Big Sky, MT, USA; Original contains black and white illustrations
Report No.(s): IEEEAC Paper #1403; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40594

Two methods of estimating received photon counts given a realistic noisy and bandlimited optical channel are presented. The function of estimating photon counts is critical in any optical communications receiver. The purpose of this work is to compare two methods, neither of which is generically optimal, with realistic channels-for the purpose of assessing which is more appropriate for application in a hardware receiver given the current state-of-the art. Author
Channels (Data Transmission); Counting; Optical Communication; Photons

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20080008153 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Model of the Plasma Potential Distribution in the Plume of a Hollow Cathode
Katz, Ira; Mikellides, Ioannis G.; Goebel, Dan M.; July 12, 2004; 10 pp.; In English; Joint Propulsion Conference, 12-14 Jul. 2006, Fort Lauderdale, FL, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40572

In this paper we present results from a new model of the plasma potentials in the plume just downstream of the hollow cathode keeper. We examine the electron drift velocity as the hollow cathode plasma and neutral gas expand downstream of the keeper. If the drift velocity exceeds the thermal velocity a double layer potential structure develops that is the source of hot electrons. Ions are accelerated upstream through the double layer. The locations of the double layers are calculated using

a simple model. It is shown that as the cathode gas flow increases, the location of the double layer moves farther downstream. Author

Plumes; Plasma Potentials; Plasmas (Physics); Hollow Cathodes; Gas Flow; Drift Rate; Hot Electrons

76
SOLID-STATE PHYSICS

Includes condensed matter physics, crystallography, and superconductivity. For related information see also *33 Electronics and Electrical Engineering*; and *36 Lasers and Masers*.

20080006596 NASA Langley Research Center, Hampton, VA, USA

Efficient Single-Frequency Thulium Doped Fiber Laser Near 2-micrometers

Geng, Jihong; Wu, Jianfeng; Jiang, Shibin; Yu, Jirong; [2007]; 3 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 478643.02.02.02.04; Copyright; Avail.: CASI: A01, Hardcopy

We demonstrate highly efficient diode-pumped single-frequency fiber laser with 35% slope efficiency and 50mW output power operating near 2 micrometers, which generated from a 2-cm long piece of highly Tm(3+)-doped germanate glass fiber pumped at 800nm.

Author

Fiber Lasers; Frequencies; Glass Fibers; Laser Materials; Thulium; Doped Crystals

20080007132 NASA Langley Research Center, Hampton, VA, USA

Solid State Lasers from an Efficiency Perspective

Barmes, Norman P.; [2007]; 17 pp.; In English

Contract(s)/Grant(s): WBS 698671.01.07.02; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080007132

Solid state lasers have remained a vibrant area of research because several major innovations expanded their capability. Major innovations are presented with emphasis focused on the laser efficiency. A product of efficiencies approach is developed and applied to describe laser performance. Efficiency factors are presented in closed form where practical and energy transfer effects are included where needed. In turn, efficiency factors are used to estimate threshold and slope efficiency, allowing a facile estimate of performance. Spectroscopic, thermal, and mechanical data are provided for common solid state laser materials.

Author

Solid State Lasers; Efficiency; Energy Storage; Semiconductor Lasers; Laser Outputs

20080008375 National Central Univ., Chung-Li, Taiwan, Province of China

Log-Scale Method with Equivalent Circuit Model in Semiconductor Device Simulations

Li, Szu-Jun; Ho, Chi-Hon; Liao, Chien Nan; Tsai, Yao-Tsung; Journal of the Chinese Institute of Engineers: Vol. 30, No. 5; July 2007, pp. 843-846; In English; See also 20080008363; Copyright; Avail.: Other Sources

Semiconductor device simulations sometimes have to solve for large-scale and small-scale variables at the same time, especially with density-gradient models and hydrodynamic models. The usual way is to use the scaling factors, but scaled variables are still not of the same order of magnitude. We propose a log-scale method to make all variables of similar orders without scaling factors. All variables in similar orders of magnitude will help Newton-Raphson iterations to easily converge in device simulations. We use the divergence theorem of Gauss to discretize Poisson1\ and continuity equations, using the element-by-element method and develop an equivalent circuit model. The electron and hole concentrations are presented for a diode and an MOS capacitor by using the log-scale method and the equivalent circuit model. The numerical results show the great capability of the equivalent circuit model with log-scale method

Author

Divergence; Equivalent Circuits; Metal Oxide Semiconductors; Semiconductor Devices; Simulation

20080008376 National Taipei Univ. of Technology, Taipei, Taiwan, Province of China

On the Reverse Short-Channel Effect and Threshold Voltage Roll-Off Controls for 90 nm Node MOSFETs

Chen, Shuang-Yuan; Tu, Chia-Hao; Lin, Jung-Chun; Chen, Ying-Tsung; Zhuang, Sheng-Jun; Huang, Heng-Sheng; Liu, Chuan-Hsi; Chou, Sam; Ko, Joe; Journal of the Chinese Institute of Engineers: Vol. 30, No. 5; July 2007, pp. 847-853; In English; See also 20080008363; Original contains black and white illustrations; Copyright; Avail.: Other Sources

In order to let device designers tune the short channel behavior of MOSFETs, a method is proposed in this work to demonstrate how to use LDD (lightly doped drain) and pocket implants to control RSCE (reverse short channel effect) and threshold voltage (V(sub t)) roll-off. The method is based on the process parameters and silicon data of the 90 nm node technology of UMC (United Microelectronics Corporation). With the help of computers, 17 different process conditions of 8 different gate lengths were simulated using ISE TCAD to collect V, variation data. Four characteristics representing the short channel behaviors of the MOSFETs were designed and extracted from the simulated data. Their empirical equations were also established subsequently. After verification, those mathematical models were demonstrated to help device designers in choosing the most suitable LDD and pocket implant parameters to generate required V(sub t) characteristics.

