



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

**Scientific and Technical
Information Program Office**

Scientific and Technical Aerospace Reports

STAIR

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NASA STI Program ... in Profile

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

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- **TECHNICAL PUBLICATION.** Reports of completed research or a major significant phase of research that present the results of NASA Programs and include extensive data or theoretical analysis. Includes compilations of significant scientific and technical data and information deemed to be of continuing reference value. NASA counterpart of peer-reviewed formal professional papers but has less stringent limitations on manuscript length and extent of graphic presentations.
- **TECHNICAL MEMORANDUM.** Scientific and technical findings that are preliminary or of specialized interest, e.g., quick release reports, working papers, and bibliographies that contain minimal annotation. Does not contain extensive analysis.
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- **CONFERENCE PUBLICATION.** Collected papers from scientific and technical conferences, symposia, seminars, or other meetings sponsored or co-sponsored by NASA.
- **SPECIAL PUBLICATION.** Scientific, technical, or historical information from NASA programs, projects, and missions, often concerned with subjects having substantial public interest.
- **TECHNICAL TRANSLATION.** English-language translations of foreign scientific and technical material pertinent to NASA's mission.

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

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

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Introduction

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

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

STAR includes citations to R&D results reported in:

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

The NASA STI Program

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

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

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

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

NASA STI Availability Information

NASA Center for AeroSpace Information (CASI)

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

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

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

National Technical Information Service (NTIS)

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

The Federal Depository Library Program (FDLP)

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

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

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

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[Subject Term Index](#)

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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.

2008002364 NASA Langley Research Center, Hampton, VA, USA

Enhanced Oceanic Operations Human-In-The-Loop In-Trail Procedure Validation Simulation Study

Murdoch, Jennifer L.; Bussink, Frank J. L.; Chamberlain, James P.; Chartrand, Ryan C.; Palmer, Michael T.; Palmer, Susan O.; June 2008; 144 pp.; In English; Original contains color and black and white illustrations

Report No.(s): NASA/TP-2008-215313; L-19442; Copyright; Avail.: CASI: [A07](#), Hardcopy

The Enhanced Oceanic Operations Human-In-The-Loop In-Trail Procedure (ITP) Validation Simulation Study investigated the viability of an ITP designed to enable oceanic flight level changes that would not otherwise be possible. Twelve commercial airline pilots with current oceanic experience flew a series of simulated scenarios involving either standard or ITP flight level change maneuvers and provided subjective workload ratings, assessments of ITP validity and acceptability, and objective performance measures associated with the appropriate selection, request, and execution of ITP flight level change maneuvers. In the majority of scenarios, subject pilots correctly assessed the traffic situation, selected an appropriate response (i.e., either a standard flight level change request, an ITP request, or no request), and executed their selected flight level change procedure, if any, without error. Workload ratings for ITP maneuvers were acceptable and not substantially higher than for standard flight level change maneuvers, and, for the majority of scenarios and subject pilots, subjective acceptability ratings and comments for ITP were generally high and positive. Qualitatively, the ITP was found to be valid and acceptable. However, the error rates for ITP maneuvers were higher than for standard flight level changes, and these errors may have design implications for both the ITP and the study's prototype traffic display. These errors and their implications are discussed.

Author

Workloads (Psychophysiology); Simulation; Civil Aviation; Commercial Aircraft; Acceptability; Errors

20080023418 Power Superconductor Applications Corp., New Castle, PA, USA

High Velocity Linear Induction Launcher with Exit-Edge Compensation for Testing of Aerospace Components

Kuznetsov, Stephen; Marriott, Darin; June 10, 2008; 8 pp.; In English; 14th International Electromagnetic Launch Symposium, 10-13 Jun. 2008, Victoria, BC, Canada; Original contains color and black and white illustrations

Contract(s)/Grant(s): NND07AA47C; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023418>

Advances in ultra high speed linear induction electromagnetic launchers over the past decade have focused on magnetic compensation of the exit and entry-edge transient flux wave to produce efficient and compact linear electric machinery. The paper discusses two approaches to edge compensation in long-stator induction catapults with typical end speeds of 150 to 1,500 m/s. In classical linear induction machines, the exit-edge effect is manifest as two auxiliary traveling waves that produce a magnetic drag on the projectile and a loss of magnetic flux over the main surface of the machine. In the new design for the Stator Compensated Induction Machine (SCIM) high velocity launcher, the exit-edge effect is nulled by a dual wavelength machine or alternately the airgap flux is peaked at a location prior to the exit edge. A four (4) stage LIM catapult is presently being constructed for 180 m/s end speed operation using double-sided longitudinal flux machines. Advanced exit and entry edge compensation is being used to maximize system efficiency, and minimize stray heating of the reaction armature. Each stage will output approximately 60 kN of force and produce over 500 G s of acceleration on the armature. The advantage of this design is there is no ablation to the projectile and no sliding contacts, allowing repeated firing of the launcher without maintenance of any sort. The paper shows results of a parametric study for 500 m/s and 1,500 m/s linear induction launchers

incorporating two of the latest compensation techniques for an air-core stator primary and an iron-core primary winding. Typical thrust densities for these machines are in the range of 150 kN/sq.m. to 225 kN/sq.m. and these compete favorably with permanent magnet linear synchronous machines. The operational advantages of the high speed SCIM launcher are shown by eliminating the need for pole-angle position sensors as would be required by synchronous systems. The stator power factor is also improved.

Derived from text

Electromagnetic Propulsion; Launchers; Parameterization; Induction Motors; Aerospace Systems; Aerospace Engineering; Linearity

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.

20080022415 NASA Glenn Research Center, Cleveland, OH, USA

Volume Dynamics Propulsion System Modeling for Supersonics Vehicle Research

Kopasakis, George; Connolly, Joseph W.; Paxson, Daniel E.; Ma, Peter; May 2008; 17 pp.; In English; ASME Turbo Expo, 9-13 Jun. 2008, Berlin, Germany; Original contains color and black and white illustrations

Contract(s)/Grant(s): GT2008-50524; WBS 984754.02.07.03.20.02

Report No.(s): NASA/TM--2008-215172; E-16415; GT2008-50524; Copyright; Avail.: CASI: [A03](#), Hardcopy

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

Author

Propulsion System Performance; Dynamic Structural Analysis; Supersonics; Dynamic Response; Turbojet Engines; Servomechanisms; Yaw; Angle of Attack

20080023459 NASA Langley Research Center, Hampton, VA, USA

Boundary Layer Transition on X-43A

Berry, Scott; Daryabeigi, Kamran; Wurster, Kathryn; Bittner, Robert; June 23, 2008; 17 pp.; In English; 40th AIAA Thermophysics Conference, 23-26 Jun. 2008, Seattle, WA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 732759.07.05

Report No.(s): AIAA-2008-3736; L-6068; Copyright; Avail.: CASI: [A03](#), Hardcopy

The successful Mach 7 and 10 flights of the first fully integrated scramjet propulsion systems by the Hyper-X (X-43A) program have provided the means with which to verify the original design methodologies and assumptions. As part of Hyper-X's propulsion-airframe integration, the forebody was designed to include a spanwise array of vortex generators to promote boundary layer transition ahead of the engine. Turbulence at the inlet is thought to provide the most reliable engine design and allows direct scaling of flight results to groundbased data. Pre-flight estimations of boundary layer transition, for both Mach 7 and 10 flight conditions, suggested that forebody boundary layer trips were required to ensure fully turbulent conditions upstream of the inlet. This paper presents the results of an analysis of the thermocouple measurements used to infer the dynamics of the transition process during the trajectories for both flights, on both the lower surface (to assess trip performance) and the upper surface (to assess natural transition). The approach used in the analysis of the thermocouple data is outlined, along with a discussion of the calculated local flow properties that correspond to the transition events as identified in the flight data. The present analysis has confirmed that the boundary layer trips performed as expected for both flights,

providing turbulent flow ahead of the inlet during critical portions of the trajectory, while the upper surface was laminar as predicted by the pre-flight analysis.

Author

Boundary Layer Control; Hypersonic Speed; Vortex Generators; Turbulent Flow; Supersonic Combustion Ramjet Engines; Propulsion System Configurations; Flow Characteristics; Engine Airframe Integration; Propulsion System Performance

20080023461 NASA Langley Research Center, Hampton, VA, USA

Infrared Imaging of Boundary Layer Transition Flight Experiments

Berry, Scott A.; Horvath, Thomas J., Jr.; Schwartz, Richard; Ross, Martin; Anderson, Brian; Campbell, Charles H.; June 23, 2008; 11 pp.; In English; 40th AIAA Thermophysics Conference, 23-26 Jun. 2008, Seattle, WA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 510505.04.07.01.22

Report No.(s): AIAA 2008-4027; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Hypersonic Thermodynamic Infrared Measurement (HYTHIRM) project is presently focused on near term support to the Shuttle program through the development of an infrared imaging capability of sufficient spatial and temporal resolution to augment existing on-board Orbiter instrumentation. Significant progress has been made with the identification and inventory of relevant existing optical imaging assets and the development, maturation, and validation of simulation and modeling tools for assessment and mission planning purposes, which were intended to lead to the best strategies and assets for successful acquisition of quantitative global surface temperature data on the Shuttle during entry. However, there are longer-term goals of providing global infrared imaging support to other flight projects as well. A status of HYTHIRM from the perspective of how two NASA-sponsored boundary layer transition flight experiments could benefit by infrared measurements is provided. Those two flight projects are the Hypersonic Boundary layer Transition (HyBoLT) flight experiment and the Shuttle Boundary Layer Transition Flight Experiment (BLT FE), which are both intended for reducing uncertainties associated with the extrapolation of wind tunnel derived transition correlations for flight application. Thus, the criticality of obtaining high quality flight data along with the impact it would provide to the Shuttle program damage assessment process are discussed. Two recent wind tunnel efforts that were intended as risk mitigation in terms of quantifying the transition process and resulting turbulent wedge locations are briefly reviewed. Progress is being made towards finalizing an imaging strategy in support of the Shuttle BLT FE, however there are no plans currently to image HyBoLT.

Author

Boundary Layer Transition; Hypersonic Boundary Layer; Infrared Imagery; Imaging Techniques; Infrared Radiation; Surface Temperature; Transition Flight

20080023462 NASA Langley Research Center, Hampton, VA, USA

Assessment and Mission Planning Capability For Quantitative Aerothermodynamic Flight Measurements Using Remote Imaging

Horvath, Thomas; Splinter, Scott; Daryabeigi, Kamran; Wood, William; Schwartz, Richard; Ross, Martin; June 23, 2008; 14 pp.; In English; 40th AIAA Thermophysics Conference, 23-26 Jun. 2008, Seattle, WA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 510505.04.07.01.22

Report No.(s): AIAA 2008-4022; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023462>

High resolution calibrated infrared imagery of vehicles during hypervelocity atmospheric entry or sustained hypersonic cruise has the potential to provide flight data on the distribution of surface temperature and the state of the airflow over the vehicle. In the early 1980 s NASA sought to obtain high spatial resolution infrared imagery of the Shuttle during entry. Despite mission execution with a technically rigorous pre-planning capability, the single airborne optical system for this attempt was considered developmental and the scientific return was marginal. In 2005 the Space Shuttle Program again sponsored an effort to obtain imagery of the Orbiter. Imaging requirements were targeted towards Shuttle ascent; companion requirements for entry did not exist. The engineering community was allowed to define observation goals and incrementally demonstrate key elements of a quantitative spatially resolved measurement capability over a series of flights. These imaging opportunities were extremely beneficial and clearly demonstrated capability to capture infrared imagery with mature and operational assets of the US Navy and the Missile Defense Agency. While successful, the usefulness of the imagery was, from an engineering perspective, limited. These limitations were mainly associated with uncertainties regarding operational aspects of data acquisition. These uncertainties, in turn, came about because of limited pre-flight mission planning capability, a poor understanding of several factors including the infrared signature of the Shuttle, optical hardware limitations, atmospheric

effects and detector response characteristics. Operational details of sensor configuration such as detector integration time and tracking system algorithms were carried out ad hoc (best practices) which led to low probability of target acquisition and detector saturation. Leveraging from the qualified success during Return-to-Flight, the NASA Engineering and Safety Center sponsored an assessment study focused on increasing the probability of returning spatially resolved scientific/engineering thermal imagery. This paper provides an overview of the assessment task and the systematic approach designed to establish confidence in the ability of existing assets to reliably acquire, track and return global quantitative surface temperatures of the Shuttle during entry. A discussion of capability demonstration in support of a potential Shuttle boundary layer transition flight test is presented. Successful demonstration of a quantitative, spatially resolved, global temperature measurement on the proposed Shuttle boundary layer transition flight test could lead to potential future applications with hypersonic flight test programs within the USAF and DARPA along with flight test opportunities supporting NASA's project Constellation.

Author

Mission Planning; Hypersonic Flight; Boundary Layer Transition; Atmospheric Effects; Imaging Techniques; In-Flight Monitoring; Infrared Imagery

20080023498 Tamkang Univ., Taipei, Taiwan, Province of China

Predicting Peak Pressures from Computed CFD Data and Artificial Neural Networks Algorithm

Chang, Cheng-Hsin; Shang, Neng-Chou; Wu, Cho-Sen; Chen, Chern-Hwa; Journal of the Chinese Institute of Engineers, Volume 31, No.1; January 2008, pp. 95-103; In English; See also [20080023495](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

The goal of this paper is to predict the peak pressure coefficients by combining two simulation models, steady-state Reynolds averaged CFD model and Artificial Neural Networks (ANN). Many previous studies have shown that CFD can predict mean pressure coefficients, C_p well if inlet profiles, grid adaptation and the turbulent model are well chosen. However, the design codes for wind loads are based on peak pressure coefficients in wind tunnel experiments. The combination of two simulation methods, CFD and ANN, allows us to predict the peak pressure coefficients. The peak surface pressure values on master WERFL models inside urban street canyons are determined by the prognostic model FLUENT using the k-epsilon turbulence model and Artificial Neural Networks algorithm. The results are compared against fluid modeling from wind tunnel tests.

Author

Computational Fluid Dynamics; Neural Nets; K-Epsilon Turbulence Model; Reynolds Averaging; Pressure Ratio; Loads (Forces)

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.

20080022928 Space and Naval Warfare Systems Center, San Diego, CA USA

Automated Launch, Recovery, and Refueling for Small Unmanned Aerial Vehicles

Mullens, Katherine; Burmeister, Aaron; Wills, Mike; Stroumtsos, Nicholas; Denewiler, Thomas; Thomas, Kari; Stancliff, Stephen; Feb 2006; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477747; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477747>

Small unmanned aerial vehicles (UAVs) are hindered by their limited payload and duration. Consequently, UAVs spend little time in their area of operation, returning frequently to base for refueling. The effective payload and duration of small UAVs is increased by moving the support base closer to the operating area; however this increases risk to personnel. Performing the refueling operations autonomously allows the support base to be located closer to the operating area without increasing risk to personnel. Engineers at SPAWAR Systems Center San Diego (SSC San Diego) are working to develop technologies for automated launch, recovery, refueling, rearming, and re-launching of small UAVs. These technologies are intended to provide forward-refueling capabilities by teaming small UAVs with large unmanned ground vehicles (UGVs). The UGVs have larger payload capacities so they can easily carry fuel for the UAVs in addition to their own fuel and mission

payloads. This paper describes a prototype system that launched and recovered a remotely-piloted UAV from a UGV and performed automated refueling of a UAV mockup.

DTIC

Autonomy; Launching; Pilotless Aircraft; Refueling; Remotely Piloted Vehicles; Robotics; Unmanned Ground Vehicles

20080023177 Air Univ., Maxwell AFB, AL USA

CADRE Quick-Look: Airspace Management in Global CONOPs (CENTAF CENTRIC)

Wathen, Alexander M; Jan 2004; 3 pp.; In English

Report No.(s): AD-A477328; No Copyright; Avail.: Defense Technical Information Center (DTIC)

It has been one year since the conclusion of the full-up combat operations of Operation Iraqi Freedom (OIF) and Central Command Air Forces (CENTAF) has yet to release the lessons learned formulated by their expert airspace managers. OIF provided a unique opportunity for experienced airspace managers who had teamed together to prepare and execute Operation Enduring Freedom (OEF) to work together again. OIF was the most complex, saturated, and intensive airspace scenario ever experienced. It is doubtful there will ever again be another major combat operation like it from the airspace point of view. It is imperative that the airspace management community benefit from the techniques and procedures those professionals developed in building and executing the OIF airspace plan. This issue of CADRE Quick-Look presents some notes derived from interviews with a number of airspace managers who participated in OIF.

DTIC

Airspace; Command and Control

20080023269 Library of Congress, Washington, DC USA

Air Force Air Refueling: The KC-X Aircraft Acquisition Program

Knight, William; Bolkcom, Christopher; Feb 28, 2008; 42 pp.; In English

Report No.(s): AD-A477691; CRS-RL34398; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477691>

The KC-X program, the first of three planned programs intended to recapitalize the Air Force's air refueling fleet, is expected to acquire 179 new, commercial off-the-shelf airliners modified to accomplish air refueling missions. Both Boeing and a consortium consisting of Northrop Grumman and European Aerospace Defense Company (EADS) - the parent company of Airbus - are in competition for KC-X. Boeing offered a variant of the 767-200 while Northrop Grumman/EADS submitted a version of the Airbus 330-200. The Air Force is expected to announce source selection soon. Air Force in-flight aerial refueling aircraft, often referred to as 'tankers', provide both persistence and range to Department of Defense (DOD) fighters, bombers, airlift and surveillance aircraft. As such, the Air Force's tanker fleet greatly multiplies the effectiveness of DOD air power across the continuum of military operations. Today, the KC-135, which makes up the preponderance of the Air Force's tanker force, is among the Air Force's oldest aircraft.

DTIC

Air to Air Refueling; Commercial Aircraft; Defense Program

20080023270 Library of Congress, Washington, DC USA

Air Force Air Refueling: The KC-X Aircraft Acquisition Program

Knight, William; Bolkcom, Christopher; Mar 4, 2008; 45 pp.; In English

Report No.(s): AD-A477693; CRS-RL34398; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477693>

The KC-X program, the first of three planned programs intended to recapitalize the Air Force's air refueling fleet, is expected to acquire 179 new, commercial off-the-shelf airliners modified to accomplish air refueling missions. The program is expected to cost approximately \$35 billion. Both Boeing and a consortium consisting of Northrop Grumman and European Aeronautic Defence and Space Company (EADS) - the parent company of Airbus - were in competition for KCX. Boeing offered a variant of the 767-200, while Northrop Grumman submitted a version of the Airbus 330-200. On February 29, 2008, the Air Force awarded the KC-X contract to Northrop Grumman. The initial \$12.1 billion KC-X contract provides for the purchase the first 68 KC-45s of the anticipated 179 aircraft. Air Force in-flight aerial refueling aircraft, often referred to as tankers, provide both persistence and range to Department of Defense (DOD) fighters, bombers, airlift and surveillance

aircraft. As such, the Air Force's tanker fleet greatly multiplies the effectiveness of DOD air power across the continuum of military operations. Today, the KC-135, which makes up the preponderance of the Air Force's tanker force, is among the Air Force's oldest aircraft.

DTIC

Air to Air Refueling; C-135 Aircraft

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.

20080022367 Maryland Univ., College Park, MD, USA

An Overview of Autogyros and The McDonnell XV-1 Convertiplane

Harris, Franklin D.; October 2003; 284 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAG2-1597; WU SAT292004D

Report No.(s): NASA/CR-2003-212799; A-0310910; No Copyright; Avail.: CASI: [A13](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080022367>

This report and its lengthy appendix first reviews early autogyro history. The period from Juan de la Cierva's invention in the early 1920s through to the U. S. Army Air Corps' choice, in 1943, of the helicopter instead of the more fully developed autogyro, is examined from a technical point of view. With this historical background in hand, simple aerodynamic technology for rotors, wings, propeller, and fuselages is provided for reference. The McDonnell XV-1 convertiplane development and its program are discussed in detail, with particular emphasis on the wind tunnel and flight testing that was accomplished with two prototype aircraft in the early 1950s. The tip drive rotor system with its ingeniously designed hub was well suited to high speed rotorcraft. The configuration was conceived by Kurt Hohenemser and Fred Dubloff. Many photographs taken of the XV-1 stored at Fort Rucker are included in this report's appendix.

Author

Autogyros; Aerodynamics; Flight Tests; V/STOL Aircraft; Rotary Wing Aircraft; Helicopters

20080022370 NASA Glenn Research Center, Cleveland, OH, USA

Chapter 44: Rotorcraft Systems Health Management

Dempsey, Paula J.; Zakrajsek, James J.; [2008]; 15 pp.; In English

Contract(s)/Grant(s): WBS 877868.02.07.03.01.01; No Copyright; Avail.: Other Sources

This chapter provides an overview of today's rotorcraft health monitoring technologies for detecting anomalies in dynamic mechanical systems. Standard practices in acquiring and processing vibration data are discussed, lessons learned from systems currently installed on rotorcraft are summarized, and future challenges to developing more advanced rotorcraft health monitoring systems are outlined.

Author

Rotary Wing Aircraft; Detection; Vibration; Systems Management; Procedures

20080022412 NASA Glenn Research Center, Cleveland, OH, USA

IceVal DatAssistant: An Interactive, Automated Icing Data Management System

Levinson, Laurie H.; Wright, William B.; May 2008; 31 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 457280.02.07.03.02

Report No.(s): NASA/TM--2008-215158; E-16399; AIAA-2008-0443; Copyright; Avail.: CASI: [A03](#), Hardcopy

As with any scientific endeavor, the foundation of icing research at the NASA Glenn Research Center (GRC) is the data acquired during experimental testing. In the case of the GRC Icing Branch, an important part of this data consists of ice tracings taken following tests carried out in the GRC Icing Research Tunnel (IRT), as well as the associated operational and environmental conditions documented during these tests. Over the years, the large number of experimental runs completed has served to emphasize the need for a consistent strategy for managing this data. To address the situation, the Icing Branch has recently elected to implement the IceVal DatAssistant automated data management system. With the release of this system, all publicly available IRT-generated experimental ice shapes with complete and verifiable conditions have now been compiled

into one electronically-searchable database. Simulation software results for the equivalent conditions, generated using the latest version of the LEWICE ice shape prediction code, are likewise included and are linked to the corresponding experimental runs. In addition to this comprehensive database, the IceVal system also includes a graphically-oriented database access utility, which provides reliable and easy access to all data contained in the database. In this paper, the issues surrounding historical icing data management practices are discussed, as well as the anticipated benefits to be achieved as a result of migrating to the new system. A detailed description of the software system features and database content is also provided; and, finally, known issues and plans for future work are presented.

Author

Aircraft Icing; Data Management; Data Bases; Data Processing; Computerized Simulation; Data Storage; Ice Formation

20080022422 Analex Corp., Cleveland, OH, USA

Application of the Systematic Sensor Selection Strategy for Turbofan Engine Diagnostics

Sowers, T. Shane; Kopasakis, George; Simon, Donald L.; May 2008; 16 pp.; In English; ASME Turbo Expo, 9-13 Jun. 2008, Berlin, Germany; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 645846.02.07.03.03.01

Report No.(s): NASA/TM-2008-215200; GT2008-50525; E-16422-1; Copyright; Avail.: CASI: [A03](#), Hardcopy

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

Author

Fault Detection; Engine Design; Turbofan Engines; Heuristic Methods; Diagnosis

20080022946 NASA Langley Research Center, Hampton, VA, USA

Comparison of ALE and SPH Simulations of Vertical Drop Tests of a Composite Fuselage Section into Water

Jackson, Karen E.; Fuchs, Yvonne T.; June 08, 2008; 20 pp.; In English; 10th International LS-DYNA User's Conference, 8-10 Jun. 2008, Dearborn, MI, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 877868.02.07.07.05.02; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080022946>

Simulation of multi-terrain impact has been identified as an important research area for improved prediction of rotorcraft crashworthiness within the NASA Subsonic Rotary Wing Aeronautics Program on Rotorcraft Crashworthiness. As part of this effort, two vertical drop tests were conducted of a 5-ft-diameter composite fuselage section into water. For the first test, the fuselage section was impacted in a baseline configuration without energy absorbers. For the second test, the fuselage section was retrofitted with a composite honeycomb energy absorber. Both tests were conducted at a nominal velocity of 25-ft/s. A detailed finite element model was developed to represent each test article and water impact was simulated using both Arbitrary Lagrangian Eulerian (ALE) and Smooth Particle Hydrodynamics (SPH) approaches in LS-DYNA, a nonlinear, explicit transient dynamic finite element code. Analytical predictions were correlated with experimental data for both test configurations. In addition, studies were performed to evaluate the influence of mesh density on test-analysis correlation.

Author

Rotary Wing Aircraft; Energy Absorption; Crashworthiness; Drop Tests; Honeycomb Structures; Hydrodynamics; Lagrangian Function; Prediction Analysis Techniques

20080022954 NASA Langley Research Center, Hampton, VA, USA

Soft Soil Impact Testing and Simulation of Aerospace Structures

Fasanella, Edwin L.; Jackson, Karen E.; Kellas, Sotiris; June 08, 2008; 14 pp.; In English; 10th International LS-DYNA User's Conference, 8-10 Jun. 2008, Dearborn, MI, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 877868.02.07.07.05.02; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080022954>

In June 2007, a 38-ft/s vertical drop test of a 5-ft-diameter, 5-ft-long composite fuselage section that was retrofitted with a novel composite honeycomb Deployable Energy Absorber (DEA) was conducted onto unpacked sand. This test was one of a series of tests to evaluate the multi-terrain capabilities of the DEA and to generate test data for model validation. During the test, the DEA crushed approximately 6-in. and left craters in the sand of depths ranging from 7.5- to 9-in. A finite element model of the fuselage section with DEA was developed for execution in LS-DYNA, a commercial nonlinear explicit transient dynamic code. Pre-test predictions were generated in which the sand was represented initially as a crushable foam material MAT_CRUSHABLE_FOAM (Mat 63). Following the drop test, a series of hemispherical penetrometer tests were conducted to assist in soil characterization. The penetrometer weighed 20-lb and was instrumented with a tri-axial accelerometer. Drop tests were performed at 16-ft/s and crater depths were measured. The penetrometer drop tests were simulated as a means for developing a more representative soil model based on a soil and foam material definition MAT_SOIL_AND_FOAM (Mat 5) in LS-DYNA. The model of the fuselage with DEA was reexecuted using the updated soil model and test-analysis correlations are presented.

Author

Soils; Impact Tests; Aircraft Structures; Fuselages; Finite Element Method; Mathematical Models

20080023202 Air Force Research Lab., Wright-Patterson AFB, OH USA

AVEC: A Computational Design Environment for Conceptual Innovations

Blair, Maxwell; Feb 2008; 41 pp.; In English

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

Report No.(s): AD-A477612; AFRL-RB-WP-TR-2008-3061; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477612>

This report summarizes programming techniques that aid multidisciplinary design programmers in developing computational designs that measure AFRL technology effectiveness. These techniques have been collected into an object-oriented design environment. The Air Vehicle Environment in C++ (AVEC) prototypes a practical approach toward computational design. Design innovators will benefit from AVEC at one of three levels. These three levels target (a) the end user through interactive operations and file I/O, (b) the object-oriented programmer through a compiled library of properly documented and inheritable objects, and (c) the AVEC developer who wishes to enhance AVEC capability with modifications to the source code. The pilot code presented here focuses on parent-child relationships, automated dependency management, geometry, meshing and analysis. All together, the overall capability leads to design variant management that will populate a response surface model and thereby address design optimization. The target SensorCraft design mission involves a suite of aeroelastic concepts with geometric non-linearity, in the form of non-linear coupling, large deformations and follower forces. DTIC

Aircraft Design; C++ (Programming Language); Computer Aided Design

20080023203 Air Force Research Lab., Wright-Patterson AFB, OH USA

Rapid Prototyping-Unmanned Combat Air Vehicle (UCAV)/Sensorcraft

Tyler, Charles; Schwartz, Richard J; Fleming, Gary; Fonov, Sergey; Jan 2008; 300 pp.; In English

Contract(s)/Grant(s): Proj-A04V

Report No.(s): AD-A477571; AFRL-RB-WP-TR-2008-3034; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477571>

To characterize and improve upon aircraft designs in an expedient and efficient manner, it is imperative to generate approaches for rapidly assessing new aircraft designs. Recent technological advancements have enabled faster and more accurate assessment in three specific areas: computational fluid dynamics (CFD) modeling, rapid prototyping (RP), and experimental global measurements. The Air Force Research Laboratory Air Vehicles Directorate (AFRL/RB) initiated a joint computational/experimental ground testing program to investigate and analyze the flow field of the unmanned combat air vehicle (UCAV) X45-A as well as a strike tanker configuration. The test program used various rapid prototyping

manufacturing technologies to fabricate models for ground testing; implemented innovative, nonintrusive measurement techniques; and compared CFD results with experimental data acquired from ground tests.

DTIC

Aircraft Models; Combat; Computational Fluid Dynamics; Rapid Prototyping; Research Management

20080023207 Advanced Composites Group, Inc., Tulsa, OK USA

Complex Structures for Manned/Unmanned Aerial Vehicles. Delivery Order 0019: Low Temp Composite Processing Mechanical Property Data

Ridgard, Chris; Jan 2008; 82 pp.; In English

Contract(s)/Grant(s): FA8650-05-D-5807-0019; Proj-4347

Report No.(s): AD-A477671; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477671>

After several years of effort, a new generation of out of autoclave processable resin systems has been developed which it is believed will replace older oven vacuum bag cure (OVBC) resins such as the Advanced Composites Group, Inc. (ACG) LTM45EL material. The first of these new resins, MTM45 and MTM45-1, have been demonstrated to offer mechanical performance and toughness at a level comparable to that of state-of-the-art toughened resin systems used for military and civil airframes, while still permitting cure at relatively low temperatures out of the autoclave. The level of maturity of the new materials, perceived and otherwise, together with the limited amount of available performance data, is currently limiting the application of this much needed technology on aircraft programs. Significant progress has been made to address this situation by embarking on a program of work over the last three years which has put in place the baseline design allowable data and addresses manufacturability issues which arise with non-autoclave curing.

DTIC

Composite Materials; Drone Vehicles; Mechanical Properties; Pilotless Aircraft; Plastics; Vacuum

20080023401 NASA Glenn Research Center, Cleveland, OH, USA

Misalignment in Gas Foil Journal Bearings: An Experimental Study

Howard, Samuel A.; May 2008; 20 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 877686.02.07.03.01.01

Report No.(s): NASA/TM-2008-215223; E-16489-1; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023401>

As gas foil journal bearings become more prevalent in production machines, such as small gas turbine propulsion systems and microturbines, system-level performance issues must be identified and quantified in order to provide for successful design practices. Several examples of system-level design parameters that are not fully understood in foil bearing systems are thermal management schemes, alignment requirements, balance requirements, thrust load balancing, and others. In order to address some of these deficiencies and begin to develop guidelines, this paper presents a preliminary experimental investigation of the misalignment tolerance of gas foil journal bearing systems. Using a notional gas foil bearing supported rotor and a laser-based shaft alignment system, increasing levels of misalignment are imparted to the bearing supports while monitoring temperature at the bearing edges. The amount of misalignment that induces bearing failure is identified and compared to other conventional bearing types such as cylindrical roller bearings and angular contact ball bearings. Additionally, the dynamic response of the rotor indicates that the gas foil bearing force coefficients may be affected by misalignment.

Author

Gas Bearings; Journal Bearings; Misalignment; Rotor Dynamics; Gas Turbines; Alignment

20080023404 General Electric Aircraft Engines, Cincinnati, OH, USA

Intelligent Engine Systems

Xie, Ming; May 2008; 38 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS3-01135; WBS 984754.02.07.03.11.03

Report No.(s): NASA/CR-2008-215233; E-16523; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023404>

A high bypass jet engine fan case represents one of the largest, heaviest single components in an engine. In addition to supporting the inlet and providing the fan flowpath, the most critical function is the containment of a failed fan blade. In this development program, a lightweight, low-cost composite containment case with diagnostic capabilities was developed,

fabricated, and tested. The fan case design, containment methods, and diagnostic concepts evaluated in the initial Propulsion 21 program were improved and scaled up to a full case design.

Author

Fabrication; Fan Blades; Gas Turbine Engines; Aircraft Fuel Systems; Aircraft Engines; Systems Engineering; Mechanical Properties

20080023446 NASA Marshall Space Flight Center, Huntsville, AL, USA

UID...Leaving Its Mark on the Universe

Schramm, Harry F., Jr.; April 30, 2008; 34 pp.; In English; (AIAG) Auto ID/RFID Showcase, 30 Apr. 2008, Novi, MI, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: [C01](#), CD-ROM: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023446>

Since 1975 bar codes on products at the retail counter have been accepted as the standard for entering product identity for price determination. Since the beginning of the 21 st century, the Data Matrix symbol has become accepted as the bar code format that is marked directly on a part, assembly or product that is durable enough to identify that item for its lifetime. NASA began the studies for direct part marking Data Matrix symbols on parts during the Return to Flight activities after the Challenger Accident. Over the 20 year period that has elapsed since Challenger, a mountain of studies, analyses and focused problem solutions developed by and for NASA have brought about world changing results. NASA Technical Standard 6002 and NASA Handbook 6003 for Direct Part Marking Data Matrix Symbols on Aerospace Parts have formed the basis for most other standards on part marking internationally. NASA and its commercial partners have developed numerous products and methods that addressed the difficulties of collecting part identification in aerospace operations. These products enabled the marking of Data Matrix symbols in virtually every situation and the reading of symbols at great distances, severe angles, under paint and in the dark without a light. Even unmarkable delicate parts now have a process to apply a chemical mixture, recently trademarked as Nanocodes, that can be converted to Data Matrix information through software. The accompanying intellectual property is protected by ten patents, several of which are licensed. Direct marking Data Matrix on NASA parts dramatically decreases data entry errors and the number of parts that go through their life cycle unmarked, two major threats to sound configuration management and flight safety. NASA is said to only have people and stuff with information connecting them. Data Matrix is one of the most significant improvements since Challenger to the safety and reliability of that connection.

Author

Universe; Manned Space Flight; Long Duration Space Flight; Aerospace Safety; Aerospace Systems; Lunar Surface

20080023463 NASA Langley Research Center, Hampton, VA, USA

Decentralized Control of Sound Radiation from an Aircraft-Style Panel Using Iterative Loop Recovery

Schiller, Noah H.; Cabell, Randolph H.; Fuller, Chris R.; July 04, 2008; 6 pp.; In English; Acoustics '08 Paris Conference and Exhibition - 155th Acoustical Society of America, 29 Jun. - 4 Jul. 2008, Paris, France; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 877868.02.07.07.04.01; Copyright; Avail.: CASI: [A02](#), Hardcopy

A decentralized LQG-based control strategy is designed to reduce low-frequency sound transmission through periodically stiffened panels. While modern control strategies have been used to reduce sound radiation from relatively simple structural acoustic systems, significant implementation issues have to be addressed before these control strategies can be extended to large systems such as the fuselage of an aircraft. For instance, centralized approaches typically require a high level of connectivity and are computationally intensive, while decentralized strategies face stability problems caused by the unmodeled interaction between neighboring control units. Since accurate uncertainty bounds are not known a priori, it is difficult to ensure the decentralized control system will be robust without making the controller overly conservative. Therefore an iterative approach is suggested, which utilizes frequency-shaped loop recovery. The approach accounts for modeling error introduced by neighboring control loops, requires no communication between subsystems, and is relatively simple. The control strategy is validated using real-time control experiments performed on a built-up aluminum test structure representative of the fuselage of an aircraft. Experiments demonstrate that the iterative approach is capable of achieving 12 dB peak reductions and a 3.6 dB integrated reduction in radiated sound power from the stiffened panel.

Author

Sound Waves; Iteration; Control Systems Design; Linear Quadratic Gaussian Control; Panels; Mathematical Models; Loop Transfer Recovery; Aircraft Structures

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.

20080022357 NASA Dryden Flight Research Center, Edwards, CA, USA

Instrument Display Visual Angles for Conventional Aircraft and the MQ-9 Ground Control Station

Bendrick, Gregg A.; Kamine, Tovy Haber; May 12, 2008; 1 pp.; In English; Annual Scientific Meeting of the Aerospace Medical Association, 12-16 May 2008, Boston, MA, USA; Original contains black and white illustrations; Copyright;

Avail.: CASI: [A01](#), Hardcopy

Aircraft instrument panels should be designed such that primary displays are in optimal viewing location to minimize pilot perception and response time. Human Factors engineers define three zones (i.e. 'cones') of visual location: 1) 'Easy Eye Movement' (foveal vision); 2) 'Maximum Eye Movement' (peripheral vision with saccades), and 3) 'Head Movement' (head movement required). Instrument display visual angles were measured to determine how well conventional aircraft (T-34, T-38, F-15B, F-16XL, F/A-18A, U-2D, ER-2, King Air, G-III, B-52H, DC-10, B747-SCA) and the MQ-9 ground control station (GCS) complied with these standards, and how they compared with each other. Methods: Selected instrument parameters included: attitude, pitch, bank, power, airspeed, altitude, vertical speed, heading, turn rate, slip/skid, AOA, flight path, latitude, longitude, course, bearing, range and time. Vertical and horizontal visual angles for each component were measured from the pilot's eye position in each system. Results: The vertical visual angles of displays in conventional aircraft lay within the cone of 'Easy Eye Movement' for all but three of the parameters measured, and almost all of the horizontal visual angles fell within this range. All conventional vertical and horizontal visual angles lay within the cone of 'Maximum Eye Movement'. However, most instrument vertical visual angles of the MQ-9 GCS lay outside the cone of 'Easy Eye Movement', though all were within the cone of 'Maximum Eye Movement'. All the horizontal visual angles for the MQ-9 GCS were within the cone of 'Easy Eye Movement'. Discussion: Most instrument displays in conventional aircraft lay within the cone of 'Easy Eye Movement', though mission-critical instruments sometimes displaced less important instruments outside this area. Many of the MQ-9 GCS systems lay outside this area. Specific training for MQ-9 pilots may be needed to avoid increased response time and potential error during flight.

Author

Display Devices; Head Movement; Peripheral Vision; Human Factors Engineering; T-38 Aircraft; U-2 Aircraft; F-16 Aircraft; B-52 Aircraft; Control Boards; Flight Paths; Ground Based Control

07

AIRCRAFT PROPULSION AND POWER

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

20080022304 Bachman and Lapointe, P.C., New Haven, CT, USA

Nozzle (PAT-APPL-10 843 812)

Chen, A. G., Inventor; Fotahe, C. G., Inventor; 11 May 04; 7 pp.; In English

Contract(s)/Grant(s): DEFC02-00CH11060

Patent Info.: Filed 11 May 04; US-Patent-Appl-SN-10-843-812

Report No.(s): PB2007-109080; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The fuel injector has a first means defining a number of flowpaths each having an inlet for receiving air and an outlet for discharging a fuel/air mixture. One or more arrays of vanes are each positioned to impart swirl to an associated one or more of the flowpaths. Second means are provided for introducing the fuel to the air.

NTIS

Fuel Injection; Gas Turbine Engines; Patent Applications

20080022305 Alston and Bird, LLP, Charlotte, NC, USA

System and Method for Controlling the Temperature and Infrared Signature of an Engine

Iya, S. K., Inventor; Roe, G. M., Inventor; 22 Apr 04; 12 pp.; In English

Contract(s)/Grant(s): AF-F33615-99-D-2952

Patent Info.: Filed Filed 22 Apr 04; US-Patent-Appl-SN-10-830-193

Report No.(s): PB2007-109079; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A system and method for cooling at least a portion of an engine are provided. The engine is cooled using a fuel, such as a high heat sink fuel, that is subsequently used for combustion in the engine. The fuel can be used to cool one or more of the gases and/or components in the engine, thereby cooling the engine including an exhaust nozzle. For example, the fuel can be circulated through one or more heat exchanging devices that are disposed inside or outside a passage of the engine, and the fuel can absorb thermal energy from the engine or air that flows in the engine passage. In any case, the cooling of the engine can result in a reduction to the infrared signature of the engine.

NTIS

Cooling Systems; Exhaust Nozzles; Infrared Signatures; Patent Applications

20080022424 NASA Glenn Research Center, Cleveland, OH, USA

An Adaptive Instability Suppression Controls Method for Aircraft Gas Turbine Engine Combustors

Kopasakis, George; DeLaat, John C.; Chang, Clarence T.; May 2008; 24 pp.; In English; Original contains black and white illustrations

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

Report No.(s): NASA/TM-2008-215202; E-16414-1; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080022424>

An adaptive controls method for instability suppression in gas turbine engine combustors has been developed and successfully tested with a realistic aircraft engine combustor rig. This testing was part of a program that demonstrated, for the first time, successful active combustor instability control in an aircraft gas turbine engine-like environment. The controls method is called Adaptive Sliding Phasor Averaged Control. Testing of the control method has been conducted in an experimental rig with different configurations designed to simulate combustors with instabilities of about 530 and 315 Hz. Results demonstrate the effectiveness of this method in suppressing combustor instabilities. In addition, a dramatic improvement in suppression of the instability was achieved by focusing control on the second harmonic of the instability. This is believed to be due to a phenomena discovered and reported earlier, the so called Intra-Harmonic Coupling. These results may have implications for future research in combustor instability control.