Author

Doped Crystals; Field Effect Transistors; Metal Oxide Semiconductors; Threshold Voltage

77
PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

Includes quantum mechanics; theoretical physics; and statistical mechanics. For related information see also *72 Atomic and Molecular Physics, 73 Nuclear Physics*, and *25 Inorganic, Organic and Physical Chemistry*.

20080006666 Saint Mary's Univ., San Antonio, TX USA

Conduction and Convection of Heat Produced by the Attenuation of Laser Beams in Liquids

Goldberg, Irwin S; Garcia, Misty; Maswadi, Saher; Thomas, Robert J; Clark, Clifton D; Sep 2007; 44 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8650-06-1-6747; Proj-7757

Report No.(s): AD-A474628; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Mathematical models are used to simulate temperature changes that are induced by the absorption of energy from propagating laser beams in water. Both convective and conductive heat transfer are considered. Thermally insulated surfaces as well as surfaces involving heat transfer with the surroundings are considered. The simulated results demonstrate the importance of thermal convection. In the first part of this report containers with closed surfaces are considered. In the second part of the report free-surface effects are considered: These effects include evaporative heat loss and the occurrence of surface tension produced by temperature gradients at the surface (the Marangoni effect). Evaporative heat loss is simulated and the Marangoni effect is discussed. The quantitative determination of the temperature changes in the water due to the heat transferred by an absorbed laser beam could facilitate the improvement of models involving the optics of laser beam penetration in liquids.

DTIC

Conductive Heat Transfer; Convection; Laser Beams; Liquids; Thermal Conductivity

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*.

20080007234 NASA, Washington, DC, USA

Societal Impact of Spaceflight

Dick, Steven J., Editor; Lunius, Roger D., Editor; December 2007; 698 pp.; In English; Original contains color and black and white illustrations

Report No.(s): NASA/SP-2007-4801; Copyright; Avail.: CASI: EA5, Hardcopy

Since the dawn of spaceflight advocates of a robust space effort have argued that human activity beyond Earth makes a significant difference in everyday life. Assertions abound about the 'impact' of spaceflight on society and it relationship to the larger contours of human existence. Fifty years after the Space age began, it is time to examine the effects of spaceflight on

society in a historically rigorous way. Has the Space age indeed had a significant effect on society? If so what are those influences? What do we mean by an 'impact' on society? And what parts of society? Conversely, has society had any effect on spaceflight? What would be different had there been no Space Age? The purpose of this volume is to examine these and related questions through scholarly research, making use especially of the tools of the historian and the broader social sciences and humanities. Herein a stellar array of scholars does just that and arrives at sometimes surprising conclusions. Once contemplated, the subject is broad, rich and stimulating. Spaceflight has commercial, and economic dimensions as well as social, cultural and ideological ramifications. It touches on enduring American values of pioneering, progress, enterprise and rugged individualism. Worldwide it encompasses international cooperation and competition, and affects foreign policies, national security, and questions of global environment. Viewing Earth from space, and space from the vicinity of Earth, alters world views, conceptions of self and others, and our understanding of our place and purpose in the universe.
Derived from text
Space Flight; Histories; Documentation; Social Factors; Space Exploration

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20080007491 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
The JPL Cost Risk Analysis Approach that Incorporates Engineering Realism
Harmon, Corey C.; Warfield, Keith R.; Rosenberg, Leigh S.; May 23, 2006; 19 pp.; In English; International Society of Parametric Analysts (ISPA) Conference, 23-26 May 2006, Seattle, WA, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40591

This paper discusses the JPL Cost Engineering Group (CEG) cost risk analysis approach that accounts for all three types of cost risk. It will also describe the evaluation of historical cost data upon which this method is based. This investigation is essential in developing a method that is rooted in engineering realism and produces credible, dependable results to aid decision makers.
Author
Cost Analysis; Risk

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*.

20080006580 Naval Postgraduate School, Monterey, CA USA
F.I.R.E. Experiment Planning and Reporting Structure
Schacher, Gordon; Jul 1, 2007; 56 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00178-04-D-4045/V701
Report No.(s): AD-A475179; NPS-IS-07-002; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The FORCEnet Innovation and Research Enterprise (FIRE) knowledge management system is used for operational experiment planning and reporting. The system has a prescribed structure that includes forms and database reports for all planning and reporting elements. This report describes FIRE's structure and planning process, and provides directions for the input to be provided for each planning element.
DTIC
Data Management; Experiment Design; Fires; Information Management; Knowledge Based Systems; Military Operations; Planning

20080006586 Naval Postgraduate School, Monterey, CA USA

Mapping Experiment Results to Operational Capabilities

Schacher, Gordon; Nov 1, 2007; 50 pp.; In English; Original contains color illustrations

Report No.(s): AD-A475185; NPS-97-08-001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This work addresses the reporting of results from military operational experiments. These experiments are designed to examine a defined set of specific objectives, goals, and metrics, and results are developed for those objectives and goals. The results often apply to a fairly broad range of interests in addition to the experiment and its direct objectives. The authors refer to these as 'Areas of Interest' (AoI). The purpose of the work is to develop a structure and methodology, a schema, for mapping experiment results to these AoI. Figure 1 illustrates the basic mapping structure, which shows that results mapping is done at the objective level. The structure developed can be used for mapping experiment results to any military AoI. Initial work in this project has been mapped from Trident Warrior experiments to the following: Joint Capabilities Integration and Development System (JCIDS) Joint Capability Areas (JCAs), FORCEnet Capabilities, Naval Netwar FORCEnet Enterprise (NNFE) Capabilities List (NCL), and Operational Capability Gaps. The mapping described here focuses mainly on net-centric warfare: on information development, information flow, and decision-making. Force application activities are included, but less extensively. The structure does accommodate supported JCAs, but using it to do a good mapping of operational effectiveness results to them would require some expansion of the structure.

DTIC

Data Processing; Information Management; Knowledge Based Systems; Mapping; Military Operations

20080008141 Massachusetts Univ., Amherst, MA USA

An Enhanced Collaborative-Software Environment for Information Fusion at the Unit of Action

Corkill, Daniel; Dec 7, 2007; 50 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W15P7T-05-P621

Report No.(s): AD-A474815; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes research associated with the development of a highly responsive decision-support technology that can improve the effectiveness of analysts and decision makers - within the Army's Brigade Combat Teams (BCTs). These analysts and decision makers must work with large data volumes- in time-constrained and uncertain operating environments. This joint research and proof-of-concept effort involved the University of Massachusetts Amherst (UMass), BBTech Corporation, and the U.S. Army RDECOM CERDEC Intelligence and Information Warfare Directorate, Fort Monmouth, NJ.- This final report focuses on the UMass portion of the effort. This research was performed in the context of the CIFA (Collaborative Information-Fusion Assistant) decision-support environment, a prototype suite of tools and technologies developed jointly in this effort. CIFA can augment and support Army personnel in answering Priority Intelligence Requirements (PIRs) associated with monitoring, assessing, and responding to enemy courses of action and other battlespace-environment - characteristics. At present, time constraints and information overload often result in hasty, partial analysis of the information available to intelligence personnel. CIFA helps Army analysts and decision makers focus their attention on appropriate data by providing spatially - and temporally aggregated views of the environment and by ensuring that important information has not been overlooked. Research activities were performed in three main areas: 1) blackboard-based temporal and spatial aggregation and abstraction; 2) presentation of real-time battlespace assessments and user alerts; and 3) principled integration of sensor data, human-generated reports, and automated processing results. This report discusses the issues we addressed, the techniques we developed and our evaluations of them, and lessons learned.

DTIC

Multisensor Fusion; Decision Making; Decision Support Systems; Management Information Systems; Software Engineering; Computer Programs

20080008357 Defence Research and Development Canada, Valcartier, Quebec Canada

The ComplexityHub Web Site: Needs, Requirements, and Development

Couture, M; DuCharme, M; Nov 2007; 32 pp.; In English; Original contains color illustrations

Report No.(s): AD-A475283; DRDC VALCARTIER TN 2007-407; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This document presents a high-level description of the ComplexityHub web site. It lists the main needs, requirements and layouts for most web pages of the site. This text originates from conception and development works that was initiated by DRDC Valcartier during summer 2007. The goal was to build a national and international collaboration tool that is dedicated to studies on complexity.

DTIC

Internets; Websites; Internet Resources

20080008362 Information International Associates, Inc., Oak Ridge, TN, USA
Formats for Digital Preservation: A Review of Alternatives and Issues
Mar 1, 2007; 32 pp.; In English
Report No.(s): AD-A471545; No Copyright; Avail.: CASI: A03, Hardcopy

CENDI Members recognize digital formats as acceptable means of preserving Government information (CENDI, 2007). This review of alternative formats and the issues related to them was undertaken in the interest of implementing best practices in information life-cycle management, to dispel any misunderstandings related to digital formats, and to provide agencies with enough information so they can determine what the most appropriate preservation format is for them.
Author
Digital Systems; Format; Preserving; Information Management; Documents; Records Management

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.

20080008371 National Chin-Yi Inst. of Tech., Taichung, Taiwan, Province of China
Experimental Evaluation of a Real-Time Kinematic GPS Positioning Technique
Huang, Guo-Shing; Tsai, Ching Chih; Journal of the Chinese Institute of Engineers: Vol. 30, No. 5; July 2007, pp. 791-800; In English; See also 20080008363
Contract(s)/Grant(s): NSC 91-2213-E-167-001; Copyright; Avail.: Other Sources

This paper presents a methodology for observing GPS carrier phase data with the least-squares algorithm and the extended Kalman filter to improve positioning accuracy of the real-time kinematic GPS (KGPS). The integer least-squares method is first employed to solve the GPS integer ambiguities, and the extended Kalman filter scheme is then used to find real-time kinematic position estimates by incorporating with the vehicle kinematics of the user station. Experimental results show that thc proposed KGPS algorithm is not only effective in providing more precise position estimates and reducing the detrimental effect of the cycle slip, but also useful for realtime vehicle navigation and high-accuracy surveying.
Author
Algorithms; Global Positioning System; Kalman Filters; Kinematics; Least Squares Method

88
SPACE SCIENCES (GENERAL)

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through 93*.

20080008525 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Combinations of Earth Orientation Measurements: SPACE2005, COMB2005, and POLE2005
Gross, Richard S.; September 2006; 25 pp.; In English; Original contains black and white illustrations
Report No.(s): JPL Publication 06-3; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40600

Independent Earth orientation measurements taken by the space-geodetic techniques of lunar and satellite laser ranging, by very long baseline interferometry, and by the Global Positioning System have been combined using a Kalman filter. The resulting combined Earth orientation series, SPACE2005, consists of values and uncertainties for Universal Time, polar motion, and their rates that span from September 28, 1976, to January 7, 2006, at daily intervals and is available in versions whose epochs are given at either midnight or noon. The space-geodetic measurements used to generate SPACE2005 have then been combined with optical astrometric measurements to form two additional combined Earth orientation series: (1) COMB2005, consisting of values and uncertainties for Universal Time, polar motion, and their rates that span from January 20, 1962, to January 7, 2006, at daily intervals and which is also available in versions whose epochs are given at either

midnight or noon; and (2) POLE2005, consisting of values and uncertainties for polar motion and its rate that span from January 20, 1900, to December 21, 2005, at 30.4375-day intervals.
Author
Global Positioning System; Earth Orientation; Very Long Base Interferometry; Satellite Laser Ranging; Geodetic Surveys; Kalman Filters; Optical Measurement; Astrometry