Author

Combustion Chambers; Engine Control; Adaptive Control; Gas Turbine Engines; Active Control

20080022430 NASA Glenn Research Center, Cleveland, OH, USA

Modeling of Fixed-Exit Porous Bleed Systems

Slater, John W.; Saunders, John D.; May 2008; 21 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 561581.02.10.03.32

Report No.(s): NASA/TM-2008-215178; AIAA Paper 2008-0094; E-16423; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080022430>

A model has been developed to simulate a fixed-exit porous bleed system for supersonic inlets. The fixed-exit model allows the amount of bleed flow to vary according to local flow conditions and fixed-exit characteristics of the bleed system. This variation is important for the control of shock-wave/boundary-layer interactions within the inlet. The model computes the bleed plenum static pressure rather than requiring its specification. The model was implemented in the Wind-US computational fluid dynamics code. The model was then verified and validated against experimental data for bleed on a flat plate with and without an impinging oblique shock and for bleed in a Mach 3.0 axisymmetric, mixed-compression inlet. The model was able to accurately correlate the plenum pressures with bleed rates and simulate the effect of the bleed on the downstream boundary layer. Further, the model provided a realistic simulation of the initiation of inlet unstart. The results provide the most in-depth examination to date of bleed models for use in the simulation of supersonic inlets. The results also highlight the limitations of the models and aspects that require further research.

Author

Supersonic Inlets; Boundary Layers; Computational Fluid Dynamics; Oblique Shock Waves; Pressure Reduction; Static Pressure; Mach Number

20080023304 NASA Glenn Research Center, Cleveland, OH, USA

Pre-Stall Behavior of a Transonic Axial Compressor Stage via Time-Accurate Numerical Simulation

Chen, Jen-Ping; Hathaway, Michael D.; Herrick, Gregory P.; June 2008; 21 pp.; In English; ASME Turbo Expo 2007, 14-17 May 2007, Montreal, Canada; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 877868.02.07.03.01.02

Report No.(s): NASA/TM-2008-215163; ARL-TR-4085; E-16405; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023304>

CFD calculations using high-performance parallel computing were conducted to simulate the pre-stall flow of a transonic compressor stage, NASA compressor Stage 35. The simulations were run with a full-annulus grid that models the 3D, viscous, unsteady blade row interaction without the need for an artificial inlet distortion to induce stall. The simulation demonstrates the development of the rotating stall from the growth of instabilities. Pressure-rise performance and pressure traces are compared with published experimental data before the study of flow evolution prior to the rotating stall. Spatial FFT analysis of the flow indicates a rotating long-length disturbance of one rotor circumference, which is followed by a spike-type breakdown. The analysis also links the long-length wave disturbance with the initiation of the spike inception. The spike instabilities occur when the trajectory of the tip clearance flow becomes perpendicular to the axial direction. When approaching stall, the passage shock changes from a single oblique shock to a dual-shock, which distorts the perpendicular trajectory of the tip clearance vortex but shows no evidence of flow separation that may contribute to stall.

Author

Computational Fluid Dynamics; Transonic Compressors; Rotating Stalls; Fast Fourier Transformations; Boundary Layer Separation; Turbocompressors; Separated Flow; Oblique Shock Waves

20080023400 NASA Glenn Research Center, Cleveland, OH, USA

A Cryogenic High-Power-Density Bearingless Motor for Future Electric Propulsion

Choi, Benjamin; Siebert, Mark; June 2008; 21 pp.; In English; 2008 Propulsion-Safety and Affordable Readiness (P-SAR) Conference, 19-20 Mar. 2008, Myrtle Beach, SC, USA; Original contains color and black and white illustrations

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

Report No.(s): NASA/TM-2008-215211; E-16485; Paper no. 3114; Copyright; Avail.: CASI: [A03](#), Hardcopy

The NASA Glenn Research Center (GRC) is developing a high-power-density switched-reluctance cryogenic motor for all-electric and pollution-free flight. However, cryogenic operation at higher rotational speeds markedly shortens the life of mechanical rolling element bearings. Thus, to demonstrate the practical feasibility of using this motor for future flights, a non-contact rotor-bearing system is a crucial technology to circumvent poor bearing life that ordinarily accompanies cryogenic operation. In this paper, a bearingless motor control technology for a 12-8 (12 poles in the stator and 8 poles in the rotor) switched-reluctance motor operating in liquid nitrogen (boiling point, 77 K (-196 C or -321 F)) was presented. We pushed previous disciplinary limits of electromagnetic controller technique by extending the state-of-the-art bearingless motor operating at liquid nitrogen for high-specific-power applications. The motor was levitated even in its nonlinear region of magnetic saturation, which is believed to be a world first for the motor type. Also we used only motoring coils to generate motoring torque and levitation force, which is an important feature for developing a high specific power motor.

Author

Cryogenics; Electric Propulsion; Magnetic Bearings; Mechanical Engineering; Motors; Radiant Flux Density

20080023402 General Electric Aircraft Engines, Cincinnati, OH, USA

System Study: Technology Assessment and Prioritizing Update

May 2008; 26 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS3--01135; WBS 984754.02.07.03.11.03

Report No.(s): NASA/CR-2008-215224; E-16492; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023402>

For the Intelligent Engine System (Propulsion 21) study, each technology was evaluated to determine the impact to fuel burn, acoustics, and NO_x emissions. The optimum combination of technologies and their overall benefits to the system were also evaluated, resulting in noise improvement potential of 1.89 EPNdB cumulative margin, -1.34 percent fuel burn, and 50 percent NO_x reduction from the 2015 UEET-QAT baseline. All the technology evaluations, except T18-20D, were based on new engines, where the engine was resized to obtain the maximum system benefit while maintaining the same cycle parameters as the 2015 UEET-QAT baseline. The impact of turbine clearance control on deteriorated engines, T18-20D, was also

evaluated. Recommendations for future system study work include, but were not limited to, validation of a university-developed engine deterioration model and customer value analysis as figures of merit beside fuel burn, emissions, and acoustics.

Author

Technology Assessment; Acoustics; Nitrogen Oxides; Aircraft Fuel Systems; Aircraft Engines

08

AIRCRAFT STABILITY AND CONTROL

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

20080022957 NASA Langley Research Center, Hampton, VA, USA

Adaptive Flight Control Research at NASA

Motter, Mark A.; June 02, 2008; 6 pp.; In English; 14th Yale Workshop on Adaptive and Learning Systems, 2-5 Jun. 2008, New Haven, CT, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 561581.02.08.07.14.03; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080022957>

A broad overview of current adaptive flight control research efforts at NASA is presented, as well as some more detailed discussion of selected specific approaches. The stated objective of the Integrated Resilient Aircraft Control Project, one of NASA's Aviation Safety programs, is to advance the state-of-the-art of adaptive controls as a design option to provide enhanced stability and maneuverability margins for safe landing in the presence of adverse conditions such as actuator or sensor failures. Under this project, a number of adaptive control approaches are being pursued, including neural networks and multiple models. Validation of all the adaptive control approaches will use not only traditional methods such as simulation, wind tunnel testing and manned flight tests, but will be augmented with recently developed capabilities in unmanned flight testing.

Author

Adaptive Control; Flight Control; Flight Tests; Aircraft Control; Actuators; Maneuverability

20080023308 NASA Glenn Research Center, Cleveland, OH, USA

An Active Damping at Blade Resonances Using Piezoelectric Transducers

Choi, Benjamin; Morrison, Carlos; Duffy, Kirsten; June 2008; 23 pp.; In English; 2008 Propulsion-Safety and Affordable Readiness (P-SAR) Conference, 18-20 Mar. 2008, Myrtle Beach, SC, USA; Original contains color and black and white illustrations

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

Report No.(s): NASA/TM-2008-215212; E-16486; Paper no. 3124; Copyright; Avail.: CASI: [A03](#), Hardcopy

The NASA Glenn Research Center (GRC) is developing an active damping at blade resonances using piezoelectric structure to reduce excessive vibratory stresses that lead to high cycle fatigue (HCF) failures in aircraft engine turbomachinery. Conventional passive damping work was shown first on a nonrotating beam made by Ti-6Al-4V with a pair of identical piezoelectric patches, and then active feedback control law was derived in terms of inductor, resistor, and capacitor to control resonant frequency only. Passive electronic circuit components and adaptive feature could be easily programmable into control algorithm. Experimental active damping was demonstrated on two test specimens achieving significant damping on tip displacement and patch location. Also a multimode control technique was shown to control several modes.

Author

Active Control; Control Theory; Piezoelectric Transducers; Fan Blades; Vibration Damping; Resonance

20080023464 NASA Langley Research Center, Hampton, VA, USA

Decentralized Control of Sound Radiation using a High-Authority/Low-Authority Control Strategy with Anisotropic Actuators

Schiller, Noah H.; Cabell, Randolph H.; Fuller, Chris R.; July 03, 2008; 6 pp.; In English; Acoustics '08 Paris Conference and Exhibition - 155th Acoustical Society of A, 29 Jun. - 4 Jul. 2008, Paris, France; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 877868.02.07.07.04.01; Copyright; Avail.: CASI: [A02](#), Hardcopy

This paper describes a combined control strategy designed to reduce sound radiation from stiffened aircraft-style panels.

The control architecture uses robust active damping in addition to high-authority linear quadratic Gaussian (LQG) control. Active damping is achieved using direct velocity feedback with triangularly shaped anisotropic actuators and point velocity sensors. While active damping is simple and robust, stability is guaranteed at the expense of performance. Therefore the approach is often referred to as low-authority control. In contrast, LQG control strategies can achieve substantial reductions in sound radiation. Unfortunately, the unmodeled interaction between neighboring control units can destabilize decentralized control systems. Numerical simulations show that combining active damping and decentralized LQG control can be beneficial. In particular, augmenting the in-bandwidth damping supplements the performance of the LQG control strategy and reduces the destabilizing interaction between neighboring control units.

Author

Actuators; Anisotropy; Panels; Sound Waves; Aircraft Structures; Active Control; Control Systems Design

09

RESEARCH AND SUPPORT FACILITIES (AIR)

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

20080022418 NASA Glenn Research Center, Cleveland, OH, USA

2006 Icing Cloud Calibration of the NASA Glenn Icing Research Tunnel

Ide, Robert F.; Sheldon, David W.; May 2008; 19 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 122711.03.07.03.02

Report No.(s): NASA/TM-2008-215177; E-16421; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080022418>

In order to improve icing cloud uniformity, changes were made to the tunnel at the NASA Glenn Research Center in the vicinity of the spray bars. These changes necessitated a complete recalibration of the icing clouds. This report describes the methods used in the recalibration, including the procedure used to optimize the uniformity of the icing cloud and the use of a standard icing blade technique for measurement of liquid water content. The instruments and methods used to perform the droplet size calibration are also described. The liquid water content/droplet size operating envelopes of the icing tunnel are shown for a range of airspeeds and compared to the FAA icing certification criteria.

Author

Drops (Liquids); Ice Formation; Clouds (Meteorology); Drop Size; Aircraft Icing; Moisture Content; Calibrating; Wind Tunnels

12

ASTRONAUTICS (GENERAL)

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

20080022309 Shimokaji and Associates P.C., Irvine, CA, USA

Automatic Generation of Telemetry Flight Software, Accompanying Specifications, and Decode Files

Gvillo, D. W., Inventor; 27 Apr 04; 25 pp.; In English

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

Patent Info.: Filed Filed 27 Apr 04; US-Patent-Appl-SN-10-832-638

Report No.(s): PB2007-109075; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A computer readable media, includes instructions capable of being interpreted for execution by a computer processor. The instructions provide information sufficient for: reading a master telemetry definition data file; producing a source code for implementing a data stream telemetry method, and generating documentation files for the source code. The source code includes a get component, a format component, and a blocks component. The get component includes source code for accessing flight software variable values according to the master telemetry definition data file. The format component includes

source code for scaling the flight software variable values according to the master telemetry definition data file. The format component includes source code for formatting the values as telemetry stream parameters according to the master telemetry definition data file. The blocks component includes source code for placing telemetry parameters into a data stream according to the master telemetry definition data file.

NTIS

Applications Programs (Computers); Computer Programs; Flight Control; Patent Applications; Specifications; Telemetry

20080023592 American Inst. of Aeronautics and Astronautics, Reston, VA, USA

Back-to-Back Growth Years for Space Launches

Caceres, Marco; Aerospace America; March 2008; ISSN 0740-722X; 5 pp.; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

Recently, the number of launch missions has seen a steady increase. This is primarily attributable to three factors: a noticeable increase in the number of Long March rockets being launched by China; a marked increase in the number of launches by Atlas and Delta rockets; and, the space shuttle's resumption of regular operations for 2006. Apart from the Long March, Atlas/Delta and space shuttle programs, the launch rates for all other space launch vehicles during the last few years have either remained relatively flat or declined. The once exception would be ISC Kosmotras' Dnepr rocket, which gradually increased its launch missions from one in 2005 to two in 2006 and three in 2007. While the number of orbital launch missions has increased by 19% during the past two years, the number of satellites launched or attempted has risen by 39.8%. The main difference between the present and the past lies in the greater diversity of commercial satellites, the greater variety of countries launching civil satellites, and the greater number of US military satellites being launched. The higher number of commercial satellites during the 2006-2007 period has been due to a noticeable increase in Earth imaging satellites. As for the higher number of US military satellites going up recently, this is largely due to many more technology development satellites, particularly from Defense Advanced Research Projects Agency (DARPA). On the civil side, there are simply more scientific, Earth observation, communications, navigation, and technology development satellites being launched, with China accounting for a larger share of the civil market. Additionally, more countries are becoming active in the civil market, which currently includes Belarussia, China, France, India, Japan, Russia, South Korea, Taiwan, the Netherlands, and the US. A rich representation of nationalities within the civil satellite market is quickly becoming the norm and will contribute to increased activity in the industry.

Derived from text

Spacecraft Launching; Rocket Launching; Aerospace Industry

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*.

20080023208 California Univ., Los Angeles, CA USA

Vector Fluxgate Magnetometer (VMAG) Development for DSX

Moldwin, Mark B; Jul 2, 2007; 17 pp.; In English

Contract(s)/Grant(s): FA8718-05-C-0025; Proj-1010

Report No.(s): AD-A477672; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477672>

UCLA is building a three-axis fluxgate magnetometer for the AFRL-mission. The instrument is designed to measure the medium-Earth orbit geomagnetic field with precision of 0.1 nT and provide the field direction to within 1 degree. The instrument will provide the DC magnetic field for phase space density calculations of energetic particles, the magnetic field vector information for the Loss Cone Imager (LCI) payload, and the ULF wave environment. The project is on schedule for engineering unit completion in May 2007 and flight unit delivery in March 2008.

DTIC

Instruments; Magnetic Fields; Magnetometers

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*.

20080022348 NASA Dryden Flight Research Center, Edwards, CA, USA

Did Vertigo Kill America's Forgotten Astronaut?

Bendrick, Gregg A.; Merlin, Peter W.; October 31, 2007; 1 pp.; In English; Annual Scientific Meeting of the Aerospace Medical Association, 12-16 May 2008, Boston, MA, USA; Copyright; Avail.: CASI: [A01](#), Hardcopy

On November 15, 1967, U.S. Air Force test pilot Major Michael J. Adams was killed while flying the X-15 rocket-propelled research vehicle in a parabolic spaceflight profile. This flight was part of a joint effort with NASA. An electrical short in one of the experiments aboard the vehicle caused electrical transients, resulting in excessive workload by the pilot. At altitude Major Adams inappropriately initiated a flat spin that led to a series of unusual aircraft attitudes upon atmospheric re-entry, ultimately causing structural failure of the airframe. Major Adams was known to experience vertigo (i.e. spatial disorientation) while flying the X-15, but all X-15 pilots most likely experienced vertigo (i.e. somatogravic, or 'Pitch-Up', illusion) as a normal physiologic response to the accelerative forces involved. Major Adams probably experienced vertigo to a greater degree than did others, since prior aeromedical testing for astronaut selection at Brooks AFB revealed that he had an unusually high degree of labyrinthine sensitivity. Subsequent analysis reveals that after engine burnout, and through the zenith of the flight profile, he likely experienced the oculo-gravic ('Elevator') illusion. Nonetheless, painstaking investigation after the mishap revealed that spatial disorientation (Type II, Recognized) was NOT the cause, but rather, a contributing factor. The cause was in fact the misinterpretation of a dual-use flight instrument (i.e. Loss of Mode Awareness), resulting in confusion between yaw and roll indications, with subsequent flight control input that was inappropriate. Because of the altitude achieved on this flight, Major Adams was awarded Astronaut wings posthumously. Understanding the potential for spatial disorientation, particularly the oculo-gravic illusion, associated with parabolic spaceflight profiles, and understanding the importance of maintaining mode awareness in the context of automated cockpit design, are two lessons that have direct application to the commercial space industry today.

Author

Vertigo; X-15 Aircraft; Rocket Vehicles; Flight Control; Test Pilots; Structural Failure; Workloads (Psychophysiology); Astronauts; Physiological Responses

20080022435 NASA Johnson Space Center, Houston, TX, USA

History of On-Orbit Satellite Fragmentations (14th Edition)

Johnson, Nicholas L.; Stansbery, Eugene; Whitlock, David O.; Abercromby, Kira J.; Shoots, Debra; May 2008; 504 pp.; In English; Original contains color and black and white illustrations

Report No.(s): NASA/TM-2008-214779; S-1030; No Copyright; Avail.: CASI: [A22](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080022435>

Since the first serious satellite fragmentation occurred in June 1961 (which instantaneously increased the total Earth satellite population by more than 400%) the issue of space operations within the finite region of space around the Earth has been the subject of increasing interest and concern. The prolific satellite fragmentations of the 1970s and the marked increase in the number of fragmentations in the 1980s served to widen international research into the characteristics and consequences of such events. Continued events in all orbits in later years make definition and historical accounting of those events crucial to future research. Large, manned space stations and the growing number of operational robotic satellites demand a better understanding of the hazards of the dynamic Earth satellite population.

Author

Spacecraft Breakup; Fragmentation; Space Debris; Large Space Structures; Hazards; Robotics

20080023129 ISRO Satellite Centre, Peenya, Bangalore, India

Journal of Spacecraft Technology, Volume 18, No. 1

Narayana, K. Badari, Editor; January 2008; ISSN 0971-1600; 72 pp.; In English; See also 20080023130 - 20080023136; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

Topics covered include: Dual Gimbal Antenna Mechanism; An On-Board Computer System for ISRO Satellite Programme: Spacecraft Bus Management Unit; Implementation of 2 Gigabit Rate Data Handling System for Synthetic

Aperture Radar (SAR) Payload; Critical Chain Project Management - A New Project Management Philosophy for Multi-Project Environment; Configuration Studies of an Inflatable Paraboloid Reflector; Investigation of MLF for with PZT Powder Coated Composite Laminates using ASTM Standards; and Design and Development of 1k x 1k Frame Transfer Imager.

Derived from text

Data Systems; Synthetic Aperture Radar; Payloads; Bus Conductors; Airborne/Spaceborne Computers; Gimbals; Parabolic Bodies

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*.

20080022425 NASA Glenn Research Center, Cleveland, OH, USA

IPv6 and IPsec Tests of a Space-Based Asset, the Cisco Router in Low Earth Orbit (CLEO)

Ivancic, William; Stewart, David; Wood, Lloyd; Jackson, Chris; Northam, James; Wilhelm, James; May 2008; 71 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 430728.02.04.02.01

Report No.(s): NASA/TM-2008-215203; E-16474; Copyright; Avail.: CASI: [A04](#), Hardcopy

This report documents the design of network infrastructure to support testing and demonstrating network-centric operations and command and control of space-based assets, using IPv6 and IPsec. These tests were performed using the Cisco router in Low Earth Orbit (CLEO), an experimental payload onboard the UK--Disaster Monitoring Constellation (UK-DMC) satellite built and operated by Surrey Satellite Technology Ltd (SSTL). On Thursday, 29 March 2007, NASA Glenn Research Center, Cisco Systems and SSTL performed the first configuration and demonstration of IPsec and IPv6 onboard a satellite in low Earth orbit. IPv6 is the next generation of the Internet Protocol (IP), designed to improve on the popular IPv4 that built the Internet, while IPsec is the protocol used to secure communication across IP networks. This demonstration was made possible in part by NASA's Earth Science Technology Office (ESTO) and shows that new commercial technologies such as mobile networking, IPv6 and IPsec can be used for commercial, military and government space applications. This has direct application to NASA's Vision for Space Exploration. The success of CLEO has paved the way for new spacebased Internet technologies, such as the planned Internet Routing In Space (IRIS) payload at geostationary orbit, which will be a U.S. Department of Defense Joint Capability Technology Demonstration. This is a sanitized report for public distribution. All real addressing has been changed to psueco addressing.

Author

Protocol (Computers); Internets; Communication Networks; Network Control; Command and Control; Low Earth Orbits; Satellite Orbits; Earth Sciences; Payloads

20080023034 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Autonomous Congestion Control in Delay-Tolerant Networks

Burleigh, Scott; Jennings, Esther; Schoolcraft, Joshua; June 22, 2006; 13 pp.; In English; 9th International Conference on Space Operations (SpaceOps), 19-24 Jun. 2006, Rome, Italy; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/40800>

This presentation highlights communication congestion control in delay-tolerant networks (DTNs). Large-scale future space exploration will offer complex communication challenges that may be best addressed by establishing a network infrastructure. However, current internet techniques for congestion control are not well suited for operation of a network over interplanetary distances. An alternative, delay-tolerant technique for congestion control in a delay-tolerant network is presented. A simple DTN was constructed and an experimental congestion control mechanism was applied. The mechanism appeared to be effective and each router was able to make its bundle acceptance decisions autonomously. Future research will examine more complex topologies and alternative bundle acceptance rules that might enhance performance.

Derived from text

Communication Networks; Network Control; Space Communication; Delay; Autonomy

20080023297 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Analytic Calculation of Noise Power Robbing, NPR, and Polarization Isolation Degradation

Peters, Robert; Woolner, Peter; Ekelman, Ernest; [2008]; 8 pp.; In English; American Institute of Aeronautics and Astronautics, Inc. conference, 10-12 Jun. 2008, San Diego, CA, USA; Original contains color illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

Three Geostationary Operational Environmental Satellite (GOES) R transponders (services) required analysis and measurements to develop an accurate link budget. These are a) Search and Rescue transponder which suffers from power robbing due to thermal uplink noise, b) the Data Collection Platform Report which suffers from degradation due to NPR (Noise Power Ratio), and c) GOES Rebroadcast transponder which uses a dual circular downlink L band for which there was no depolarization data. The first two services required development of extended link budget to analytically calculate the impact of these degradations which are shown to have a significant impact on the link budget. The third service required measurements of atmospheric L band CP depolarization as there were no known previous measurements and results are reported her

Author

GOES Satellites; Data Collection Platforms; Degradation; Satellite Transmission; Thermal Noise

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*.

2008002369 NASA Glenn Research Center, Cleveland, OH, USA

Design Review of Seals on the Apollo Spacecraft

Finkbeiner, Joshua R.; Dunlap, Patrick H., Jr.; Steinetz, Bruce M.; Daniels, Christopher C.; [2008]; 29 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

The Apollo spacecraft required advancements in seal design to support human spaceflight to the moon and to return the crews safely to Earth. High-temperature seals were required for gaps in the thermal protection system to protect the underlying structures from the high heating environment of superorbital reentry. Reliable pressure seals were also required to prevent the loss of habitable atmosphere during missions to the moon. A review is presented of some of the seals used on the Apollo spacecraft for the gap between the heat shield and backshell and for penetrations through the heat shield, docking hatches, windows, and the capsule pressure hull.

Author

Thermal Protection; Seals (Stoppers); Heat Shielding; Design Analysis; Apollo Spacecraft

2008002377 NASA Glenn Research Center, Cleveland, OH, USA

Effect of Orion Post-Touchdown Parachute Release Time on Vehicle Rollover

Lawrence, Charles; Georgiadis, Nicholas J.; Littell, Justin; May 2008; 19 pp.; In English; Original contains color illustrations Contract(s)/Grant(s): WBS 510505.05.03.07.04

Report No.(s): NASA/TM--2008-215066; E-16289; Copyright; Avail.: CASI: [A03](#), Hardcopy

The effects that the Orion parachutes have on the vehicle response once the vehicle lands on the ground are examined in this report. A concern with the Orion landing is that structural accelerations will cause vehicle and/or crew injuries or that the vehicle may roll over. The parachute effects are thought to have the potential of pulling the vehicle over during conditions such as higher winds or in some cases stabilizing the vehicle by preventing its motions after touchdown. A collection of representative landing conditions is used to assess the post-touchdown parachute release effect, and it was determined that, in general, there is no significant advantage or disadvantage to releasing the parachutes past the time when the vehicle touches ground. For landing conditions when there is a high horizontal wind, retaining the parachutes has a detrimental effect on vehicle rollover because the drag force on the parachutes pulls the vehicle over. Under this condition, some form of automated parachute release should be a requirement given that an attached parachute may cause the vehicle to roll over. An automated

system would ensure that the release occur within 0.50 sec of touchdown (time when parachute regains tension), which is not enough time for a crew-operated manual release.

Author

Spacecraft Design; Astronauts; Stabilization; Touchdown; Spacecraft Landing

20080023014 Government Accountability Office, Washington, DC, USA

Polar-orbiting Satellite Acquisition Faces Delays; Decisions Needed on whether and how to Ensure Climate Data Continuity

May 2008; 53 pp.; In English; Original contains color and black and white illustrations

Report No.(s): GAO-08-518; No Copyright; Avail.: CASI: [A04](#), Hardcopy

The National Polar-orbiting Operational Environmental Satellite System (NPOESS) is a tri-agency acquisition--managed by the Department of Commerce's National Oceanic and Atmospheric Administration (NOAA), the Department of Defense (DOD), and the National Aeronautics and Space Administration (NASA)--that has experienced escalating costs, schedule delays, and technical difficulties. These factors led to a June 2006 decision to restructure the program by reducing the number of satellites and sensors, increasing estimated costs to \$12.5 billion, and delaying the first two satellites by 3 to 5 years. GAO was asked to evaluate progress in restructuring the acquisition, assess the status of key program components and risks, and assess NASA's, NOAA's, and DOD's plans for obtaining the data originally planned to be collected by NPOESS sensors, but eliminated by the restructuring. To do so, GAO analyzed program and contractor data, attended program reviews, and interviewed agency officials. GAO recommends that Commerce, NASA, and DOD coordinate to develop plans on whether and how to restore climate and space weather sensors removed from the NPOESS program. GAO is also reemphasizing a prior recommendation for agency executives to finalize acquisition documents. Agency officials agreed with both recommendations. Derived from text

Costs; NASA Programs; Meteorological Satellites; Production Costs; Economic Analysis; Financial Management

20080023092 Honeybee Robotics Ltd., New York, NY, USA

Sample Manipulation System for Sample Analysis at Mars

Mumm, Erik; Kennedy, Tom; Carlson, Lee; Roberts, Dustyn; 39th Aerospace Mechanisms Symposium; May 2008, pp. 303-316; In English; See also [20080023060](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Sample Analysis at Mars (SAM) instrument will analyze Martian samples collected by the Mars Science Laboratory Rover with a suite of spectrometers. This paper discusses the driving requirements, design, and lessons learned in the development of the Sample Manipulation System (SMS) within SAM. The SMS stores and manipulates 74 sample cups to be used for solid sample pyrolysis experiments. Focus is given to the unique mechanism architecture developed to deliver a high packing density of sample cups in a reliable, fault tolerant manner while minimizing system mass and control complexity. Lessons learned are presented on contamination control, launch restraint mechanisms for fragile sample cups, and mechanism test data.

Author

Mars Surface Samples; Contamination; Fault Tolerance; Systems Analysis; Roving Vehicles

20080023116 NASA Marshall Space Flight Center, Huntsville, AL, USA

Ares Project Overview - Quality in Design

Cianciola, Chris; Crane, Kenneth; March 03, 2008; 9 pp.; In English; 16th Annual Conference on Quality in the Space and Defense Industries, 3-4 Mar. 2008, Cape Canaveral, FL, USA; Original contains color illustrations; No Copyright; Avail.:

CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023116>

This presentation introduces the audience to the overall goals of the Ares Project, which include providing human access to low-Earth orbit, the Moon, and beyond. The presentation also provides an overview of with the vehicles that will execute those goals and progress made on the vehicles to date. The briefing will provide an introduction to Lean, Six Sigma, and Kaizen practices Ares will use to improve the overall effectiveness and quality of its efforts. Finally, the briefing includes a summary of Safety and Mission Assurance practices being implemented within[Ares to ensure safety and quality early in the design process. Integrating Safety and Mission Assurance in Design: This presentation describes how the Ares Projects are learning from the successes and failures of previous launch systems in order to maximize safety and reliability while maintaining fiscal responsibility. The Ares Projects are integrating Safer T and Mission Assurance into design activities and

embracing independent assessments by Quality experts in thorough reviews of designs and processes. Incorporating Lean thinking into the design process, Ares is also streamlining existing processes and future manufacturing flows which will yield savings during production. Understanding the value of early involvement of Quality experts, the Ares Projects are leading launch vehicle development into the 21st century.

Derived from text

Low Earth Orbits; Advanced Recon Electric Spacecraft; Ares 1 Launch Vehicle; Safety

20080023305 NASA Glenn Research Center, Cleveland, OH, USA

Orion Crew Member Injury Predictions during Land and Water Landings

Lawrence, Charles; Littell, Justin D.; Fasanella, Edwin L.; Tabiei, Ala; June 2008; 19 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 510505.01.03.01.06

Report No.(s): NASA/TM-2008-215171; E-16365-1; Copyright; Avail.: CASI: [A03](#), Hardcopy

A review of astronaut whole body impact tolerance is discussed for land or water landings of the next generation manned space capsule named Orion. LS-DYNA simulations of Orion capsule landings are performed to produce a low, moderate, and high probability of injury. The paper evaluates finite element (FE) seat and occupant simulations for assessing injury risk for the Orion crew and compares these simulations to whole body injury models commonly referred to as the Brinkley criteria. The FE seat and crash dummy models allow for varying the occupant restraint systems, cushion materials, side constraints, flailing of limbs, and detailed seat/occupant interactions to minimize landing injuries to the crew. The FE crash test dummies used in conjunction with the Brinkley criteria provides a useful set of tools for predicting potential crew injuries during vehicle landings.

Author

Astronauts; Impact Tolerances; Risk; Space Capsules; Water Landing; Crashes; Flight Crews; Predictions

20080023306 NASA Glenn Research Center, Cleveland, OH, USA

Evaluation of Separation Mechanism Design for the Orion/Ares Launch Vehicle

Konno, Kevin E.; Catalano, Daniel A.; Krivanek, Thomas M.; June 2008; 20 pp.; In English; 35th Aerospace Mechanisms Symposium, 7-9 May 2008, Huntsville, AL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 644423.06.32.03.06.03

Report No.(s): NASA/TM-2008-215182; E-16305-1; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023306>

As a part of the preliminary design work being performed for the Orion vehicle, the Orion to Spacecraft Adaptor (SA) separation mechanism mechanism was analyzed and sized, with findings presented here. Sizing is based on worst case abort condition as a result of an anomaly driving the launch vehicle engine thrust vector control hard-over causing a severe vehicle pitch over. This worst case scenario occurs just before Upper Stage Main Engine Cut-Off (MECO) when the vehicle is the lightest and the damping effect due to propellant slosh has been reduced to a minimum. To address this scenario and others, two modeling approaches were invoked. The first approach was a detailed Simulink model to quickly assess the Service Module Engine nozzle to SA clearance for a given separation mechanism. The second approach involved the generation of an Automatic Dynamic Analysis of Mechanical Systems (ADAMS) model to assess secondary effects due to mass centers of gravity that were slightly off the vehicle centerline. It also captured any interference between the Solar Arrays and the Spacecraft Adapter. A comparison of modeling results and accuracy are discussed. Most notably, incorporating a larger SA flange diameter allowed for a natural separation of the Orion and its engine nozzle even at relatively large pitch rates minimizing the kickoff force. Advantages and disadvantages of the Simulink model vs. a full geometric ADAMS model are discussed as well.

Author

Launch Vehicles; Thrust Vector Control; Service Modules; Gravitation; Adapters; Damping

20080023323 NASA Marshall Space Flight Center, Huntsville, AL, USA

NanoSail-D

Montgomery, Edward E., IV; Adams, Charles L.; April 09, 2008; 19 pp.; In English; CubeSat Developers' Workshop, 9-11 Apr. 2008, San Luis Obispo, CA, USA; Original contains color illustrations; Copyright; Avail.: CASI: [C01](#), CD-ROM:

[A03](#), Hardcopy

The 'NanoSail-D' mission is currently scheduled for launch onboard a Falcon-1 Launch Vehicle in the early June 2008

timeframe. The NanoSail-D spacecraft will consist of a solar sail subsystem stowed in a 2U volume and a 1U spacecraft bus, provided by Ames Research Center. The primary objectives of the NanoSail-D technology demonstration mission are to fabricate, stow and deploy on-orbit a solar sail and perform a de-orbit maneuver to demonstrate a potential orbital debris mitigation technology. The NanoSail-D mission is being developed through a collaborative effort between the NASA Marshall Space Flight Center and the NASA Ames Research Center Small Spacecraft Office. Details of the NanoSail-D system will be presented, including: 1) design details of the solar sail reflective membrane quadrants, gossamer booms, deployment system and passive attitude control system, 2) design analysis results including structural, thermal, environmental, orbital debris and safety, and 3) test results including deployment, ascent venting, launch vibration and PPOD integration verification.

Author

Solar Sails; Launch Vehicles; Control Systems Design; Attitude Control; Design Analysis; Bus Conductors

20080023343 Emergent Space Technologies, Inc., Greenbelt, MD, USA

Three Axis Control of the Hubble Space Telescope Using Two Reaction Wheels and Magnetic Torquer Bars for Science Observations

Hur-Diaz, Sun; Wirzburger, John; Smith, Dan; June 29, 2008; 16 pp.; In English; F. Landis Markley Astronautics Symposium, 29 Jun. - 2 Jul. 2008, Cambridge, MD, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS5-50000

Report No.(s): AAS-08-279; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Hubble Space Telescope (HST) is renowned for its superb pointing accuracy of less than 10 milli-arcseconds absolute pointing error. To accomplish this, the HST relies on its complement of four reaction wheel assemblies (RWAs) for attitude control and four magnetic torquer bars (MTBs) for momentum management. As with most satellites with reaction wheel control, the fourth RWA provides for fault tolerance to maintain three-axis pointing capability should a failure occur and a wheel is lost from operations. If an additional failure is encountered, the ability to maintain three-axis pointing is jeopardized. In order to prepare for this potential situation, HST Pointing Control Subsystem (PCS) Team developed a Two Reaction Wheel Science (TRS) control mode. This mode utilizes two RWAs and four magnetic torquer bars to achieve three-axis stabilization and pointing accuracy necessary for a continued science observing program. This paper presents the design of the TRS mode and operational considerations necessary to protect the spacecraft while allowing for a substantial science program.

Author

Hubble Space Telescope; Attitude Control; Pointing Control Systems; Control Systems Design; Three Axis Stabilization; Reaction Wheels; Torquers; Spacecraft Control; Systems Engineering

20080023344 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Hubble Space Telescope Reduced-Gyro Control Law Design, Implementation, and On-Orbit Performance

Clapp, Brian R.; Ramsey, Patrick R.; Wirzburger, John H.; Smith, Daniel C.; VanArsadall, John C.; June 29, 2008; 22 pp.; In English; F. Landis Markley Astronautics Symposium, 29 Jun. - 2 Jul. 2008, Cambridge, MD, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NAS5-50000

Report No.(s): AAS-08-278; Copyright; Avail.: CASI: [A03](#), Hardcopy

Following gyro failures in April 2001 and April 2003, HST Pointing Control System engineers designed reduced-gyro control laws to extend the spacecraft science mission. The Two-Gyro Science (TGS) and One-Gyro Science (OGS) control laws were designed and implemented using magnetometers, star trackers, and Fine Guidance Sensors in succession to control vehicle rate about the missing gyro axes. Both TGS and OGS have demonstrated on-orbit pointing stability of 7 milli-arcseconds or less, which depends upon the guide star magnitude used by the Fine Guidance Sensor. This paper describes the design, implementation, and on-orbit performance of the TGS and OGS control law fine-pointing modes using Fixed Head Star Trackers and Fine Guidance Sensors, after successfully achieving coarse-pointing control using magnetometers.

Author

Guidance Sensors; Hubble Space Telescope; Pointing Control Systems; Control Theory; Gyroscopes; Star Trackers

20080023584 Italian Aerospace Research Center, Capua, Italy

Flight Test Experiments Foreseen for USV

Russo, G.; Flight Experiments for Hypersonic Vehicle Development; June 2007, pp. 12-1 - 12-38; In English; See also [20080023582](#); Original contains color and black and white illustrations

Report No.(s): Paper 12; Copyright; Avail.: CASI: [A04](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Strategic Target of the USV Program is the development of a multi-purpose flying testbed for 'advanced' atmospheric

re-entry from a circular LEO at about 200 km The technological developments associated to this target are focused on the evolution of space transportation systems, oriented towards the aerospaceplane (SSTO-HTHL), believed to be sooner or later the future generation system concept.

Author

Flight Tests; Aerospace Planes; Low Earth Orbits; Reentry; Single Stage to Orbit Vehicles

20080023611 NASA Goddard Space Flight Center, Greenbelt, MD, USA

SDO FlatSat Facility

Amason, David L.; May 26, 2008; 15 pp.; In English; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023611>

The goal of the Solar Dynamics Observatory (SDO) is to understand and, ideally, predict the solar variations that influence life and society. It's instruments will measure the properties of the Sun and will take high definition images of the Sun every few seconds, all day every day. The FlatSat is a high fidelity electrical and functional representation of the SDO spacecraft bus. It is a high fidelity test bed for Integration & Test (I & T), flight software, and flight operations. For I & T purposes FlatSat will be a driver to development and dry run electrical integration procedures, STOL test procedures, page displays, and the command and telemetry database. FlatSat will also serve as a platform for flight software acceptance and systems testing for the flight software system component including the spacecraft main processors, power supply electronics, attitude control electronic, gimbal control electronics and the S-band communications card. FlatSat will also benefit the flight operations team through post-launch flight software code and table update development and verification and verification of new and updated flight operations products. This document highlights the benefits of FlatSat; describes the building of FlatSat; provides FlatSat facility requirements, access roles and responsibilities; and, and discusses FlatSat mechanical and electrical integration and functional testing.

Derived from text

Spacecraft; Simulators; Satellites; Electrical Engineering; Systems Engineering; Systems Integration; Bus Conductors; Electric Equipment Tests

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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*.

20080023068 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

The Mars Climate Sounder In-Flight Positioning Anomaly

Jau, Bruno M.; Kass, David; 39th Aerospace Mechanisms Symposium; May 2008, pp. 271-288; In English; See also [20080023060](#); Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

The paper discusses the Mars Climate Sounder (MCS) instrument's in-flight positioning errors and presents background material about it. A short overview of the instrument's science objectives and data acquisition techniques is provided. The brief mechanical description familiarizes the reader with the MCS instrument. Several key items of the flight qualification program, which had a rigorous joint drive test program but some limitations in overall system testing, are discussed. Implications this might have had for the flight anomaly, which began after several months of flawless space operation, are mentioned. The detection, interpretation, and instrument response to the errors is discussed. The anomaly prompted engineering reviews, renewed ground, and some in-flight testing. A summary of these events, including a timeline, is included. Several items of concern were uncovered during the anomaly investigation, the root cause, however, was never found. The instrument is now used with two operational constraints that work around the anomaly. It continues science gathering at an only slightly diminished pace that will yield approximately 90% of the originally intended science.

Author

Sounding; Climate; Mars Environment; Instrument Errors; Positioning

20080023069 Honeybee Robotics Ltd., New York, NY, USA

Icy Soil Acquisition Device for the 2007 Phoenix Mars Lander

Chu, Philip; Wilson, Jack; Davis, Kiel; Shiraishi, Lori; Burke, Kevin; 39th Aerospace Mechanisms Symposium; May 2008, pp. 289-302; In English; See also [20080023060](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Icy Soil Acquisition Device is a first of its kind mechanism that is designed to acquire ice-bearing soil from the surface of the Martian polar region and transfer the samples to analytical instruments, playing a critical role in the potential discovery of existing water on Mars. The device incorporates a number of novel features that further the state of the art in spacecraft design for harsh environments, sample acquisition and handling, and high-speed low torque mechanism design.

Author

Phoenix Mars Lander; Ice; Soils; Spacecraft Design; Mars Surface

20080023079 EADS Astrium Ltd., Friedrichshafen, Germany

Scanning System Development and Associated Bearing Cage Instability Issue

Schmid, Manfred; Hehr, Christian; 39th Aerospace Mechanisms Symposium; May 2008, pp. 117-130; In English; See also [20080023060](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Scan equipment used to control the MicroWave Radiometer Imager (MWRI) of the polar orbiting FY3 meteorological satellite was developed and delivered to the customer by Astrium Satellites GmbH. The instrument detects and monitors meteorological and biosphere environmental anomalies. The key elements of the design and the most important design requirements and design features are described hereunder. Special attention is paid to the bearing cage anomaly observed on the Scan Compensation Mechanism during the test campaign and to the subsequent root cause investigation performed.

Author

Scanners; Meteorological Satellites; Microwave Radiometers; Bearings; Systems Engineering; Biosphere

20080023130 University B.D.T. Coll. of Engineering, Davangere, Karnataka, India

Configuration Studies of an Inflatable Paraboloid Reflector

Jairaja, R.; Ranganath, R.; Nataraju, B. S.; Siddeswarappa, B.; Journal of Spacecraft Technology, Volume 18, No. 1; January 2008, pp. 37-47; In English; See also [20080023129](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

DGA mechanism is essentially a two axis rotary drive actuator which rotates an antenna about two orthogonal axes by stipulated angles. The DGA mechanism makes the data transmit antenna to track the ground station in real time and transmit the data to ground station while the spacecraft is taking images. The need to slew the DGA during imagery collection while minimizing jitter of the spacecraft has led to challenging requirements for the gimbal mechanism and its components. A Shape memory alloy based Pin-puller assembly is also developed for the hold down and release of DGA mechanism. The mechanism has been designed, qualified and already flown onboard Cartosat-2 satellite. The on-orbit performance of mechanism is satisfactory.

Author

Gimbals; Actuators; Shape Memory Alloys; Real Time Operation; Mechanical Drives; Reflectors; Parabolic Bodies

20080023135 ISRO Satellite Centre, Peenya, Bangalore, India

An On-Board Computer System for ISRO Satellite Programme: Spacecraft Bus Management Unit

Agrawal, V. K.; Kishore, J. K.; Udupa, Subramanya; Sudhakar, S.; Parameswaran, K.; Journal of Spacecraft Technology, Volume 18, No. 1; January 2008, pp. 8-21; In English; See also [20080023129](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

The advances in VLSI technology leading to availability of high performance microprocessors, ASICs/FPGAs, high density memories and also improved packaging technology for space applications has made miniaturization possible in spacecraft electronics. Traditionally, attitude and orbit control, telecommands, telemetry, sensor electronics, thermal management etc., are generally implemented as stand-alone sub-systems. The feasibility of miniaturization in spacecraft electronics has led to the integration of the above systems into a single on-board computer system to realize the same functions. This paper presents an on-board computer system also known as the spacecraft Bus Management unit (BMU) for our ISRO satellite programme. The advantage gained due to BMU for Cartosat-2 is shown w.r.t. distributed systems used in

TES. The integrated concept realized as MMU was largely responsible for the body mounted solar panel configuration in SRE. The performance of BMU in Cartosat-2 and MMU in SRE has been satisfactory.

Author

Airborne/Spaceborne Computers; Microprocessors; Very Large Scale Integration; Temperature Control; Telemetry; Bus Conductors; Attitude Control

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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*.

20080022410 NASA Glenn Research Center, Cleveland, OH, USA

Progress of Ongoing NASA Lithium-Ion Cell Verification Testing for Aerospace Applications

McKissock, Barbara I.; Manzo, Michelle A.; Miller, Thomas B.; Reid, Concha M.; Bennett, William R.; Gemeiner, Russel; May 2008; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 083229.04.15.01.01.03

Report No.(s): NASA/TM--2008-215154; E-16394; Copyright; Avail.: CASI: [A03](#), Hardcopy

A Lithium-ion Verification and Validation Program with the purpose to assess the capabilities of current aerospace lithium-ion (Li-ion) battery cells to perform in a low-earth-orbit (LEO) regime was initiated in 2002. This program involves extensive characterization and LEO life testing at ten different combinations of depth-of-discharge, temperature, and end-of-charge voltage. The test conditions selected for the life tests are defined as part of a statistically designed test matrix developed to determine the effects of operating conditions on performance and life of Li-ion cells. Results will be used to model and predict cell performance and degradation as a function of test operating conditions. Testing is being performed at the Naval Surface Warfare Center/Crane Division in Crane, Indiana. Testing was initiated in September 2004 with 40 Ah cells from Saft and 30 Ah cells from Lithion. The test program has been expanded with the addition of modules composed of 18650 cells from ABSL Power Solutions in April 2006 and the addition of 50 Ah cells from Mine Safety Appliances Co. (MSA) in June 2006. Preliminary results showing the average voltage and average available discharge capacity for the Saft and Lithion packs at the test conditions versus cycles are presented.

Author

Electric Batteries; Lithium; Low Earth Orbits; Metal Ions; Aerospace Engineering; Performance Prediction; Proving; Degradation

20080022419 NASA Glenn Research Center, Cleveland, OH, USA

Power System Trade Studies for the Lunar Surface Access Module

Kohout, Lisa, L.; May 2008; 16 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 182306.06.01.03

Report No.(s): NASA/TM-2008-215179; E-16424; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080022419>

A Lunar Lander Preparatory Study (LLPS) was undertaken for NASA's Lunar Lander Pre-Project in 2006 to explore a wide breadth of conceptual lunar lander designs. Civil servant teams from nearly every NASA center responded with dozens of innovative designs that addressed one or more specific lander technical challenges. Although none of the conceptual lander designs sought to solve every technical design issue, each added significantly to the technical database available to the Lunar Lander Project Office as it began operations in 2007. As part of the LLPS, a first order analysis was performed to identify candidate power systems for the ascent and descent stages of the Lunar Surface Access Module (LSAM). A power profile by mission phase was established based on LSAM subsystem power requirements. Using this power profile, battery and fuel cell systems were modeled to determine overall mass and volume. Fuel cell systems were chosen for both the descent and ascent stages due to their low mass. While fuel cells looked promising based on these initial results, several areas have been identified for further investigation in subsequent studies, including the identification and incorporation of peak power requirements into the analysis, refinement of the fuel cell models to improve fidelity and incorporate ongoing technology developments, and broadening the study to include solar power.

Author

Lunar Surface; Fuel Cells; Descent; Ascent; Lunar Landing Modules; Spacecraft Landing

20080023322 NASA Marshall Space Flight Center, Huntsville, AL, USA

Pratt and Whitney Overview and Advanced Health Management Program

Inabinett, Calvin; April 07, 2008; 23 pp.; In English; University of Alabama IEEE Meeting, 7 Apr. 2008, Tuscaloosa, AL, USA; Original contains color illustrations

Contract(s)/Grant(s): NAS8-01140; No Copyright; Avail.: CASI: **C01**, CD-ROM: **A03**, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023322>

Hardware Development Activity: Design and Test Custom Multi-layer Circuit Boards for use in the Fault Emulation Unit; Logic design performed using VHDL; Layout power system for lab hardware; Work lab issues with software developers and software testers; Interface with Engine Systems personnel with performance of Engine hardware components; Perform off nominal testing with new engine hardware.

Author

Circuit Boards; Logic Design; Hardware Description Languages; Engine Parts; VHSIC (Circuits)

23

CHEMISTRY AND MATERIALS (GENERAL)

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

20080022315 Evan Law Group, LLC, Chicago, IL, USA

Wax Particles for Protection of Activators, and Multifunctional Autonomically Healing Composite Materials

Moore, J. S., Inventor; Rule, J. D., Inventor; White, S. R., Inventor; Sottos, N. R., Inventor; Brown, E. N., Inventor; 7 May 04; 12 pp.; In English

Contract(s)/Grant(s): AFOSR-F49620-03-1-0179

Patent Info.: Filed Filed 7 May 04; US-Patent-Appl-SN-10-840-937

Report No.(s): PB2007-109070; No Copyright; Avail.: CASI: **A03**, Hardcopy

A composite material comprises (i) a polymer, (ii) a polymerizer, (iii) a protected corresponding activator for the polymerizer, and (iv) a plurality of capsules. The polymerizer is in the capsules, and the corresponding activator is protected with a corresponding encapsulant for the polymer and the polymerizer.

NTIS

Activation; Composite Materials; Healing; Patent Applications; Protection; Waxes

20080023086 Sandia National Labs., Albuquerque, NM, USA

Launch Lock Mechanism Design Fault Tree Use and Coatings Study

Villa, Daniel; Toledo, Gustavo; 39th Aerospace Mechanisms Symposium; May 2008, pp. 131-144; In English; See also **20080023060**; Original contains color and black and white illustrations; Copyright; Avail.: CASI: **A03**, Hardcopy

Characteristics of a design process of a launch lock (LL) mechanism are described. This process began with generation of data that proved a previous design would not perform its function reliably. The redesign was then accomplished through the use of fault tree analysis, which helped make a better connection between requirements and actual failure scenarios. FEA modeling techniques for proper stiffness verification through testing are explored. Proto-type testing revealed that coatings at a volatile spherical joint interface became the primary area of concern as multiple configurations failed. Boron Carbide, bare AM355 to Ti6Al4V with Braycote 600EF, Tiodize, Diamond-like nano-carbon (DLN), and improperly configured coatings of MoS₂ and TiCN were all shown to have unacceptable particle generation. TiCN and MoS₂ doped with SbO₃ and Au were shown to meet cleanliness requirements once coating parameters were properly controlled.

Author

Launching; Fault Trees; Boron Carbides; Doped Crystals; Stiffness; Aluminum Alloys

20080023123 Whitham, Curtis and Christofferson, P.C., Reston, VA, USA

Materials for Use as Proton Conducting Membranes for Fuel Cells

Einsla, B. R., Inventor; McGrath, J. E., Inventor; 2 May 05; 19 pp.; In English

Contract(s)/Grant(s): DE-FC36-01G0 11086

Patent Info.: Filed Filed 2 May 05; US-Patent-Appl-SN-11-119-353

Report No.(s): PB2007-109267; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A family of polymers having pendent sulfonate moieties connected to polymeric main chain phenyl groups are described. These polymers are prepared by the steps of polymerization (using a monomer with a phenyl with an alkoxy substitution), deprotection by converting the alkoxy to a hydroxyl, and functionalization of the polymer with a pendant sulfonate group. As an example, sulfonated poly(arylene ether sulfone) copolymers with pendent sulfonic acid groups are synthesized by the direct copolymerization of methoxy-containing poly(arylene ether sulfone)s, then converting the methoxy groups to the reactive hydroxyl form, and finally functionalizing the hydroxyl form with proton-conducting sites through nucleophilic substitution. The family of polymers may have application in proton exchange membranes and in other applications.

NTIS

Fuel Cells; Membranes; Protons; Polymers

20080023125 Smith (Perkins) and Cohen, LLP, Boston, MA, USA

Multiblock Copolymers Having Improved Mechanical Properties

Rathore, O., Inventor; Sogah, D. Y., Inventor; 25 Apr 05; 27 pp.; In English

Contract(s)/Grant(s): NSF-DMR-9632275; NSF-DMR-0079992

Patent Info.: Filed Filed 25 Apr 05; US-Patent-Appl-SN-11-113-494

Report No.(s): PB2007-109265; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Replacement of the amorphous peptide domain of a structural biopolymer, such as silk from silkworms or spiders, with a nonpeptide segment while maintaining the .beta.-sheet forming crystalline segments provides synthetic multiblock copolymers having solid-state structures and mechanical properties similar to the naturally occurring structural biopolymer is described herein. Such synthetic multiblock copolymers may be produced as films or fibers.

NTIS

Biopolymers; Copolymers; Mechanical Properties; Multiblock Grids; Peptides

20080023217 Orrick, Herrington and Sutcliffe, LLP, Irvine, CA, USA

High Aspect Ratio C-Mems Architecture

Madou, M. J., Inventor; Wang, C., Inventor; Jia, G., Inventor; Taherabadi, L., Inventor; Park, B., Inventor; 11 Feb 05; 19 pp.; In English

Contract(s)/Grant(s): DMI-0428958

Patent Info.: Filed Filed 11 Feb 05; US-Patent-Appl-SN-11 057 389

Report No.(s): PB2007-109129; No Copyright; Avail.: CASI: [A03](#), Hardcopy

C-MEMS architecture having high aspect ratio carbon structures and improved systems and methods for producing high aspect ratio C-MEMS structures are provided. Specifically, high aspect ratio carbon structures are microfabricated by pyrolyzing a patterned carbon precursor polymer. Pyrolysing the polymer preferably comprises a multi-step process in an atmosphere of inert and forming gas at high temperatures that trail the glass transit temperature (T_g) for the polymer. Multi-layer C-MEMS carbon structures are formed from multiple layers of negative photoresist, wherein a first layer forms carbon interconnects and the second and successive layers form high aspect ratio carbon structures. High-conductivity interconnect traces to connect C-MEMS carbon structures are formed by depositing a metal layer on a substrate, patterning a polymer precursor on top of the metal layer and pyrolyzing the polymer to create the final structure. The interconnects of a device with high aspect ratio electrodes are insulated using a self aligning insulation method.

NTIS

Carbon; High Aspect Ratio; Microelectromechanical Systems; Patent Applications

20080023228 Brookhaven National Lab., Upton, NY USA

Carboranylporphyrins and Uses Thereof

Wu, H., Inventor; Miura, M., Inventor; 20 May 04; 16 pp.; In English

Contract(s)/Grant(s): DE-AC02-098CH10886

Patent Info.: Filed Filed 20 May 04; US-Patent-Appl-SN-10-848-741

Report No.(s): PB2007-109204; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention is directed to low toxicity boronated compounds and methods for their use in the treatment, visualization, and diagnosis of tumors. More specifically, the present invention is directed to low toxicity carborane-containing 5, 10, 15, 20-tetraphenylporphyrin compounds and methods for their use particularly in boron neutron capture therapy (BNCT) and photodynamic therapy (PDT) for the treatment of tumors of the brain, head and neck, and surrounding tissue. The invention is also directed to using these carborane-containing tetraphenyl porphyrin compounds to methods of tumor imaging and/or diagnosis such as MRI, SPECT, or PET.

NTIS

Boron; Brain; Capture Effect; Neutrons; Patent Applications; Therapy; Toxicity; Tumors

20080023229 Minnesota Univ., Minneapolis, MN, USA

Production of Hydrogen from Alcohols

Deluga, G. A., Inventor; Schmidt, L. D., Inventor; 30 Sep 03; 24 pp.; In English

Contract(s)/Grant(s): DE-FG02-88ER1878

Patent Info.: Filed Filed 30 Sep 03; US-Patent-Appl-SN-10-676-324

Report No.(s): PB2007-109203; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A process for producing hydrogen from ethanol or other alcohols. The alcohol, optionally in combination with water, is contacted with a catalyst comprising rhodium. The overall process is preferably carried out under autothermal conditions.

NTIS

Alcohols; Ethyl Alcohol; Hydrogen Production; Patent Applications

20080023233 Hoffmann and Baron, LLP, Syosset, NY, USA

Flame Retardant and Uv Absorptive Polymethylmethacrylate Nanocomposites

Rafailovich, M., Inventor; Si, M., Inventor; Goldman, M., Inventor; 27 Sep 02; 14 pp.; In English

Contract(s)/Grant(s): NSF-DMR080604

Patent Info.: Filed Filed 27 Sep 02; US-Patent-Appl-SN-10-490-882

Report No.(s): PB2007-109264; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A composition which includes polymethylmethacrylate and an organoclay functionalized with intercalation agent, wherein said intercalation agent is a reaction product of a polyamine and an alkyl halide in a polar solvent, preferably a dimethyl, ditallow ammonium functionalized monmorillonite clay.

NTIS

Flame Retardants; Nanocomposites; Patent Applications; Polymethyl Methacrylate

20080023613 NASA, Washington, DC, USA

Method and system for fiber optic determination of gas concentrations in liquid receptacles

Nguyen, Quang-Viet, Inventor; June 10, 2008; 24 pp.; In English

Patent Info.: Filed April 28, 2006; US-Patent-7,385,692; US-Patent-Appl-SN-11/412,924; No Copyright; Avail.: CASI:

[A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023613>

A system for determining gas compositions includes a probe, inserted into a source of gaseous material, the probe having a gas permeable sensor tip and being capable of sending and receiving light to and from the gaseous material, a sensor body, connected to the probe, situated outside of the source and a fiber bundle, connected to the sensor body and communicating light to and from the probe. The system also includes a laser source, connected to one portion of the fiber bundle and providing laser light to the fiber bundle and the probe a Raman spectrograph, connected to another portion of the fiber bundle, receiving light from the probe and filtering the received light into specific channels and a data processing unit, receiving and analyzing the received light in the specific channels and outputting concentration of specific gas species in the gaseous material based on the analyzed received light.

Official Gazette of the U.S. Patent and Trademark Office

Fiber Optics; Gas Composition; Gas Detectors; Concentration (Composition)

COMPOSITE MATERIALS

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

2008002368 NASA Glenn Research Center, Cleveland, OH, USA

Multi-Scale/Multi-Functional Probabilistic Composite Fatigue

Chamis, Christos C.; May 18, 2008; 13 pp.; In English; SAMPE 2008 Conference, 18-22 May 2008, Long Beach, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 526282.01.03.02.02.04

Report No.(s): L010; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/2008002368>

A multi-level (multi-scale/multi-functional) evaluation is demonstrated by applying it to three different sample problems. These problems include the probabilistic evaluation of a space shuttle main engine blade, an engine rotor and an aircraft wing. The results demonstrate that the blade will fail at the highest probability path, the engine two-stage rotor will fail by fracture at the rim and the aircraft wing will fail at 109 fatigue cycles with a probability of 0.9967.

Author

Degradation; Fracturing; Probability Theory; Space Shuttle Main Engine; Failure; Composite Materials

20080023131 Indian Space Research Organization, Ahmedabad, India

Investigation of MLF for with PZT Powder Coated Composite Laminates using ASTM Standards

Munjal, B. S.; Sarma, P. V. B. A. S.; Trivedi, H. V.; Journal of Spacecraft Technology, Volume 18, No. 1; January 2008, pp. 48-60; In English; See also [20080023129](#); Original contains color and black and white illustrations; Copyright; Avail.:

Other Sources

As per the literature survey, thin hybrid layers of viscoelastic and magnetostrictive powders can give vibration damping of smart structural systems. Though, these smart materials can be used for damping of thin flexible structural systems, they have some typical practical limitations of usage in the domain of microwave antenna applications due to sometimes EMI (Electro-Magnetic Interference) and EMC (Electro-Magnetic Coupling) issues at higher transmit and receive radio frequencies. In this paper, an attempt has been made in the hither to fore unexplored domain of investigation of the use of thin hybrid, high sensitivity ferroelectrically soft piezo electric ceramic material coatings (SP-4 and SP-5A) in lieu of Magnetostrictive powder layers for passive vibration damping effects on a wide gamut of composite materials at ambient temperature of 72.4 F(22.4 C). This paper, presents the estimation of Composite Loss Factor (CLF) or also called Modal Loss Factor (MLF) for piezo powder coated composites at ambient temperature. The encouraging results w.r.t. the MLF and increased damping at resonant frequencies for piezo coated CFRP composites, may make the investigation a possible candidate for Radio Frequency (RF) applications in future w.r.t damping out the micro-vibrations experienced in-orbit by today's sophisticated high frequency Earth observation satellite antennae reflectors with improved pointing accuracies and resolutions and that too with negligible weight penalty due to thin hybrid piezo coating.

Author

Smart Materials; Magnetostriction; Viscoelasticity; Ceramic Coatings; Composite Materials; Microwave Antennas; Vibration Damping; Powder (Particles); Radio Frequencies

20080023143 NASA Glenn Research Center, Cleveland, OH, USA

Novel Noncontact Method for Simultaneously Measuring Absolute Thickness and Physical Density in Dielectric Materials

Roth, Donald J.; Seebo, Jeffrey P.; Winfree, W. P.; [2007]; 27 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 939904.05.03.02.01; Copyright; Avail.: Other Sources

This article describes a noncontact single-sided terahertz electromagnetic measurement and imaging method that simultaneously measures density and thickness variation in dielectric (insulating) materials. The method was demonstrated for two materials--Space Shuttle External Tank sprayed-on foam insulation and a silicon nitride ceramic. It is believed that this method can be used as a noncontact measurement method for dielectric materials backed by a conducting or semi-conducting material where density and thickness variation require precision mapping for the dielectric.

Author

Dielectrics; Electromagnetic Measurement; Thickness; Silicon Nitrides; Ceramics; Insulation; Foams; Imaging Techniques

20080023399 NASA Glenn Research Center, Cleveland, OH, USA

Enigmatic Moisture Effects on Al₂O₃ Scale and TBC Adhesion

Smialek, James L.; June 2008; 16 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.16.02

Report No.(s): NASA/TM-2008-215206; E-16480; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023399>

Alumina scale adhesion to high temperature alloys is known to be affected primarily by sulfur segregation and reactive element additions. However, adherent scales can become partially compromised by excessive strain energy and cyclic cracking. With time, exposure of such scales to moisture can lead to spontaneous interfacial decohesion, occurring while the samples are maintained at ambient conditions. Examples of this Moisture-Induced Delayed Spallation (MIDS) are presented for NiCrAl and single crystal superalloys, becoming more severe with sulfur level and cyclic exposure conditions. Similarly, delayed failure or Desk Top Spallation (DTS) results are reviewed for thermal barrier coatings (TBCs), culminating in the water drop failure test. Both phenomena are discussed in terms of moisture effects on bulk alumina and bulk aluminides. A mechanism is proposed based on hydrogen embrittlement and is supported by a cathodic hydrogen charging experiment. Hydroxylation of aluminum from the alloy interface appears to be the relevant basic reaction.

Author

Adhesion; Aluminum Oxides; Heat Resistant Alloys; Moisture; Thermal Control Coatings; Aluminum Alloys

20080023445 NASA Marshall Space Flight Center, Huntsville, AL, USA

Application of Pi Preform Composite Joints in Fabrication of NASA Composite Crew Module Demonstration Structure

Higgins, John E.; Pelham, Larry; April 07, 2008; 5 pp.; In English; 49th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 7-10 Apr. 2008, Schaumburg, IL, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: [C01](#), CD-ROM: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023445>

This paper will describe unique and extensive use of pre-woven and impregnated pi cross-sections in fabrication of a carbon composite demonstration structure for the Composite Crew Module (CCM) Program. The program is managed by the NASA Safety and Engineering Center with participants from ten NASA Centers and AFRL. Multiple aerospace contractors are participating in the design development, tooling and fabrication effort as well. The goal of the program is to develop an agency wide design team for composite habitable spacecraft. The specific goals for this development project are: a) To gain hands on experience in design, building and testing a composite crew module. b) To validate key assumptions by resolving composite spacecraft design details through fabrication and testing of hardware. This paper will focus on the design and fabrication issues supporting selection of the Lockheed Martin patented Pi pre-form to provide sound composite joints a numerous locations in the structure. This abstract is based on Preliminary Design data. The final design will continue to evolve through the fall of 2007 with fabrication mostly completed by conference date.

Author

Fabrication; Preforms; Spacecraft Modules; Composite Structures; Spacecraft Design

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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*.

20080022288 UT-Battelle, LLC, Oak Ridge, TN, USA

Tandem-in-time and-in-Space Mass Spectrometer and Associated Method for Tandem Mass Spectrometry

Goeringer, D. E., Inventor; Mcluckey, S. A., Inventor; 13 May 04; 9 pp.; In English

Contract(s)/Grant(s): DE-AC05-00OR22725

Patent Info.: Filed Filed 13 May 04; US-Patent-Appl-SN-10-845-468

Report No.(s): PB2007-109092; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Applicant's present invention comprises an apparatus having a tandem configuration of a three-dimensional or linear RF multipole ion trap, a linear RF multipole device and a time-of-flight mass spectrometer, and the associated method of operation generating an associated product ion mass spectrum and a mass spectrum of residual parent ions wherein the associated

product ion mass spectrum is combined with the mass spectrum of the residual parent ions to generate a three-dimensional mass spectrum of parent and associated product ions from a single, stored population of heterogeneous ions.

NTIS

Mass Spectrometers; Mass Spectroscopy

20080022327 Ross (Sheridan) PC, Denver, CO, USA

Recovery of Organic Acids

Verser, T. W., Inventor; Eggeman, T. J., Inventor; 28 Jan 05; 15 pp.; In English

Contract(s)/Grant(s): DE-FG36-03GO13010

Patent Info.: Filed Filed 28 Jan 05; US-Patent-Appl-SN-11-046-206

Report No.(s): PB2007-109164; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method is disclosed for the recovery of an organic acid from a dilute salt solution in which the cation of the salt forms an insoluble carbonate salt. A tertiary amine and CO₂ are introduced to the solution to form the insoluble carbonate salt and a complex between the acid and an amine. A water immiscible solvent, such as an alcohol, is added to extract the acid/amine complex from the dilute salt solution to a reaction phase. The reaction phase is continuously dried and a product between the acid and the solvent, such as an ester, is formed.

NTIS

Patent Applications; Solubility; Alcohols; Esters

20080022347 Xerox Palo Alto Research Center, CA, USA

Thermal Sensing

Bruce, R. H., Inventor; De Bruyker, D., Inventor; Torres, F. E., Inventor; Wolkin, M. V., Inventor; 27 Jun 05; 37 pp.; In English

Contract(s)/Grant(s): HHSN266200400058C; N01-A1-40058

Patent Info.: Filed Filed 27 Jun 05; US-Patent-Appl-SN-11-167 746

Report No.(s): PB2007-109115; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In thermal sensing devices, such as for calorimetry, a support layer or central layer can have a thermometer element or other thermal sensor on one side and a thermally conductive structure or component on the other. The thermally conductive structure can conduct temperature or other thermal input signals laterally across the support layer or central layer. The temperature or signals can then be provided to the thermometer element, such as by thermal contact through the support layer. An electrically conducting, thermally isolating anti-coupling layer, such as of gold or chromium, can reduce capacitive coupling between the thermally conductive structure and the thermometer element or other thermal sensor.

NTIS

Detection; Patent Applications; Temperature Measurement

20080022360 Hoag (Foley), LLP, Boston, MA, USA

Copper-Catalyzed Formation of Carbon-Heteroatom and Carbon-Carbon Bonds

Buchwald, S. L., Inventor; Klapars, A., Inventor; Kwong, F. Y., Inventor; Streiter, E. R., Inventor; Zanon, J., Inventor; 24 May 05; 62 pp.; In English

Contract(s)/Grant(s): NIH-R01 GM58160

Patent Info.: Filed Filed 24 May 05; US-Patent-Appl-SN-11-090-951

Report No.(s): PB2007-109071; No Copyright; Avail.: CASI: [A04](#), Hardcopy

One aspect of the present invention relates to copper-catalyzed carbon-heteroatom and carbon-carbon bond-forming methods. In certain embodiments, the present invention relates to copper-catalyzed methods of forming a carbon-sulfur bond between the sulfur atom of a thiol moiety and the activated carbon of an aryl, heteroaryl, or vinyl halide or sulfonate. In other embodiments, the present invention relates to copper(II)-catalyzed methods of forming a carbon-nitrogen bond between the nitrogen atom of an amide and the activated carbon of an aryl, heteroaryl, or vinyl halide or sulfonate. In certain embodiments, the present invention relates to copper-catalyzed methods of forming a carbon-carbon bond between the carbon atom of cyanide ion and the activated carbon of an aryl, heteroaryl, or vinyl halide or sulfonate. In another embodiment, the present invention relates to a copper-catalyzed method of transforming an aryl, heteroaryl, or vinyl chloride or bromide into the corresponding aryl, heteroaryl, or vinyl iodide. Yet another embodiment of the present invention relates to a tandem method, which may be practiced in a single reaction vessel, wherein the first step of the method involves the copper-catalyzed formation of an aryl, heteroaryl, or vinyl iodide from the corresponding aryl, heteroaryl, or vinyl chloride or bromide; and the

second step of the method involves the copper-catalyzed formation of an aryl, heteroaryl, or vinyl nitrile, amide or sulfide from the aryl, heteroaryl, or vinyl iodide formed in the first step.

NTIS

Bonding; Carbon; Catalysis; Chemical Bonds; Copper; Joints (Junctions); Patent Applications

20080022931 Air Force Research Lab., Wright-Patterson AFB, OH USA

Sonic Fatigue Testing of a Functionally Graded Ti/TiB Material

Byrd, Larry; Tuegel, Eric J; Quast, Jeffrey; Boehlert, Carl; Jan 2008; 147 pp.; In English

Contract(s)/Grant(s): Proj-A0AM

Report No.(s): AD-A477877; AFRL-RB-WP-TR-2008-3021; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477877>

The objective of this program was to determine how a functionally graded metal-ceramic material responds to high-frequency loading that is characteristic of sonic fatigue. This material has potential use as skins of aerodynamically heated structure and will experience fluctuating pressure that may result in sonic fatigue. Fatigue cracking starts in the brittle ceramic-rich layer. It was thought that the ductile metal-rich layers would increase the life of the specimen over a monolithic ceramic-rich specimen. This could not be confirmed nor refuted with the limited test data obtained. It was clear that a better sonic fatigue test method is needed for these types of materials. The current test method does not maintain sufficient control of the test.

DTIC

Acoustic Fatigue; Ceramics; Fatigue Tests; Functionally Gradient Materials; Titanium; Titanium Borides

20080023117 Michigan Univ., Ann Arbor, MI, USA

Np Incorporation into Uranyl Alteration Phases: A Quantum Mechanical Approach

Shuller, L.; Ewing, R.; Becker, U.; Nov. 30, 2006; 13 pp.; In English

Report No.(s): DE2007-899954; No Copyright; Avail.: National Technical Information Service (NTIS)

No abstract available

Quantum Mechanics; Radiochemistry

20080023124 Du Pont de Nemours (E. I.) and Co., Wilmington, DE, USA

Method for Purifying and Recovering Silk Proteins Using Magnetic Affinity Separation

Hoffmann, C., Inventor; Keller, K., Inventor; 20 Apr 05; 23 pp.; In English

Contract(s)/Grant(s): DE-FC36-99G010287

Patent Info.: Filed Filed 20 Apr 05; US-Patent-Appl-SN-11-110-424

Report No.(s): PB2007-109266; No Copyright; Avail.: CASI: A03, Hardcopy

A method for the purification of recombinant silk proteins from a sample using magnetic affinity separation is described. The recombinant silk protein is expressed with an affinity tag which has a high binding affinity for an affinity ligand immobilized on magnetic particles. In the method, the processes of clarification of the crude silk protein extract, concentration of the product and purification of the product are combined in a single step involving the affinity capture of the spider silk protein onto the magnetic particles directly from the extract. The product yields are improved due to the reduced number of steps in the purification process.

NTIS

Magnetic Fields; Proteins; Separators; Silk

20080023218 Drexel Univ., Philadelphia, PA, USA

Atomic Scale Investigations of the Struc. and Dynamics of Complex Catalytic Materials

Sohlberg, K.; May 2007; 20 pp.; In English

Report No.(s): DE2007-903413; No Copyright; Avail.: National Technical Information Service (NTIS)

By some accounts, catalysis impacts = 30% of GDP in developed countries (Maxwell, I. E. Nature 394, 325-326 (1998)). Catalysis is the enabling technology for petroleum production, for control of gaseous emissions from petroleum combustion, and for the production of industrial and consumer chemicals. Future applications of catalysis are potentially even more far reaching. There is an ever-growing need to move the economy from a fossil-fuel energy base to cleaner alternatives. Hydrogen-based combustion systems and fuel cells could play a dominant role, given a plentiful and inexpensive source of

hydrogen. Photocatalysis is the most promising clean technology for hydrogen production, relying solely on water and sunlight, but performance enhancements in photocatalysis are needed to make this technology economically competitive. Given the enormously wide spread utilization of catalysts, even incremental performance enhancements would have far-reaching benefits for multiple end-use sectors. In the area of fuel and chemical production, such improvements would translate into vast reductions in energy consumption. At the consumption end, improvements in the catalysts involved would yield tremendous reductions in pollution. In the area of photocatalysis, such efficiency improvements could finally render hydrogen an economically viable fuel. Prerequisite to the non-empirical design and refinement of improved catalysts is the identification of the atomic-scale structure and properties of the catalytically active sites. This has become a major industrial research priority. The focus of this research program was to combine atomic-resolution Z-contrast electron microscopy with first-principles density functional theory calculations to deliver an atomic-scale description of heterogeneous catalytic systems that could form the basis for non-empirical design of improved catalysts with greater energy efficiency.

NTIS

Atoms; Catalysis; Electron Microscopy

20080023227

Microbubble Compositions, and Methods for Preparing and Using Same

Kilbanov, A. L., Inventor; Ley, K. F., Inventor; Rycank, J. J., Inventor; 11 Jul 03; 23 pp.; In English

Contract(s)/Grant(s): NIH T32 HL07284-26; NIH RO1 HL64381

Patent Info.: Filed Filed 11 Jul 03; US-Patent-Appl-SN-10-511-383

Report No.(s): PB2007-109209; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Described are microbubble compositions including microbubbles having membranes that incorporate modified surface features that may be useful, for example, in facilitating binding to a target surface or substance. The surface features may include non-spherical attributes such as crenations, folds, projections, or wrinkles, which can increase the deformability of the microbubble membrane. Such microbubble compositions can be incorporated into targeted ultrasound contrast agents and methodologies. Methods for preparing modified microbubble compositions include providing microbubbles having spherical membranes, and converting the spherical membranes to non-spherical membranes having surface features as mentioned above. Targeting substances can be incorporated into the membranes before or after their conversion from spherical to non-spherical forms.

NTIS

Bubbles; Membrane Structures; Spherical Shells

20080023231 Senniger Powers Leavitt and Roedel, Saint Louis, MO, USA

Platinum-Ruthenium-Palladium Fuel Cell Electrocatalyst

Gorer, A., Inventor; 23 Jan 04; 11 pp.; In English

Contract(s)/Grant(s): DE-FG03-97ER92449-2

Patent Info.: Filed Filed 23 Jan 04; US-Patent-Appl-SN-10-763-842

Report No.(s): PB2007-109201; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A catalyst suitable for use in a fuel cell, especially as an anode catalyst, that contains platinum at a concentration that is between about 20 and about 60 atomic percent, ruthenium at a concentration that is between about 20 and about 60 atomic percent, palladium at a concentration that is between about 5 and about 45 atomic percent, and having an atomic ratio of platinum to ruthenium that is between about 0.7 and about 1.2. Alternatively, the catalyst may contain platinum at a concentration that is between about 25 and about 50 atomic percent, ruthenium at a concentration that is between about 25 and about 55 atomic percent, palladium at a concentration that is between about 5 and about 45 atomic percent, and having a difference between the concentrations of ruthenium and platinum that is no greater than about 20 atomic percent.

NTIS

Electrocatalysts; Fuel Cells; Patent Applications

20080023237 Rutgers - The State Univ., New Brunswick, NJ, USA

First Principles Investigations of Americium, Plutonium and their Mixtures using Dynamical Mean Field Theory. (Report for March 1, 2006-February 28, 2007)

Kotliar, G.; Savrasov, S.; Apr. 2007; 4 pp.; In English

Report No.(s): DE2007-902173; No Copyright; Avail.: National Technical Information Service (NTIS)

We developed a relativistic dynamical mean field approach to study the properties of Plutonium Americium mixtures.

NTIS

Actinide Series; Americium; Plutonium

METALS AND METALLIC MATERIALS

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

20080022292 Thomas Jefferson National Accelerator Facility, Newport News, VA, USA

Physical and Mechanical Properties of Niobium for SRF Science and Technology

Myneni, G. R.; January 2007; 7 pp.; In English

Report No.(s): DE2007-909317; No Copyright; Avail.: National Technical Information Service (NTIS)

Optimized mechanical and physical properties of high purity niobium are crucial for obtaining high performance SRF particle beam accelerator structures consistently. This paper summarizes these important material properties for both high purity polycrystalline and single crystal niobium.

NTIS

Mechanical Properties; Niobium; Research and Development; Superconducting Cavity Resonators; Technologies

20080023118 Missouri Univ., Rolla, MO, USA

AISI/DOE Technology Roadmap Program for the Steel Industry TRP 0150: Steelmaking Nozzles That Resist Clogging

Smith, J. D.; Peaslee, K. D.; Van Aken, D. C.; January 2006; 275 pp.; In English

Report No.(s): DE2007-899850; No Copyright; Avail.: Department of Energy Information Bridge

The overall objective of the research was to develop combinations of steelmaking practices, hot metal flow conditions, and refractory systems for submerged entry nozzles (SENs) that resist clogging and are able to withstand the thermal stresses that are experienced during use. The major findings were; (i) nozzle permeability was found to have no significant effect on clogging, (ii) calcium titanate reacted with alumina present in molten steel to form liquid calcium aluminates which could dramatically reduce clogging, (iii) microscopy on spent simulation nozzles showed no accretion formation in the nozzles coated with calcium titanate, and (iv) air aspiration does not play a significant role in nozzle clogging at the levels of permeability studied.

NTIS

Inclusions; Industries; Plugging; Steels

20080023121 Dinsmore and Shohl, Dayton, OH, USA

Chromium-Free Welding Consumable

Frankel, G. S., Inventor; Lippold, J. C., Inventor; 25 Mar 05; 10 pp.; In English

Contract(s)/Grant(s): DACA 72-03-P-0014

Patent Info.: Filed Filed 25 Mar 05; US-Patent-Appl-SN-11-090-976

Report No.(s): PB2007-109272; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A chromium-free welding consumable and a method of welding stainless steel to reduce the presence of chromium emissions. The consumable is made from an alloy that reduces the emission of chromium during a welding process, and include predominantly nickel, with between approximately five and twenty five percent by weight copper, up to approximately five percent by weight of palladium, up to approximately ten percent by weight of molybdenum and up to five percent non-copper alloying ingredients. Welding consumables made from the alloy are particularly well-suited for welding austenitic stainless steels, such as type 304 stainless steel. The method involves using chromium-free weld filler material with a stainless steel base material.

NTIS

Chromium; Stainless Steels; Welding

20080023506 National Central Univ., Jung-Li, Taiwan, Province of China

Effect of Pre-Straining and Natural Aging on Precipitation Behavior of Aluminum Alloy 6022

Shen, Chin-Hui; Ou, Bin-Lung; Journal of the Chinese Institute of Engineers, Volume 31, No.1; January 2008, pp. 181-187; In English; See also [20080023495](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

The influences of natural aging and pre-straining on the age-hardening response of AA6022 (Al-0.6Mg-1.0Si) has been investigated in this study. The precipitation behaviors of samples of the alloy were analyzed using differential scanning calorimetry (DSC), as well as by measuring the electrical conductivity, and confirmed by microstructure observation using transmission electron microscopy (TEM). Tensile tests and microhardness measurements were performed to determine the mechanical properties of the samples. With an increase in the natural aging time at room temperature (RT), more GP zones

(I) are formed, which leads to a lower peak microhardness in artificially aged specimens. The initial decrease in the microhardness of the naturally aged sample during artificial aging could be attributed to the reversion of GP zones (I) that formed during natural aging. Pre-straining has a marked influence on the subsequent precipitation process of the AA6022, and indicates that suitable pre-straining can significantly reduce the detrimental effects of natural aging on the artificial aging kinetics.

Author

Aluminum Alloys; Precipitation Hardening; Time Temperature Parameter; Mechanical Properties; Aging (Metallurgy); Microhardness; Transmission Electron Microscopy

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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*.

20080023091 Honeybee Robotics Ltd., New York, NY, USA

Evaluation of Perfluoropolyether Lubricant Lifetime in the High Stress and High Stress-Cycle Regime for Mars Applications

Herman, Jason; Davis, Kiel; 39th Aerospace Mechanisms Symposium; May 2008, pp. 69-82; In English; See also [20080023060](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The successful operation of long-life, highly loaded mechanisms used for planetary exploration or autonomous structures assembly will depend upon the ability to effectively lubricate rolling-element bearings. As new tools are developed (i.e., drill, abraders, robotic manipulators, etc.) that interact with their environment in a more direct manner, lubricants will be pushed past the bounds that current scientific literature has published. This paper details results from bearing lubrication lifetime testing performed in support of Honeybee Robotics development of the Mars Science Laboratory (MSL) Surface Removal Tool (SRT). This testing was done due to the lack of available data in research literature that is applicable to the lubrication regime the SRT bearings are being designed for. Based on the test results, the chosen bearing arrangement can be used for the SRT Grind Shaft bearings with the use of a Braycote Micronic 601EF grease-plate with a 10 vol% grease slurry fill (50/50 wt% Braycote Micronic 601EF and Brayco 815Z). This arrangement showed no signs of detrimental degradation over the course of the 3x life test. The purely grease-plated bearing ran at a consistently higher torque and showed signs of failure beginning at approximately $2.2 \times 10^{(exp 7)}$ revs (approximately $6.3 \times 10^{(exp 7)}$ stress-cycles) with a torque over-limit failure at approximately $4.5 \times 10^{(exp 7)}$ revs (approximately $1.3 \times 10^{(exp 8)}$ stress-cycles). Barring cold-start torque margin limitations, it is recommended that any long-life bearing application include some vol% grease-pack in addition to a standard grease-plate to reduce parasitic torque and increase bearing life. While these results are specific to a particular environment and loading condition, they demonstrate the extended capabilities of a commonly used flight lubricant outside of the range that is published in current research literature.

Author

Lubricants; Life (Durability); Polymers; Bearings; Mechanical Devices; Mechanical Engineering

20080023204 InHand Electronics, Inc., Rockville, MD USA

Soldier Flexible Personal Digital Assistant Program

Price, Mark; Woytowich, Jason; Carlson, Marc; Jan 8, 2008; 31 pp.; In English

Contract(s)/Grant(s): W911QY-07-C-0022

Report No.(s): AD-A477617; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477617>

The main goal of the Soldier Flexible Personal Digital Assistant Program was to develop prototypes of a novel flexible display technology device for demonstration in a laboratory setting and use in Future Force Warrior (FFW) demonstrations. This device was designed to meet the needs of FFW and to provide situational awareness, mapping software, and other data for the soldier. The key unique feature of the Soldier Flexible PDA Program is the integration of state-of-the-art flexible display technology. This technology, available in different forms from E-Ink and from the U.S. Army Flexible Display Center

at Arizona State University, can be used to create novel packages and mechanical enclosures that better conform to body-worn computing requirements and also have relatively low power requirements. The reduction of the size and weight of batteries needed will lengthen mission profiles and also improve body-worn requirements.