89
ASTRONOMY

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

20080006641 Naval Observatory, Washington, DC USA
Sloan Digital Sky Survey Standard Star Catalog for Stripe 82: The Dawn of Industrial 1% Optical Photometry
Ivezic, Zeljko; Smith, J A; Miknaitis, Gajus; Lin, Huan; Tucker, Douglas; Lupton, Robert H; Gunn, James E; Knapp, Gillian R; Strauss, Michael A; Sesar, Branimir; Sep 2007; 27 pp.; In English
Report No.(s): AD-A475266; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We describe a standard star catalog constructed using multiple SDSS photometric observations (at least four per band, with a median of 10) in the ugriz system. The catalog includes 1.01 million nonvariable unresolved objects from the equatorial stripe 82 in the right ascension range and with the corresponding r-band (approximately Johnson V-band) magnitudes in the range 14-22. The distributions of measurements for individual sources demonstrate that the photometric pipeline correctly estimates random photometric errors, which are below 0.01 mag for stars brighter than 19.5, 20.5, 20.5, 20, and 18.5 in ugriz, respectively (about twice as good as for individual SDSS runs). Several independent tests of the internal consistency suggest that the spatial variation of photometric zero points is not larger than 0.01 mag (rms). In addition to being the largest available data set with optical photometry internally consistent at the ~1% level, this catalog provides a practical definition of the SDSS photometric system. Using this catalog, we show that photometric zero points for SDSS observing runs can be calibrated within a nominal uncertainty of 2% even for data obtained through 1 mag thick clouds, and we demonstrate the existence of He and H white dwarf sequences using photometric data alone. Based on the properties of this catalog, we conclude that upcoming large-scale optical surveys such as the Large Synoptic Survey Telescope will be capable of delivering robust 1% photometry for billions of sources.
DTIC
Astronomical Catalogs; Optical Measurement; Photometry; Sky Surveys (Astronomy)

20080008142 Naval Observatory, Washington, DC USA
The Kepler Mission and Eclipsing Binaries
Koch, David; Borucki, William; Basri, Gibor; Brown, Timothy; Caldwell, Douglas; Christensen-Dalsgaard, Jorgen; Cochran, William; DeVore, Edna; Dunham, Edward; Gautier, Thomas N; Geary, John; Gilliland, Ronald; Gould, Alan; Jenkins, Jon; Kondo, Yoji; Lathan, David; Lissauer, Jack; Monet, David; Jan 2006; 9 pp.; In English
Report No.(s): AD-A471048; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1017/S1743921307004085

The Kepler Mission is a space-based photometric mission with a differential photometric precision of 14 ppm (at V = 12 for a 6.5 hour transit). It is designed to continuously observe a single field of view (FOV) of greater then 100 square degrees in the Cygnus-Lyra region for four or more years. The primary goal of the mission is to monitor more than one-hundred thousand stars for transits of Earth-size and smaller planets in the habitable zone of solar-like stars. In the process, many eclipsing binaries (EB) will also be detected and light curves produced. To enhance and optimize the mission results, the stellar characteristics for all the stars in the Kepler FOV with V < 16 will have been determined prior to launch. As part of the verification process, stars with transit candidates will have radial-velocity follow-up observations performed to determine the component masses and thereby separate eclipses caused by stellar companions from transits caused by planets. The result will be a rich database on EBs. The community will have access to the archive for further analysis, such as, for EB modeling of the high-precision light curves. A guest observer program is also planned to allow for photometric observations of objects not on the target list but within the FOV.
Author
Astronomical Observatories; Eclipsing Binary Stars; Extrasolar Planets; Planet Detection

20080008410 Ohio State Univ., Columbus, OH, USA

Optical and X-Ray Observations of GRB 060526: A Complex Afterglow Consistent with an Achromatic Jet Break

Dai, X.; Halpern, J. P.; Morgan, N. D.; Armstrong, E.; Mirabal, N.; Haislip. J. B.; Reichart, D. E.; Stanek, K. Z.; The Astrophysical Journal; March 20, 2007; Volume 513, pp. 509-513; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNG06GJ25G; Copyright; Avail.: Other Sources

We obtained 98 R-band and 18 B, r', i' images of the optical afterglow of GRB 060526 (z = 3.21) with the MDM 1.3 m, 2.4 m, and the PROMPT telescopes at CTIO over the five nights following the burst trigger. Combining these data with other optical observations reported in GCN and the Swift XRT observations, we compare the optical and X-ray afterglow light curves of GRB 060526. Both the optical and X-ray afterglow light curves show rich features, such as flares and breaks. The densely sampled optical observations provide very good coverage at T > 10(exp 4) s. We observed a break at 2.4 x 10(exp 5) sin the optical afterglow light curve. Compared with the X-ray afterglow light curve, the break is consistent with an achromatic break supporting the beaming models of GRBs. However, the prebreak and postbreak temporal decay slopes are difficult to explain in simple afterglow models. We estimated a jet angle of theta(sub j) approx. 7deg and a prompt emission size of R(sub prompt) approx. 2 x 10(exp 14) cm. In addition, we detected several optical flares with amplitudes of (Delta)m approx. 0.2,0.6, and 0.2 mag. The X-ray afterglows detected by Swift have shown complicated decay patterns. Recently, many well-sampled optical afterglows also show decays with flares and multiple breaks. GRB 060526 provides an additional case of such a complex, well-observed optical afterglow. The accumulated well-sampled afterglows indicate that most of the optical afterglows are complex.