DTIC

Display Devices; Software Development Tools

20080023212 Williams (Hovey), LLP, Kansas City, MO, USA

Anti-Reflective Coatings using Vinyl Ether Crosslinkers

Guerrero, D. J., Inventor; Cox, R. C., Inventor; Weimer, M. W., Inventor; 14 Apr 05; 9 pp.; In English

Contract(s)/Grant(s): DASG60-01-C-0047

Patent Info.: Filed Filed 14 Apr 05; US-Patent-Appl-SN-11 105 862

Report No.(s): PB2007-109135; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Novel, wet developable anti-reflective coating compositions and methods of using those compositions are provided. The compositions comprise a polymer and/or oligomer having acid functional groups and dissolved in a solvent system along with a crosslinker and a photoacid generator. The preferred acid functional group is a carboxylic acid, while the preferred crosslinker is a vinyl ether crosslinker. In use, the compositions are applied to a substrate and thermally crosslinked. Upon exposure to light, the cured compositions will decrosslink, rendering them soluble in typical photoresist developing solutions (e.g., alkaline developers).

NTIS

Antireflection Coatings; Ethers; Oligomers; Polymers; Chemical Compounds

20080023214 Virginia Univ., Charlottesville, VA, USA

Method for Manufacture of Cellular Materials and Structures for Blast and Impact Mitigation and Resulting Structure

Wadley, H. N. G., Inventor; 23 Jul 03; 10 pp.; In English

Contract(s)/Grant(s): N00014-01-1-1051

Patent Info.: Filed Filed 23 Jul 03; US-Patent-Appl-SN-10 522 068

Report No.(s): PB2007-109132; No Copyright; Avail.: CASI: [A02](#), Hardcopy

Provided is the utilization of face panels containing core materials topologically structured at small scale, relative to a system (e.g. ship hull) that utilize them. They are optimized to absorb or reflect the energy subject to, while also possessing the ability to efficiently support high structural loads. It is entirely compatible with double-hull ship design concepts, because the volume between the hulls is used to locate the energy absorbing material substructures. The approach can be generalized to provide protection from impacts of low, intermediate or high intensity. The technology to design such structures requires materials selection and cell topology designs coupled with and techniques for the affordable manufacturing of structures that must be able to sustain severe dynamic deformations. It requires a coupling of effects occurring and phenomena that occur at the materials and structural levels.

NTIS

Panels; Foams; Impact Tolerances; Absorbers (Materials); Substructures; Structural Design; Manufacturing

20080023215 Gifford, Krass, Groh, Sprinkle & Citkowski, P.C., Troy, MI, USA

Method and Apparatus for the Chemical Vapor Deposition of Materials

Fanton, M. A., Inventor; Snyder, D. W., Inventor; Skowronski, M., Inventor; 10 Jan 05; 7 pp.; In English

Contract(s)/Grant(s): N002402-D-6604

Patent Info.: Filed Filed 10 Jan 05; US-Patent-Appl-SN-11 032 449

Report No.(s): PB2007-109131; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The halide chemical vapor deposition process deposits a chemical compound comprised of at least two different elements. The method employs a first process gas which includes a halogenated compound of a first one of the at least two different elements, and a second process gas which includes hydrogen and a second one of at least two different elements. The process gases are maintained in separation until they are contacted in a deposition chamber proximate a substrate. The gases, which

are generally preheated to a temperature of less than their thermal decomposition temperatures, are contacted in a deposition region proximate the substrate, and react to generate a deposition species and a hydrogen halide which is removed. Also disclosed is an apparatus for practicing the invention.

NTIS

Patent Applications; Vapor Deposition

20080023216 Virginia Univ., Charlottesville, VA, USA

Apparatus and Method for High Rate Uniform Coating, including Non-Line of Sight

Hass, D. D., Inventor; Queheillait, D. T., Inventor; Wadley, H. N. G., Inventor; 25 Apr 03; 33 pp.; In English

Contract(s)/Grant(s): N00014-00-1-0342

Patent Info.: Filed Filed 25 Apr 03; US-Patent-Appl-SN-10 512 161

Report No.(s): PB2007-109130; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A direct vapor deposition (DVD) apparatus and method is taught, that provides a carrier gas flow entraining vapor atoms for the coating of regions on a substrate that are not in line-of-sight. The degree of non line-of-sight (NLOS) coating, hence thickness uniformity around the substrate is a sensitive function of the flow conditions. For a fixed background pressure in the region of deposition, an increase in the uniformity of the coating thickness is accomplished as the flow velocity is reduced. This improvement in uniformity is a result of an increase in the fraction of vapor atoms which deposit in NLOS positions on the substrate such as backside (21) of fiber (65) as indicated by vapor streamlines (51). Vapor impact width (VIW) is the width of the vapor flux impacting on some area of the fiber. Front side coating (FSC) width is the vapor width of atoms impacting on the substrate frontside (22).

NTIS

Coating; Line of Sight; Patent Applications; Vapor Deposition

20080023222 Tufts Univ., Boston, MA, USA; Massachusetts Inst. of Tech., Cambridge, MA, USA

Silk Biomaterials and Methods of Use Thereof

Kaplan, D. L., Inventor; Jin, H. J., Inventor; Rutledge, G., Inventor; Fridrikh, S., Inventor; 23 Dec 04; 35 pp.; In English

Contract(s)/Grant(s): NIH-R01 DE13405-01A1; NSF-DMR0090384

Patent Info.: Filed Filed 23 Dec 04; US-Patent-Appl-SN-11-020-650

Report No.(s): PB2007-109233; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention provides an all-aqueous process and composition for production of silk biomaterials, e.g., fibers, films, foams and mats. In the process, at least one biocompatible polymer, such as poly(ethylene oxide) (PEO) (a well-documented biocompatible material), was blended with the silk protein prior to processing e.g., electrospinning. We discovered that this step avoids problems associated with conformational transitions of fibroin during solubilization and reprocessing from aqueous solution which lead to embrittled materials. Moreover, the process avoids the use of organic solvents that can pose problems when the processed biomaterials are exposed to cells in vitro or in vivo.

NTIS

Silk; Polymer Blends; Aqueous Solutions; Chemical Composition

20080023230 Carrithers Law Office, PLLC, Louisville, KY, USA

Carbon Nanopipettes Methods of Making and Applications

Sunkara, M. K., Inventor; Mani, R. C., Inventor; 9 Sep 04; 10 pp.; In English

Contract(s)/Grant(s): NSF-9876259

Patent Info.: Filed Filed 9 Sep 04; US-Patent-Appl-SN-10-936-889

Report No.(s): PB2007-109202; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A new morphological manifestation of carbon based nanostructures in the form of tapered whiskers with uniform 1-3 nm hollowness. The base of the whiskers is in the sub-micron scale, tapering uniformly to form a pointed tip in the form of a pipette. The hollow nanopipettes have a shell containing helical graphitic sheets.

NTIS

Pipettes; Nanostructures (Devices)

20080023232 Advanced Ceramics Research, Inc., Tucson, AZ, USA

Methods for Preparation of Metallic and Ceramic Foam Products and Products Made

Artz, G., Inventor; Vaidyanathan, R., Inventor; Fulcher, M. L., Inventor; Rigali, M. J., Inventor; Lombardi, J. L., Inventor; 28 Jan 05; 16 pp.; In English

Contract(s)/Grant(s): DAAD19-OO-C-0225; DAAD19-01-C-0054

Patent Info.: Filed 28 Jan 05; US-Patent-Appl-SN-11-045-408

Report No.(s): PB2007-109200; No Copyright; Avail.: CASI: **A03**, Hardcopy

The present invention relates to the fabrication of low cost, in situ, porous metallic, ceramic and cermet foam structures having improved mechanical properties such as energy absorption and specific stiffness. Methods of fabricating the structures from compositions including ceramic and/or metallic powders are provided. The flowable compositions also include an immiscible phase that results in pores within the final structure. Furthermore, the structures may be shaped to have external porosity, such as with mesh-like structures.

NTIS

Ceramics; Fabrication; Metal Foams; Patent Applications

20080023444 NASA Marshall Space Flight Center, Huntsville, AL, USA

Evaluation of the Effect of Silicone Contamination on Various Bond Systems and the Feasibility of Removing the Contamination

Stanley, Stephanie D.; April 06, 2008; 22 pp.; In English; American Chemical Society Meeting, 6-10 Apr. 2008, New Orleans, LA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NAS8-97238; Copyright; Avail.: CASI: **C01**, CD-ROM: **A03**, Hardcopy

Silicone is a contaminant that can cause catastrophic failure of a bond system depending on the materials and processes used to fabricate the bond system. Unfortunately, more and more materials are fabricated using silicone. The purpose of this testing was to evaluate which bond systems are sensitive to silicone contamination and whether or not a cleaning process could be utilized to remove the silicone to bring the bond system performance back to baseline. Due to the extensive nature of the testing attempts will be made to generalize the understanding within classes of substrates, bond systems, and surface preparation and cleaning methods. This study was done by contaminating various meta! (steel, inconel, and aluminum), phenolic (carbon cloth phenolic and glass cloth phenolic), and rubber (natural rubber, asbestos-silicone dioxide filled natural butyldiene rubber, silica-filled ethylene propylenediene monomer, and carbon-filled ethylene propylenediene monomer) substrates which were then bonded using various adhesives and coatings (epoxy-based adhesives, paints, ablative compounds, and Chemlok adhesives) to determine the effect silicone contamination has on a given bond system's performance. The test configurations depended on the bond system being evaluated. The study also evaluated the feasibility of removing the silicone contamination by cleaning the contaminated substrate prior to bonding. The cleaning processes also varied depending on bond system.

Author

Bonding; Contamination; Fabrication; Silicones; Feasibility Analysis

20080023615 Clemson Univ., Clemson, SC USA

Process for separating metallic from semiconducting single-walled carbon nanotubes

Sun, Ya-Ping, Inventor; May 20, 2008; 15 pp.; In English

Contract(s)/Grant(s): NCC1-01036

Patent Info.: Filed December 16, 2004; US-Patent-7,374,685; US-Patent-Appl-SN-11/013,900; No Copyright; Avail.:

CASI: **A03**, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023615>

A method for separating semiconducting single-walled carbon nanotubes from metallic single-walled carbon nanotubes is disclosed. The method utilizes separation agents that preferentially associate with semiconducting nanotubes due to the electrical nature of the nanotubes. The separation agents are those that have a planar orientation, .pi.-electrons available for association with the surface of the nanotubes, and also include a soluble portion of the molecule. Following preferential association of the separation agent with the semiconducting nanotubes, the agent/nanotubes complex is soluble and can be solubilized with the solution enriched in semiconducting nanotubes while the residual solid is enriched in metallic nanotubes.

Official Gazette of the U.S. Patent and Trademark Office

Carbon Nanotubes; Phase Separation (Materials); Semiconductors (Materials)

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*.

20080022409 NASA Glenn Research Center, Cleveland, OH, USA

Fuel Cell Thermal Management Through Conductive Cooling Plates

Colozza, Anthony J.; Burke, Kenneth A.; May 2008; 50 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 038957.04.02.03.01

Report No.(s): NASA/TM--2008-215149; E-16392; Copyright; Avail.: CASI: [A03](#), Hardcopy

An analysis was performed to evaluate the concept of utilizing conductive cooling plates to remove heat from a fuel cell stack, as opposed to a conventional internal cooling loop. The potential advantages of this type of cooling system are reduced stack complexity and weight and increased reliability through the reduction of the number of internal fluid seals. The conductive cooling plates would extract heat from the stack transferring it to an external coolant loop. The analysis was performed to determine the required thickness of these plates. The analysis was based on an energy balance between the thermal energy produced within the stack and the heat removal from the cooling plates. To accomplish the energy balance, the heat flow into and along the plates to the cooling fluid was modeled. Results were generated for various numbers of cells being cooled by a single cooling plate. The results provided cooling plate thickness, mass, and operating temperature of the plates. It was determined that utilizing high-conductivity pyrolytic graphite cooling plates can provide a specific cooling capacity (W/kg) equivalent to or potentially greater than a conventional internal cooling loop system.

Author

Fuel Cells; Temperature Control; Heat Transmission; Operating Temperature; Thermal Energy; Cooling Systems; Hydrogen Fuels

20080022944 NASA Marshall Space Flight Center, Huntsville, AL, USA

Numerical Determination of Critical Conditions for Thermal Ignition

Luo, W.; Wake, G. C.; Hawk, C. W.; Litchford, R. J.; February 2008; 98 pp.; In English; Original contains color and black and white illustrations

Report No.(s): NASA/TP-2008-215194; M-1218; Copyright; Avail.: CASI: [A05](#), Hardcopy

The determination of ignition or thermal explosion in an oxidizing porous body of material, as described by a dimensionless reaction-diffusion equation of the form $\tau u = \tau_0 u + \tau_1 e^{-1/u}$ over the bounded region O , is critically reexamined from a modern perspective using numerical methodologies. First, the classic stationary model is revisited to establish the proper reference frame for the steady-state solution space, and it is demonstrated how the resulting nonlinear two-point boundary value problem can be reexpressed as an initial value problem for a system of first-order differential equations, which may be readily solved using standard algorithms. Then, the numerical procedure is implemented and thoroughly validated against previous computational results based on sophisticated path-following techniques. Next, the transient nonstationary model is attacked, and the full nonlinear form of the reaction-diffusion equation, including a generalized convective boundary condition, is discretized and expressed as a system of linear algebraic equations. The numerical methodology is implemented as a computer algorithm, and validation computations are carried out as a prelude to a broad-ranging evaluation of the assembly problem and identification of the watershed critical initial temperature conditions for thermal ignition. This numerical methodology is then used as the basis for studying the relationship between the shape of the critical initial temperature distribution and the corresponding spatial moments of its energy content integral and an attempt to forge a fundamental conjecture governing this relation. Finally, the effects of dynamic boundary conditions on the classic storage problem are investigated and the groundwork is laid for the development of an approximate solution methodology based on adaptation of the standard stationary model.

Author

Ignition; Temperature Distribution; Reaction-Diffusion Equations; Explosions; Numerical Analysis; Boundary Conditions; Coordinates; Convection; Critical Temperature

SPACE PROCESSING

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

20080022947 NASA Marshall Space Flight Center, Huntsville, AL, USA

Sulfur ‘Concrete’ for Lunar Applications - Environmental Considerations

Grugel, R. N.; February 2008; 52 pp.; In English; Original contains color and black and white illustrations

Report No.(s): NASA/TM-2008-215250; M-1223; No Copyright; Avail.: CASI: [A04](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080022947>

Commercial use of sulfur concrete on Earth is well established, particularly in corrosive, e.g., acid and salt, environments. Having found troilite (FeS) on the Moon raises the question of using extracted sulfur as a lunar construction material, an attractive alternative to conventional concrete as it does not require water. For the purpose of this Technical Memorandum, it is assumed that lunar ore is mined, refined, and the raw sulfur processed with appropriate lunar regolith to form, for example, bricks. With this stipulation, it is then noted that the viability of sulfur concrete in a lunar environment, which is characterized by lack of an atmosphere and extreme temperatures, is not well understood. The work presented here evaluates two sets of small sulfur concrete samples that have been prepared using JSC-1 lunar simulant as an aggregate addition. One set was subjected to extended periods in high vacuum to evaluate sublimation issues, and the other was cycled between room and liquid nitrogen temperatures to investigate their subsequent mechanical integrity. Results are presented from both investigations, discussed, and put into the context of the lunar environment.

Author

Lunar Environment; Concretes; Sulfur; Sublimation; Liquid Nitrogen; Lunar Rocks

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*.

20080023495 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China

Journal of the Chinese Institute of Engineers, Volume 31, No.1

Chen, Shi-Shuenn, Editor; January 2008; ISSN 0253-3839; 191 pp.; In English; See also 20080023496 - 20080023513; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

Topics covered include: Breakup of Compound Liquid Jets under Periodic Excitation at Small Core-to-Shell Mass Ratios; Investigating Mechanical Properties of Epoxy/Organoclay Nanocomposites; An Efficient Algorithm to Obtain the Optimal Topology of Industrial Structural Design Problems; Parametric Deflection Corrections of Annular Sandwich Panels under Transverse Central Loads; Development of Geometrically Based Fabrication Emulator for MEMS Micromachining and Excimer Laser Ablation; Antiplane Problem of an Internal Crack Normal to the Interface of Two Bonded Functionally Graded Piezoelectric/Piezomagnetic Materials; Statistical Tests for Discerning Differences of Robustness of Horizontal Geodetic Networks due to Different Approaches; Modeling the Effect of Ground Improvement on Reducing Movement during Bermed Excavation in Clay; Predicting Peak Pressures from Computed CFD Data and Artificial Neural Networks Algorithm; Velocity Profiles of Nonlinear Shallow-Water Flows; Computer-Aided Evolution for Solving the Analytic Kronig-Penny Model; Novel Beamforming Implementation Using Cascade Second-Order Factors for Reduction of Weight Quantization Effect; Robust Stability of Discrete Singular Systems with Delayed State; Effect of Adjacent Channel Interference on Uplink Capacity in a Macrocell-Microcell-Overlapping WCDMA System; The Study of 2.4 GHz Radiation for PCB with WLAN Units; Discrete-Time Variable Structure Control for Robust Tracking and Model Following; Low-Complexity Hybrid Demosaicing for Color Filter Arrays; and Effect of Pre-Straining and Natural Aging on Precipitation Behavior of Aluminum Alloy 6022. Derived from text

Computational Fluid Dynamics; Velocity Distribution; Transverse Loads; Statistical Tests; Structural Design; Optimal Control; Micromachining; Microelectromechanical Systems

20080023513 National Cheng Kung Univ., Tainan, Taiwan, Province of China

Antiplane Problem of an Internal Crack Normal to the Interface of Two Bonded Functionally Graded Piezoelectric/ Piezomagnetic Materials

Chue, Ching-Hwei; Hsu, Wei-Hung; Journal of the Chinese Institute of Engineers, Volume 31, No.1; January 2008, pp. 53-69; In English; See also [20080023495](#); Original contains black and white illustrations

Contract(s)/Grant(s): NSC95-2221-E-006-046; Copyright; Avail.: Other Sources

This paper studies the antiplane problem of an internal impermeable or permeable crack normal to the interface of two bonded functionally graded piezoelectric/ piezomagnetic materials (FGPPMs). The material properties are assumed in exponential forms along the crack direction. Fourier transforms are used to reduce the crack problems to a system of singular integral equations, which is solved numerically by using the Gauss-Chebyshev integration technique. The stress, electric displacement and magnetic induction intensity factors at the crack tips are obtained numerically. The energy density theory is applied to study the effects of nonhomogeneous material parameter β_1 , and β_2 , boundary conditions and crack position on the fracture behavior. Some sub-problems are also discussed.

Author

Piezoelectricity; Magnetic Induction; Boundary Conditions; Cracks; Fracture Mechanics; Fourier Transformation; Crack Tips

32

COMMUNICATIONS AND RADAR

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

20080022325 Klauber and Jackson, Hackensack, NJ, USA

Independently Center Fed Dipole Array

Grebel, H., Inventor; Ni, N., Inventor; 17 May 05; 9 pp.; In English

Patent Info.: Filed 17 May 05; US-Patent-Appl-SN-11-130-839

Report No.(s): PB2007-109192; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A dipole array is provided for use as an Ultra Short Pulse (USP) transmitter or receiver in UWB communications systems, which reduces the output pulse dispersion. Instead of having all the dipole elements serially fed by a transmission line, the feeding in the array is made independently through a central point and the radiation is emitted and received broadsided with respect to the array plane. This configuration minimizes the relative time delay between radiating resonance frequencies.

NTIS

Patent Applications; Telecommunication; Dipole Antennas; Resonant Frequencies

20080022372 NASA Glenn Research Center, Cleveland, OH, USA

Space Telecommunications Radio Systems (STRS) Hardware Architecture Standard: Release 1.0 Hardware Section

Reinhart, Richard C.; Kacpura, Thomas J.; Smith, Carl R.; Liebetreu, John; Hill, Gary; Mortensen, Dale J.; Andro, Monty; Scardelletti, Maximilian C.; Farrington, Allen; May 2008; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 439432.07.02.03.03

Report No.(s): NASA/TP--2008-214471; E-16161; Copyright; Avail.: CASI: [A03](#), Hardcopy

This report defines a hardware architecture approach for software-defined radios to enable commonality among NASA space missions. The architecture accommodates a range of reconfigurable processing technologies including general-purpose processors, digital signal processors, field programmable gate arrays, and application-specific integrated circuits (ASICs) in addition to flexible and tunable radiofrequency front ends to satisfy varying mission requirements. The hardware architecture consists of modules, radio functions, and interfaces. The modules are a logical division of common radio functions that compose a typical communication radio. This report describes the architecture details, the module definitions, the typical functions on each module, and the module interfaces. Tradeoffs between component-based, custom architecture and a functional-based, open architecture are described. The architecture does not specify a physical implementation internally on each module, nor does the architecture mandate the standards or ratings of the hardware used to construct the radios.

Author

Radio Equipment; Telecommunication; Application Specific Integrated Circuits; Field-Programmable Gate Arrays; Mission Planning; NASA Space Programs; Signal Processing; Aerospace Systems

20080022949 Williams (Hovey), LLP, Kansas City, MO, USA

ISM Band to U-NII Band Frequency Transverter and Method of Frequency Transversion

Stepp, J. D., Inventor; Hensley, D., Inventor; 21 Apr 05; 17 pp.; In English

Contract(s)/Grant(s): DE AC04-01AL66850

Patent Info.: Filed Filed 21 Apr 05; US-Patent-Appl-SN-11 111 555

Report No.(s): PB2007-109153; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A frequency transverter and method for enabling bi-frequency dual-directional transfer of digitally encoded data on an RF carrier by translating between a crowded or otherwise undesirable first frequency band, such as the 2.4 GHz ISM band, and a less-crowded or otherwise desirable second frequency band, such as the 5.0 GHz-6.0 GHz U-NII band. In a preferred embodiment, the transverter connects between an existing data radio and its existing antenna, and comprises a bandswitch; an input RF isolating device; a transmuter; a converter; a dual output local oscillator; an output RF isolating device; and an antenna tuned to the second frequency band. The bandswitch allows for bypassing the transverter, thereby facilitating its use with legacy systems. The transmuter and converter are adapted to convert to and from, respectively, the second frequency band.

NTIS

Frequencies; Patent Applications; Oscillators

20080022950 Lawrence Livermore National Lab., Livermore, CA USA

Position Estimation of Transceivers in Communication Networks

Kent, C. A., Inventor; Dowla, F., Inventor; 28 Apr 04; 10 pp.; In English

Contract(s)/Grant(s): W-7405-ENG-48

Patent Info.: Filed Filed 28 Apr 04; US-Patent-Appl-SN-10 834 706

Report No.(s): PB2007-109154; No Copyright; Avail.: CASI: [A02](#), Hardcopy

This invention provides a system and method using wireless communication interfaces coupled with statistical processing of time-of-flight data to locate by position estimation unknown wireless receivers. Such an invention can be applied in sensor network applications, such as environmental monitoring of water in the soil or chemicals in the air where the position of the network nodes is deemed critical. Moreover, the present invention can be arranged to operate in areas where a Global Positioning System (GPS) is not available, such as inside buildings, caves, and tunnels.

NTIS

Communication Networks; Patent Applications; Transmitter Receivers

20080023062 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Development of a Spacecraft Antenna Pointing Gimbal

Monroe, Charles; Rossoni, Peter; 39th Aerospace Mechanisms Symposium; May 2008, pp. 415-425; In English; See also [20080023060](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The development of the pointing gimbal in the high-gain antenna system (HGAS) of the Solar Dynamics Observatory spacecraft is described. The gimbal was designed for 5 years of service in Geo-Synchronous orbit. The hardware incorporates multiple levels of redundancy, allows harnessing and waveguide along its full length across its two axes of rotation and points with an accuracy of better than 0.065 . Significant issues with actuator alignment, Electrical Contact Ring noise, pointing budget, and waveguide failures are described, along with their respective resolutions

Author

Solar Observatories; Helioseismology; Spacecraft Antennas; Gimbals; High Gain; Pointing Control Systems; Design Analysis; Mechanical Devices

20080023132 ISRO Satellite Centre, Peenya, Bangalore, India

Dual Gimbal Antenna Mechanism

Kumar, Abhishek; Ramakrishna, M. V.; Viswanatha, N.; Journal of Spacecraft Technology, Volume 18, No. 1; January 2008, pp. 1-7; In English; See also [20080023129](#); Original contains color and black and white illustrations; Copyright; Avail.:

Other Sources

DGA mechanism is essentially a two axis rotary drive actuator which rotates an antenna about two orthogonal axes by stipulated angles. The DGA mechanism makes the data transmit antenna to track the ground station in real time and transmit the data to ground station while the spacecraft is taking images. The need to slew the DGA during imagery collection while minimizing jitter of the spacecraft has led to challenging requirements for the gimbal mechanism and its components. A Shape

memory alloy based Pin-puller assembly is also developed for the hold down and release of DGA mechanism. The mechanism has been designed, qualified and already flown onboard Cartosat-2 satellite. The on-orbit performance of mechanism is satisfactory.

Author

Actuators; Gimbals; Real Time Operation; Shape Memory Alloys; Mechanical Drives

20080023146 NASA Glenn Research Center, Cleveland, OH, USA

Open Architecture Standard for NASA's Software-Defined Space Telecommunications Radio Systems

Reinhart, Richard C.; Johnson, Sandra K.; Kacpura, Thomas J.; Hall, Charles S.; Smith, Carl R.; Liebetreu, John; May 2008; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 439432.04.07.01

Report No.(s): NASA/TP-2008-214941; E-16174; Copyright; Avail.: CASI: [A03](#), Hardcopy

NASA is developing an architecture standard for software-defined radios used in space- and ground-based platforms to enable commonality among radio developments to enhance capability and services while reducing mission and programmatic risk. Transceivers (or transponders) with functionality primarily defined in software (e.g., firmware) have the ability to change their functional behavior through software alone. This radio architecture standard offers value by employing common waveform software interfaces, method of instantiation, operation, and testing among different compliant hardware and software products. These common interfaces within the architecture abstract application software from the underlying hardware to enable technology insertion independently at either the software or hardware layer. This paper presents the initial Space Telecommunications Radio System (STRS) Architecture for NASA missions to provide the desired software abstraction and flexibility while minimizing the resources necessary to support the architecture.

Author

Applications Programs (Computers); Architecture (Computers); Telecommunication; Radio Equipment; Transmitter Receivers; Aerospace Systems

20080023284 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Applying EVM to Satellite on Ground and In-Orbit Testing - Better Data in Less Time

Peters, Robert; Lebbink, Elizabeth-Klein; Lee, Victor; Model, Josh; Wezalis, Robert; Taylor, John; [2008]; 8 pp.; In English; Original contains color illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

Using Error Vector Magnitude (EVM) in satellite integration and test allows rapid verification of the Bit Error Rate (BER) performance of a satellite link and is particularly well suited to measurement of low bit rate satellite links where it can result in a major reduction in test time (about 3 weeks per satellite for the Geosynchronous Operational Environmental Satellite [GOES] satellites during ground test) and can provide diagnostic information. Empirical techniques developed to predict BER performance from EVM measurements and lessons learned about applying these techniques during GOES N, O, and P integration test and post launch testing, are discussed.

Author

GOES Satellites; Satellite Communication; Performance Tests; Ground Tests; Satellite Orbits; Bit Error Rate; Testing Time; Signal Analyzers

20080023465 NASA Langley Research Center, Hampton, VA, USA

A Preliminary Study of CO₂ Flux Measurements by Lidar

Gibert, Fabien; Koch, Grady J.; Beyon, Jeffrey Y.; Hilton, T.; Davis, Kenneth J.; Andrews, Arlyn; Ismail, Syed; Singh, Upendra N.; June 23, 2008; 4 pp.; In English; 24th International Laser Radar Conference, 23-27 Jun. 2008, Boulder, Co, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 478643.02.02.02.09; Copyright; Avail.: CASI: [A01](#), Hardcopy

A mechanistic understanding of the global carbon cycle requires quantification of terrestrial ecosystem CO₂ fluxes at regional scales. In this paper, we analyze the potential of a Doppler DIAL system to make flux measurements of atmospheric CO₂ using the eddy-covariance and boundary layer budget methods and present results from a ground based experiment. The goal of this study is to put CO₂ flux point measurements in a mesoscale context. In June 2007, a field experiment combining a 2-m Doppler Heterodyne Differential Absorption Lidar (HDIAL) and in-situ sensors of a 447-m tall tower (WLEF) took place in Wisconsin. The HDIAL measures simultaneously: 1) CO₂ mixing ratio, 2) atmosphere structure via aerosol

backscatter and 3) radial velocity. We demonstrate how to synthesize these data into regional flux estimates. Lidar-inferred fluxes are compared with eddy-covariance fluxes obtained in-situ at 396m AGL from the tower. In cases where the lidar was not yet able to measure the fluxes with acceptable precision, we discuss possible modifications to improve system performance.

Author

Carbon Dioxide; Ecosystems; Flux Quantization; Optical Radar; Differential Absorption Lidar; Doppler Radar

20080023577 Zagreb Univ., Zagreb, Croatia

Towards New Generation of Mobile Communications: Discovery of Ubiquitous Resources

Podobnik, Vedran; Jezic, Gordan; Trzec, Krunoslav; *Electrotechnical Review*, Volume 75, Nos. 1-2; January 2008, pp. 31-36; In English; See also [20080023568](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

Continual advances in wireless telecommunications together with the rapid proliferation of various types of portable devices are paving the road towards new generation of mobile communications. Next-generation mobile networks will create environments crowded with diverse types of ubiquitous semantic-aware communication-enabled devices which will provide a remarkable selection of resources (information and services). Consequently, such an environment will require efficient mechanisms which can match supplies (available resources) to demands (requested resources), anywhere and anytime. In this paper, we propose an economic approach to solving this problem combined with AI (Artificial Intelligence) concepts. We implemented a multi-agent system for enabling autonomous inter-device coordination in the heterogeneous environment of pervasive next-generation mobile networks. The efficiency of our model is realized by applying a resource discovery process which uses two-level filtration of available resources before a final ranked set of eligible resources is recommended to requesters in response to their needs. The filtration processes do not only consider the semantic information associated with available resources, but also ratings regarding the actual performance of resource providers (with respect to both price and quality) and the prices paid by providers for advertising their resources.

Author

Mobile Communication Systems; Information Systems; Telecommunication; Coordination; Autonomy; Artificial Intelligence; Filtration; Marketing

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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*.

20080022279 California Univ., Berkeley, CA, USA; Lawrence Livermore National Lab., Livermore, CA USA

Fiberoptic Fabry-Perot Optical Processor

Pocha, M. D., Inventor; McConaghy, C. F., Inventor; Wood, B. E., Inventor; Meyer, G. A., Inventor; 20 May 05; 16 pp.; In English

Contract(s)/Grant(s): DE-W-7405-ENG-48

Patent Info.: Filed 20 May 05; US-Patent-Appl-SN-11-134-548

Report No.(s): PB2007-109196; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An optical signal processor having a monolithic prism supporting one or more channels, and constructed from a first glass block joined to a second glass block at a beam splitter interface. The monolithic prism has thin film beam splitters and filters (such as I and Q filters) either deposited directly on the prism or attached to it. The beam splitter interface, and the thin film beam splitters and filters are arranged relative to each other so that a portion of the return-ranging collimated encoded beam from an external optical sensor is reflected to all the filters. And detectors are connected over the filters to detect particular components of the collimated encoded beam which are passed through the respective filters.

NTIS

Fiber Optics; Optical Computers; Optical Data Processing; Patent Applications; Signal Analyzers; Signal Processing

20080022283 Steptoe and Johnson LLP, Washington, DC, USA

Blue Light Emitting Semiconductor Nanocrystal Materials

Steckel, J. S., Inventor; Zimmer, J. P., Inventor; Coe-Sullivan, S., Inventor; Stott, N. E., Inventor; Bulovic, V., Inventor; 4 Mar 05; 20 pp.; In English

Contract(s)/Grant(s): NSF-DMR 0213282; DAAD-19-02-0002

Patent Info.: Filed 4 Mar 05; US-Patent-Appl-SN-11-071-244

Report No.(s): PB2007-109189; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A semiconductor nanocrystal includes a core including a first semiconductor material and an overcoating including a second semiconductor material. A monodisperse population of the nanocrystals emits blue light over a narrow range of wavelengths with a high quantum efficiency.

NTIS

Color; Nanocrystals; Patent Applications; Semiconductors (Materials)

20080022284 Park, Vaughan and Fleming, LLP, Davis, CA, USA

Switching Devices Based on Half-Metals

Fong, C. Y., Inventor; Qian, M., Inventor; Yuang, L. H., Inventor; 20 May 05; 10 pp.; In English

Patent Info.: Filed 20 May 05; US-Patent-Appl-SN-11-134-002

Report No.(s): PB2007-109188; No Copyright; Avail.: CASI: [A02](#), Hardcopy

One embodiment of the present invention provides a switching device that can vary a spin-polarized current based on an input signal. The switching device comprises a first conducting region, a second conducting region, and a half-metal region interposed between the first conducting region and the second conducting region. The half-metal region comprises a material which, at the intrinsic Fermi level, has substantially zero available electronic states in a minority spin channel. Changing the voltage of the half-metal region with respect to the first conducting region moves its Fermi level with respect to the electron energy bands of the first conducting region, which changes the number of available electronic states in the majority spin channel, and in doing so, changes the majority-spin polarized current passing through the switching device.

NTIS

Metals; Patent Applications; Switching; Electron Energy; Electric Potential

20080022323 Wright State Univ., Dayton, OH, USA

Electrodynamics of Direct Current Discharge

Shang, J. S.; Huang, P. G.; Yan, H.; Surzhikov, S. T.; January 07, 2008; 18 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): NCC3-1040; NCC3-590

Report No.(s): AIAA Paper 2008-1101; Copyright; Avail.: CASI: [A03](#), Hardcopy

A drift-diffusion model to simulate direct current discharge including the externally applied magnetic field is analyzed by a high-resolution, diagonally dominant numerical procedure. Three different configurations of direct current discharge were studied numerically - the electrodynamic structures of the classic parallel electrodes of infinite and finite dimension, as well as, the side-by-side electrode configurations. In the final configuration, an externally applied transverse magnetic field has also been applied in computational simulation to study the Lorentz force effect to the discharging structure. The solutions were compared with classic results, similar numerical simulations, and experimental observations of the discharging physics. Overall, the agreement is very good and the model can be used as a basis for the design of flow control experiments.

Author

Electrodynamics; Direct Current; Magnetic Fields; Lorentz Force; Diffusion

20080022414 NASA Glenn Research Center, Cleveland, OH, USA

A Temperature Sensor using a Silicon-on-Insulator (SOI) Timer for Very Wide Temperature Measurement

Patterson, Richard L.; Hammoud, Ahmad; Elbuluk, Malik; Culley, Dennis E.; May 2008; 14 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 939904.01.03.02.01

Report No.(s): NASA/TM--2008-215159; E-16401; Copyright; Avail.: CASI: [A03](#), Hardcopy

A temperature sensor based on a commercial-off-the-shelf (COTS) Silicon-on-Insulator (SOI) Timer was designed for extreme temperature applications. The sensor can operate under a wide temperature range from hot jet engine compartments to cryogenic space exploration missions. For example, in Jet Engine Distributed Control Architecture, the sensor must be able

to operate at temperatures exceeding 150 C. For space missions, extremely low cryogenic temperatures need to be measured. The output of the sensor, which consisted of a stream of digitized pulses whose period was proportional to the sensed temperature, can be interfaced with a controller or a computer. The data acquisition system would then give a direct readout of the temperature through the use of a look-up table, a built-in algorithm, or a mathematical model. Because of the wide range of temperature measurement and because the sensor is made of carefully selected COTS parts, this work is directly applicable to the NASA Fundamental Aeronautics/Subsonic Fixed Wing Program--Jet Engine Distributed Engine Control Task and to the NASA Electronic Parts and Packaging (NEPP) Program. In the past, a temperature sensor was designed and built using an SOI operational amplifier, and a report was issued. This work used an SOI 555 timer as its core and is completely new work.

Author

SOI (Semiconductors); Temperature Measurement; Temperature Sensors; Electronic Packaging; Jet Engines; Distributed Parameter Systems; Timing Devices; Engine Control; Active Control

20080022416 NASA Glenn Research Center, Cleveland, OH, USA

Development of a Temperature Sensor for Jet Engine and Space Missions Environments

Patterson, Richard L.; Hammoud, Ahmad; Culley, Dennis E.; Elbuluk, Malik; May 16, 2008; 14 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC06BA07B; WBS 939904.01.03.02.01

Report No.(s): NASA/TM-2008-215160; E-16402; Copyright; Avail.: CASI: [A03](#), Hardcopy

Electronic systems in aerospace and in space exploration missions are expected to encounter extreme temperatures and wide thermal swings. To address the needs for extreme temperature electronics, research efforts exist at the NASA Glenn Research Center (GRC) to develop and evaluate electronics for extreme temperature operations, and to establish their reliability under extreme temperature operation and thermal cycling; conditions that are typical of both the aerospace and space environments. These efforts are supported by the NASA Fundamental Aeronautics/Subsonic Fixed Wing Program and by the NASA Electronic Parts and Packaging (NEPP) Program. This work reports on the results obtained on the development of a temperature sensor geared for use in harsh environments.

Author

Temperature Sensors; Jet Engines; Electronic Packaging; Thermal Cycling Tests; Aerospace Environments

20080022951 Bachman and Lapointe, P.C., New Haven, CT, USA

Silicon Based Substrate Hafnium Oxide Top Environmental/Thermal Top Barrier Layer and Method for Preparing

Bhatia, T., Inventor; Sun, E. Y., Inventor; 13 May 04; 7 pp.; In English

Contract(s)/Grant(s): N00014-01-C-0032

Patent Info.: Filed Filed 13 May 04; US-Patent-Appl-SN-10 846 968

Report No.(s): PB2007-109152; No Copyright; Avail.: CASI: [A02](#), Hardcopy

A top barrier layer for a silicon containing substrate which inhibits the formation of gaseous species of silicon when exposed to a high temperature aqueous environment and comprises at least 65 mol % hafnium oxide.

NTIS

Barrier Layers; Hafnium Oxides; Patent Applications; Silicon; Silicon Oxides; Substrates

20080023024 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

FPGA Insertion Guideline

Sheldon, Douglas; June 2008; 30 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS7-03001; 102197

Report No.(s): JPL Publication 08-20; Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2014/40824>

A guideline for inserting field programmable gate arrays (FPGAs) in NASA missions is discussed. Technology qualification, design and validation processes, and application-specific risk reduction methodologies are provided and integrated into a methodology.

Author

Field-Programmable Gate Arrays; Qualifications; Reliability; Computer Programming

20080023095 Baker and Botts, New York, NY, USA

Methods for Producing Uniform Large-Grained and Grain Boundary Location Manipulated Polycrystalline Thin Film Semiconductors using Sequential Lateral Solidification

Im, J. S., Inventor; Sposili, R. S., Inventor; Crowder, M. A., Inventor; 1 Jun 05; 12 pp.; In English

Contract(s)/Grant(s): N6601-98-1-8913

Patent Info.: Filed Filed 1 Jun 05; US-Patent-Appl-SN-11 141 815

Report No.(s): PB2007-109151; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Methods for processing an amorphous silicon thin film sample into a polycrystalline silicon thin film are disclosed. In one preferred arrangement, a method includes the steps of generating a sequence of excimer laser pulses, controllably modulating each excimer laser pulse in the sequence to a predetermined fluence, homogenizing each modulated laser pulse in the sequence in a predetermined plane, masking portions of each homogenized fluence controlled laser pulse in the sequence with a two dimensional pattern of slits to generate a sequence of fluence controlled pulses of line patterned beamlets, each slit in the pattern of slits being sufficiently narrow to prevent inducement of significant nucleation in region of a silicon thin film sample irradiated by a beamlet corresponding to the slit, irradiating an amorphous silicon thin film sample with the sequence of fluence controlled slit patterned beamlets to effect melting of portions thereof corresponding to each fluence controlled patterned beamlet pulse in the sequence of pulses of patterned beamlets, and controllably sequentially translating a relative position of the sample with respect to each of the fluence controlled pulse of slit patterned beamlets to thereby process the amorphous silicon thin film sample into a single or polycrystalline silicon thin film.

NTIS

Amorphous Silicon; Grain Boundaries; Patent Applications; Polycrystals; Position (Location); Semiconductors (Materials); Silicon Films; Solidification; Thin Films

20080023098 Ratnerprestia, Valley Forge, PA, USA

Image Sensor with Deep Well Region and Method of Fabricating the Image Sensor

Janesick, J. R., Inventor; Dines, E. L., Inventor; Muzilla, M. S., Inventor; Stapelbroek, M. G., Inventor; 14 Jun 05; 17 pp.; In English

Patent Info.: Filed Filed 14 Jun 05; US-Patent-Appl-SN-11 152 364

Report No.(s): PB2007-109150; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An imager, an image sensor included in the imager and a method of fabricating the image sensor are provided. The image sensor having a substrate with front and back sides to produce image data, includes a transparent conductive coating arranged on the back side of the substrate, a first well region of a first conductive type having first and second opposite sides, the first side being arranged adjacent with the front side of the image sensor; and a second well region of a second conductive type, different from the first conductive type and having a deep well region provided adjacent with the second side of the first well region, the transparent conductive coating configured to develop or to receive a first potential and the first well region configured to receive a second potential to substantially deplete a region between the transparent conductive coating and the first well region.

NTIS

Fabrication; Illuminating; Patent Applications; Semiconductors (Materials)

20080023220 Landiorio and Teska, Waltham, MA, USA

Electronic and Optoelectronic Component Packaging Technique

Farell, B., Inventor; Jaynes, P., Inventor; Taylor, M., Inventor; 8 Apr 05; 20 pp.; In English

Contract(s)/Grant(s): DAAH01-00-C-R070

Patent Info.: Filed Filed 8 Apr 05; US-Patent-Appl-SN-11-101-925

Report No.(s): PB2007-109240; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A packaging method including assembling components on a substrate, manufacturing a lid assembly to include a plurality of integrated covers, and mating the lid assembly to the substrate.

NTIS

Electronic Packaging; Electro-Optics; Packaging; Assembly; Semiconductor Devices

20080023223 Sparkman (Klarquist), LLP, Portland, OR, USA

Method for Synthesizing Nanoscale Structures in Defined Locations

Jiao, J., Inventor; Tuggle, D. W., Inventor; Foxley, S., Inventor; 31 Jul 03; 15 pp.; In English

Contract(s)/Grant(s): NSF-DMR-0097575; NSF-ECS-0127061

Patent Info.: Filed Filed 31 Jul 03; US-Patent-Appl-SN-10-522-850

Report No.(s): PB2007-109222; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method is disclosed for directly synthesizing nanoscale structures, particularly in defined locations. The method overcomes problems in nanoscale manufacturing by enabling the direct fabrication of composites useful for constructing electronic devices. In one aspect of the method, nanotubes and arrays of nanotubes are synthesized directly at defined locations useful for constructing electronic devices.

NTIS

Nanotechnology; Synthesis; Nanofabrication; Nanocomposites; Nanostructures (Devices)

20080023224 Van Deuren (Reinhart Boerner) S.C., Milwaukee, WI, USA

Organic Light-Emitting Diodes and Methods for Assembly and Enhanced Charge Injection

Marks, T. J., Inventor; Huang, Q., Inventor; Cui, J., Inventor; Veinot, J., Inventor; 18 Nov 04; 30 pp.; In English

Contract(s)/Grant(s): NSF-N0014-95-1-1319; DMR-00769097

Patent Info.: Filed Filed 18 Nov 04; US-Patent-Appl-SN-10-992-624

Report No.(s): PB2007-109221; No Copyright; Avail.: CASI: [A03](#), Hardcopy

New organic light-emitting diodes and related electroluminescent devices and methods for fabrication, using siloxane self-assembly techniques.

NTIS

Light Emitting Diodes; Electroluminescence; Self Assembly; Siloxanes; Fabrication; Injection; Charge Transfer

20080023263 Texas Univ. System, Austin, TX, USA

Remote Center Compliant Flexure Device

Choi, B. J., Inventor; Sreenivasan, S. V., Inventor; Johnson, S. C., Inventor; 28 Feb 05; 22 pp.; In English

Contract(s)/Grant(s): DARPA-N66001-98-1-8914

Patent Info.: Filed Filed 28 Feb 05; US-Patent-Appl-SN-11-068-526

Report No.(s): PB2007-109219; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An apparatus to control displacement of a body spaced-apart from a surface includes a flexure system having a first flexure member defining a first axis of rotation and a second flexure member defining a second axis of rotation. A body is coupled to the flexure system to move about a plurality of axes. An actuation system is coupled to the flexure system to selectively constrain movement of the body along a subset of the plurality of axes.

NTIS

Elastic Properties; Flexing; Lithography; Manufacturing

20080023307 NASA Glenn Research Center, Cleveland, OH, USA

RF MEMS Switches with SiC Microbridges for Improved Reliability

Scardelletti, Maximilian C.; Zorman, Christian A.; Oldham, Daniel R.; May 2008; 11 pp.; In English; IEEE Antennas and Propagation, 5-12 Jul. 2008, San Diego, CA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 122711.03.11.03.04.03.02

Report No.(s): NASA/TM-2008-215201; E-16472; IEEE Paper 2961; Copyright; Avail.: CASI: [A03](#), Hardcopy

Radio frequency (RF) microelectromechanical (MEMS) switches offer superior performance when compared to the traditional semiconductor devices such as PIN diodes or GaAs transistors. MEMS switches have a return loss (RL) better than -25 dB, negligible insertion loss (IL), isolation better than -30 dB, and near zero power consumption. However, RF MEMS switches have several drawbacks the most serious being long-term reliability. The ability for the switch to operate for millions or even billions of cycles is a major concern and must be addressed. MEMS switches are basically grouped in two categories, capacitive and metal-to-metal contact. The capacitive type switch consists of a movable metal bridge spanning a fixed electrode and separated by a narrow air gap and thin insulating material. The metal-to-metal contact type utilizes the same basic design but without the insulating material. After prolonged operation the metal bridges, in most of these switches, begin to sag and eventually fail to actuate. For the metal-to-metal type, the two metal layers may actually fuse together. Also if the switches are not packaged properly or protected from the environment moisture may build up and cause stiction between the

top and bottom electrodes rendering them useless. Many MEMS switch designs have been developed and most illustrate fairly good RF characteristics. Nevertheless very few have demonstrated both great RF performance and ability to perform millions/billions of switching cycles. Of these, nearly all are of metal-to-metal type so as the frequency increases RF performance decreases.

Author

Microelectromechanical Systems; Radio Frequencies; P-I-N Junctions; Junction Diodes; Switches; Semiconductor Devices; Capacitance

20080023310 NASA Marshall Space Flight Center, Huntsville, AL, USA

Dispersive Elements for Enhanced Laser Gyroscopy and Cavity Stabilization

Smith, David D.; Chang, Hongrok; Diels, J. C.; January 22, 2007; 9 pp.; In English; SPIE Photonics West, 22-26 Jan. 2007, San Jose, CA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): CDDF03-17; CDDF04-08; Copyright; Avail.: CASI: [A02](#), Hardcopy

We analyze the effect of a highly dispersive element placed inside a modulated optical cavity on the frequency and amplitude of the modulation to determine the conditions for cavity self-stabilization and enhanced gyroscopic sensitivity. We find an enhancement in the sensitivity of a laser gyroscope to rotation for normal dispersion, while anomalous dispersion can be used to self-stabilize an optical cavity. Our results indicate that atomic media, even coherent superpositions in multilevel atoms, are of limited use for these applications, because the amplitude and phase filters work against one another, i.e., decreasing the modulation frequency increases its amplitude and vice-versa. On the other hand, for optical resonators the dispersion reversal associated with critical coupling enables the amplitude and phase filters to work together. We find that for over-coupled resonators, the absorption and normal dispersion on-resonance increase the contrast and frequency of the beat-note, respectively, resulting in a substantial enhancement of the gyroscopic response. Under-coupled resonators can be used to stabilize the frequency of a laser cavity, but result in a concomitant increase in amplitude fluctuations. As a more ideal solution we propose the use of a variety of coupled-resonator-induced transparency that is accompanied by anomalous dispersion.

Author

Frequency Modulation; Phase Shift; Laser Cavities; Amplitude Modulation; Synchronism; Rotation; Frequencies

20080023497 I-Shou Univ., Kaohsiung, Taiwan, Province of China

Novel Beamforming Implementation Using Cascade Second-Order Factors for Reduction of Weight Quantization Effect

Chiang, Ching-Tai; Wu, Rong-Ching; Journal of the Chinese Institute of Engineers, Volume 31, No.1; January 2008, pp. 141-147; In English; See also [20080023495](#); Original contains black and white illustrations

Contract(s)/Grant(s): NSC 95-221-E-214-025; Copyright; Avail.: Other Sources

In order to reduce the effect of weight quantization error on array beamforming patterns, a novel implementation structure is presented. By factoring the array pattern function into cascade second-order factors, we develop a novel beamforming structure to overcome the pattern distortion caused by weight quantization error. To quantify the quantization effect, we analyze the total zeros' displacements in the array pattern function due to a finite weight wordlength. It turns out that the conventional structure is highly sensitive to weight quantization if the zeros in the array pattern function are tightly clustered. The novel structure using cascade second-order factors is generally much less sensitive to the weight quantization error. Taking account of the quantized bit size of array weight, simulation examples show much better performance from the novel beamforming structure as compared to the corresponding conventional structure.

Author

Beamforming; Displacement; Simulation; Errors; Distortion

20080023502 National Cheng Kung Univ., Tainan, Taiwan, Province of China

Effect of Adjacent Channel Interference on Uplink Capacity in a Macrocell-Microcell-Overlapping WCDMA System

Chen, Wen-Tzu; Journal of the Chinese Institute of Engineers, Volume 31, No.1; January 2008, pp. 157-161; In English; See also [20080023495](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

This paper studies the impacts of adjacent channel interference (ACI) on uplink capacity in a macrocell/microcell wideband code-division multiple access (WCDMA) system. A method is presented for computing ACI and deriving capacity limitations. This method is based on an interference analysis that considers propagation loss, random distribution of mobile

users, and mutual coupling effects between ACIs. In addition to mobile users in other cells, the home cell's mobile users contribute part of the ACT resulting from other cells via the mutual coupling effect.

Author

Code Division Multiple Access; Electromagnetic Interference; Broadband; Statistical Distributions

20080023503 Yuan-Ze Univ., Chung-Li, Taiwan, Province of China

The Study of 2.4 GHZ Radiation for PCB with WLAN Units

Chen, Hsing-Yi; Chiang, Chuan-Chou; Journal of the Chinese Institute of Engineers, Volume 31, No.1; January 2008, pp. 163-166; In English; See also [20080023495](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

The finite-difference time-domain (FDTD) method is successfully used to study electric field distributions on a printed circuit board (PCB) built in a wireless local area network (WLAN) communication unit. Simulation results of electric field distributions on the PCB are presented and compared with those obtained from measurement data for an opened metallic case of the WLAN communication unit. From measurement data and simulation results, it is found that simulation results have a good agreement with measurement data for an opened WLAN communication unit. From simulation results, it is also found that a resonant effect with a factor of 2 in the magnitude of electric fields on a test plane with a height of 1 cm over the PCB occurs for a closed WLAN communication unit.

Author

Finite Difference Time Domain Method; Circuit Boards; Printed Circuits; Finite Difference Theory; Time Domain Analysis; Electric Fields; Local Area Networks; Communication Equipment

20080023568 Electrotechnical Society of Slovenia, Ljubljana, Slovenia

Electrotechnical Review, Volume 75, Nos. 1-2

Zajc, Baldomir, Editor; January 2008; 88 pp.; In Slovene; See also 20080023569 - 20080023581; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Topics covered include: Isomorphic Assignments and Knowledge Assessment; BLDC Machine Rotor Position Detection by Means of Stator Winding Inductance Variation Measurement; Analysis of Measures for Flicker Mitigation in the Slovenian Transmission Network; Multiple Antenna Techniques in WiMAX Systems; Towards New Generation of Mobile Communications: Discovery of Ubiquitous Resources; Robust Control Design with QFT; An Approach to Create Project-Specific Software Development Process; MAC Protocols for Wireless Sensor Networks; A Thermal Torso Manikin Incorporating Physiological Characteristics of Sweating and Heating; Automation of the Resistance Bridge Calibrator; Digital Video Quality at Transmission over the Noisy Channel (DCT and DWT-Based Codec); Increase in Efficiency of a Dry-Gas Scrubbing System for an Aluminium Reduction Line; and Linearized Poisson Boltzmann Theory in Cylindrical Geometry. Derived from text

Antenna Design; Inductance; Digital Television; Computer Programming; Calibrating; Decoders

20080023570 Ljubljana Univ., Ljubljana, Slovenia

Isomorphic Assignments and Knowledge Assessment

Kosir, Andrej; Electrotechnical Review, Volume 75, Nos. 1-2; January 2008, pp. 1-6; In English; See also [20080023568](#); Copyright; Avail.: Other Sources

In this paper we deal with theoretical issues of equally difficult assignments (tasks) given to students and an automatic generation of equally difficult assignments in the context of the classic and distance-learning environment. Using the abstract concept of isomorphisms, we introduce isomorphic assignments as being equivalent or at least comparably difficult in terms of finding their solutions. First we define the assignment as a pair (B, P) where B is the description of the assignment and P is the sequence of steps one has to take in order to find its solution. Isomorphic assignments are then defined as assignments from a chosen area that have the same or at least comparable difficulty of finding their solution (exact definition follows in the paper). The role of isomorphic assignments in the field of fair knowledge assessments is to enhance quality of assessments in terms of comparability of the estimated marks given to different students of the underlying course. We expect that the rate of undesired or illegal collaborations between students can be significantly lowered by using isomorphic assignments. This is one of the important aspects of the learning process. Besides, the concept of isomorphic assignments provides a theoretical background for design and application of a random generation of isomorphic assignments. Such generator can be used to produce a larger number of isomorphic assignments. In this paper we introduce an exact definition of isomorphic assignments together with an educational example from the field of linear electric circuit analysis. We define difficulty of a given

assignment by mapping the sequence of solution steps into nonnegative real numbers. We also present guidelines for a random generator of isomorphic assignments with a predefined level of difficulty.

Author

Electric Networks; Network Analysis; Estimating; Education; Linear Circuits

20080023571 Talum d.d., Kidricevo, Slovenia

Increase in Efficiency of a Dry-Gas Scrubbing System for an Aluminium Reduction Line

Verdenik, Anton; *Electrotechnical Review*, Volume 75, Nos. 1-2; January 2008, pp. 76-81; In English; See also [20080023568](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

Industry constantly coping with the pressure to minimize energy consumption and implement of protocols targeting reduction of greenhouse gases emission. For that purpose modern aluminium smelters use alumina-based dry scrubbers integrated in the closed loop with the electrolytic cells in order to capture fluoride evolved in the smelting process. The electrical energy used for maintaining gas flows is the most important operational cost. By substituting fans dampers for gas flow adjustment with variable speed drives, the system performance is improved. Energy consumption is reduced by 25%, ventilation system noise is reduced by 3dB and there are less greenhouse gases released as result of a faster start-up of the system.

Author

Aluminum Oxides; Scrubbers; Smelting; Electrolytic Cells; Feedback Control; Greenhouse Effect; Mechanical Drives; Gas Flow; Energy Consumption

20080023573 Ljubljana Univ., Ljubljana, Slovenia

BLDC Machine Rotor Position Detection by Means of Stator Winding Inductance Variation Measurement

Flisar, Uros; Nemeč, Mitja; Zajec, Peter; Nastran, Janez; *Electrotechnical Review*, Volume 75, Nos. 1-2; January 2008, pp. 12-17; In English; See also [20080023568](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

Permanent magnet brushless direct current (BLDC) motors are replacing brush motors in numerous applications as they offer significant energy efficiency improvements, lower acoustic noise and better reliability to name just a few of their advantages. Generally, a BLDC motor drive uses one or more sensors giving positional information allowing the magnetic field of rotor magnets and the magnetic field of stator windings to be kept synchronized. Such realization results in a higher drive cost due to sensor wiring and its implementation in the motor. Therefore, for cost and technical reasons, sensorless operation is an essential capability of the brushless motor controller. This paper presents two methods for BLDC machine rotor position detection based on measuring inductance variations in the stator windings, their advantages and drawbacks, as well as their practical implementation using a modern approach to motor control. The inductance variation is a function of the changing the flux due to position of the rotor magnets and saturation effect of the stator core when impressed by the stator current.

Author

Magnetic Fields; Brushes; Rotors; Stators; Winding; Approach Control; Inductance

20080023574 Ljubljana Univ., Ljubljana, Slovenia

Automation of the Resistance Bridge Calibrator

Podgornik, T.; Bojkovski, J.; Batagelj, V.; Drnovsek, J.; *Electrotechnical Review*, Volume 75, Nos. 1-2; January 2008, pp. 64-69; In English; See also [20080023568](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

In this paper we present full automation of the resistance bridge calibrator (RBC). The device is employed to calibrate AC and DC resistance bridges employed in primary thermometry. It consists of a resistor network made of 4 main resistors from which 35 different resistance values can be realized by switching 8 toggle switches on the calibrator panel. Up to 70 resistance ratios can be measured when the standard resistor and calibrator are interchanged. Literature shows that the resistor temperature coefficient may still effect measurement results. Placing the calibrator in a thermally stable environment can reduce it, but does not solve the problem of manual switching the calibrator switches. Our objective was to ensure full automation of the calibrator in which a computer would control the calibrator and receive the measurements from the bridge. Computer operation would completely substitute manual operation during which an operator has to be present, meaning that, repeated calibration measurements would be carried out with no active involvement of the personnel (at night or during weekends). We first set up a mechanical interface for manipulating the RBC switches. For this purpose we connected eight

low torque servomotors to the switches via semi-rigid connector links, thus avoiding the switches from being mechanically harmed. We then made an interface between the servomotors and the computer. The interface was constructed around a simple 8-bit microcontroller. It enables different levels of commands to be sent from the computer to the mechanical unit. The interface also provides power for the motors which can be switched off during measurements. Finally we developed a control application to control the calibration process. In this application, end positions of switches are calibrated thus enabling the system to be used for different calibrators. The program switches combinations, gathers measurements from the bridge and calculates nonlinearity of the bridge.

Author

Resistors; Calibrating; Thermal Stability; Alternating Current; Temperature Measurement; Switches

20080023575 Ljubljana Univ., Ljubljana, Slovenia

Linearized Poisson Boltzmann Theory in Cylindrical Geometry

Bohinc, Klemen; Iglc, Ales; Slivnik, Tomaz; *Electrotechnical Review*, Volume 75, Nos. 1-2; January 2008, pp. 82-84; In English; See also [20080023568](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

The linearized Poisson-Boltzmann theory was applied to the system of a charged cylindrical surface in contact with an electrolyte solution composed of monovalent counter- and co-ions. An analytical solution for the spatial dependence of the electric potential and the concentration of counter and co-ions inside the charged tube was obtained.

Author

Cylindrical Bodies; Electric Potential; Ions

20080023576 Ljubljana Univ., Ljubljana, Slovenia

Multiple Antenna Techniques in WiMAX Systems

Celcer, T.; Plevel, S.; Javornik, T.; Fortuna, C.; Kandus, G.; *Electrotechnical Review*, Volume 75, Nos. 1-2; January 2008, pp. 24-30; In English; See also [20080023568](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

Multiple antenna systems can offer significant improvements in system performance due to their ability to exploit multipath signal propagation and take advantage of its random nature in order to achieve diversity or spatial multiplexing gain. As such, they are very suitable for implementation in WiMAX (Worldwide Interoperability for Microwave Access) systems to improve its performance in harsh urban and indoor environments. WiMAX physical layer is based on Orthogonal Frequency Division Multiplexing (OFDM), which is very robust to multipath propagation and enables straightforward usage of MIMO techniques. In this paper multiple antenna techniques and their use in Fixed and Mobile WiMAX systems are discussed. We present test results, collected with field measurements during a Fixed WiMAX system deployment, and describe results obtained by applying a channel simulator whose parameters are tuned according to field measurement data. A performance comparison between STC (Space-Time Coding) and non-STC operation mode is analyzed for different coding and modulation schemes specified in the standard.

Author

Antenna Design; Multipath Transmission; Frequency Division Multiplexing; Deployment; Microwave Equipment

20080023578 Maribor Univ., Maribor, Slovenia

Robust Control Design with QFT

Igree, Dalibor; Chowdhury, Amor; Svec, Rajko; *Electrotechnical Review*, Volume 75, Nos. 1-2; January 2008, pp. 37-43; In English; See also [20080023568](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

The quantitative feedback theory (QFT) design is a graphic technique for designing feedback controllers which is probably the only known technique that simultaneously considers large parametric uncertainty and phase information. The ability to satisfy robust stability and different performance constraints with the minimum possible cost of feedback is the biggest advantage of the method. The downside is that the method, though systematic and powerful in hands of an experienced control engineer, has only recently lent itself to a formal mathematical form as is the case with the more recent paradigms such as H_∞ control and p-synthesis. A major advantage of QFT is that the design is performed in the frequency domain. This enables a good insight into the plant operation and difficulties that may arise during the controller design. Uncertainties can be caused either by changing the plant characteristics or ambient conditions or by unknown external disturbances. QFT starts by defining the plant and then specifying its uncertainties. The defined uncertainties are then used to determine the differential gain and phase from the nominal ones, over the range of frequencies through which the plant operates. At each distinct frequency, differential gains and phases are used to generate the Plant template. The given example illustrates the steps taken in the QFT

controller design. The aim of the present work is to present the usage of the QFT method for the controller design. To allow for a more illustrative presentation we made an experiment with a real object with the controller designed according to the QFT method. In the paper we show the complete procedure of the QFT design from the model analysis to the controller design. At the end we also compared the system performances of the QFT and H, controller design.

Author

Feedback; Controllers; Robustness (Mathematics); Stability; Frequencies

20080023579 Ljubljana Univ., Ljubljana, Slovenia

Analysis of Measures for Flicker Mitigation in the Slovenian Transmission Network

Blazic, Bostjan; Matvoz, Dejan; Papic, Igor; *Electrotechnical Review*, Volume 75, Nos. 1-2; January 2008, pp. 18-23; In English; See also [20080023568](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

In the paper we evaluate different solutions for mitigating flicker which is giving rise to serious problems in the Slovenian transmission network. Flicker, which is known to be one of the major disturbances affecting the voltage quality, is in Slovenia caused by three large arc furnaces located at the ironworks of Jesenice, Ravne and Store. According to the standard SIST EN 50160 [1], flicker at the transmission level makes it difficult, or even impossible, to maintain an adequate voltage quality at the distribution level. In order to solve the issue, we started by implementing in PSCAD a simulation model of the Slovenian transmission network (Fig. 1). Additionally to the basic network elements we also developed an arc furnace model and an IEC flicker meter model [2] - [4]. To allow for flicker compensation, we used our static var compensator (SVC) and static compensator (STATCOM) models (Figs. 2 and 3). With the network model we tried to capture as much as possible of the real network conditions [2]. Thus obtained flicker values are given in the first column of Table 1. Solutions enabling flicker mitigation can be divided into two groups, i.e. system solutions and compensation solutions. The first group involves changes in the network topology and network elements, whereas the second group foresees solutions achieved by using devices permitting compensation of the fluctuating reactive power. By using STATCOM for the case of the Ravne arc-furnace compensation (Fig. 4) [5], the reactive power from the network is close to zero. The ultimate result is reduced fluctuation of the network voltage and consequently also lower flicker. In our investigation of the possible measures for flicker mitigation, we took into account also the cost and practical feasibility aspects of the various available solutions. Based on the simulations results, we propose solutions for the three above mentioned Slovenian ironworks. The issue of Jesenice can be solved by adopting separate feeding (using one of the two 400/110 kV transformers) by means of which the flicker would be reduced to an acceptable level; by installing a STATCOM at Ravne the flicker value would be reduced by a factor of 4, and in case of Store it would be quite sufficient to use a series inductor since the flicker levels are here relatively low. Reduced flicker levels obtained by using the proposed solutions are shown in Table 1. Results obtained by taking individual measures are shown in columns 'Kompenzacija Jesenice', 'Kompenzacija Ravne' and 'Kompenzacija Store', and results obtained by using the complete solution to the flicker issue copied with in the Slovenian power transmission network are given in the last column.

Author

Electric Potential; Transformers; Arc Heating; Flicker; Reactivity; Static Models; Heating Equipment

20080023580 Kragujevac Univ., Jovana Cvijica, Serbia

MAC Protocols for Wireless Sensor Networks

Pesovic, Uros; Peulic, Aleksandar; Cucej, Zarko; *Electrotechnical Review*, Volume 75, Nos. 1-2; January 2008, pp. 50-55; In English; See also [20080023568](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

The paper presents a brief survey of the Medium Access Control (MAC) protocols for Wireless Sensor Networks (WSN). It describes pros and cons of some known solutions of the MAC protocols with emphasis on their energy efficiency. The main goal in WSN is prolonging the lifetime of the sensor node, that is usually battery powered and can thus be achieved by designing energy-efficient MAC protocols. Results obtained from simulations of the MAC protocols are also presented and commented on.

Author

Protocol (Computers); Wireless Communication; Access Control

20080023581 Maribor Univ., Maribor, Slovenia

Digital Video Quality at Transmission over the Noisy Channel (DCT and DWT-Based Codec)

Fras, Matjaz; Planinsic, Peter; *Electrotechnical Review*, Volume 75, Nos. 1-2; January 2008, pp. 70-75; In English; See also [20080023568](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

The paper describes the impact of the quantization step on the quality of the video signal of the transform-based

compression digital video. In our investigation transform compressions are first based on discrete cosine transform (DCT), and then on discrete wavelet transform (DWT). In transform compression is usually employed lossy-data compression. Our purpose was to implement two different video codec's in Matlab Simulink [4] and determine how quantization and noisy channel affect the quality of the received digital video signal. When using discrete cosine transform [9], we distributed the whole picture into small macro blocks of 16 x 16 pixels. In these blocks the discrete cosine transform was executed followed by scalar quantization, 'zig-zag' scanning and fixed-length coding. When using the discrete wavelet transform [I, 2, 31], the transform was executed on the whole image (frame). The transformed coefficients were divided with quantization steps and fixed-length encoding. We first simulated the impact of the quantization step on the quality of the digital video. The standard quality measures between the original and reconstructed digital video signal were the mean absolute error (MAE), mean square error (MSE) and peak signal-to-noise ratio (PSNR). The DCT codec caused the well known blocking effect in the reconstructed video seen in Figure 6. Figure 8 shows the effect of quantization at a discrete wavelet codec on the reconstructed video, the so called blurring effect. The second part of the paper describes the transfer of the digital video signal over the noise channel using the QAM digital modulation technique. By using the AWGN (Additive White Gaussian Noise) block in Matlab-Simulink, we changed the signal-to-noise ratio (SNR) in the communication channel.

Author

Digital Television; Data Compression; Quadrature Amplitude Modulation; Signal to Noise Ratios; Video Signals; Coding; Digital Techniques

20080023617 Montana Tech of the Univ. of Montana, Butte, MT, USA

Method of detecting system function by measuring frequency response

Morrison, John L., Inventor; Morrison, William H., Inventor; July 1, 2008; 22 pp.; In English

Contract(s)/Grant(s): NNA05AC24C

Patent Info.: Filed July 5, 2007; US-Patent-7,395,163; US-Patent-Appl-SN-11/825,629; No Copyright; Avail.: CASI: **A03**, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023617>

Real time battery impedance spectrum is acquired using one time record, Compensated Synchronous Detection (CSD). This parallel method enables battery diagnostics. The excitation current to a test battery is a sum of equal amplitude sin waves of a few frequencies spread over range of interest. The time profile of this signal has duration that is a few periods of the lowest frequency. The voltage response of the battery, average deleted, is the impedance of the battery in the time domain. Since the excitation frequencies are known, synchronous detection processes the time record and each component, both magnitude and phase, is obtained. For compensation, the components, except the one of interest, are reassembled in the time domain. The resulting signal is subtracted from the original signal and the component of interest is synchronously detected. This process is repeated for each component.

Official Gazette of the U.S. Patent and Trademark Office

Frequency Measurement; Frequency Response; Impedance; Real Time Operation

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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*.

20080022286 Quarles and Brady, LLP., Milwaukee, WI, USA

Permanent Magnet Machine and Method with Reluctance Poles for High Strength Undiffused Brushless Operation

Hsu, J. S., Inventor; 21 Dec 04; 12 pp.; In English

Contract(s)/Grant(s): DE-AC05-00 0R22725

Patent Info.: Filed 21 Dec 04; US-Patent-Appl-SN-11-019-75

Report No.(s): PB2007-109185; No Copyright; Avail.: CASI: **A03**, Hardcopy

A method and apparatus in which a rotor (11) and a stator (17) define a radial air gap (20) for receiving AC flux and at least one, and preferably two, DC excitation assemblies (23, 24) are positioned at opposite ends of the rotor (20) to define secondary air gaps (21, 22). Portions of PM material (14a, 14b) are provided as boundaries separating the rotor pole portions (12a, 12b) of opposite polarity from other portions of the rotor (11) and from each other to define PM poles (12a, 12b) for conveying the DC flux to or from the primary air gap (20) and for inhibiting flux from leaking from the pole portions prior

to reaching the primary air gap (20). The portions of PM material (14a, 14b) are spaced from each other so as to include reluctance poles (15) of ferromagnetic material between the PM poles (12a, 12b) to interact with the AC flux in the primary-air gap (20).

NTIS

High Strength; Patent Applications; Permanent Magnets; Reluctance; Rotors; Stators

20080022311 Kentucky Univ., KY, USA

Comprehensive Validation of an Intermittency Transport Model for Transitional Low-Pressure Turbine Flows

Suzen, Y. B.; Huang, P. G.; The Aeronautical Journal; March 2005; Volume 109, No. 1093, pp. 101-118; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NCC3-590; NCC3-1040

Report No.(s): Paper No. 2889; Copyright; Avail.: Other Sources

A transport equation for the intermittency factor is employed to predict transitional flows under the effects of pressure gradients, freestream turbulence intensities, Reynolds number variations, flow separation and reattachment. and unsteady wake-blade interactions representing diverse operating conditions encountered in low-pressure turbines. The intermittent behaviour of the transitional flows is taken into account and incorporated into computations by modifying the eddy viscosity, μ_t , with the intermittency factor, γ . Turbulent quantities are predicted by using Menter's two-equation turbulence model (SST). The onset location of transition is obtained from correlations based on boundary-layer momentum thickness, acceleration parameter, and turbulence intensity. The intermittency factor is obtained from a transport model which can produce both the experimentally observed streamwise variation of intermittency and a realistic profile in the cross stream direction. The intermittency transport model is tested and validated against several well documented low pressure turbine experiments ranging from flat plate cases to unsteady wake-blade interaction experiments. Overall, good agreement between the experimental data and computational results is obtained illustrating the predicting capabilities of the model and the current intermittency transport modelling approach for transitional flow simulations.

Author

Turbulence Models; Transition Flow; Intermittency; Mathematical Models; Pressure Gradients; Reynolds Number; Separated Flow; Eddy Viscosity

20080022312 North Dakota State Univ., Fargo, ND, USA

Simulations of Flow Separation Control using Plasma Actuators

Suzen, Y. B.; Huang, P. G.; January 09, 2006; 9 pp.; In English; 44th AIM Aerospace Sciences Meeting and Exhibit, 9-12 Jan. 2006, Reno, NV, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NCC3-1040

Report No.(s): AIAA Paper 2006-877; Copyright; Avail.: CASI: [A02](#), Hardcopy

A mathematical model was developed for plasma actuators used in flow control applications. The effects of the plasma actuators on the external flow are incorporated into Navier Stokes computations as a body force vector, which is given as a product of the net charge density and the electric field. The model computes this body force vector by solving two additional equations: one for the electric field due to the applied AC voltage at the electrodes and the other for the charge density representing the ionized air. The details of model development, initial model calibration, and validation using available experimental data are presented. The effects of plasma actuator on control of flow separation on a PAK-B blade are demonstrated numerically.

Author

Plasma Control; Boundary Layer Separation; Actuators; Mathematical Models; Electric Fields; Separated Flow; Plasmas (Physics); Ionized Gases

20080022313 NASA Glenn Research Center, Cleveland, OH, USA

Numerical Simulations of Plasma Based Flow Control Applications

Suzen, Y. B.; Huang, P. G.; Jacob, J. D.; Ashpis, D. E.; June 06, 2005; 11 pp.; In English; 35th Fluid Dynamics Conference and Exhibit, 6-9 Jun. 2005, Toronto, Ontario, Canada; Original contains black and white illustrations

Contract(s)/Grant(s): NCC3-1040

Report No.(s): AIAA Paper 2005-4633; Copyright; Avail.: CASI: [A03](#), Hardcopy

A mathematical model was developed to simulate flow control applications using plasma actuators. The effects of the plasma actuators on the external flow are incorporated into Navier Stokes computations as a body force vector. In order to

compute this body force vector, the model solves two additional equations: one for the electric field due to the applied AC voltage at the electrodes and the other for the charge density representing the ionized air. The model is calibrated against an experiment having plasma-driven flow in a quiescent environment and is then applied to simulate a low pressure turbine flow with large flow separation. The effects of the plasma actuator on control of flow separation are demonstrated numerically.

Author

Mathematical Models; Plasma Control; Magnetohydrodynamic Flow; Actuators; Density (Number/Volume); Plasmas (Physics); Separated Flow; Low Pressure; Boundary Layer Separation

20080022317 NASA Glenn Research Center, Cleveland, OH, USA

Numerical Simulations of Flow Separation Control in Low-Pressure Turbines using Plasma Actuators

Suzen, Y. B.; Huang, P. G.; Ashpis, D. E.; January 08, 2007; 8 pp.; In English; 45th AIAA Aerospace Sciences Meeting and Exhibit, 8-11 Jan. 2007, Reno, NV, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NCC3-1040; NCC3-582

Report No.(s): AIAA Paper 2007-937; Copyright; Avail.: CASI: [A02](#), Hardcopy

A recently introduced phenomenological model to simulate flow control applications using plasma actuators has been further developed and improved in order to expand its use to complicated actuator geometries. The new modeling approach eliminates the requirement of an empirical charge density distribution shape by using the embedded electrode as a source for the charge density. The resulting model is validated against a flat plate experiment with quiescent environment. The modeling approach incorporates the effect of the plasma actuators on the external flow into Navier Stokes computations as a body force vector which is obtained as a product of the net charge density and the electric field. The model solves the Maxwell equation to obtain the electric field due to the applied AC voltage at the electrodes and an additional equation for the charge density distribution representing the plasma density. The new modeling approach solves the charge density equation in the computational domain assuming the embedded electrode as a source therefore automatically generating a charge density distribution on the surface exposed to the flow similar to that observed in the experiments without explicitly specifying an empirical distribution. The model is validated against a flat plate experiment with quiescent environment.

Author

Boundary Layer Separation; Plasma Density; Separated Flow; Actuators; Plasmas (Physics); Low Pressure; Electric Fields

20080022319 NASA Glenn Research Center, Cleveland, OH, USA

Simulations of Plasma Flow Control in Low-Pressure Turbines

Dennis, K.; Suzen, Y. B.; Uygun, N.; Huang, P. G.; Ashpis, D. E.; January 7, 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): NCC3-1040; NCC3-582

Report No.(s): AIAA Paper 2008-0543; Copyright; Avail.: CASI: [A03](#), Hardcopy

A recently introduced phenomenological model to simulate flow control applications using plasma actuators has been employed in numerical simulation of a low pressure turbine flow separation control experiment. Due to the transitional nature of these flowfields the simulations incorporated the transition model based on local variables. The effectiveness of plasma actuators in flow separation control are demonstrated numerically and the flexibility and capabilities of the new simulation methodology coupling the plasma actuator model with transition model are illustrated.

Author

Magnetohydrodynamic Flow; Boundary Layer Separation; Actuators; Flow Distribution; Separated Flow; Plasmas (Physics); Pressure Regulators

20080022324 Kentucky Univ., Lexington, KY, USA

Unstructured Numerical Simulation of Experimental Linear Plasma Actuator Synthetic Jet Flows

Santhanakrishnan, Arvind; Reasor, Daniel A., Jr.; LeBeau, Raymond P., Jr.; January 07, 2008; 18 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): NCC3-1040

Report No.(s): AIAA Paper 2008-541; Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper presents a comparison between experimental data and computational results for the linear plasma synthetic jet actuator (L-PSJA). The L-PSJA configuration consists of two exposed electrode strips separated by an embedded electrode, similar to two linear dielectric barrier discharge actuators being placed back-to-back. Experiments have shown that the resulting flowfield is similar to a surface jet, and by pulsing the power to the electrodes an oscillatory flowfield similar to a

synthetic jet can be produced. The computational model used for the plasma forcing is the Suzen-Huang plasma actuator model which has been placed in an incompressible, unstructured grid code. Both quiescent and crossflow conditions are simulated and compared to the available experimental measurements. The objective is to assess the capabilities of the plasma actuator model for the L-PSJA configuration.

Author

Actuators; Jet Control; Plasmas (Physics); Flow Distribution; Cross Flow; Electrodes; Linear Programming; Magnetohydrodynamic Flow; Unstructured Grids (Mathematics)

20080022326 Ansys CFX Germany, Bavaria, Germany

A Correlation-Based Transition Model using Local Variables, Part 2, Test Cases and Industrial Applications

Langtry, R. B.; Menter, F. R.; Likki, S. R.; Suzen, Y. B.; Huang, P. G.; Volker, S.; Journal of Turbomachinery; July 2006; Volume 128, Issue 4, pp. 423-434; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NCC3-1040; NCC3-590

Report No.(s): Paper No. 2004-GT-53434; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1115/1.2184353>

A new correlation-based transition model has been developed, which is built strictly on local variables. As a result, the transition model is compatible with modern computational fluid dynamics (CFD) methods using unstructured grids and massive parallel execution. The model is based on two transport equations, one for the intermittency and one for the transition onset criteria in terms of momentum thickness Reynolds number. The proposed transport equations do not attempt to model the physics of the transition process (unlike, e.g., turbulence models), but form a framework for the implementation of correlation-based models into general-purpose CFD methods.

Author

Computational Fluid Dynamics; Momentum; Unstructured Grids (Mathematics); Turbulence Models; Reynolds Number

20080022350 NASA Glenn Research Center, Cleveland, OH, USA

A Computational Fluid Dynamics Study of Transitional Flows in Low-Pressure Turbines under a Wide Range of Operating Conditions

Suzen, Y. B.; Huang, P. G.; Ashpis, D. E.; Volino, R. J.; Corke, T. C.; Thomas, F. O.; Huang, J.; Lake, J. P.; King, P. I.; Journal of Turbomachinery; July 2007; Volume 129, Issue 3, pp. 527-541; In English; Original contains black and white illustrations

Contract(s)/Grant(s): C-31011-K; NCC3-1040; NCC3-590; NCC3-935; NCC3-775

Report No.(s): AIAA Paper 2003-3591; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1115/1.2218888>

A transport equation for the intermittency factor is employed to predict the transitional flows in low-pressure turbines. The intermittent behavior of the transitional flows is taken into account and incorporated into computations by modifying the eddy viscosity, $\mu_{(sub\ p)}$ with the intermittency factor, γ . Turbulent quantities are predicted using Menter's two-equation turbulence model (SST). The intermittency factor is obtained from a transport equation model which can produce both the experimentally observed streamwise variation of intermittency and a realistic profile in the cross stream direction. The model had been previously validated against low-pressure turbine experiments with success. In this paper, the model is applied to predictions of three sets of recent low-pressure turbine experiments on the Pack B blade to further validate its predicting capabilities under various flow conditions. Comparisons of computational results with experimental data are provided. Overall, good agreement between the experimental data and computational results is obtained. The new model has been shown to have the capability of accurately predicting transitional flows under a wide range of low-pressure turbine conditions.

Author

Turbines; Computational Fluid Dynamics; Low Pressure; Predictions; Turbulence Models; Intermittency; Eddy Viscosity

20080022352 NASA Langley Research Center, Hampton, VA, USA; George Washington Univ., USA

Pressure and Thrust Measurements of a High-Frequency Pulsed-Detonation Actuator

Nguyen, Namtran C.; Cutler, Andrew D.; June 2008; 58 pp.; In English

Contract(s)/Grant(s): NNL06AA16A; WBS 526282.01.07.04.06

Report No.(s): NASA/CR-2008-215315; No Copyright; Avail.: CASI: A04, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080022352>

This paper describes the development of a small-scale, high-frequency pulsed detonation actuator. The device utilized a fuel mixture of H₂ and air, which was injected into the device at frequencies of up to 1200 Hz. Pulsed detonations were

demonstrated in an 8-inch long combustion volume, at approx.600 Hz, for the lambda/4 mode. The primary objective of this experiment was to measure the generated thrust. A mean value of thrust was measured up to 6.0 lb, corresponding to specific impulse of 2611 s. This value is comparable to other H₂-fueled pulsed detonation engines (PDEs) experiments. The injection and detonation frequency for this new experimental case was approx.600 Hz, and was much higher than typical PDEs, where frequencies are usually less than 100 Hz. The compact size of the model and high frequency of detonation yields a thrust-per-unit-volume of approximately 2.0 lb/cu in, and compares favorably with other experiments, which typically have thrust-per-unit-volume values of approximately 0.01 lb/cu in.

Author

Pulse Detonation Engines; Combustion; Detonation; Thrust Measurement; Actuators; Specific Impulse

20080022355 Stites and Harbison, PLLC, Nashville, TN, USA

Chiral Temperature Gradient Focusing

Ross, D. J., Inventor; Vreeland, W. N., Inventor; Blaiss, K. M., Inventor; 24 Jan 05; 21 pp.; In English

Patent Info.: Filed 24 Jan 05; US-Patent-Appl-SN-11-039-955

Report No.(s): PB2007-109183; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method and device are provided for concentrating and separating materials in fluids within a fluidic device having a fluid conduit such as a channel or capillary. The concentration is achieved by balancing the electrophoretic velocity of a material against the bulk flow of fluid in the presence of a temperature gradient. An additive is added to the fluid which interacts with the material and which modifies the normal electrophoretic mobility of the material. Using an appropriate fluid, the temperature gradient can generate a corresponding gradient in the electrophoretic velocity so that the electrophoretic and bulk velocities sum to zero at a unique position along the conduit and the material will be focused at that position. The method and device may be adapted for use with a variety of materials including fluorescent dyes, amino acids, proteins, DNA and to concentrate a dilute material.