Author

Gamma Ray Bursts; Afterglows; Visual Observation; X Rays; Light Curve

20080008413 Columbia Univ., New York, NY, USA

GRB 050826: A Subluminous Event at z=0.296 Finds Its Place in the Luminosity Distribution of Gamma-Ray Burst Afterglows

Mirabal, N.; Halpern J. P.; O'Brien, P. T.; The Astrophysical Journal; June 2007; Volume 661, pp. L127-L130; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNG06GJ25G; NNH05ZDA001N; Copyright; Avail.: Other Sources

We present the optical identification and spectroscopy of the host galaxy of GRB 050826 at redshift z = 0.296 +/- 0.001. Image subtraction among observations obtained on three consecutive nights reveals a fading object 5 hr after the burst, confirming its identification as the optical afterglow of this event. Deep imaging shows that the optical afterglow is offset by 0.4' (1.76 kpc) from the center of its irregular host galaxy, which is typical for long-duration gamma-ray bursts. Combining these results with X-ray measurements acquired by the Swift XRT instrument, we find that GRB 050826 falls entirely within the subluminous, subenergetic group of long gamma-ray bursts at low redshift (z less than or equal to 0.3). The results are discussed in the context of models that possibly account for this trend, including the nature of the central engine, the evolution of progenitor properties as a function of redshift, and incompleteness in current gamma-ray burst samples.

Author

Gamma Ray Bursts; Red Shift; Luminosity; Image Processing; Afterglows; Galaxies

20080008551 Naval Observatory, Washington, DC USA

Polaris: Mass and Multiplicity

Evans, Nancy Remage; Schaefer, Gail; Bond, Howard E.; Nelan, Edmund; Bono, Giuseppe; Karovska, Margarita; Wolk, Scott; Sasselov, Dimitar; Guinan, Edward; Engle, Scott; Schlegel, Eric; Mason, Brian; Proceedings of the International Astronomical Union; Jan 2006; Volume 2, pp. 102-104; In English; Symposium on the International Astronomical Union on Binary Stars as Critical Tools and Tests in Contemporary Astrophysics, August 2006, USA

Contract(s)/Grant(s): NAS8-03060; NAS8-39073; HST-GO-10593.01-A; GO6-7011A

Report No.(s): AD-A471047; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1017/S1743921307003870

Polaris, the nearest and brightest classical Cepheid, is a member of at least a triple system. It has a wide (18') physical companion, the F-type dwarf Polaris B. Polaris itself is a single-lined spectroscopic binary with an orbital period of approximately 30 years. By combining Hipparcos measurements of the instantaneous proper motion with long-term measurements and the Kamper radial-velocity orbit, have predicted the astrometric orbit of the close companion. Using the Hubble Space Telescope and the Advanced Camera for Surveys' High-Resolution Channel with an ultraviolet (F220W) filter, we have now directly detected the close companion. Based on the Wielen et al. orbit, the Hipparcos parallax, and our measurement of the separation (0'.176 +or- 0'.002), we find a preliminary mass of 5.0 +or- 1.5 M(circle dot solar) for the

Cepheid and 1.38 +or- 0.61 M(circle dot solar) for the close companion. These values will be refined by additional HST observations scheduled for the next 3 years. We have also obtained a Chandra ACIS-I image of the Polaris field. Two distant companions C and D are not X-rays sources and hence are not young enough to be physical companions of the Cepheid. There is one additional stellar X-ray source in the field, located 253' from Polaris A, which is a possible companion. Further investigation of such a distant companion is valuable to confirm the full extent of the system.
Author
Binary Stars; Cepheid Variables; Stellar Mass; Measurement; Stellar Parallax; Parallax; X Ray Astronomy

20080008575 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Project Status Update and ESA Science Breadth Discussion for the Origins Subcommittee (OS)
Marr, James C., IV; Shao, Mike; July 1, 2003; 19 pp.; In English; Origins Subcommittee Meeting, Washington, DC, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40613

This viewgraph presentation is composed of two sections The first reviews the features and the science goals of the Space Interferometry Mission (ESA). The goals are: (1) Perform a search for other planetary systems by surveying 2000 nearby stars for astrometric signatures of planetary companion, (2) Survey a sample of 200 nearby stars for orbiting planets down to terrestrial-type masses (3) Improve best current catalog of star positions by >lOOx and extend to fainter stars to allow extension of stellar knowledge to include our entire galaxy (4) Study dynamics and evolution of stars and star clusters in our galaxy to understand how our galaxy was formed and how it will evolve. (5) Calibrate luminosities of important stars and cosmological distance indicators to improve our understanding of stellar processes and to measure precise distance in the distant universe. The presentation also reviews the accomplishments since 2002, the plans for the subsequent 6 months. The second entitled 'The Breadth of ESA Science,' reviews ESA science goals in a larger context. ESA will serve to complement and pave the way for the Terrestrial Planet Finder (TPF). ESA observations of the motions of stars will tell us about the distribution of all gravitating mass (light plus dark matter) in the Galaxy. ESA observations of the motions of dwarf galaxies around our own will determine the mass distribution (light plus dark matter in the Halo. ESA will greatly extend these observations to test the theories of accretion disks around super massive black holes. ESA has advantages for studying AGN and other very compact objects.
CASI
Astronomical Interferometry; NASA Space Programs; Spaceborne Astronomy; Cosmology; Terrestrial Planets

90
ASTROPHYSICS

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

20080007086 California Inst. of Tech., Pasadena, CA, USA
Cosmic Star Formation from 0.5<z<20 with Spitzer
Chary, Ranga-Ram; May 28, 2006; 17 pp.; In English; Study Galaxy Evolution with Spitzer and Herschel, 28 May 2006, Crete, Greece; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40584

This viewgraph presentation reviews some findings from the Spitzer telescope about star formation. The presentation shows charts summarizing information from the Spitzer Telescope and other observations.
CASI
Star Formation; H Alpha Line; Astrophysics; Cosmology; Infrared Astronomy; Spaceborne Astronomy