NTIS

Chirality; Fluidics; Patent Applications; Temperature Gradients

20080022365 NASA Langley Research Center, Hampton, VA, USA

Allowable Trajectory Variations for Space Shuttle Orbiter Entry-Aeroheating CFD

Wood, William A.; Alter, Stephen J.; June 2008; 30 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 377816.06.02.03.08

Report No.(s): NASA/TM-2008-215312; L-19447; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080022365>

Reynolds-number criteria are developed for acceptable variations in Space Shuttle Orbiter entry trajectories for use in computational aeroheating analyses. The criteria determine if an existing computational fluid dynamics solution for a particular trajectory can be extrapolated to a different trajectory. The criteria development begins by estimating uncertainties for seventeen types of computational aeroheating data, such as boundary layer thickness, at exact trajectory conditions. For each type of datum, the allowable uncertainty contribution due to trajectory variation is set to be half of the value of the estimated exact-trajectory uncertainty. Then, for the twelve highest-priority datum types, Reynolds-number relations between trajectory variation and output uncertainty are determined. From these relations the criteria are established for the maximum allowable trajectory variations. The most restrictive criterion allows a 25% variation in Reynolds number at constant Mach number between trajectories.

Author

Computational Fluid Dynamics; Trajectories; Space Shuttle Orbiters; Reynolds Number; Aerodynamic Heating; Analysis (Mathematics)

20080022428 NASA Langley Research Center, Hampton, VA, USA

Correlations for Boundary-Layer Transition on Mars Science Laboratory Entry Vehicle Due to Heat-Shield Cavities

Hollis, Brian R.; Liechty, Derek S.; June 2008; 92 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 52628201070405

Report No.(s): NASA/TP-2008-215317; L-19475; No Copyright; Avail.: CASI: [A05](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080022428>

The influence of cavities (for attachment bolts) on the heat-shield of the proposed Mars Science Laboratory entry vehicle has been investigated experimentally and computationally in order to develop a criterion for assessing whether the boundary

layer becomes turbulent downstream of the cavity. Wind tunnel tests were conducted on the 70-deg sphere-cone vehicle geometry with various cavity sizes and locations in order to assess their influence on convective heating and boundary layer transition. Heat-transfer coefficients and boundary-layer states (laminar, transitional, or turbulent) were determined using global phosphor thermography.

Author

Boundary Layers; Cavities; Heat Shielding; Turbulence; Thermography; Heat Transfer Coefficients; Convective Heat Transfer

20080023006 Toledo Univ., OH, USA

New Rig to Test Journal Oil Lubricated Wave Bearings

Dimofte, Florin; Ene, Nicoleta M.; Handschuh, Robert F.; Keith, Theo G., Jr.; October 22, 2007; 3 pp.; In English; Proceedings of ASME/STLE international Joint Tribology Conference, 22-24 Oct. 2007, San Diego, CA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NNC06AA06A; NCC3-1012

Report No.(s): IJTC2007-44293; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023006>

A new rig to test journal fluid film bearings was designed, manufacture and installed at NASA Glenn Research Center in Cleveland, Ohio, USA. This rig can apply total radial loads to 133,000 N (30,000 lbs) and can rotate the shaft to speeds to 13,000 RPM. The test bearing has a diameter of 68 mm and is 38 mm long. Two such bearings are used to support the total load. The shaft is also supported by two fluid film bearings. The rig is well instrumented for measuring oil flow, oil inlet and outlet temperatures, bearing sleeve temperatures along its circumference and the oil temperatures in oil supply pockets. The shaft position is monitored by proximity probes. Vibration levels at four locations are also displayed and recorded. Preliminary tests of wave bearings at 8,000 RPM and loads to 20,000 N (4,500 lbs) show a good correlation between the test and prediction data.

Author

Shafts (Machine Elements); Journal Bearings; Fluid Films; Sleeves; Position (Location); Inlet Temperature; Loads (Forces)

20080023021 Toledo Univ., Toledo, OH, USA

Temperature Distribution of a Wave Journal Bearing. Comparison with Test Data

Ene, Nicoleta M.; Dimofte, Florin; Keith, Theo G., Jr.; Handschuh, Robert F.; October 22, 2007; 3 pp.; In English; Proceedings of ASME/STLE International Joint Tribology Conference, 22-24 Oct. 2007, San Diego, CA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NNC06AA06A

Report No.(s): IJTC2007-44280; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023021>

An advanced three-dimensional model is developed to compute the temperature distribution in a wave journal bearing. The analysis takes into account the heat transfer between the film and both the shaft and the bush. The theoretical results are validated by comparison with experimental data.

Author

Journal Bearings; High Temperature; Three Dimensional Models; Fluid Films; Heat Transfer; Shafts (Machine Elements)

20080023030 Naval Postgraduate School, Monterey, CA, USA

A Critical Review of the Transport and Decay of Wake Vortices in Ground Effect

Sarpkaya, T.; April 27, 2004; 82 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNL04AA29I; No Copyright; Avail.: CASI: [A05](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023030>

This slide presentation reviews the transport and decay of wake vortices in ground effect and cites a need for a physics-based parametric model. The encounter of a vortex with a solid body is always a complex event involving turbulence enhancement, unsteadiness, and very large gradients of velocity and pressure. Wake counter in ground effect is the most dangerous of them all. The interaction of diverging, area-varying, and decaying aircraft wake vortices with the ground is very complex because both the vortices and the flow field generated by them are altered to accommodate the presence of the ground (where there is very little room to maneuver) and the background turbulent flow. Previous research regarding vortex models, wake vortex decay mechanisms, time evolution within in ground effect of a wake vortex pair, laminar flow in ground effect,

and the interaction of the existing boundary layer with a convected vortex are reviewed. Additionally, numerical simulations, 3-dimensional large-eddy simulations, a probabilistic 2-phase wake vortex decay and transport model and a vortex element method are discussed. The devising of physics-based, parametric models for the prediction of (operational) real-time response, mindful of the highly three-dimensional and unsteady structure of vortices, boundary layers, atmospheric thermodynamics, and weather convective phenomena is required. In creating a model, LES and field data will be the most powerful tools.

Derived from text

Aircraft Wakes; Vortices; Ground Effect (Aerodynamics); Vortex Breakdown; Turbulent Flow; Models

20080023145 NASA Glenn Research Center, Cleveland, OH, USA

Experimentation for the Maturation of Deep Space Cryogenic Refueling Technologies

Chato, David J.; June 2008; 96 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 253225.04.01.02.03

Report No.(s): NASA/TP-2008-214929; E-15763; No Copyright; Avail.: CASI: [A05](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023145>

This report describes the results of the 'Experimentation for the Maturation of Deep Space Cryogenic Refueling Technology' study. This study identifies cryogenic fluid management technologies that require low-gravity flight experiments bring technology readiness levels to 5 to 6; examines many possible flight experiment options; and develops near-term low-cost flight experiment concepts to mature the core technologies. A total of 25 white papers were prepared by members of the project team in the course of this study. The full text of each white paper is included and 89 relevant references are cited. The team reviewed the white papers that provided information on new or active concepts of experiments to pursue and assessed them on the basis of technical need, cost, return on investment, and flight platform. Based on this assessment the 'Centaur Test Bed for Cryogenic Fluid Management' was rated the highest. 'Computational Opportunities for Cryogenics for Cryogenic and Low-g Fluid Systems' was ranked second, based on its high scores in state of the art and return on investment, even though scores in cost and time were second to last. 'Flight Development Test Objective Approach for In-space Propulsion Elements' was ranked third.

Author

Microgravity; Cryogenic Fluids; Refueling; Aerospace Engineering; Fluid Management

20080023226 Toledo Univ., Toledo, OH, USA

Advanced Experimental and Numerical Analysis of a Pressurized Air Wave Bearings

Sescu, Adrian; Sescu, Carmen; Dimofte, Florin; Afjeh, Abdollah A.; Handschuh, Robert; October 22, 2007; 3 pp.; In English; Proceedings of ASME/STLE International Joint Tribology Conference, 22-24 Oct. 2007, San Diego, CA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NNC06AA06A

Report No.(s): IJTC2007-44398; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023226>

Experimental, analytical, and numerical investigations have been done in the field of gas lubrication, but few people focused on details of fluid flow between the sliding surfaces. In this work the entire pressurized wave bearing is analyzed in detail. The numerical study using a three-dimensional commercial code and a two-dimensional finite difference code gives information about the flow at many levels. The numerically computed flow rates using the commercial code are compared with experimental results determined at NASA Glenn Research Center on an experimental rig. The calculated discharge coefficient is used in the finite difference code which solves the Reynolds equation. The holes effect is considered as a source term, instead of applying hybrid type boundary conditions on the holes contours. Data from experimental tests, commercial three-dimensional code, and two-dimensional code are reported and compared to each other. Good agreement was found between numerical study and experiment.

Author

Gas Bearings; Fluid Flow; Numerical Analysis; Finite Difference Theory; Reynolds Equation; Gas Lubricants; Flow Velocity

20080023235 Argonne National Lab., IL USA

Nonequilibrium Pattern Formation and Spatiotemporal Chaos in Fluid Convection (Final Report, January 1, 2002-December 31, 2005)

Cross, M.; Greenside, H.; Fischer, P.; January 2005; 3 pp.; In English

Contract(s)/Grant(s): DE-FG03-98ER14891

Report No.(s): DE2007-903072; No Copyright; Avail.: Department of Energy Information Bridge

The final report for grant number DE-FG03-98ER14891 summarizes the application of the unique simulation capabilities

developed under DOE support to investigations of important issues in pattern formation and spatiotemporal chaos in Rayleigh-Benard convection, particularly emphasizing quantitative contact with the active experimental programs.
NTIS

Chaos; Convection; Heat Transfer; Rayleigh-Benard Convection

20080023309 ASRC Aerospace Corp., Cleveland, OH, USA

Investigation of Flow Instabilities in the Inlet Ducts of DP-1C VTOL Aircraft

Lepicovsky, Jan; June 2008; 50 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC06BA07B; WBS 561581.02.08.03.11.01

Report No.(s): NASA/CR-2008-215216; E-16504; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023309>

An investigation of flow instabilities in the inlet ducts of a two-engine vertical takeoff and landing aircraft DP-1C is described in this report. Recent tests revealed that the engines stall during run ups while the aircraft is operating on the ground. These pop stalls occurred at relatively low power levels, sometimes as low as 60 percent of the engine full speed. Inability to run the engines up to the full speed level is attributed to in-ground effects associated with hot gas ingestion. Such pop stalls were never experienced when the aircraft was tested on an elevated grid platform, which ensured that the aircraft was operating in out-of-the-ground-effect conditions. Based on available information on problems experienced with other vertical takeoff and landing aircraft designs, it was assumed that the engine stalls were caused by partial ingestion of hot gases streaming forward from the main exit nozzle under the aircraft inlets, which are very close to the ground. It was also suggested that the nose wheel undercarriage, located between the inlets, may generate vortices or an unstable wake causing intense mixing of hot exit gases with incoming inlet flow, which would enhance the hot gas ingestion. After running a short three-day series of tests with fully instrumented engine inlets, it is now believed the most probable reason for engine pop stalls are random ingestions of a vortex generated between the two streams moving in opposite directions: outbound hot gas stream from the main nozzle close to the ground and inbound inlet flow above. Originally, the vortex is in a horizontal plane. However, at a certain velocity ratio of these two streams, the vortex attaches either to the ground or the aircraft surface at one end and the other end is swallowed by one of the aircraft inlets. Once the vortex enters the inlet duct, a puff of hot air can be sucked through the vortex core into the engine, which causes a serious inlet flow field distortion followed by an engine stall. Once the engine stalls, the outflow from the inlet pushes the vortex away and the engine resumes normal operation. This hypothesis needs to be verified experimentally; e.g., by extensive smoke flow visualization ahead of the aircraft inlets.

Author

Flow Visualization; Engine Tests; Flow Stability; Engine Inlets; Vertical Landing; Ducts; Vertical Takeoff Aircraft

20080023391 Toledo Univ., Toledo, OH, USA

A Dynamic Analysis of Hydrodynamic Wave Journal Bearings

Ene, Nicoleta M.; Dimofte, Florin; Keith, Theo G.; Tribology Transactions; January 2008; ISSN 1040-2004/1547-357X;

Volume 51, pp. 82-91; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNC06AA06A; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1080/10402000701741194>

The purpose of this paper is to study the dynamic behavior of a three-wave journal bearing using a transient approach. The transient analysis permits the determination of the rotor behavior after the fractional frequency whirl appears. The journal trajectory is determined by solving a set of nonlinear equations of motion using the Runge-Kutta method. The fluid film forces are computed by integrating the transient Reynolds equation at each time step location of the shaft with respect to the bearing. Because of the large values of the rotational speeds, turbulent effects were included in the computations. The influence of the temperature on the viscosity was also considered. Numerical results were compared to experimental results obtained at the NASA Glenn Research Center. Comparisons of the theoretical results with experimental data were found to be in good agreement. The numerical and experimental results showed that the fluid film of a three-wave journal bearing having a diameter of 30 mm, a length of 27 mm, and a wave amplitude ratio greater than 0.15 is stable even at rotational speeds of 60,000 RPM. For lower wave amplitude ratios, the threshold speed at which the fluid film becomes unstable depends on the wave amplitude and on the supply pocket pressure. Even if the fluid film is unstable, the wave bearing maintains the whirl orbit inside the bearing clearance.

Author

Journal Bearings; Surges; Wave Propagation; Flow Stability; Dynamic Response; Fluid Films

20080023452 NASA Langley Research Center, Hampton, VA, USA

Successes and Challenges for Flow Control Simulations

Rumsey, Christopher L.; June 23, 2008; 26 pp.; In English; 4th AIAA Flow Control Conference, 23-26 Jun. 2008, Seattle, WA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 599489

Report No.(s): AIAA-2008-4311; L-5943; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023452>

A survey is made of recent computations published for synthetic jet flow control cases from a CFD workshop held in 2004. The three workshop cases were originally chosen to represent different aspects of flow control physics: nominally 2-D synthetic jet into quiescent air, 3-D circular synthetic jet into turbulent boundarylayer crossflow, and nominally 2-D flow-control (both steady suction and oscillatory zero-net-mass-flow) for separation control on a simple wall-mounted aerodynamic hump shape. The purpose of this survey is to summarize the progress as related to these workshop cases, particularly noting successes and remaining challenges for computational methods. It is hoped that this summary will also by extension serve as an overview of the state-of-the-art of CFD for these types of flow-controlled flow fields in general.

Author

Surveys; Flow Distribution; Computational Fluid Dynamics; Aerodynamic Configurations; Turbulence; Jet Flow; Mass Flow

20080023453 NASA Langley Research Center, Hampton, VA, USA

Turbulence Model Behavior in Low Reynolds Number Regions of Aerodynamic Flowfields

Rumsey, Christopher L.; Spalart, Philippe R.; June 23, 2008; 19 pp.; In English; 38th AIAA Fluid Dynamics Conference and Exhibit, 23-26 Jun. 2008, Seattle, WA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581

Report No.(s): AIAA-2008-4403; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023453>

The behaviors of the widely-used Spalart-Allmaras (SA) and Menter shear-stress transport (SST) turbulence models at low Reynolds numbers and under conditions conducive to relaminarization are documented. The flows used in the investigation include 2-D zero pressure gradient flow over a flat plate from subsonic to hypersonic Mach numbers, 2-D airfoil flow from subsonic to supersonic Mach numbers, 2-D subsonic sink-flow, and 3-D subsonic flow over an infinite swept wing (particularly its leading-edge region). Both models exhibit a range over which they behave transitionally in the sense that the flow is neither laminar nor fully turbulent, but these behaviors are different: the SST model typically has a well-defined transition location, whereas the SA model does not. Both models are predisposed to delayed activation of turbulence with increasing freestream Mach number. Also, both models can be made to achieve earlier activation of turbulence by increasing their freestream levels, but too high a level can disturb the turbulent solution behavior. The technique of maintaining freestream levels of turbulence without decay in the SST model, introduced elsewhere, is shown here to be useful in reducing grid-dependence of the model's transitional behavior. Both models are demonstrated to be incapable of predicting relaminarization; eddy viscosities remain weakly turbulent in accelerating or laterally-strained boundary layers for which experiment and direct simulations indicate turbulence suppression. The main conclusion is that these models are intended for fully turbulent high Reynolds number computations, and using them for transitional (e.g., low Reynolds number) or relaminarizing flows is not appropriate.

Author

Turbulence Models; Shear Stress; Low Reynolds Number; Aerodynamics; Laminar Flow; Computational Fluid Dynamics

20080023454 NASA Langley Research Center, Hampton, VA, USA

Design of a Mach-3 Nozzle for TBCC Testing in the NASA LaRC 8-ft High Temperature Tunnel

Gaffney, Richard L., Jr.; Norris, Andrew T.; June 23, 2008; 17 pp.; In English; 26th AIAA Aerodynamic Measurement Technology and Ground Testing Conference, 23-26 Jun. 2008, Seattle, WA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 599489.02.07.07.03.01

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ONLINE: <http://hdl.handle.net/2060/20080023454>

A new nozzle is being constructed for the NASA Langley Research Center 8-Foot High Temperature Tunnel. The axisymmetric nozzle was designed with a Mach-3 exit flow for testing Turbine-Based Combined-Cycle engines at a Mach number in the vicinity of the transition from turbojet to ramjet operation. The nozzle contour was designed using the NASA Langley IMOCND computer program which solves the potential equation using the classical method of characteristics. To

include viscous effects, the design procedure iterated the MOC contour generation with CFD Navier-Stokes calculations, adjusting MOC input parameters until target nozzle-exit conditions were achieved in the Navier-Stokes calculations. The design process was complicated by a requirement to use the final 29.5 inches of an existing 54.5-inch exit-diameter Mach-5 nozzle contour. This was accomplished by generating a Mach-3 contour that matched the radius of the Mach-5 contour at the match point and using a 3rd order polynomial to create a smooth transition between the two contours. During the final evaluation of the design it was realized that the throat diameter is more than half that of the upstream mixing chamber. This led to the concern that large vortical structures generated in the mixer would persist downstream, affecting nozzle-exit flow. This concern was addressed by analyzing the results of three-dimensional, viscous, numerical simulations of the entire flowfield, from the exit of the facility combustor to the nozzle exit. An analysis of the solution indicated that large scale structures do not pass through the throat and that both the total temperature and species (CO₂) are well mixed in the mixer, providing uniform flow to the nozzle and subsequently the test cabin.

Author

Nozzle Flow; Turbine Engines; Supersonic Speed; Contours; Turbojet Engines; Computational Fluid Dynamics; Computerized Simulation

20080023457 NASA Langley Research Center, Hampton, VA, USA

PLIF Visualization of Active Control of Hypersonic Boundary Layers Using Blowing

Bathel, Brett F.; Danehy, Paul M.; Inman, Jennifer A.; Alderfer, David W.; Berry, Scott A.; June 18, 2008; 19 pp.; In English; 38th AIAA Fluid Dynamics Conference and Exhibit, 23-26 Jun. 2008, Seattle, WA, USA; Original contains color and black and white illustrations

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Planar laser-induced fluorescence (PLIF) imaging was used to visualize the boundary layer flow on a 1/3-scale Hyper-X forebody model. The boundary layer was perturbed by blowing out of orifices normal to the model surface. Two blowing orifice configurations were used: a spanwise row of 17-holes spaced at 1/8 inch, with diameters of 0.020 inches and a single-hole orifice with a diameter of 0.010 inches. The purpose of the study was to visualize and identify laminar and turbulent structures in the boundary layer and to make comparisons with previous phosphor thermography measurements of surface heating. Jet penetration and its influence on the boundary layer development was also examined as was the effect of a compression corner on downstream boundary layer transition. Based upon the acquired PLIF images, it was determined that global surface heating measurements obtained using the phosphor thermography technique provide an incomplete indicator of transitional and turbulent behavior of the corresponding boundary layer flow. Additionally, the PLIF images show a significant contribution towards transition from instabilities originating from the underexpanded jets. For this experiment, a nitric oxide/nitrogen mixture was seeded through the orifices, with nitric oxide (NO) serving as the fluorescing gas. The experiment was performed in the 31-inch Mach 10 Air Tunnel at NASA Langley Research Center.

Author

Laser Induced Fluorescence; Hypersonic Boundary Layer; Boundary Layer Flow; Blowing; Active Control; Scientific Visualization; Gas Jets; Hypersonic Aircraft; Forebodies

20080023460 NASA Langley Research Center, Hampton, VA, USA

Boundary Layer Receptivity due to Roughness and Freestream Sound for Supersonic Flows over Axisymmetric Cones

Balakumar, P.; June 23, 2008; 17 pp.; In English; 38th AIAA Fluid Dynamics Conference and Exhibit, 23-26 Jun. 2008, Seattle, WA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.07.14.04; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023460>

The receptivity of supersonic boundary layers due to the interaction of a two-dimensional acoustic wave with a three-dimensional roughness is numerically investigated over a 5-degree sharp tipped straight cone at a free stream Mach number of 3.5 and a high Reynolds number of $10(\exp 6)/\text{inch}$. Both the steady and unsteady solutions are obtained by solving the full Navier-Stokes equations using the fifth-order accurate weighted essentially non-oscillatory (WENO) scheme for spatial discretization and using third-order total-variation-diminishing (TVD) Runge-Kutta scheme for temporal integration. The simulations are performed with different roughness heights and roughness locations. The steady computations with the roughness reveal that the perturbations induced by the roughness remain very close to the wall and do not penetrate to the outer part of the boundary layer. The effects of the roughness persist for about 10 boundary layer thicknesses downstream of each element. The unsteady simulation shows the generation of unstable three-dimensional first mode disturbances within a short distance from the roughness. However, the amplitudes of the instability waves are very small near the neutral point, on the order of $10(\exp -4)$ compared to the free stream disturbances. The receptivity coefficients due to the roughness elements

located very close to the tip are one order of magnitude smaller than those due to the roughness elements located closer to the neutral point.

Author

Supersonic Boundary Layers; Sound Waves; Supersonic Flow; Angle of Attack; Acoustic Instability; Boundary Layer Thickness; Axisymmetric Bodies; Cones; Boundary Layers; Computational Fluid Dynamics

20080023499 National Cheng Kung Univ., Tainan, Taiwan, Province of China

Breakup of Compound Liquid Jets under Periodic Excitation at Small Core-to-Shell Mass Ratios

Chiu, Sheng-Lin; Lin, Ta-Hui; Journal of the Chinese Institute of Engineers, Volume 31, No.1; January 2008, pp. 1-8; In English; See also [20080023495](#); Original contains black and white illustrations

Contract(s)/Grant(s): NSC95-2218-E-006-019; Copyright; Avail.: Other Sources

A periodic excitation was applied to a compound liquid jet, which was composed of a core liquid, water, surrounded by a shell liquid, diesel oil, for an experimental investigation on its breakup. The core-to-shell mass ratio, γ , and the ratio of disturbance wavelength to undisturbed diameter of the compound jet, Λ/D , were taken into consideration as parameters to describe the breakup processes of the compound jet. For $\gamma < 0.36$, the compound jet breakup was classified into six patterns. By comparing the breakup of a single diesel jet to that of a water-in-diesel compound jet, two conclusions were drawn. First, the uniform drop regime of the compound jet was wider than that of the single jet. Second, both the single jet and water-in-diesel compound jet broke randomly in the range of $\Lambda/D < 3$.

Author

Excitation; Fluid Jets; Mass Ratios; Diesel Fuels

20080023508 National Taiwan Univ., Taipei, Taiwan, Province of China

Velocity Profiles of Nonlinear Shallow-Water Flows

Lin, Meng-Yu; Huang, Liang-Hsiung; Journal of the Chinese Institute of Engineers, Volume 31, No.1; January 2008, pp. 105-120; In English; See also [20080023495](#); Original contains black and white illustrations

Contract(s)/Grant(s): MOEA/WRB/ST-910002V3; Copyright; Avail.: Other Sources

In this study, a numerical algorithm using VHS (vertical/horizontal splitting) is proposed for the simulation of vertical profiles of velocity in depth-averaged shallow water modeling. After temporal discretization, the governing equations form a two-point boundary value problem set, and a shooting method is then proposed to solve it. This algorithm is verified with three theoretical test cases: finite depth Ekman layer, plane laminar jet flow, and rotating disk flow. The computed results indicate good accuracy. Finally, the ability of nonlinear calculations in realistic problems is revealed by applying the present algorithm to the tidal estuary of the Zhusui River in Taiwan. This algorithm provides a simple and accurate method for depth-averaged shallow-water modeling to yield information on vertical profiles of velocity.

Author

Algorithms; Velocity Distribution; Shallow Water; Laminar Flow; Water Flow; Boundary Value Problems

20080023582 NATO Research and Technology Organization, Neuilly-sur-Seine, France

Flight Experiments for Hypersonic Vehicle Development

June 2007; In English; RTO-ATV/VKI Lecture Series, 24-27 Oct. 2005, Rhode St. Genese, Belgium; See also 20080023583 - 20080023591

Report No.(s): RTO-EN-AVT-130; AC/323(AVT-130)TP/115; Copyright; Avail.: CASI: [C01](#), CD-ROM

This RTO-AVT/VKI Lecture Series brought together specialists from Europe, USA, and Russia to discuss flight experiments that pertain to the development of hypersonic vehicles. The notes of this Lecturer Series provide an important resource for researchers interested in the development and interpretation of reliable flight experiments. Following a discussion of ground-test strategies that complement flight experiments and basic instrumentation issues, past and current flight experiment programs are presented with detailed discussion of the results, or expected results. Finally, advanced instrumentation concepts that are being developed to study critical aerothermodynamic phenomena on future hypersonic flight experiments are described. The lecture notes were prepared under the combined sponsorship of the RTO AVT Panel, the von Karman Institute for Fluid Dynamics, and the European Office of Air Force Research and Development.

Author

Aerothermodynamics; Hypersonic Vehicles; Computational Fluid Dynamics; Aerospace Engineering; Flight Tests

20080023583 Technische Hochschule, Stuttgart, Germany

Advanced Integrated TPS and Non Equilibrium Chemistry Instrumentation

Auweter-Kurtz, Monika; Fertig, Markus; Herdrich, Georg; Winter, Michael; Flight Experiments for Hypersonic Vehicle Development; June 2007, pp. 15-1 - 15-50; In English; See also [20080023582](#); Original contains color and black and white illustrations

Contract(s)/Grant(s): AZ: 23-729.86-1/1

Report No.(s): Paper 15; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Different flight experiments/instrumentations developed and being developed at IRS were presented. Typical flight data were shown such as temperature histories of the PYREX on MIRKA and corresponding data of the HEATIN experiment. These data were postprocessed e.g. the HEATIN data were used to determine the heat flux distribution along the entire contour of the spherical capsule. In addition, the data were reproduced using the URANUS code equipped with an appropriate surface reaction model. Furthermore, the entire development history of PYREX for X-38 together with typical qualification and approval steps is depicted. The miniaturized spectrometer RESPECT, planned to be flown aboard the EXPERT capsule, is based on the experience with flight experiments such as PYREX in combination with the know-how in the field of plasma diagnostics. The experiments PHLUX, Boundary Layer Probe and Radiometer Probe show a consistent development and leads to the wish to have a combination of such experiments (..COMPARE). Although plasma wind tunnels and computer simulation programs can not fully replace actual flights, the paper shows that they are required as support for the experiments. Here, the spectrometer RESPECT would provide an important contribution for the better understanding of the plasma-wall situation and is, therefore, an important contribution within the proposed experiments. So far, for RESPECT and the Radiometer Probe the next step has to be an engineering model, COMPARE, however, still needs to be functionally qualified and applied in the IRS plasma wind tunnels.

Author

Boundary Layers; Plasma Diagnostics; Heat Flux; Computerized Simulation; Thermal Protection; Atmospheric Entry; Celestial Bodies; Surface Reactions; X-38 Crew Return Vehicle

20080023585 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands

Aerothermodynamic Reentry Flight Experiments Expert

Muylaert, J.; Walpot, L.; Ottens, H.; Cipollini, F.; Flight Experiments for Hypersonic Vehicle Development; June 2007, pp. 13-1 - 13-34; In English; See also [20080023582](#); Original contains color and black and white illustrations

Report No.(s): Paper 13; Copyright; Avail.: CASI: [A07](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The paper addresses the ESA in flight Aerothermodynamic (ATD) research programme referred to as EXPERT: the European EXPerimental Re-entry Testbed. The objective of this in-flight research programme is to design and instrument generic configurations, for in-flight measurements of critical ATD phenomena using state-of-the-art instrumentation. Hypersonic flight data are required for improved understanding of the following critical ATD phenomena : a) Transition, b) Catalicity and oxidation, c) Real gas effects on shock wave boundary layer interactions, d) Microaerothermodynamics, e) Blackout. Special attention is given to the design of the flight measurement sensors themselves, their integration into the TPS as well as to the measurement of the free stream parameters during re-entry using an Air Data System. In addition to the procurement of 'good enough' hypersonic data, the EXPERT programme includes also windtunnel testing and numerical simulations to complete the above listed critical ATD validation process including windtunnel to flight extrapolation activities. The present paper will report on: selection of reference mission profiles offered by Volna launcher, geometrical design optimisation of the configuration and elaborate on the embarked payloads for the provision of the hypersonic data associated with the above listed critical ATD phenomena.

Author

Aerothermodynamics; Reentry; Shock Wave Interaction; Air Data Systems; Hypersonic Flight; In-Flight Monitoring

20080023586 Eidgenoessische Technische Hochschule, Zurich, Switzerland

Shock Wave/Boundary Layer Interaction Experiment on Control Surface

Schlamp, Stefan; Prochazka, Lukas; Roesgen, Thomas; Flight Experiments for Hypersonic Vehicle Development; June 2007, pp. 14-1 - 14-22; In English; See also [20080023582](#); Original contains color and black and white illustrations

Report No.(s): Paper 14; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The shock wave/boundary layer interaction (SWBLI) experiment is part of the EXPERT mission. SWBLI is studied on

two identical fixed compression ramps made of C/SiC, which are models for control surfaces. The flow separates on the flat surfaces upstream of the compression ramps and reattaches on the ramp surfaces. A reattachment shock results, which interacts with the boundary layer. One ramp is instrumented with thermocouples. An infrared camera (InGaAs detector array) views the inside of the second flap. A 50 nm bandpass in front of the detector extends its temperature measurement range to over 2,000 K. This provides temperature maps with a spatial resolution of O (1 mm) at 30 Hz. The heat flux on the flap's exterior is obtained from the temperature distribution history and the known thermal properties of the structure using an inverse method. The locations of the detachment and reattachment shocks are very sensitive to numerical errors and changes of the flow conditions. This flow phenomenon is thus highly suitable to validate numerical results and to examine if and how wind tunnel results can be extrapolated to re-entry flows. The status quo of the payload design is described; CFD and FEM results are presented.

Author

Boundary Layers; Shock Waves; Control Surfaces; Indium Gallium Arsenides; Thermocouples; Thermodynamic Properties; Wave Interaction; Computational Fluid Dynamics

20080023587 EADS Space Transportation, Les Mureaux, France

Re-Entry Flight Experiments Lessons Learned - The Atmospheric Reentry Demonstrator ARD

Tran, Philippe; Paulat, J. C.; Boukhobza, P.; Flight Experiments for Hypersonic Vehicle Development; June 2007, pp. 10-1 - 10-46; In English; See also [20080023582](#); Original contains color and black and white illustrations

Report No.(s): Paper 10; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Atmospheric Reentry Demonstrator (ARD) successfully completed its atmospheric reentry flight on October 21st, 1998. This paper provides with a summary of the ARD flight data and presents some lessons learned that can be advantageously used for the development of future re-entry vehicles with precise landing capabilities. This paper widely uses materials from a series of presentations dedicated to ARD Post-Flight analysis during the 2001 International Symposium on Re-entry systems and technologies in Arcachon.

Author

Atmospheric Entry; Lessons Learned; Postflight Analysis; Proving

20080023588 Centre National d'Etudes Spatiales, Evry, France

Pre-X Experimental Re-Entry Lifting Body: Design of Flight Test Experiments for Critical Aerothermal Phenomena

Baiocco, Paolo; Flight Experiments for Hypersonic Vehicle Development; June 2007, pp. 11-1 - 11-18; In English; See also [20080023582](#); Original contains color and black and white illustrations

Report No.(s): Paper 11; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Atmospheric glided re-entry is one of the main key technologies for future space vehicle applications. In this frame Pre-X is the CNES proposal to perform in-flight experimentation mainly on reusable thermal protections, aero-thermo-dynamics and guidance to secure the second generation of re-entry X vehicles. This paper describes the system principles and main aerothermodynamic experiences currently foreseen on board the vehicle. A preliminary in-flight experimentation and measurement plan has been assessed defining the main objectives in terms of reusable Thermal Protection System (TPS) and Aero Thermo Dynamics (ATD) data on the most critical phenomena. This flight aims also to take the opportunity to fly some innovative measurements. A complete system loop has been performed including the operations, ground system assessment, and visibility analysis. The vehicle re-entry point is at 120 km and the mission objectives are fulfilled between Mach 25 and 5. Then the vehicle has to pass to subsonic speeds, the parachute opens and it is finally recovered in the sea. The VEGA and DNEPR launch vehicles are compatible of the Pre-X experimental vehicle.

Author

Aerothermodynamics; Thermal Protection; Atmospheric Entry; Experiment Design; Flight Tests; Hypersonic Speed; Aerodynamics

20080023589 Hyperschall Technologie Goettingen (HTG), Goettingen, Germany

Controlled Hypersonic Flight Air Data System and Flight Instrumentation

Koppenwallner, Georg; Flight Experiments for Hypersonic Vehicle Development; June 2007, pp. 17-1 - 17-30; In English; See also [20080023582](#); Original contains color and black and white illustrations

Report No.(s): Paper 17; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The main task of an air data system, namely to deduce from measurement on the body the aerodynamic free stream

conditions will be outlined. Emphasis will also be given to the limitations of aerodynamic systems. A short review of the aerodynamic probe functions relating measured quantities to the desired free stream conditions and vehicle orientation will be given. After explaining the principle elements of an air data system the design of individual components will be outlined. The design of an air data system depends strongly on the flight envelope, re-entry trajectory and vehicle structure. Flight envelope and re-entry trajectory influence primarily the sensor range and sensor head design. Vehicle structure has a strong influence on the probe installment. The principal components are: Probe heads, Probe mounting elements, sensors, sensor electronics, harness and data acquisition system. In a similar way the design of calorimetric heat flux sensors will be explained. Testing and flight qualification are one of the mayor efforts during development of an air data system and flight instrumentation. Therefore the principal steps for these activities will also be outlined.

Author

Air Data Systems; Flight Instruments; Flight Control; Flight Tests; Hypersonic Flight; Data Acquisition

20080023590 Office National d'Etudes et de Recherches Aerospatiales, Palaiseau, France

Advanced Concept for Air Data System using EBF and Lidar

Mohamed, A. K.; Bonnet, J.; Flight Experiments for Hypersonic Vehicle Development; June 2007, pp. 16-1 - 16-32; In English; See also [20080023582](#); Original contains color and black and white illustrations

Report No.(s): Paper 16; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We describe here two innovative in-flight measurement techniques for onboard operation on atmospheric re-entry demonstrator vehicles like EXPERT or pre-X actually in study in Europe. The first one is the Electron Beam Fluorescence (EBF) technique which aims at characterising shock layer chemistry through measurements of density, rotational and vibrational temperatures of N₂ and NO in low density hypersonic flows. These data are of great importance for the validation of the modelling tools commonly used for aerothermodynamics simulations, since they include a variety of thermo-chemical models yet to be fully validated with relevant flight data. The second measurement technique is a short range Rayleigh Lidar for measurements of upstream total density which is a primary variable in many aerodynamic key features like forces or heat flux.

Author

Electron Beams; Air Data Systems; Optical Radar; Heat Flux; Aerothermodynamics; Aerodynamic Forces

20080023591 Calspan-Buffalo Univ. Research Center, Buffalo, NY, USA

Aerothermal and Propulsion Ground Testing that Can Be Conducted to Increase Chances for Successful Hypervelocity Flight Experiments

Holden, Michael S.; Flight Experiments for Hypersonic Vehicle Development; June 2007, pp. 1-1 - 1-36; In English; See also [20080023582](#); Original contains color and black and white illustrations

Report No.(s): Paper 1; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Ground tests at fully duplicated or well simulated flight conditions are essential to minimize the risks associated with flight test programs from the perspective of overall vehicle performance and detailed measurements to investigate flow phenomena associated with real gas effects, boundary layer transition, turbulence and shock interaction phenomena and mixing and combustion. Both flight test and ground test planning and evaluation should be totally integrated and supported by detailed numerical computations employing DSMC, Navier-Stokes and empirical prediction methods. Hypersonic ground test facilities are available to perform full-scale testing at fully duplicated flight conditions of vehicles up to 3 to 6 meters in length. Flight test programs should be conducted in concert with and not at the expense of improving our ground test facilities and measurements techniques.

Author

Aerothermodynamics; Hypersonic Flight; Ground Tests; Prediction Analysis Techniques; Computerized Simulation; Flight Tests; Monte Carlo Method

20080023614 Isothermal Systems Research, Inc., Liberty Lake, WA USA

Actuated atomizer

Tilton, Charles, Inventor; Weiler, Jeff, Inventor; Palmer, Randall, Inventor; Appel, Philip, Inventor; May 13, 2008; 15 pp.; In English

Contract(s)/Grant(s): NAS8-40644

Patent Info.: Filed October 24, 2002; US-Patent-7,370,817; US-Patent-Appl-SN-10/281,391; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023614>

An actuated atomizer is adapted for spray cooling or other applications wherein a well-developed, homogeneous and generally conical spray mist is required. The actuated atomizer includes an outer shell formed by an inner ring; an outer ring; an actuator insert and a cap. A nozzle framework is positioned within the actuator insert. A base of the nozzle framework defines swirl inlets, a swirl chamber and a swirl chamber. A nozzle insert defines a center inlet and feed ports. A spool is positioned within the coil housing, and carries the coil windings having a number of turns calculated to result in a magnetic field of sufficient strength to overcome the bias of the spring. A plunger moves in response to the magnetic field of the windings. A stop prevents the pintle from being withdrawn excessively. A pintle, positioned by the plunger, moves between first and second positions. In the first position, the head of the pintle blocks the discharge passage of the nozzle framework, thereby preventing the atomizer from discharging fluid. In the second position, the pintle is withdrawn from the swirl chamber, allowing the atomizer to release atomized fluid. A spring biases the pintle to block the discharge passage. The strength of the spring is overcome, however, by the magnetic field created by the windings positioned on the spool, which withdraws the plunger into the spool and further compresses the spring.

Official Gazette of the U.S. Patent and Trademark Office

Actuators; Atomizers; Sprayers

35

INSTRUMENTATION AND PHOTOGRAPHY

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

20080022927 Science Applications International Corp., San Diego, CA USA

Application of State-Estimation Techniques for Spatial, Temporal, and Polarization Diverse Waveforms

Garnham, John W; Roman, Jaime R; Stiles, James M; Boerner, Wolfgang-Martin; Oct 2007; 203 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-03-C-0114; Proj-517R

Report No.(s): AD-A477568; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477568>

A novel radar system design philosophy is presented in which the radar adapts in time as the functional mode and environment evolve. In that context, the main subsystems change to meet performance and functional requirements. Two key aspects of the concept proposed herein are the consideration of the receiver function as a parameter estimation problem, and the selection of the waveform to be transmitted as an optimization problem with information-theoretic criteria. Two new information theoretic for waveform selection in radar and other sensing applications are introduced. One criterion is based on the concept of mutual information, and the other is based on changes in the Fisher information of the received signal. This second criterion is referred to herein as marginal information, to emphasize the fact that it is based on a change in information. Marginal information is itself a novel measure introduced in this work, and is shown to be inherently associated with minimum mean-squared error estimation criteria because Fisher information is related to the Cramer-Rao bound for the estimation error of any unbiased estimator.

DTIC

Estimating; Radar Transmitters; State Estimation; Waveforms

20080023029 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Commercial Sensor Survey Testing Progress Report

Becker, Heidi N.; Dolphin, Michael D.; Thorborun, Dennis O.; Alexander, James W.; Salomon, Phil M.; April 2008; 33 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS7-03001; WBS 939904.01.11.30; Proj. 102197

Report No.(s): JPL Publication 08-22; Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2014/40825>

The NASA Electronic Parts and Packaging (NEPP) Sensor Technology Commercial Sensor Survey task is geared toward benefiting future NASA space missions with low-cost, short-duty-cycle, visible imaging needs. Such applications could include imaging for educational outreach purposes or short surveys of spacecraft, planetary, or lunar surfaces. Under the task, inexpensive commercial grade complementary metal oxide semiconductor (CMOS) sensors were surveyed in fiscal year 2007 (FY07) and three sensors were selected for total ionizing dose (TID) and displacement damage dose (DDD) tolerance testing. The selected sensors had to meet selection criteria chosen to support small, low-mass cameras that produce good resolution color images. This document discusses the progress of FY08 radiation testing on the Micron and OmniVision sensors selected in FY07 for radiation tolerance testing.