20080007087 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Cold Atomic Hydrogen, Narrow Self-Absorption, and the Age of Molecular Clouds
Goldsmith, Paul F.; May 22, 2006; 61 pp.; In English; Scientific Colloquium at Istitut de Radioastronomie Millimetrique (IRAM), 22 May 2006, Grenoble, France; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40585

This viewgraph presentation reviews the history, and current work on HI and its importance in star formation. Through many observations of HI Narrow Self Absorption (HINSA) the conclusions are drawn and presented. Local molecular clouds have HI well-mixed with molecular constituents This HI is cold, quiescent, and must be well-shielded from the UV radiation field The density and fractional abundance (wrt H2) of the cold HI are close to steady state values The time required to convert

these starless clouds from purely HI initial state to observed present composition is a few to ten million years This timescale is a lower limit - if dense clouds being swept up from lower density regions by shocks, the time to accumulate material to get A(sub v) is approximately 1 and provide required shielding may be comparable or longer
CASI
Hydrogen; Molecular Clouds; Self Absorption; Star Formation; Hydrogen Clouds; Hydrogen Atoms

20080008515 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Terrestrial Planet Finder Interferometer Science Working Group Report
Lawson, Peter R., Editor; Lay, Oliver P., Editor; Johnston, Kenneth J., Editor; Beichman, Charles A., Editor; March 1, 2007; 212 pp.; In English; Original contains color and black and white illustrations
Report No.(s): JPL Publication 07-1; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40599

Over the past two years, the focus of the project for the interferometric version of the Terrestrial Planet Finder(TPF-I) has been on the development of the scientific rational for the mission, the assessment of TPF-I architectures, the laboratory demonstration of key technologies, and the development of a detailed technology roadmap. The Science Working Group (SWG), in conjunction with European colleagues working on the European Space Agency's (ESA's) Darwin project, has reaffirmed the goals of TPF-I as part of a broad vision for the detection and characterization of Earth-like planets orbiting nearby stars and for the search for life on those planets. The SWG also helped to assess the performance of different interferometric configurations for TPF-I/Darwin. Building on earlier SWG reports, this document restates the scientific case for TPF-I, assesses suitable target stars and relevant wavelengths for observation, discusses dramatic new capabilities for general astrophysical observations, and summarizes how Spitzer has improved our knowledge of the incidence of zodiacal emission on the search for planets. This document discusses in some detail on laboratory advances in interferometric nulling and formation flying. Laboratory experiments have now achieved stable narrow- and broad-band nulling the levels of 10-6 and 2.0x10-5, respectively. A testbed has demonstrated formation flying using two realistic spacecraft mockups. With a suitably funded program of technology development, as summarized herein and described in more detail in the Technology Plan for the Terrestrial Planet Finder Interferometer (2005), the National Aeronautics and Space Administration (NASA) and ESA would be able to start within the coming decade a full-scale TPF-I/Darwin mission capable of finding Earths orbiting more than 150 nearby stars, or a scaled back interferometer capable of studying more than 30 stars. Finding evidence for life on just one of those planets would revolutionize our understanding of our place in the cosmos.
Author
Terrestrial Planets; Interferometry; Earth Orbits; NASA Programs; Astrophysics

91
LUNAR AND PLANETARY SCIENCE AND EXPLORATION

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

20080006604 NASA Glenn Research Center, Cleveland, OH, USA
NEXT Ion Propulsion System Configurations and Performance for Saturn System Exploration
Benson, Scott W.; Riehl, John P.; Oleson, Steven R.; July 08, 2007; 15 pp.; In English; 43rd Joint Propulsion Conference and Exhibit, 8-11 Jul. 2007, Cincinnati, OH, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 348620.04.06.03.11; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080006604

The successes of the Cassini/Huygens mission have heightened interest to return to the Saturn system with focused robotic missions. The desire for a sustained presence at Titan, through a dedicated orbiter and in-situ vehicle, either a lander or aerobot, has resulted in definition of a Titan Explorer flagship mission as a high priority in the Solar System Exploration Roadmap. The discovery of active water vapor plumes erupting from the tiger stripes on the moon Enceladus has drawn the attention of the space science community. The NASA's Evolutionary Xenon Thruster (NEXT) ion propulsion system is well suited to future missions to the Saturn system. NEXT is used within the inner solar system, in combination with a Venus or Earth gravity assist, to establish a fast transfer to the Saturn system. The NEXT system elements are accommodated in a separable Solar Electric Propulsion (SEP) module, or are integrated into the main spacecraft bus, depending on the mission architecture and performance requirements. This paper defines a range of NEXT system configurations, from two to four thrusters, and the Saturn system performance capability provided. Delivered mass is assessed parametrically over total trip

time to Saturn. Launch vehicle options, gravity assist options, and input power level are addressed to determine performance sensitivities. A simple two-thruster NEXT system, launched on an Atlas 551, can deliver a spacecraft mass of over 2400 kg on a transfer to Saturn. Similarly, a four-thruster system, launched on a Delta 4050 Heavy, delivers more than 4000 kg spacecraft mass. A SEP module conceptual design, for a two thruster string, 17 kW solar array, configuration is characterized.
Author
Ion Propulsion; Xenon; Trajectory Optimization; Solar Electric Propulsion; Saturn (Planet); Propulsion System Performance; Propulsion System Configurations

20080006786 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
An Overview of the Juno Mission to Jupiter
Grammier, Richard S.; June 4, 2006; 9 pp.; In English; 25th International Symposium on Space Technology and Science (ISTS), 4-11 Jun. 2006, Kanazawa, Japan; Original contains color and black and white illustrations
Report No.(s): ISTS 2006-o-2-06V; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40581