Author

Cameras; Electronic Packaging; Radiation Tolerance; Displacement; Planetary Surfaces

20080023064 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Precision Linear Actuator for Space Interferometry Mission (SIM) Siderostat Pointing

Cook, Brant; Braun, David; Hankins, Steve; Koenig, John; Moore, Don; 39th Aerospace Mechanisms Symposium; May 2008, pp. 373-386; In English; See also [20080023060](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

'SIM PlanetQuest will exploit the classical measuring tool of astrometry (interferometry) with unprecedented precision to make dramatic advances in many areas of astronomy and astrophysics'(1). In order to obtain interferometric data two large steerable mirrors, or Siderostats, are used to direct starlight into the interferometer. A gimbaled mechanism actuated by linear actuators is chosen to meet the unprecedented pointing and angle tracking requirements of SIM. A group of JPL engineers designed, built, and tested a linear ballscrew actuator capable of performing submicron incremental steps for 10 years of continuous operation. Precise, zero backlash, closed loop pointing control requirements, lead the team to implement a ballscrew actuator with a direct drive DC motor and a precision piezo brake. Motor control commutation using feedback from a precision linear encoder on the ballscrew output produced an unexpected incremental step size of 20 nm over a range of 120 mm, yielding a dynamic range of 6,000,000:1. The results prove linear nanometer positioning requires no gears, levers, or hydraulic converters. Along the way many lessons have been learned and will subsequently be shared.

Author

Astronomical Interferometry; Actuators; Interferometers; Linear Systems; Mirrors; Precision; Position Sensing

20080023134 ISRO Satellite Centre, Peenya, Bangalore, India

Implementation of 2 Gigabit Rate Data Handling System for Synthetic Aperture Radar (SAR) Payload

Dutta, Chayan; Subramanian, Vivek R.; Lalitkrushna, Thakar; Nelson, Annie; Nagaraj, S. R.; Seshiah, R.; Journal of Spacecraft Technology, Volume 18, No. 1; January 2008, pp. 22-29; In English; See also [20080023129](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

Remote sensing satellite having SAR [1-3] payload has advantages over optical payload in terms of its capability in imaging during day, night and all weather conditions. A further different mode of SAR payload such as spot mode and strip map mode satisfies different needs of users. Whether imaging is done in spot mode or strip map mode, images can be taken for different locations from nadir across the swath. The SAR payload data captured are burst in nature. Based on the location of the spot/strip map from nadir the data rate of the payload varies, since the pulse repeating frequency varies. Further for image resolution of 1 meter the data rate of payload goes up to 1.5Gbps approximately (after compression). All these features of a high resolution SAR payload, makes the interface between SAR and data handling system complex in terms of very high data rate, variable data rate and its burst nature. This paper explains a new configuration of data handling system that supports very high data rate formatting and can handle payload data, which are burst in nature, having variable data rates. The configuration supports formatting of payload data from 1Mbps to 1.8Gbps. The paper also highlights about the high frequency PCB design, high-speed interfaces and high-speed device selection. Issues like selection of a suitable electrical interface between data handling, payload and data recorder, which can cater data rate up to 1.8 Gbps and save power, harness and weight

is discussed. The electrical interface adopted in this configuration saves 80% power and reduces harness by 70% compared to single channel TTL/ECL/LVDS interfaces.

Author

Synthetic Aperture Radar; Payloads; Data Recorders; Image Resolution; Imaging Techniques; High Resolution; Data Systems; Harnesses; Satellite Observation

20080023136 Semi-Conductor Laboratory, S.A.S. Nagar, Punjab, India

Design and Development of 1k x 1k Frame Transfer Imager

Umamathi, B.; Das Gupta, Sudipto; Mishra, Vinita; Hira, Priya; Roy, J. N.; Journal of Spacecraft Technology, Volume 18, No. 1; January 2008, pp. 61-66; In English; See also [20080023129](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

The process and device design of 1K x 1K frame transfer imager for star sensor application are described. Both conventional and MPP device architectures are fabricated and characterized. The design, fabrication and packaging issues involved in the fabrication of this large array frame transfer device are highlighted. The inverted mode clocking principle and its advantage in reducing surface dark current in the device are discussed.

Author

Charge Coupled Devices; Dark Current; Fabrication; Electric Potential; Imaging Techniques

20080023211 Buchanan Ingersoll, PC, Alexandria, VA, USA

System for Amplifying Optical Detection of Cantilever Deflection

Majumdar, A., Inventor; Satyanarayana, S., Inventor; 6 Jul 04; 11 pp.; In English

Contract(s)/Grant(s): R21 CA8632-01; DE-FG03-98ER14870

Patent Info.: Filed 6 Jul 04; US-Patent-Appl-SN-10 883 964

Report No.(s): PB2007-109136; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A sensor system configured to amplify cantilever deflection, having: a reflective membrane connected to a cantilever, wherein the reflective membrane rotates more than the cantilever when the cantilever deflects. A sensor system, including: a cantilever having a first end and a second end, the first end being held at a first fixed location and the second end being free to move; and a reflective membrane having a first end and a second end, the first end being held at a second fixed location and the second end being attached to the cantilever.

NTIS

Sensors; Amplification; Optical Measurement; Detection; Deflection

20080023458 NASA Langley Research Center, Hampton, VA, USA

A System Trade Study of Remote Infrared Imaging for Space Shuttle Reentry

Schwartz, Richard J.; Ross, Martin N.; Baize, Rosemary; Horvath, Thomas J.; Berry, Scott A.; Krasa, Paul W.; June 23, 2008; 14 pp.; In English; 26th AIAA Aerodynamic Measurement Technology and Ground Testing Conference, 23-26 Jun. 2008, Seattle, WA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 599489.02.07.07.06.04

Report No.(s): AIAA 2008-4023; Copyright; Avail.: CASI: [A03](#), Hardcopy

A trade study reviewing the primary operational parameters concerning the deployment of imaging assets in support of the Hypersonic Thermodynamic Infrared Measurements (HYTHIRM) project was undertaken. The objective was to determine key variables and constraints for obtaining thermal images of the Space Shuttle orbiter during reentry. The trade study investigated the performance characteristics and operating environment of optical instrumentation that may be deployed during a HYTHIRM data collection mission, and specified contributions to the Point Spread Function. It also investigated the constraints that have to be considered in order to optimize deployment through the use of mission planning tools. These tools simulate the radiance modeling of the vehicle as well as the expected spatial resolution based on the Orbiter trajectory and placement of land based or airborne optical sensors for given Mach numbers. Lastly, this report focused on the tools and methodology that have to be in place for real-time mission planning in order to handle the myriad of variables such as trajectory ground track, weather, and instrumentation availability that may only be known in the hours prior to landing.

Author

Infrared Radiation; Infrared Imagery; Imaging Techniques; Space Shuttle Orbiters; Optical Measuring Instruments; Hypersonics; Real Time Operation; Trajectories; Data Acquisition

20080023505 National Taiwan Normal Univ., Taipei, Taiwan, Province of China

Low-Complexity Hybrid Demosaicing for Color Filter Arrays

Su, Chung-Yen; Journal of the Chinese Institute of Engineers, Volume 31, No.1; January 2008, pp. 173-179; In English; See also [20080023495](#); Original contains black and white illustrations

Contract(s)/Grant(s): NSC96-2516-S-003-004; Copyright; Avail.: Other Sources

This paper presents a cost-effective hybrid demosaicing algorithm for Bayer color filter array images. Unlike many iterative methods that require interpolating each color plane many times, the proposed algorithm requires only three times. Two edge-sensitive algorithms, one modified and the other new, are proposed to interpolate green pixels along the edge orientation in the color-difference space. Experimental results show that the proposed algorithm achieves more satisfying image quality than previous demosaicing techniques in terms of subjective and objective measurements, especially at peak signal-to-noise ratio.

Author

Algorithms; Interpolation; Image Resolution; Iterative Solution; Pixels

20080023523 NASA, Washington, DC USA

Method and system for sensing and identifying foreign particles in a gaseous environment

Choi, Sang H., Inventor; Park, Yeonjoon, Inventor; May 20, 2008; 7 pp.; In English

Patent Info.: Filed September 28, 2006; US-Patent-7,375,808; US-Patent-Appl-SN-11/536,120; No Copyright; Avail.:

CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023523>

An optical method and system sense and identify a foreign particle in a gaseous environment. A light source generates light. An electrically-conductive sheet has an array of holes formed through the sheet. Each hole has a diameter that is less than one quarter of the light's wavelength. The sheet is positioned relative to the light source such that the light is incident on one face of the sheet. An optical detector is positioned adjacent the sheet's opposing face and is spaced apart therefrom such that a gaseous environment is adapted to be disposed there between. Alterations in the light pattern detected by the optical detector indicate the presence of a foreign particle in the holes or on the sheet, while a laser induced fluorescence (LIF) signature associated with the foreign particle indicates the identity of the foreign particle.

Official Gazette of the U.S. Patent and Trademark Office

Optical Measuring Instruments; Gas Composition; Detectors

36

LASERS AND MASERS

Includes lasing theory, laser pumping techniques, maser amplifiers, laser materials, and the assessment of laser and maser outputs. For cases where the application of the laser or maser is emphasized see also the specific category where the application is treated. For related information see also *76 Solid-State Physics*.

20080022354 NASA Langley Research Center, Hampton, VA, USA

Side-Line Tunable Laser Transmitter for Differential Absorption Lidar Measurements of CO₂: Design and Application to Atmospheric Measurements

Koch, Grady J.; Beyon, Jeffrey Y.; Gibert, Fabien; Barnes, Bruce W.; Ismail, Syed; Petros, Mulugeta; Petzar, Paul J.; Yu, Jirong; Modlin, Edward A.; Davis, Kenneth J.; Singh, Upendra N.; [2007]; 38 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 478643.02.05.04.07

Report No.(s): LAR-16099-1; LAR-16394-1; Copyright; Avail.: Other Sources

A 2 m-wavelength, 90-mJ, 5-Hz pulsed holmium laser is described with wavelength control to precisely tune and lock the wavelength at a desired offset up to 2.9 GHz from the center of a CO₂ absorption line. Once detuned from line center the laser wavelength is actively locked to keep the wavelength within 1.9 MHz standard deviation about the setpoint. This wavelength control allows optimization of the optical depth for a differential absorption lidar (DIAL) measuring atmospheric CO₂ concentrations. The laser transmitter has been coupled with a coherent heterodyne receiver for measurements of CO₂ concentration using aerosol backscatter; wind and aerosols are also measured with the same lidar and provide useful additional information on atmospheric structure. Range-resolved CO₂ measurements were made with less than 2.4% standard deviation using 500-m range bins and 6.7 minute (1000 pulse pairs) integration time. Measurement of a horizontal column showed a precision of the CO₂ concentration to less than 0.7% standard deviation using a 30 minute (4500 pulse pairs) integration time,

and comparison with a co-located in-situ sensor showed the DIAL to measure the same trend of a diurnal variation and to detect shorter time scale CO₂ perturbations. For vertical column measurements the lidar was setup at the WLEF tall tower site in Wisconsin to provide meteorological profiles and to compare the DIAL measurements with in-situ sensors distributed on the tower up to 396-m height. Assuming the DIAL column measurement extending from 153-m altitude to 1353-m altitude should agree with the tower in-situ sensor at 396-m altitude, there was a 7.9 ppm root-mean-square difference between the DIAL and in-situ sensor using a 30-minute rolling average on the DIAL measurement.

Author

Tunable Lasers; Transmitters; Holmium; Perturbation; Differential Absorption Lidar; Carbon Dioxide Concentration; Atmospheric Composition; Pulsed Lasers; Optical Radar

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*.

20080022417 NASA Glenn Research Center, Cleveland, OH, USA

Gas Foil Bearing Misalignment and Unbalance Effects

Howard, Samuel A.; May 2008; 19 pp.; In English; Original contains color and black and white illustrations

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

Report No.(s): NASA/TM-2008-215176; E-16419; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080022417>

The effects of misalignment and unbalance on gas foil bearings are presented. The future of U.S. space exploration includes plans to conduct science missions aboard space vehicles, return humans to the Moon, and place humans on Mars. All of these endeavors are of long duration, and require high amounts of electrical power for propulsion, life support, mission operations, etc. One potential source of electrical power of sufficient magnitude and duration is a nuclear-fission-based system. The system architecture would consist of a nuclear reactor heat source with the resulting thermal energy converted to electrical energy through a dynamic power conversion and heat rejection system. Various types of power conversion systems can be utilized, but the Closed Brayton Cycle (CBC) turboalternator is one of the leading candidates. In the CBC, an inert gas heated by the reactor drives a turboalternator, rejects excess heat to space through a heat exchanger, and returns to the reactor in a closed loop configuration. The use of the CBC for space power and propulsion is described in more detail in the literature (Mason, 2003). In the CBC system just described, the process fluid is a high pressure inert gas such as argon, krypton, or a helium-xenon mixture. Due to the closed loop nature of the system and the associated potential for damage to components in the system, contamination of the working fluid is intolerable. Since a potential source of contamination is the lubricant used in conventional turbomachinery bearings, Gas Foil Bearings (GFB) have high potential for the rotor support system. GFBs are compliant, hydrodynamic journal and thrust bearings that use a gas, such as the CBC working fluid, as their lubricant. Thus, GFBs eliminate the possibility of contamination due to lubricant leaks into the closed loop system. Gas foil bearings are currently used in many commercial applications, both terrestrial and aerospace. Aircraft Air Cycle Machines (ACMs) and ground-based microturbines have demonstrated histories of successful long-term operation using GFBs (Heshmat et al., 2000). Small aircraft propulsion engines, helicopter gas turbines, and high-speed electric motors are potential future applications.

Author

Gas Bearings; Foil Bearings; Turbomachinery; Thrust Bearings; Journal Bearings; Turbogenerators; Rotors; Heat Sources; Engine Design

20080022426 NASA Glenn Research Center, Cleveland, OH, USA

Compliant Foil Journal Bearing Performance at Alternate Pressures and Temperatures

Bruckner, Robert J.; Puleo, Bernadette J.; May 2008; 15 pp.; In English; Turbo Expo 2008 Gas Turbine Technical Congress and Exposition sponsored, 9-13 Jun. 2008, Berlin, Germany, Germany

Contract(s)/Grant(s): WBS 877866.02.07.03.01.01

Report No.(s): NASA/TM-2008-215219; GT2008-50174; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080022426>

An experimental test program has been conducted to determine the highly loaded performance of current generation gas foil bearings at alternate pressures and temperatures. Typically foil bearing performance has been reported at temperatures

relevant to turbomachinery applications but only at an ambient pressure of one atmosphere. This dearth of data at alternate pressures has motivated the current test program. Two facilities were used in the test program, the ambient pressure rig and the high pressure rig. The test program utilized a 35 mm diameter by 27 mm long foil journal bearing having an uncoated Inconel X-750 top foil running against a shaft with a PS304 coated journal. Load capacity tests were conducted at 3, 6, 9, 12, 15, 18, and 21 krpm at temperatures from 25 to 500 C and at pressures from 0.1 to 2.5 atmospheres. Results show an increase in load capacity with increased ambient pressure and a reduction in load capacity with increased ambient temperature. Below one-half atmosphere of ambient pressure a dramatic loss of load capacity is experienced. Additional lightly loaded foil bearing performance in nitrogen at 25 C and up to 48 atmospheres of ambient pressure has also been reported. In the lightly loaded region of operation the power loss increases for increasing pressure at a fixed load. Knowledge of foil bearing performance at operating conditions found within potential machine applications will reduce program development risk of future foil bearing supported turbomachines.

Author

Foil Bearings; Gas Bearings; Shafts (Machine Elements); Pressure Distribution; Journal Bearings; High Pressure; Performance Tests; Turbomachinery

20080023023 Toledo Univ., Toledo, OH, USA

A Stability Analysis for a Hydrodynamic Three-Wave Journal Bearing

Ene, Nicoleta M.; Dimofte, Florin; Keith, Theo G., Jr.; Tribology International; October 03, 2007; Volume 41, pp. 434-442; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNC06AA06A; Copyright; Avail.: Other Sources

The influence of the wave amplitude and oil supply pressure on the dynamic behavior of a hydrodynamic three-wave journal bearing is presented. Both, a transient and a small perturbation technique, were used to predict the threshold to fractional frequency whirl (FFW). In addition, the behavior of the rotor after FFW appeared was determined from the transient analysis. The turbulent effects were also included in the computations. Bearings having a diameter of 30 mm, a length of 27.5 mm, and a clearance of 35 microns were analyzed. Numerical results were compared to experimental results obtained at the NASA GRC. Numerical and experimental results showed that the above-mentioned wave bearing with a wave amplitude ratio of 0.305 operates stably at rotational speeds up to 60,000 rpm, regardless of the oil supply pressure. For smaller wave amplitude ratios, a threshold of stability was found. It was observed that the threshold of stability for lower wave amplitude strongly depends on the oil supply pressure and on the wave amplitude. When the FFW occurs, the journal center maintains its trajectory inside the bearing clearance and therefore the rotor can be run safely without damaging the bearing surfaces.

Author

Journal Bearings; Stability Tests; Rotation; Dynamic Characteristics; Turbulence; Rotors; Oils

20080023060 Lockheed Martin Space Systems Co., Sunnyvale, CA, USA

39th Aerospace Mechanisms Symposium

Boesiger, E. A., Compiler; May 2008; 442 pp.; In English; 39th Aerospace Mechanisms Symposium, 7-9 May 2008, Huntsville, AL, USA; See also 20080023061 - 20080023094; Original contains color and black and white illustrations

Report No.(s): NASA/CP-2008-215252; M-1225; Copyright; Avail.: CASI: [A19](#), Hardcopy

The Aerospace Mechanisms Symposium (AMS) provides a unique forum for those active in the design, production, and use of aerospace mechanisms. A major focus is the reporting of problems and solutions associated with the development and flight certification of new mechanisms. Organized by the Mechanisms Education Association, NASA Marshall Space Flight Center (MSFC) and Lockheed Martin Space Systems Company (LMSSC) share the responsibility for hosting the AMS. Now in its 39th symposium, the AMS continues to be well attended, attracting participants from both the USA and abroad. The 39th AMS was held in Huntsville, Alabama, May 7-9, 2008. During these 3 days, 34 papers were presented. Topics included gimbals and positioning mechanisms, tribology, actuators, deployment mechanisms, release mechanisms, and sensors. Hardware displays during the supplier exhibit gave attendees an opportunity to meet with developers of current and future mechanism components.

Author

Actuators; Deployment; Gimbals; Tribology; Display Devices; Aerospace Systems

20080023061 RUAG Aerospace, Nyon, Switzerland

Circular Hall Transducer for Accurate Contactless Angular Position Sensing

Sache, Laurent; Reymond, Serge; Kejik, Pavel; Sjoeholm, Mikael; Bommottet, Daniel; Gass, Volker; Gaillard, Lionel; Popovic, Radjan S.; 39th Aerospace Mechanisms Symposium; May 2008, pp. 171-184; In English; See also [20080023060](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Demands for robust, reliable and accurate angular position sensing of space mechanism are increasing steadily. As a consequence, contactless sensors providing an alternative to tribological drawbacks of the current sliding potentiometers represent a key factor for the development of future space applications. In the framework of the ESTEC activity [1] covering the selection of an angular position sensor (APS) based on MEMS technology and in collaboration with the EPFL-LMIS [2], RUAG is currently carrying out the qualification of a new contactless angular position sensor based on the Hall Effect. Providing the angle without need of a complex algorithm, it offers a more reliable, lighter, less sensitive to vibrations and cost effective sensing solution.

Author

Hall Effect; Transducers; Microelectromechanical Systems; Position Sensing; Vibration

20080023063 SpaceDev, Inc., Louisville, CO, USA

Docking System Mechanism Utilized on Orbital Express Program

Christiansen, Scott; Nilson, Troy; 39th Aerospace Mechanisms Symposium; May 2008, pp. 207-220; In English; See also [20080023060](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Autonomous docking operations are a critical aspect of unmanned satellite servicing missions. Tender spacecraft must be able to approach the client spacecraft, maneuver into position, and then attach to facilitate the transfer of fuel, power, replacement parts, etc. The philosophical approach to the docking system design is intimately linked to the overall servicing mission. The docking system functionality must be compatible with the maneuvering capabilities of both of the spacecraft involved. This paper describes significant features and functionality of the docking system that was eventually chosen for the Orbital Express (OE) mission. Key analysis efforts, which included extensive dynamic modeling, are also described. Zero-g simulation tests were performed to validate the dynamic analyses. The docking system was flown and operated on the Orbital Express mission. The system performed as intended and has contributed to demonstrating the feasibility of autonomous docking and un-docking of independent spacecraft.

Author

Autonomous Docking; Spacecraft Maneuvers; Systems Engineering

20080023065 Aerospace Corp., El Segundo, CA, USA

Measuring the EHD Film Thickness in a Rotating Ball Bearing

Ward, Peter; Leveille, Alan; Frantz, Peter; 39th Aerospace Mechanisms Symposium; May 2008, pp. 107-116; In English; See also [20080023060](#); Original contains color and black and white illustrations

Contract(s)/Grant(s): FA8802-04-C-0001; Copyright; Avail.: CASI: [A02](#), Hardcopy

This paper presents two independent ways to directly measure the change in axial deflection of a bearing that is proportional to the magnitude of the total elastohydrodynamic (EHD) film developed. The first uses multiple capacitance displacement gages as a direct measurement of axial displacement and the second method uses the change in operating preload force to calculate the axial change in the test fixture and bearing stack. Convergence of the results from two independent techniques adds confidence to the experimental process. Either method can provide accurate EHD film thickness over extended time for a complete bearing under varying load, speed and lubrication conditions. Additionally, the methods are equally applicable to non-metallic materials, such as Si₃N₄ balls, which preclude the use of other techniques. The method has some advantages to the practicing engineer over the classical ball on a flat quartz plate because the full range of bearing design parameters and kinematic interactions are operating. The EHD film thicknesses of two oils and one grease were measured in an operating 304 sized angular contact bearing for up to 600 hours of running time at 6000 rpm. EHD film thickness was determined by simultaneously measuring the resultant displacement and axial force change of the outer rings due to collapse of the EHD film when the bearing pair was brought from full speed to rest. Because each measurement of axial displacement was completed within 2 seconds, the results are not affected by a contribution due to thermal expansion. We compared a common synthetic hydrocarbon base oil (Pennzane) with a common mineral oil (Coray). We found the synthetic oil film thickness to be approximately one half that of the mineral oil. We also compared film thickness with both large and small amounts of grease. We found that the large grease amount produced a prolonged run-in transient film that was thicker than the base oil steady state film. However, with a smaller amount of grease, the thickness fell to a value that was comparable to

the base oil. Initial assessment indicates that the degree of lubricant starvation is greater than can be accounted for with conventional EHD theory.

Author

Elastohydrodynamics; Fluid Films; Film Thickness; Deflection; Ball Bearings; Aerospace Engineering; Wear Resistance; Lubricants

20080023066 NASA Marshall Space Flight Center, Huntsville, AL, USA

Space Shuttle Orbiter Atlantis Liquid Oxygen Pre-Valve Detent Roller Cracking Investigation

Holleman, Elizabeth; Eddleman, David; Jacobs, Rebecca; Richard, James; 39th Aerospace Mechanisms Symposium; May 2008, pp. 97-105; In English; See also [20080023060](#); Original contains color illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

During routine inspections of the Space Shuttle's Main Propulsion System Liquid Oxygen (LO2) pre-valve, the mechanism provided to maintain the valve in the open position was found cracked. The mechanism is a Vespel roller held against the valve visor by a stack of Belleville springs. The roller has been found cracked 3 times. All three instances were in the same valve in the same location. There are 6 pre-valves on each orbiter, and only one has exhibited this problem. Every-flight inspections were instituted and the rollers were found to be cracked after only one flight. Engineers at Marshall Space Flight Center, Johnson Space Center, and Kennedy Space Center worked together to determine a solution. There were several possible contributors to the failure: a misaligned visor, an out-of-specification edge with a sharp radius, an out-of-specification tolerance stack up of a Belleville spring stack that caused un-predicted loads on the Vespel SP-21 roller, and a dimple machined into the side of the roller to indicate LO2 compatibility that created a stress riser. The detent assembly was removed and replaced with parts that were on the low side of the tolerance stack up to eliminate the potential for high loads on the detent roller. After one flight, the roller was inspected and showed fewer signs of wear and no cracks.

Author

Cracks; Space Shuttle Orbiters; Liquid Oxygen; Valves; Misalignment; Loads (Forces); Inspection

20080023067 Ball Aerospace and Technologies Corp., Boulder, CO, USA

Cryogenic Focus Mechanism for the Spitzer Space Telescope

Schade, William C.; 39th Aerospace Mechanisms Symposium; May 2008, pp. 401-414; In English; See also [20080023060](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

A new focus mechanism was developed, tested, and flown for the Spitzer Space Telescope ('Spitzer'), one of NASA's 'Great Observatories'. Figure 1 shows the Flight Focus Mechanism (FLT-FM), now in Spitzer. The mechanism uniquely provides robust support and precise focus adjustment for the Spitzer secondary mirror, from 300 K to a 5 K cryogenic environment. This paper summarizes the requirements, performance, description, and testing of the focus mechanism, including key component level tests of a geared-stepper motor and ball screw. Also, a secondary mirror mount is described that minimizes mirror distortion and supports high loads. Several design and test challenges were overcome and lessons learned from this successful development include: a) Titanium is useful as a flexure material to liquid helium temperatures. b) Adhesive bonds at cryo-temperatures should be well understood and / or tested. c) Geared-stepper motor and ball screw components were simply modified to work to < 5 K.

Author

Mirrors; Performance Tests; Cryogenics; Focusing; Telescopes; Space Infrared Telescope Facility; Titanium; Loads (Forces)

20080023070 Ball Aerospace and Technologies Corp., Boulder, CO, USA

Focus Mechanism for Kepler Mission

Koski, Craig; 39th Aerospace Mechanisms Symposium; May 2008, pp. 359-372; In English; See also [20080023060](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Focus Mechanism built for the primary mirror on the Kepler mission provides a method for adjustment of the mirror position for the duration of the mission. The Focus Mechanism also provides structural support for the 87 kg primary mirror. The Kepler mission requirements provided some interesting and difficult design tasks for the Focus Mechanism. This paper will describe the development, design, function and testing of the Focus Mechanism. The goal of the Kepler mission is to survey our region of the Milky Way Galaxy to detect and characterize hundreds of earth-size and smaller planets near the habitable zone. The habitable zone encompasses the distances from a star where liquid water can exist on a planet's surface. The transit method will be used for detecting extrasolar planets. A transit is when a planet crosses in front of its star as viewed by an observer, resulting in a small change in the star's brightness for a repeatable amount of time. Once detected, the planet

s orbital size and mass can be calculated using Kepler's Third Law of planetary motion ($T^2 = R^3$). The size of the planet is found from the depth of the transit (how much the brightness of the star drops) along with the size of the planet's star. From this information, the planet's characteristic temperature can be calculated.

Author

Mirrors; Brightness; Kepler Laws; Solar Orbits

20080023071 NASA Glenn Research Center, Cleveland, OH, USA

Evaluation of Separation Mechanism Design for the Orion/Ares Launch Vehicle

Konno, Kevin E.; Catalano, Daniel A.; Krivanek, Thomas M.; 39th Aerospace Mechanisms Symposium; May 2008, pp. 345-358; In English; See also [20080023060](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

As a part of the preliminary design work being performed for the Orion vehicle, the Orion to Spacecraft Adaptor (SA) separation mechanism was analyzed and sized, with findings presented here. Sizing is based on worst case abort condition as a result of an anomaly driving the launch vehicle engine thrust vector control hard-over causing a severe vehicle pitch over. This worst-case scenario occurs just before Upper Stage Main Engine Cut-Off when the vehicle is the lightest and the damping effect due to propellant slosh has been reduced to a minimum. To address this scenario and others, two modeling approaches were invoked. The first approach was a detailed Simulink model to quickly assess the Service Module Engine nozzle to SA clearance for a given separation mechanism. The second approach involved the generation of an Automatic Dynamic Analysis of Mechanical Systems (ADAMS) model to assess secondary effects due to mass centers of gravity that were slightly off the vehicle centerline. It also captured any interference between the Solar Arrays and the Spacecraft Adapter. A comparison of modeling results and accuracy are discussed. Most notably, incorporating a larger SA flange diameter allowed for a natural separation of the Orion and its engine nozzle even at relatively large pitch rates minimizing the kickoff force. Advantages and disadvantages of the Simulink model vs. a full geometric ADAMS model are discussed as well.

Author

Launch Vehicles; Service Modules; Adapters; Propellants; Thrust Vector Control; Thrust

20080023072 NASA Marshall Space Flight Center, Huntsville, AL, USA

Gas Strut Separation Alternative for Ares I

Floyd, Brian; Owens, James; 39th Aerospace Mechanisms Symposium; May 2008, pp. 331-344; In English; See also [20080023060](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper presents a design alternative and the rationale for a stage separation system based on Metering Adiabatic Gas Struts (MAG Struts) for the Ares 1 launch vehicle. The MAG Strut separation system was proposed as an alternative to the current Ares 1 separation system, which relies on small solid rocket motors to provide the main separation force. This paper will describe technical issues that were addressed during the trade study and present a conceptual design of the strut system that best resolved the issues. Needed development testing and programmatic considerations will be addressed as part of the paper.

Author

Stage Separation; Solid Propellant Rocket Engines; Ares 1 Launch Vehicle; Separators; Launch Vehicles; Payloads

20080023073 NASA Marshall Space Flight Center, Huntsville, AL, USA

Large Scale Magnetostrictive Valve Actuator

Richard, James A.; Holleman, Elizabeth; Eddleman, David; 39th Aerospace Mechanisms Symposium; May 2008, pp. 45-49; In English; See also [20080023060](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

Marshall Space Flight Center's Valves, Actuators and Ducts Design and Development Branch developed a large scale magnetostrictive valve actuator. The potential advantages of this technology are faster, more efficient valve actuators that consume less power and provide precise position control and deliver higher flow rates than conventional solenoid valves. Magnetostrictive materials change dimensions when a magnetic field is applied; this property is referred to as magnetostriction. Magnetostriction is caused by the alignment of the magnetic domains in the material's crystalline structure and the applied magnetic field lines. Typically, the material changes shape by elongating in the axial direction and constricting in the radial direction, resulting in no net change in volume. All hardware and testing is complete. This paper will discuss: the potential applications of the technology; overview of the as built actuator design; discuss problems that were uncovered during the development testing; review test data and evaluate weaknesses of the design; and discuss areas for improvement

for future work. This actuator holds promises of a low power, high load, proportionally controlled actuator for valves requiring 440 to 1500 newtons load.

Author

Magnetostriction; Control Valves; Actuators; Mechanical Engineering

20080023074 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Design and Development of a Miniaturized Double Latching Solenoid Valve for the Sample Analysis at Mars Instrument Suite

Smith, James T.; 39th Aerospace Mechanisms Symposium; May 2008, pp. 51-59; In English; See also [20080023060](#); Original contains color illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

The development of the in-house Miniaturized Double Latching Solenoid Valve, or Microvalve, for the Gas Processing System (GPS) of the Sample Analysis at Mars (SAM) instrument suite is described. The Microvalve is a double latching solenoid valve that actuates a pintle shaft axially to hermetically seal an orifice. The key requirements and the design innovations implemented to meet them are described.

Author

Solenoid Valves; Miniaturization; Latches; Gas Flow; Mars Missions; Spacecraft Instruments; Mars Surface Samples; Analyzing; Mechanical Engineering

20080023075 Lockheed Martin Space Systems Co., Sunnyvale, CA, USA

Wear Life Testing of a Mission Critical Separation Interface

Wood, Jonathan P.; delaFuente, Joseph; 39th Aerospace Mechanisms Symposium; May 2008, pp. 157-170; In English; See also [20080023060](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper covers the wear life validation testing performed for a mission critical separation interface. The test was performed for the purpose of risk reduction, to demonstrate wear life margin prior to performing official qualification testing. The following is an overview of the mechanism, the design rationale of the test equipment and method, the test results, and the lessons learned. In addition to the specifics of the test, the implications of the test data on the design of launch lock mechanisms are discussed.

Author

Launching; Wear; Performance Tests; Ground Tests; Loads (Forces)

20080023076 Aerospace Corp., El Segundo, CA, USA

A Novel Grabbing/Latching Mechanism without Moving Parts

Gore, Brian W.; Hawkins, Gary F.; 39th Aerospace Mechanisms Symposium; May 2008, pp. 199-206; In English; See also [20080023060](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

A preliminary design concept and prototype hardware have been developed for a grabbing/latching mechanism that uses no moving parts. The mechanism uses an innovative material named a Machine Augmented Composite (MAC), or MACterial, in a female configuration to accept a male bar or rod with almost imperceptible resistive force. However, when a reversing force is applied to disengage the bar/rod, it is virtually impossible to remove it due to the increasingly applied holding force. In other words, the higher the removal force applied, the higher the clamping force to resist it. The theory and physics behind this and other MACterial concepts are presented herein, as well as several potential applications that have been defined; surely there are many other applications only limited by one's imagination.

Author

Clamps; Rods; Prototypes; Composite Materials; Graphite-Epoxy Composites; Matrix Materials; Loads (Forces); Elongation

20080023077 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Development of the Aquarius Antenna Deployment Mechanisms and Spring/Damper Actuator

Johnson, Joel A.; 39th Aerospace Mechanisms Symposium; May 2008, pp. 235-248; In English; See also [20080023060](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Aquarius Instrument's large radar reflector dish needed to be stowed for launch, and then deployed on-orbit. The Deployment Subsystem consisted of a cantilevered boom structure and two single-axis hinge mechanisms to accurately deploy and position the reflector dish relative to the radar feed horns. The cantilevered design demanded high stiffness and accuracy from the deployment mechanism at the root of the boom. A preload-generating end-of-travel latch was also required. To largely eliminate the need for control systems, each deployment mechanism was actuated by a passive spring motor with viscous-fluid

damping. Tough requirements and adaptation of a heritage actuator to the new application resulted in numerous challenges. Fabrication, assembly, and testing encountered additional problems, though ultimately the system was demonstrated very successfully. This paper revisits the development to highlight which design concepts worked and the many important lessons learned.

Author

Actuators; Radar Reflectors; Deployment; Damping; Launching

20080023078 NASA Johnson Space Center, Houston, TX, USA

Failure of the Trailing Umbilical System Disconnect Actuator on the International Space Station

Gilmore, Adam; Schmitt, Chris; Merritt, Laura; Bolton, V. J.; 39th Aerospace Mechanisms Symposium; May 2008, pp. 259-269; In English; See also [20080023060](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

In December of 2005, one of two trailing umbilical cables used on the International Space Station (ISS) Mobile Transporter (MT) was inadvertently severed by an internal cutter system designed to free a snagged cable or jammed reel while transporting hazardous payloads. The mechanism's intended means of actuation is electrical; however, troubleshooting revealed a mechanical actuation occurred. The investigation of the failed component revealed several lessons learned in developing hardware requirements, understanding and following the rationale behind the requirements throughout the design life cycle, understanding the impacts of gaps and tolerances in a mechanism, and the importance of identifying critical steps during assembly

Author

Actuators; Failure; Disconnect Devices; International Space Station; Payloads

20080023080 Hi-Shear Corp., Torrance, CA, USA

Electrically Powered Separation Nuts

Little, Barney; 39th Aerospace Mechanisms Symposium; May 2008, pp. 185-190; In English; See also [20080023060](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

Traditionally, over the past 50 years, space mechanisms have been powered by pyrotechniques (pyro). Pyro-powered mechanisms provide the greatest power-to-weight ratio of all types of mechanisms. Hi-Shear Technology Corporation, a major supplier of pyro-powered devices, has developed two new electrically powered separation devices, a separation nut and a cable release device.

Author

Electric Potential; Aerospace Engineering; Bolts; Rotation; Loads (Forces); Exhaust Emission; Exhaust Gases

20080023081 Dynamic Structures and Materials, LLC, Franklin, TN, USA

Linear High-Force 'Step and Repeat' Piezoelectric Motors

Paine, J. S. N.; Johns, M. E.; Sesler, J. J.; Stefanick, M. T.; Kennedy, J. A.; 39th Aerospace Mechanisms Symposium; May 2008, pp. 1-14; In English; See also [20080023060](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Dynamic Structures and Materials, LLC (DSM) has designed a patent-pending piezoelectric linear motor for demonstration in two aerospace applications related to the operation of a cryogenic 2' isolation valve and an environmental controls air handling system for next-generation space vehicles. The scaleable actuator technology provides a combination of force, stroke, and speed not previously demonstrated in other piezoelectric motor developments. The IMPULSE PiezoMotor(TradeMark) technology is presented as a viable and superior replacement for heritage pneumatic, hydraulic, and electromagnetic actuation devices. A key feature of the IMPULSE PiezoMotor(TradeMark) technology resulting from its friction-based drive architecture is a power-off-lock characteristic (fails in last position). A description of the mechanism and key performance parameters (step size, drive force, and resolution/accuracy), influence of materials on friction/wear, and power requirements are discussed.

Author

Piezoelectric Motors; Aerospace Engineering; Control Systems Design; Actuators; Valves; Environmental Control; Friction

20080023082 Thales Alenia Space, Cannes La Bocca, France

Development of a High Resolution Rotary Actuator for an Antenna Trimming Mechanism

Brossier, Jerome; Jeandot, Xavier; Baudasse, Yannick; Grima, David; Champandard, Fabrice; 39th Aerospace Mechanisms Symposium; May 2008, pp. 15-28; In English; See also [20080023060](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The High Resolution Rotary Actuator (HR..A) product is one of the main components of the Antenna Trimming System (ATS) developed for a commercial satellite. The mechanism needs to deploy and point the reflector around two axes and is composed of two HR..A in a gimballed configuration. It operates in a closed loop system using an RF beacon on the ground. This assembly is called MADPM, Multimedia Antenna Deployment and Pointing Mechanism. These mechanisms are located between the spacecraft structure and the reflector. The positions and orientations of these mechanisms on the spacecraft result from an architecture layout analysis, dealing with deployment and pointing objectives. The HR..A mechanism is developed to be able to steer a large reflector along a wide deployment angle (up to 180 with steps of 0.02), to point it with a small output resolution (0.002 each step) and to perform a large number of micro cycles. The mechanism is qualified and 6 flight models have been built in parallel of the qualification and are now assembled on the spacecraft.

Author

Feedback Control; Radio Frequencies; Spacecraft Structures; Actuators; Reflectors; High Resolution; Antenna Design

20080023083 Ball Aerospace and Technologies Corp., Boulder, CO, USA

Implications of Underdamped Stepper Mechanism Performance and Damping Solution Methodology

Brown, Shane; Starin, Scott; 39th Aerospace Mechanisms Symposium; May 2008, pp. 29-44; In English; See also [20080023060](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

When driving a stepper motor the control method of stepping the motor has a significant impact on the performance of the mechanism. When driving a stepper motor system with unipolar or wave method of control, the back-emf generated in the open, unregulated coil creates a stepper motor system that provides significantly less inherent damping compared to full bipolar control. Less damping results in higher overshoot, ringing, and potentially exciting mechanical resonances resulting in fatigue. In addition, a significantly underdamped system, particularly with significant load inertia, raises many concerns with mechanism life and performance. The mechanism described herein utilizes a Rotary Accelerometer (RA) for step counting as well as state-of-health monitoring [1]. Another consequence of an underdamped mechanism using accelerometers is that the RA data is of limited or no value, due to high overshoot acceleration. This paper presents a proven design approach to damp a stepper motor driven in a unipolar, wave fashion, or a system with significant inertia mismatch between the motor and the reflected load.

Author

Stepping Motors; Damping; Resonant Vibration; Loads (Forces); Accelerometers

20080023084 National Inst. of Aerospace, Hampton, VA, USA; NASA Langley Research Center, Hampton, VA, USA; NASA Johnson Space Center, Houston, TX, USA

Deflection Analysis of the Space Shuttle External Tank Door Drive Mechanism

Tosto, Michael A.; Trieu, Bo C.; Evernden, Brent A.; Hope, Drew J.; Wong, Kenneth A.; Lindberg, Robert E.; 39th Aerospace Mechanisms Symposium; May 2008, pp. 249-258; In English; See also [20080023060](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

Upon observing an abnormal closure of the Space Shuttle s External Tank Doors (ETD), a dynamic model was created in MSC/ADAMS to conduct deflection analyses of the Door Drive Mechanism (DDM). For a similar analysis, the traditional approach would be to construct a full finite element model of the mechanism. The purpose of this paper is to describe an alternative approach that models the flexibility of the DDM using a lumped parameter approximation to capture the compliance of individual parts within the drive linkage. This approach allows for rapid construction of a dynamic model in a time-critical setting, while still retaining the appropriate equivalent stiffness of each linkage component. As a validation of these equivalent stiffnesses, finite element analysis (FEA) was used to iteratively update the model towards convergence. Following this analysis, deflections recovered from the dynamic model can be used to calculate stress and classify each component s deformation as either elastic or plastic. Based on the modeling assumptions used in this analysis and the maximum input forcing condition, two components in the DDM show a factor of safety less than or equal to 0.5. However, to accurately evaluate the induced stresses, additional mechanism rigging information would be necessary to characterize the input forcing conditions. This information would also allow for the classification of stresses as either elastic or plastic.