Arriving in orbit around the planet Jupiter in 2016 after a five-year journey, the Juno spacecraft will begin a one-year investigation of the gas giant in order to understand its origin and evolution by determining its water abundance and constraining its core mass. In addition, Juno will map the planet's magnetic and gravitational fields, map its atmosphere, and explore the three-dimensional structure of Jupiter's polar magnetosphere and auroras. Juno will discriminate among different models for giant planet formation. These investigations will be conducted over the course of thirty-two 11-day elliptical polar orbits of the planet. The orbits are designed to avoid Jupiter's highest radiation regions. The spacecraft is a spinning, solar-powered system carrying a complement of eight science instruments for conducting the investigations. The spacecraft systems and instruments take advantage of significant design and operational heritage from previous space missions.
Author
Jupiter (Planet); Space Missions; Spacecraft Instruments; Jupiter Atmosphere; Jupiter Probes

20080007249 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Mars Science and Telecommunications Orbiter: Report of the Science Analysis Group, March 2006
Farmer, Crofton Barney; Calvin, Wendy M.; Campbell, Bruce; Fox, Jane; Haberle, Bob; Kasting, Jim; Luhmann, Janet; Nagy, Andy; Allen, Mark; Winterhalter, Daniel; March 2006; 47 pp.; In English; 15th Mars Exploration Program Analysis Group (MEPAG), 19-20 Apr. 2006, Monrovia, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40589

This document reports the findings of the Mars Science and Telecommunications Orbiter (MSTO) Science Advocacy Group (SAG), which was convened by the Mars Exploration Program Analysis Group (MEPAG) and the Mars Exploration Office at JPL to identify and prioritize areas of Mars atmospheric and surface science objectives for Mars that can be accomplished from orbit on a MSTO like mission.
Author
Telecommunication; Atmospheric Chemistry; Atmospheric Physics; Meteorology; Mars Atmosphere

20080008150 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Multijunction Solar Cells Optimized for the Mars Surface Solar Spectrum
Edmondson, Kenneth M.; Fetzer, Chris; Karam, Nasser H.; Stella, Paul; Mardesich, Nick; Mueller, Robert; September 25, 2007; 7 pp.; In English; 20th Space Photovoltaic Research and Technology (SPRAT), 25-27 Sep. 2007, Cleveland, OH, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): JPL-1268631; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40575

This paper gives an update on the performance of the Mars Exploration Rovers (MER) which have been continually performing for more than 3 years beyond their original 90-day missions. The paper also gives the latest results on the optimization of a multijunction solar cell that is optimized to give more power on the surface of Mars.
Author
Solar Cells; Roving Vehicles; Mars Exploration

20080008384 NASA Langley Research Center, Hampton, VA, USA

Imaginable Technologies for Human Missions to Mars

Bushnell, Dennis M.; [2007]; 11 pp.; In English; Submitted to Aerospace America to be published in volume 45, no. 6, pp. 24-30, June 2007

Contract(s)/Grant(s): WBS 292487.08.07.01; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20080008384

The thesis of the present discussion is that the simultaneous cost and inherent safety issues of human on-site exploration of Mars will require advanced-to-revolutionary technologies. The major crew safety issues as currently identified include reduced gravity, radiation, potentially extremely toxic dust and the requisite reliability for years-long missions. Additionally, this discussion examines various technological areas which could significantly impact Human-Mars cost and safety. Cost reductions for space access is a major metric, including approaches to significantly reduce the overall up-mass. Besides fuel, propulsion and power systems, the up-mass consists of the infrastructure and supplies required to keep humans healthy and the equipment for executing exploration mission tasks. Hence, the major technological areas of interest for potential cost reductions include propulsion, in-space and on-planet power, life support systems, materials and overall architecture, systems, and systems-of-systems approaches. This discussion is specifically offered in response to and as a contribution to goal 3 of the Presidential Exploration Vision: 'Develop the Innovative Technologies Knowledge and Infrastructures both to explore and to support decisions about the destinations for human exploration'

Derived from text

Mars Exploration; Manned Mars Missions; Cost Reduction; Spacecraft Propulsion; Weight Reduction

20080008514 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Earth-Like Exoplanets: The Science of NASA's Navigator Program

Lawson, Peter R., Editor; Traub, Wesley A., Editor; October 16, 2006; 197 pp.; In English; Original contains color and black and white illustrations

Report No.(s): JPL Publication 06-5, Rev A; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40621

This book outlines the exoplanet science content of NASA's Navigator Program, and it identifies the exoplanet research priorities. The goal of Navigator Program missions is to detect and characterize Earth-like planets in the habitable zone of nearby stars and to search for signs of life on those planets.

Author

Extrasolar Planets; NASA Programs; Navigators

20080008576 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Integrated Network Architecture for Sustained Human and Robotic Exploration

Noreen, Gary; Cesarone, Robert; Deutsch, Leslie; Edwards, Charles; Soloff, Jason; Ely, Todd; Cook, Brian; Morabito, David; Hemmati, Hamid; Piazolla, Sabino; Hastrup, Rolf; Abraham, Douglas; Miles, Sue; Manshadi, Farzin; March 5, 2005; 20 pp.; In English; IEEE Aerospace Conference, 5-12 Mar. 2005, Big Sky, MT, USA; Original contains black and white illustrations

Report No.(s): IEEEAC Paper I378; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40610

The National Aeronautics and Space Administration (NASA) Exploration Systems Enterprise is planning a series of human and robotic missions to the Earth's moon and to Mars. These missions will require communication and navigation services. This paper1 sets forth presumed requirements for such services and concepts for lunar and Mars telecommunications network architectures to satisfy the presumed requirements. The paper suggests that an inexpensive ground network would suffice for missions to the near-side of the moon. A constellation of three Lunar Telecommunications Orbiters connected to an inexpensive ground network could provide continuous redundant links to a polar lunar base and its vicinity. For human and robotic missions to Mars, a pair of areostationary satellites could provide continuous redundant links between Earth and a mid-latitude Mars base in conjunction with the Deep Space Network augmented by large arrays of 12-m antennas on Earth.

Author

NASA Programs; Space Exploration; Mars Missions; Lunar Orbiter; Deep Space Network; Robotics; Telecommunication; Moon

20080008578 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Mars Exploration Rover: Launch, Cruise, Entry, Descent, and Landing
Erickson, James K.; Manning, Robert M.; Adler, M.; October 4, 2004; 26 pp.; In English; 55th International Astronautical Congress, 4 Oct. 2004, Vancouver, Canada; Original contains black and white illustrations
Report No.(s): IAC-04-Q.3.a.03; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40606

The Mars Exploration Rover Project was an ambitious effort to land two highly capable rovers on Mars and concurrently explore the Martian surface for three months each. Launched in June and July of 2003, cruise operations were conducted through January 4, 2004 with the first landing, followed by the second landing on January 25. The prime mission for the second rover ended on April 27, 2004. This paper will provide an overview of the launch, cruise, and landing phases of the mission, including the engineering and science objectives and challenges involved in the selection and targeting of the landing sites, as well as the excitement and challenges of atmospheric entry, descent and landing execution.
Author
Roving Vehicles; Rover Project; Launching; Landing Sites; Atmospheric Entry; Descent; Mars Landing

92
SOLAR PHYSICS

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

20080006637 NASA Marshall Space Flight Center, Huntsville, AL, USA
Anticipating Cycle 24 Minimum and Its Consequences
Wilson, Robert M.; Hathaway, David H.; November 2007; 52 pp.; In English; Original contains black and white illustrations
Report No.(s): NASA/TP-2007-215134; M-1209; No Copyright; Avail.: CASI: A04, Hardcopy
ONLINE: http://hdl.handle.net/2060/20080006637

On the basis of the 12-mo moving average of monthly mean sunspot number (R) through November 2006, cycle 23 has persisted for 126 mo, having had a minimum of 8.0 in May 1996, a peak of 120.8 in April 2000, and an ascent duration of 47 mo. In November 2006, the 12-mo moving average of monthly mean sunspot number was 12.7, a value just outside the upper observed envelope of sunspot minimum values for the most recent cycles 16-23 (range 3.4-12.3), but within the 90-percent prediction interval (7.8 +/- 6.7). The first spotless day during the decline of cycle 23 occurred in January 2004, and the first occurrence of 10 or more and 20 or more spotless days was February 2006 and April 2007, respectively, inferring that sunspot minimum for cycle 24 is imminent. Through May 2007, 121 spotless days have accumulated. In terms of the weighted mean latitude (weighed by spot area) (LAT) and the highest observed latitude spot (HLS) in November 2006, 12-mo moving averages of these parameters measured 7.9 and 14.6 deg, respectively, these values being the lowest values yet observed during the decline of cycle 23 and being below corresponding mean values found for cycles 16-23. As yet, no high-latitude new-cycle spots have been seen nor has there been an upturn in LAT and HLS, these conditions having always preceded new cycle minimum by several months for past cycles. Together, these findings suggest that cycle 24 s minimum amplitude still lies well beyond November 2006. This implies that cycle 23 s period either will lie in the period 'gap' (127-134 mo), a first for a sunspot cycle, or it will be longer than 134 mo, thus making cycle 23 a long-period cycle (like cycle 20) and indicating that cycle 24 s minimum will occur after July 2007. Should cycle 23 prove to be a cycle of longer period, a consequence might be that the maximum amplitude for cycle 24 may be smaller than previously predicted.
Author
Sunspot Cycle; Latitude; Sunspots; Mean

20080007493 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Slow Mode Waves in the Heliospheric Plasma Sheet
Smith, Edward. J.; Zhou, Xiaoyan; March 17, 2007; 9 pp.; In English; Turbulence and Non-linear Processes in Astrophysical Plasmas, 17-22 Mar. 2007, Honolulu, HI, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40579

We report the results of a search for waves/turbulence in the Heliospheric Plasma Sheet (HPS) surrounding the Heliospheric Current Sheet (HCS). The HPS is treated as a distinctive heliospheric structure distinguished by relatively high Beta, slow speed plasma. The data used in the investigation are from a previously published study of the thicknesses of the HPS and HCS that were obtained in January to May 2004 when Ulysses was near aphelion at 5 AU. The advantage of using

these data is that the HPS is thicker at large radial distances and the spacecraft spends longer intervals inside the plasma sheet. From the study of the magnetic field and solar wind velocity components, we conclude that, if Alfven waves are present, they are weak and are dominated by variations in the field magnitude, B, and solar wind density, NP, that are anti-correlated. Author

Heliosphere; Plasma Waves; Magnetohydrodynamic Waves; Current Sheets; Ulysses Mission; Turbulence; Solar Wind Velocity

20080008451 Air Force Research Lab., Hanscom AFB, MA USA

Solar and Solar Wind Disturbance Predictions

Cliver, Edward W; Oct 11, 2007; 23 pp.; In English

Contract(s)/Grant(s): Proj-1010

Report No.(s): AD-A475144; AFRL-RV-HA-TR-2007-1107; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A prediction of 75, a relatively low number, has been made for peak sunspot number for solar cycle 24. Direct measurements of the solar wind magnetic field strength and speed became routinely available in the 1960s. The Interdiurnal Variability Index has been used to reconstruct the magnetic field strength of the solar wind, thereby extending the data back for a total of about 125 years. With these results and the Interhourly Variability Index, the speed of the solar wind has been determined for the same period of time. Other results include the establishment of bench marks for the extreme limits of solar-terrestrial activity and validation of the Proton Prediction Study tool for short term alerts of solar particle events. DTIC

Solar Wind; Solar Corpuscular Radiation; Solar Storms; Sunspot Cycle; Sun; Solar Terrestrial Interactions; Sunspots

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