Author

Dynamic Models; External Tanks; Construction; Space Shuttles; Rigging; Finite Element Method; Doors

20080023085 RUAG Aerospace, Wallisellen, Switzerland

Ultra Light Self-Motorized Mechanism for Deployment of Light Weight Spacecraft Appendages

Boesch, C.; Pereira, C.; John, R.; Schmidt, T.; Seifart, K.; Sparr, H.; Lautier, J. M.; Pyttel, T.; 39th Aerospace Mechanisms Symposium; May 2008, pp. 221-234; In English; See also [20080023060](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

A mechanism to deploy satellite reflector antennas was developed to provide a rotation angle of up to 90 degrees. The energy necessary for deployment is stored within curved tape springs, which are buckled and thereafter folded into stowed position. The release at the hold down points and stored energy of the buckled tapes triggers the deployment. New characteristics with respect to similar mechanisms are a complete guidance without friction combined with a high pointing stability (0.01 half cone). No additional latching elements are needed. The presented hinge integrates several functions (deployment motorization, guidance, latching and pointing stability) in a compact design weighing less than 0.6 kg (1.3 lb). This paper reports the development process from concept to finished product including material characterization, simulation, verification approach and lessons learned. The design of The Ultra Light Mechanism for Advanced Antenna Systems (ULMAAS) is not exclusively intended for deployment of reflector antennas. The concept is scaleable for different appendages, e.g., solar generators or masts.

Author

Reflector Antennas; Deployment; Appendages; Satellite Antennas; Actuators

20080023088 Utah State Univ. Research Foundation, North Logan, UT, USA

Development of a Low-Cost Fine Steering Mirror

Wassom, Steven R.; Davidson, Morgan; 39th Aerospace Mechanisms Symposium; May 2008, pp. 387-400; In English; See also [20080023060](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Space Dynamics Laboratory has used internal funds to develop a prototype low-cost two-axis fine steering mirror (FSM) for space-based and airborne applications. The FSM has a lightweight 75 mm-by-150-mm high-reflectance mirror, high angular deflection capability for along-track ground motion compensation and cross-track pointing, and a 70-Hertz bandwidth for small amplitudes to help cancel unwanted jitter. It makes use of off-the-shelf components as much as possible. Key performance parameters are: Clear aperture, 75 mm; elevation angle, +/-15 deg (mechanical); azimuth angle, +/-60 deg (mechanical); slew rate, greater than 75 deg/sec; bandwidth, 70 Hz; steady-state average error, about 1 arcsec; average power dissipation, 0.4 Watts; mirror surface, figure, <0.1 waves RMS; and total mechanical mass, 1 kg. Key components for the elevation axis include a rotary voice coil and a unique patent-pending non-contact feedback sensor. The azimuth axis features a brushless DC motor and a high-resolution optical encoder. Rapid prototyping, autocoding, and real-time hardware-in-the-loop (HIL) testing were used to develop the control algorithms. Additional accomplishments include temperature mapping of the feedback sensor, inventing a successful passive launch lock, launch vibration testing, and subjecting the system to a space-like environment at pressures down to 1e-7 torr and temperatures down to 164 K.

Author

Steering; Steady State; Mirrors; Airborne Equipment; High Resolution; Elevation Angle

20080023089 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Mars Science Laboratory Rover Mobility Bushing Development

Riggs, Benjamin; 39th Aerospace Mechanisms Symposium; May 2008, pp. 83-96; In English; See also [20080023060](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

NASA's Mars Science Laboratory (MSL) Project will send a six-wheeled rover to Mars in 2009. The rover will carry a scientific payload designed to search for organic molecules on the Martian surface during its primary mission. This paper describes the development and testing of a bonded film lubricated bushing system to be used in the mobility system of the rover. The MSL Rover Mobility System contains several pivots that are tightly constrained with respect to mass and volume. These pivots are also exposed to relatively low temperatures (-135 C) during operation. The combination of these constraints led the mobility team to consider the use of solid film lubricated metallic bushings and dry running polymeric bushings in several flight pivot applications. A test program was developed to mitigate the risk associated with using these materials in critical pivots on the MSL vehicle. The program was designed to characterize bushing friction and wear performance over the expected operational temperature range (-135 C to +70 C). Seven different bushing material / lubricant combinations were evaluated to aid in the selection of the final flight pivot bushing material / lubricant combination.

Author

Bushings; Roving Vehicles; Mars Surface; Mobility; Friction; Molecules; Lubricants

20080023093 CSA Engineering, Inc., Mountain View, CA, USA

A System for Suspending and Vibration-Isolating a Large Spacecraft for Testing in Vacuum

Kienholz, David A.; 39th Aerospace Mechanisms Symposium; May 2008, pp. 317-330; In English; See also [20080023060](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

A system is described for suspending from above a 15,900-kg (35,000-lb) payload for ground testing in a vacuum chamber. The system provides very low suspension frequencies to isolate the payload from ambient vibration. It also includes active capability to maintain a very stable ride-height and attitude of the payload. Passive magnetic dampers are included to suppress pendulum-mode lateral oscillations. Designated as the Large Suspension / Isolation System (LSIS) the system is described in terms of its design, analysis, fabrication, and component-level testing.

Author

Vibration; Vacuum Chambers; Design Analysis; Fabrication; Oscillations

20080023094 Planetary Systems Corp., Silver Spring, MD, USA

Lessons Learned Designing a Spherical Satellite Release Mechanism

Hevner, Ryan; 39th Aerospace Mechanisms Symposium; May 2008, pp. 145-156; In English; See also [20080023060](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

A low-cost mechanism, part of the CAPE ICU payload, was designed to contain and deploy two spherical satellites from the Shuttle in December 2006. Overall the system successfully placed the satellites into orbit but encountered an anomaly. This flight anomaly and subsequent investigation. The goal of this project was to design a release mechanism for two spherical satellites. The mechanism was to fly on a risk reduction mission to verify the design and operation of the system for a future, more ambitious mission. Because of the need to maintain a constant drag coefficient under any orientation, the satellites had no external appendages or hard points for contact. The spheres and their release systems had to be enclosed within the Canister for All Payload Ejections (CAPE). CAPE is an aluminum cylinder 0.56 m ID x 1.3 m long. The Space Test Program-H2-Atmospheric Neutral Density Experiment Risk Reduction Mission (STP-H2-ANDE RR) flew aboard Space Shuttle mission STS-116. The Naval Research Laboratory designed satellites were Mock ANDE Active (MAA) and Fence Calibration (FCal). MAA was 0.48 m in diameter and 52 kg. FCal was 0.44 m in diameter and 63 kg. MAA was desired to have a spin rate of 1-10 rpm upon orbit insertion. Each satellite was enclosed in its own cylinder. The cylinders were joined together by two Motorized Lightband separation systems (MLBs). When the MLBs separated, the satellites were simultaneously pushed out of the cylinders by compression springs. The name given to everything contained within the CAPE that separated from the Shuttle was the Internal Cargo Unit (ICU). At the end of one of the cylinders was a larger Lightband, CAPE Separation System (CSS) (see Figures 1-5). The ICU was ejected from the CAPE by means of the CSS, a 0.59-m diameter NEA-actuated Lightband separation system. Approximately 40 seconds later, two diameter 0.50-m MLBs, ICU Separation Systems (ISS), were to simultaneously separate at the center of the ICU. The lower halves of each Lightband with the motor mechanism were attached to the central Avionics Deck. The upper half of each Lightband was attached to the open end of each cylinder. Upon separation, each satellite ejected from the cylinders through the center of the upper ring.

Author

Lessons Learned; Aerodynamic Coefficients; Mission Planning; Ejection; Avionics; Spheres

20080023512 National Cheng Kung Univ., Tainan, Taiwan, Province of China

Development of Geometrically Based Fabrication Emulator for MEMS Micromachining and Excimer Laser Ablation

Chen, Kuo-Shen; Yeh, Hsiu-Ming; Journal of the Chinese Institute of Engineers, Volume 31, No.1; January 2008, pp. 41-51; In English; See also [20080023495](#); Original contains color and black and white illustrations

Contract(s)/Grant(s): NSC91-2218-E-006-035; NSC95-2221-E-006-399-MY2; Copyright; Avail.: Other Sources

Computer aided design (CAD) is a key point in the development of all engineering products for cost reduction and for accelerating the update of products. Unlike mechanical design, which usually yields truly 3-D objects, the 2-D extruded nature of the microelectromechanical systems (MEMS) fabrication process makes it extremely suitable to be represented using an automatic solid modeling flow. In this paper, the relationship between key MEMS fabrication procedures and their corresponding solid modeling functions are first correlated. Based on these correlations, a fabrication process emulator, called the NCKU Z-Fabricator is subsequently developed to emulate MEMS fabrication, and successful microfabrication examples are demonstrated. Finally, the simulation module for a novel multi-user MEMS platform 'SMart' and the non-traditional excimer laser ablation process are designed and demonstrated using the Z-Fabricator. Following the correlation and

methodology outlined in this paper, it is expected that users will be able to design their own process emulator to customize their own special fabrication requirements and to reduce the cost of software in a more flexible manner.

Author

Computer Aided Design; Microelectromechanical Systems; Micromachining; Laser Ablation; Fabrication; Mechanical Engineering

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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*.

20080023090 Centre National d'Etudes Spatiales, Toulouse, France

A New Structural Bonding Process for Ferromagnetic Sheet Stacking Used in Electric Motors (Rotors, Stators...)

Casteras, Christophe; Bonduelle, Bruno; Martin, Frederic; 39th Aerospace Mechanisms Symposium; May 2008, pp. 61-67; In English; See also [20080023060](#); Original contains color illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

A new structural bonding process has been developed for the assembly of the thin iron sheet stacking used in electrical motors. This process, based on screen printing technology, improves the stack cohesion and allows very precise geometrical dimension machining. A stator has been assembled based on such a structurally bonded stack, and it has been submitted to a complete qualification test sequence similar to an existing space-qualified stator with a potted stack. Process development, test results, and comparisons are presented hereafter.

Author

Structural Engineering; Bonding; Ferromagnetic Materials; Metal Sheets; Thin Films; Electric Motors

20080023507 National Chiao Tung Univ., Hsinchu, Taiwan, Province of China

Investigating Mechanical Properties of Epoxy/Organoclay Nanocomposites

Tsai, Jia-Lin; Hsu, Shin-Ming; Journal of the Chinese Institute of Engineers, Volume 31, No.1; January 2008, pp. 9-16; In English; See also [20080023495](#); Original contains black and white illustrations

Contract(s)/Grant(s): NSC94-2212-E-009-017; Copyright; Avail.: Other Sources

This study aims to investigate the organoclay effect on the mechanical properties of epoxy nanocomposites. In order to characterize the organoclay effect, three different loadings of organoclay, 2.5, 5, and 7.5 wt%, were dispersed into the epoxy with a mechanical blender followed by sonication. Tensile tests and fracture tests were carried out on these specimens to determine their stiffness, strength and fracture behaviors. The experimental results obtained from tensile tests indicate that the stiffness of the epoxy increases with the increment of organoclay inclusion; however, the corresponding failure strain decreases. On the other hand, fracture tests on single-edge-notch bending specimens reveal that the inclusion of organoclay may dramatically reduce the fracture toughness of nanocomposites. The decrease could be due to changes in the morphologies of the epoxy nanocomposites as well as the interfacial debonding between the organoclay and the surrounding epoxy.

Author

Mechanical Properties; Nanocomposites; Tensile Tests; Epoxy Resins; Fracture Strength; Stiffness; Debonding (Materials)

20080023510 National Taiwan Univ. of Science and Technology, Taipei, Taiwan, Province of China

An Efficient Algorithm to Obtain the Optimal Topology of Industrial Structural Design Problems

Lin, Chyi-Yeu; Hsu, Fang-Ming; Journal of the Chinese Institute of Engineers, Volume 31, No.1; January 2008, pp. 17-30; In English; See also [20080023495](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

The purpose of the adaptive volume constraint algorithm (AVC) proposed in this paper is to obtain a topology of structure, which is capable of satisfying both stress and displacement constraints. The final topology thus obtained becomes a feasible design in a realistic working environment considering constraints, or alternatively serves as the ideal base design in subsequent shape optimization, seeking precise agreements with all design constraints. The AVC algorithm is developed from the material distribution method or the homogenization method, in which the compliance of the structure is minimized with a fixed volume constraint (FVC). The traditional material distribution method considers neither stress nor displacement conditions. The AVC algorithm can iteratively adjust its upper volume limit by comparing the difference of the maximum stress or displacement

with the pre-specified stress/displacement constraints. The final topology becomes an optimum topology satisfying stress/displacement constraints. In this paper, the AVC algorithm is successfully applied to two industrial design problems simultaneously with stress and displacement constraints, including a bicycle frame and a machine tool frame.

Author

Algorithms; Design Optimization; Structural Design; Shape Optimization; Homogenizing; Design Analysis

20080023511 National Taiwan Univ., Taipei, Taiwan, Province of China

Parametric Deflection Corrections of Annular Sandwich Panels under Transverse Central Loads

Cheng, Jung-Ho; Chang, Chih-Kai; Journal of the Chinese Institute of Engineers, Volume 31, No.1; January 2008, pp. 31-39; In English; See also [20080023495](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

Inserts are widely used for sandwich panels under transversely concentrated loads. In addition to load capabilities, deflection predictions of such annular sandwich panels are also important in certain applications but have not been researched in detail. Although approximate formulas have been derived from the classical plate and sandwich theories, they are inaccurate and subject to many limitations. The higher-order sandwich theories or finite element method (FEM) are also available for evaluating detailed displacement fields, but are unsuitable for parametric design due to the case-by-case modeling efforts required. This study detected noticeable errors in the classical solutions and corrected them by adopting FEM with experimental verifications. The corrected results were further regressed by algebraic functions with practical design parameters and are therefore conveniently applicable for designers.

Author

Sandwich Structures; Plate Theory; Functions (Mathematics); Loads (Forces); Design Analysis; Deflection; Inserts; Transverse Loads

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GEOSCIENCES (GENERAL)

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

20080023394 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Modeling Bird Migration in Changing Habitats: Space-based Ornithology using Satellites and GIS

Smith, James A.; Deppe, Jill L.; [2008]; 1 pp.; In English; The Society for Conservation GIS, 12-15 Aug. 2008, Monterey, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

Understanding bird migration and avian biodiversity is one of the most compelling and challenging problems of modern biology with major implications for human health and conservation biology. Migration and conservation efforts cross national boundaries and are subject to numerous international agreements and treaties presenting challenges in both geographic space and time. Space based technology, coupled with geographic information systems, yields new opportunities to shed light on the distribution and movement of organisms on the planet and their sensitivity to human disturbances and environmental changes. At NASA, we are creating ecological forecasting tools for science and application users to address the consequences of loss of wetlands, flooding, drought or other natural disasters such as hurricanes on avian biodiversity and bird migration. In our work, we use individual organism biophysical models and drive these models with satellite observations and numerical weather predictions of the spatio-temporal gradients in climate and habitat. Geographic information system technology comprises one component of our overall simulation framework, especially for characterizing the changing habitats and conditions encountered by en-route migratory birds. Simulation provides a tool for studying bird migration across multiple scales and can be linked to mechanistic processes describing the time and energy budget states of migrating birds. Such models yield an understanding of how a migratory flyway and its component habitats function as a whole and link stop-over ecology with biological conservation and management. We present examples of our simulation of shorebirds, principally, pectoral sandpipers, along the central flyways of the USA and Canada from the Gulf of Mexico to Alaska.

Author

Biophysics; Birds; Geographic Information Systems; Habitats; Migration; Satellite Observation; Biosphere; Earth Sciences; Models

20080023441 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Absorption and Attenuation Coefficients Using the WET Labs ac-s in the Mid-Atlantic Bight: Field Measurements and Data Analysis

Ohi, Nobuaki; Makinen, Carla P.; Mitchell, Richard; Moisan, Tiffany A.; April 2008; 58 pp.; In English; Original contains black and white illustrations

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Ocean color algorithms are based on the parameterization of apparent optical properties as a function of inherent optical properties. WET Labs underwater absorption and attenuation meters (ac-9 and ac-s) measure both the spectral beam attenuation [$c(\lambda)$] and absorption coefficient [$a(\lambda)$]. The ac-s reports in a continuous range of 390-750 nm with a band pass of 4 nm, totaling approximately 83 distinct wavelengths, while the ac-9 reports at 9 wavelengths. We performed the ac-s field measurements at nine stations in the Mid-Atlantic Bight from water calibrations to data analysis. Onboard the ship, the ac-s was calibrated daily using Milli Q-water. Corrections for the in situ temperature and salinity effects on optical properties of water were applied. Corrections for incomplete recovery of the scattered light in the ac-s absorption tube were performed. The fine scale of spectral and vertical distributions of $c(\lambda)$ and $a(\lambda)$ were described from the ac-s. The significant relationships between a (674) and that of spectrophotometric analysis and chlorophyll a concentration of discrete water samples were observed.

Author

Absorptivity; Attenuation Coefficients; Bays (Topographic Features); Temperature Effects; Water Color; Optical Properties; Electric Fields; Chlorophylls

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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*.

20080023013 NASA Stennis Space Center, Stennis Space Center, MS, USA

Feasibility of Estimating Relative Nutrient Contributions of Agriculture using MODIS Time Series

Ross, Kenton W.; Gasser, Gerald; Spiering, Bruce; June 03, 2008; 1 pp.; In English; Poster, Gulf of Mexico Alliance Monitoring Forum, 3-6 Jun. 2008, Saint Petersburg, FL, USA; Original contains color illustrations

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Around the Gulf of Mexico, high-input crops in several regions make a significant contribution to nutrient loading of small to medium estuaries and to the near-shore Gulf. Some crops cultivated near the coast include sorghum in Texas, rice in Texas and Louisiana, sugarcane in Florida and Louisiana, citrus orchards in Mississippi and Alabama, and heavy sod and ornamental production around Mobile and Tampa Bay. In addition to crops, management of timberlands in proximity to the coasts also plays a role in nutrient loading. In the summer of 2008, a feasibility project is planned to explore the use of NASA data to enhance the spatial and temporal resolution of near-coast nutrient source information available to the coastal community. The purpose of this project is to demonstrate the viability of nutrient source information products applicable to small to medium watersheds surrounding the Gulf of Mexico. Conceptually, these products are intended to complement estuarine nutrient monitoring.

Author

Time Series Analysis; MODIS (Radiometry); Agriculture; Estimating; Nutrients; Estuaries; Farm Crops; Sorghum; Rice

20080023140 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Cloud Slicing Technique-Measuring the Unmeasurable

Bhartia, P.; Joiner, J.; Vassilkov, A.; Ziemke, J.; Chandra, S.; Krotkov, N.; January 2008; 1 pp.; In English; European Geosciences Union Annual Meeting, 14-18 Apr. 2008, Vienna, Austria; Copyright; Avail.: Other Sources; Abstract Only

In satellite remote sensing clouds are usually considered an annoying interference. Satellite investigators go to unusual lengths to try to avoid clouds or to correct for their effects, and satellite data users routinely exclude cloudy data from analysis. Yet it was shown about a decade ago using TOMS data that for the study of tropospheric constituents, such as ozone, clouds

can play a very beneficial role by allowing one to measure what otherwise cannot be directly measured from space. We call this technique 'cloud Slicing'. The so-called Convective Cloud Differential (CCD) method is one particular application of cloud slicing that has been applied successfully to data from TOMS and other similar satellite instruments to study the behavior of tropical tropospheric ozone at variety of spatial and temporal scales. However, there has been considerable confusion in the literature as to what exactly one measures from reflected sunlight instruments such as TOMS in cloudy atmospheres. We will discuss recently completed analysis of data taken by the Ozone Monitoring Instrument (OMI) on the Aura satellite in conjunction with several other instruments on the A-train satellite constellation to present new insight on how clouds affect absorption by aerosols and trace gases at reflected wavelengths (UV-SWIR). We will show several examples to illustrate how this insight is helping us to study the behavior of trace gases and aerosols in the atmosphere that cannot be studied by focusing only on cloud-free scenes.

Author

Satellite Instruments; Remote Sensing; Convection Clouds; Geophysics

20080023142 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Laser Sounder for Measuring Atmospheric CO₂ Concentrations: Progress Toward Ascends

Abshire, J. B.; Kawa, S. R.; Riris, H.; Allan, G. R.; Sun, X.; Stephen, M. A.; Wilson, E.; Burris, J. F.; Mao, J.; April 14, 2008; 2 pp.; In English; European Geosciences Union Annual Meeting, 14-18 Apr. 2008, Vienna, Austria; Copyright; Avail.:

Other Sources; Abstract Only

The next generation of space-based, active remote sensing instruments for measurement of tropospheric CO₂ promises a capability to quantify global carbon sources and sinks at regional scales. Active (laser) methods will extend CO₂ measurement coverage in time, space, and perhaps precision such that the underlying mechanisms for carbon exchange at the surface can be understood with sufficient detail to confidently project the future of carbon-climate interaction and the influence of remedial policy actions. The recent Decadal Survey for Earth Science by the US National Research Council has recommended such a mission called the Active Sensing of CO₂ Emissions over Nights, Days, and Seasons (ASCENDS) for launch in 2013-2016. We have been developing a laser technique for measurement of tropospheric CO₂ for a number of years. Our immediate goal is to develop and demonstrate the method and instrument technology that will permit measurements of the CO₂ column abundance over a horizontal path and from aircraft at the few-ppmv level. Our longer-term goal is to demonstrate the required capabilities of the technique, develop a space mission approach, and design the instrument for an ASCENDS-type mission. Our approach is to use a dual channel laser absorption spectrometer (i.e., differential absorption in altimeter mode), which continuously measures from a near-polar circular orbit. We use several co-aligned tunable fiber laser transmitters allowing simultaneous measurement of the absorption from a CO₂ line in the 1570 nm band, O₂ extinction in the oxygen A-band (near 765 nm), and aerosol backscatter in the same measurement path. We measure the energy of the laser echoes at nadir reflected from land and water surfaces, day and night. The lasers have spectral widths much narrower than the gas absorption lines and are turned on and off the selected CO₂ and O₂ lines at kHz rates. The gas extinction and column densities for the CO₂ and O₂ gases are estimated from the ratio of the on and off-line signals via the DIAL technique. We used pulsed laser signals, photon counting detectors, and time gating to isolate the laser returns from the surface, and to reject photons scattered from thin clouds and aerosols. High signal-to-noise ratios are required and the CO₂ estimates can be sensitive to small drifts or other errors in the instrument, so the absorption estimates need to be quite stable for hours. We have constructed a breadboard version of the CO₂ sensor that uses a low power fiber laser and a 20 cm diameter telescope. We have used it to make measurements of CO₂ absorption in the laboratory and over 200-m to 2-km long open horizontal paths. These have been done in several sessions extending over multiple days, which allows us to assess the measurement stability and to compare absorption variations to readings from an external in situ CO₂ sensor. We have also calculated characteristics of the technique for space including its expected measurement performance for different modulation types, and have performed an initial space mission accommodation study. We will describe these results in the presentation.

Author

Carbon Dioxide Concentration; Earth Sciences; Remote Sensing; Fiber Lasers; Earth Atmosphere; Oxygen; Atmospheric Sounding

20080023256 NASA Goddard Space Flight Center, Greenbelt, MD, USA

An Overview of the Impact of Energetic Particle Precipitation on the Mesosphere and Stratosphere

Jackman, Charles H.; May 28, 2008; 1 pp.; In English; 1st International High-Energy Particle Precipitation in the Atmosphere (HEPPA) Workshop 2008/Finnish Meteorological Institute, 28-31 May 2008, Helsinki, Finland; Original contains black and white illustrations; No Copyright; Avail.: Other Sources; Abstract Only

Energetic precipitating particles (EPPs) can cause significant constituent changes in the polar mesosphere and stratosphere

(middle atmosphere) during certain periods. Both protons and electrons can influence the polar middle atmosphere through ionization and dissociation processes. EPPs can enhance HO_x (H, OH, HO₂) through the formation of positive ions followed by complex ion chemistry and NO_x (N, NO, NO₂) through the dissociation of molecular nitrogen. The HO_x increases can lead to ozone destruction in the mesosphere and upper stratosphere via several catalytic loss cycles. Such middle atmospheric HO_x-caused ozone loss is rather short-lived due to the relatively short lifetime (hours) of the HO_x constituents. The HO_x-caused ozone depletion has been observed during several solar proton events (SPEs) in the past 40 years. HO_x enhancements due to SPEs were confirmed by observations in the past solar cycle. A number of modeling studies have been undertaken over this time period that show predictions of enhanced HO_x, accompanied by decreased ozone due to energetic particles. The NO_x family has a longer lifetime than the HO_x family and can also lead to catalytic ozone destruction. EPP-caused enhancements of the NO_x family can affect ozone promptly, if produced in the stratosphere, or subsequently, if produced in the lower thermosphere or mesosphere and transported to the stratosphere. NO_x enhancements due to auroral electrons, medium and high energy electrons, relativistic electron precipitation (REP) events, and SPEs have been measured and/or modeled for decades. Only a small number of SPEs (less than 10) in each solar cycle have sufficient flux of high energy protons (greater than 30 MeV) to produce a significant amount of NO_x directly in the stratosphere to cause a measurable ozone destruction. Very high energy electrons (greater than 1500 keV) during REP events can also produce NO_x directly in the stratosphere, however, the frequency and intensity of these electrons is uncertain. Indirect stratospheric EPP effects result when NO_x is produced in the mesosphere and lower thermosphere and transported to the stratosphere during the late fall or winter. Such EPP-produced NO_x may last up to months beyond its initial production. This EPP-produced mesospheric and lower thermospheric NO_x primarily results from auroral electrons (approx. 1- 30 keV), medium- and high-energy electrons (approx. 30-1500 keV), and medium energy protons (approx. 1-30 MeV). The EPP-caused direct and indirect effects on the stratosphere are important in the polar regions during particular years, especially near solar maximum. This talk will attempt to provide an overview of several of the EPP-related important processes and their impact on the mesosphere and stratosphere. Much progress has been made in this field in the past several years and it is anticipated that other workshop participants will address aspects of this topic in their presentations.

Author

Energetic Particles; Mesosphere; Particle Precipitation; Polar Regions; Stratosphere

20080023286 NASA Goddard Space Flight Center, Greenbelt, MD, USA

MODIS Land Data Products: Generation, Quality Assurance and Validation

Masuoka, Edward; Wolfe, Robert; Morisette, Jeffery; Sinno, Scott; Teague, Michael; Saleous, Nazmi; Devadiga, Sadashiva; Justice, Christopher; Nickeson, Jaime; [2008]; 45 pp.; In English; Original contains color and black and white illustrations
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The Moderate Resolution Imaging Spectrometer (MODIS) on-board NASA's Earth Observing System (EOS) Terra and Aqua Satellites are key instruments for providing data on global land, atmosphere, and ocean dynamics. Derived MODIS land, atmosphere and ocean products are central to NASA's mission to monitor and understand the Earth system. NASA has developed and generated on a systematic basis a suite of MODIS products starting with the first Terra MODIS data sensed February 22, 2000 and continuing with the first MODIS-Aqua data sensed July 2, 2002. The MODIS Land products are divided into three product suites: radiation budget products, ecosystem products, and land cover characterization products. The production and distribution of the MODIS Land products are described, from initial software delivery by the MODIS Land Science Team, to operational product generation and quality assurance, delivery to EOS archival and distribution centers, and product accuracy assessment and validation. Progress and lessons learned since the first MODIS data were in early 2000 are described.

Derived from text

MODIS (Radiometry); Earth Observing System (EOS); Data Products; Computer Programs; Software Engineering; Software Reliability

20080023294 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Physical Model to Estimate Snowfall over Land using AMSU-B Observations

Kim, Min-Jeong; Weinman, J. A.; Olson, W. S.; Chang, D.-E.; Skofronick-Jackson, G.; Wang, J. R.; [2008]; 46 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NASA Order S-69019-G; NCC5-584; NAG5-9668; Copyright; Avail.: CASI: [A03](#), Hardcopy

In this study, we present an improved physical model to retrieve snowfall rate over land using brightness temperature

observations from the National Oceanic and Atmospheric Administration's (NOAA) Advanced Microwave Sounder Unit-B (AMSU-B) at 89 GHz, 150 GHz, 183.3 +/- 1 GHz, 183.3 +/- 3 GHz, and 183.3 +/- 7 GHz. The retrieval model is applied to the New England blizzard of March 5, 2001 which deposited about 75 cm of snow over much of Vermont, New Hampshire, and northern New York. In this improved physical model, prior retrieval assumptions about snowflake shape, particle size distributions, environmental conditions, and optimization methodology have been updated. Here, single scattering parameters for snow particles are calculated with the Discrete-Dipole Approximation (DDA) method instead of assuming spherical shapes. Five different snow particle models (hexagonal columns, hexagonal plates, and three different kinds of aggregates) are considered. Snow particle size distributions are assumed to vary with air temperature and to follow aircraft measurements described by previous studies. Brightness temperatures at AMSU-B frequencies for the New England blizzard are calculated using these DDA calculated single scattering parameters and particle size distributions. The vertical profiles of pressure, temperature, relative humidity and hydrometeors are provided by MM5 model simulations. These profiles are treated as the a priori data base in the Bayesian retrieval algorithm. In algorithm applications to the blizzard data, calculated brightness temperatures associated with selected database profiles agree with AMSU-B observations to within about +/- 5 K at all five frequencies. Retrieved snowfall rates compare favorably with the near-concurrent National Weather Service (NWS) radar reflectivity measurements. The relationships between the NWS radar measured reflectivities $Z(\text{sub } e)$ and retrieved snowfall rate R for a given snow particle model are derived by a histogram matching technique. All of these $Z(\text{sub } e)$ - R relationships fall in the range of previously established $Z(\text{sub } e)$ - R relationships for snowfall. This suggests that the current physical model developed in this study can reliably estimate the snowfall rate over land using the AMSU-B measured brightness temperatures.

Author

Atmospheric Models; Snow; Microwave Sounding; Meteorological Radar; Precipitation Particle Measurement; Particle Size Distribution; Hydrological Cycle

20080023335 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Time Series Technique for Aerosol Retrievals over Land from MODIS: Algorithm MAIAC

Lyapustin, Alexei; Wang, Yujie; [2008]; 34 pp.; In English; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

Atmospheric aerosols interact with sun light by scattering and absorbing radiation. By changing irradiance of the Earth surface, modifying cloud fractional cover and microphysical properties and a number of other mechanisms, they affect the energy balance, hydrological cycle, and planetary climate [IPCC, 2007]. In many world regions there is a growing impact of aerosols on air quality and human health. The Earth Observing System [NASA, 1999] initiated high quality global Earth observations and operational aerosol retrievals over land. With the wide swath (2300 km) of MODIS instrument, the MODIS Dark Target algorithm [Kaufman et al., 1997; Remer et al., 2005; Levy et al., 2007] currently complemented with the Deep Blue method [Hsu et al., 2004] provides daily global view of planetary atmospheric aerosol. The MISR algorithm [Martonchik et al., 1998; Diner et al., 2005] makes high quality aerosol retrievals in 300 km swaths covering the globe in 8 days. With MODIS aerosol program being very successful, there are still several unresolved issues in the retrieval algorithms. The current processing is pixel-based and relies on a single-orbit data. Such an approach produces a single measurement for every pixel characterized by two main unknowns, aerosol optical thickness (AOT) and surface reflectance (SR). This lack of information constitutes a fundamental problem of the remote sensing which cannot be resolved without a priori information. For example, MODIS Dark Target algorithm makes spectral assumptions about surface reflectance, whereas the Deep Blue method uses ancillary global database of surface reflectance composed from minimal monthly measurements with Rayleigh correction. Both algorithms use Lambertian surface model. The surface-related assumptions in the aerosol retrievals may affect subsequent atmospheric correction in unintended way. For example, the Dark Target algorithm uses an empirical relationship to predict SR in the Blue (B3) and Red (B1) bands from the 2.1 m channel (B7) for the purpose of aerosol retrieval. Obviously, the subsequent atmospheric correction will produce the same SR in the red and blue bands as predicted, i.e. an empirical function of 2.1. In other words, the spectral, spatial and temporal variability of surface reflectance in the Blue and Red bands appears borrowed from band B7. This may have certain implications for the vegetation and global carbon analysis because the chlorophyll-sensing bands B1, B3 are effectively substituted in terms of variability by band B7, which is sensitive to the plant liquid water. This chapter describes a new recently developed generic aerosol-surface retrieval algorithm for MODIS. The Multi-Angle Implementation of Atmospheric Correction (MAIAC) algorithm simultaneously retrieves AOT and surface bi-directional reflection factor (BRF) using the time series of MODIS measurements.

Derived from text

Time Series Analysis; Aerosols; Algorithms; MODIS (Radiometry); Earth Surface; Mathematical Models; Air Quality

20080023336 Science Systems and Applications, Inc., Greenbelt, MD, USA

Challenges of AVHRR Vegetation Data for Real Time Applications

Brown, Molly; [2008]; 6 pp.; In English; Environmental Information Management Conference 2008, 10-11 Sep. 2008, Albuquerque, NM, USA; Original contains color illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

Remote sensing data has long been used to monitor global ecosystems for floods and droughts and AVHRR data, as one of the first product, has many users interested in receiving the data within hours of acquisition. With the introduction of a new series of sensors in 2000 (the AVHRR/3 series), the quality of the NDVI datasets available for real time environmental monitoring has declined. This paper provides evidence of problems of cloud contamination, calibration and noise in the real time data which are not present in the historical AVHRR NDVIg dataset. These differences introduce significant uncertainty in the use of the real time data, degrading their utility for detecting climate variations in near real time.

Author

Remote Sensing; Advanced Very High Resolution Radiometer; Normalized Difference Vegetation Index; Vegetation; Climate; Contamination; Environmental Monitoring; Ecosystems

20080023360 NASA Goddard Space Flight Center, Greenbelt, MD, USA; NASA Goddard Space Flight Center, Greenbelt, MD, USA

GEWEX Water and Energy Budget Study

Roads, J.; Bainto, E.; Masuda, K.; Rodell, Matthew; Rossow, W. B.; [2008]; 81 pp.; In English; Original contains color illustrations

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Closing the global water and energy budgets has been an elusive Global Energy and Water-cycle Experiment (GEWEX) goal. It has been difficult to gather many of the needed global water and energy variables and processes, although, because of GEWEX, we now have globally gridded observational estimates for precipitation and radiation and many other relevant variables such as clouds and aerosols. Still, constrained models are required to fill in many of the process and variable gaps. At least there are now several atmospheric reanalyses ranging from the early National Centers for Environmental Prediction/National Center for Atmospheric Research (NCEP/NCAR) and NCEP/Department of Energy (DOE) reanalyses to the more recent ERA40 and JRA-25 reanalyses. Atmospheric constraints include requirements that the models state variables remain close to in situ observations or observed satellite radiances. This is usually done by making short-term forecasts from an analyzed initial state; these short-term forecasts provide the next guess, which is corrected by comparison to available observations. While this analysis procedure is likely to result in useful global descriptions of atmospheric temperature, wind and humidity, there is no guarantee that relevant hydroclimate processes like precipitation, which we can observe and evaluate, and evaporation over land, which we cannot, have similar verisimilitude. Alternatively, the Global Land Data Assimilation System (GLDAS), drives uncoupled land surface models with precipitation, surface solar radiation, and surface meteorology (from bias-corrected reanalyses during the study period) to simulate terrestrial states and surface fluxes. Further constraints are made when a tuned water balance model is used to characterize the global runoff observational estimates. We use this disparate mix of observational estimates, reanalyses, GLDAS and calibrated water balance simulations to try to characterize and close global and terrestrial atmospheric and surface water and energy budgets to within 10-20% for long term (1986-1995), large-scale global to regional annual means.

Author

Energy Budgets; Water Resources; Hydrological Cycle; Atmospheric Models; Precipitation (Meteorology); Energy Transfer

20080023363 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Analysis of Terrestrial Water Storage Changes from GRACE and GLDAS

Syed, Tajdarul H.; Famiglietti, James S.; Rodell, Matthew; Chen, Jianli; Wilson, Clark R.; Water Resources Research Journal; February 22, 2008; ISSN 0043-1397; Volume 44; 15 pp.; In English; Original contains color and black and white illustrations

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ONLINE: <http://dx.doi.org/10.1029/2006WR005779>

Since March 2002, the Gravity Recovery and Climate Experiment (GRACE) has provided first estimates of land water storage variations by monitoring the time-variable component of Earth's gravity field. Here we characterize spatial-temporal variations in terrestrial water storage changes (TWSC) from GRACE and compare them to those simulated with the Global Land Data Assimilation System (GLDAS). Additionally, we use GLDAS simulations to infer how TWSC is partitioned into snow, canopy water and soil water components, and to understand how variations in the hydrologic fluxes act to enhance or dissipate the stores. Results quantify the range of GRACE-derived storage changes during the studied period and place them in the context of seasonal variations in global climate and hydrologic extremes including drought and flood, by impacting land

memory processes. The role of the largest continental river basins as major locations for freshwater redistribution is highlighted. GRACE-based storage changes are in good agreement with those obtained from GLDAS simulations. Analysis of GLDAS-simulated TWSC illustrates several key characteristics of spatial and temporal land water storage variations. Global averages of TWSC were partitioned nearly equally between soil moisture and snow water equivalent, while zonal averages of TWSC revealed the importance of soil moisture storage at low latitudes and snow storage at high latitudes. Evapotranspiration plays a key role in dissipating globally averaged terrestrial water storage. Latitudinal averages showed how precipitation dominates TWSC variations in the tropics, evapotranspiration is most effective in the midlatitudes, and snowmelt runoff is a key dissipating flux at high latitudes. Results have implications for monitoring water storage response to climate variability and change, and for constraining land model hydrology simulations.

Author

Water; Earth Hydrosphere; Hydrology; Hydrological Cycle

20080023364 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Use of Dual Polarization Radar in Validation of Satellite Precipitation Measurements: Rationale and Opportunities

Chandrasekar, V.; Hou, Arthur; Smith, Eric; Bringi, V. N.; Rutledge, S. A.; Gorgucci, E.; Petersen, W. A.; SkofronickJackson, Gail; [2008]; 50 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Dual-polarization weather radars have evolved significantly in the last three decades culminating in the operational deployment by the National Weather Service. In addition to operational applications in the weather service, dual-polarization radars have shown significant potential in contributing to the research fields of ground based remote sensing of rainfall microphysics, study of precipitation evolution and hydrometeor classification. Furthermore the dual-polarization radars have also raised the awareness of radar system aspects such as calibration. Microphysical characterization of precipitation and quantitative precipitation estimation are important applications that are critical in the validation of satellite borne precipitation measurements and also serves as a valuable tool in algorithm development. This paper presents the important role played by dual-polarization radar in validating space borne precipitation measurements. Starting from a historical evolution, the various configurations of dual-polarization radar are presented. Examples of raindrop size distribution retrievals and hydrometeor type classification are discussed. The quantitative precipitation estimation is a product of direct relevance to space borne observations. During the TRMM program substantial advancement was made with ground based polarization radars specially collecting unique observations in the tropics which are noted. The scientific accomplishments of relevance to space borne measurements of precipitation are summarized. The potential of dual-polarization radars and opportunities in the era of global precipitation measurement mission is also discussed.

Author

Meteorological Radar; Precipitation Measurement; Satellite Observation; Satellite-Borne Instruments

20080023368 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Neural Networks as a Tool for Constructing Continuous NDVI Time Series from AVHRR and MODIS

Brown, Molly E.; Lary, David J.; Vrieling, Anton; Stathakis, Demetris; Mussa, Hamse; [2008]; 33 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The long term Advanced Very High Resolution Radiometer-Normalized Difference Vegetation Index (AVHRR-NDVI) record provides a critical historical perspective on vegetation dynamics necessary for global change research. Despite the proliferation of new sources of global, moderate resolution vegetation datasets, the remote sensing community is still struggling to create datasets derived from multiple sensors that allow the simultaneous use of spectral vegetation for time series analysis. To overcome the non-stationary aspect of NDVI, we use an artificial neural network (ANN) to map the NDVI indices from AVHRR to those from MODIS using atmospheric, surface type and sensor-specific inputs to account for the differences between the sensors. The NDVI dynamics and range of MODIS NDVI data at one degree is matched and extended through the AVHRR record. Four years of overlap between the two sensors is used to train a neural network to remove atmospheric and sensor specific effects on the AVHRR NDVI. In this paper, we present the resulting continuous dataset, its relationship to MODIS data, and a validation of the product.

Author

Neural Nets; Radiometers; Normalized Difference Vegetation Index; Data Acquisition; Data Integration; Remote Sensing; Earth Observations (From Space)

20080023392 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Comparison of Terra and Aqua MODIS VIS Bands On-Orbit Response

Xiong, Xiaoxiong; Sun, J.; Che, N.; Choi, T.; Angal, A.; [2008]; 2 pp.; In English; IGARSS 2008, 6-11 Jul. 2008, Boston, MA, USA; Copyright; Avail.: CASI: [A01](#), Hardcopy

The Moderate Resolution Imaging Spectroradiometer (MODIS) has 36 spectral bands with a total of 490 detectors, covering spectral regions in the visible (VIS), near-infrared (NIR), short-wave infrared (SWIR), mid-wave infrared (MWIR), and long-wave infrared (LWIR). MODIS is a cross-track scanning radiometer which collects data using a rotating scan mirror (both sides) over a wide range of scan angles. The VIS, NIR, and SWIR bands (bands 1-19 and 26) make measurements of daytime surface reflected radiances, thus are referred to as the reflective solar bands (RSB). MODIS was built with a complete set of on-board calibrators, capable of providing radiometric, spatial, and spectral calibration and characterization during its entire mission. The RSB on-orbit calibration is primarily provided using a solar diffuser (SD) and a solar diffuser stability monitor (SDSM). The SD and SDSM calibration system is operated on a regular (weekly to bi-weekly) basis. The spectro-radiometric calibration assembly (SRCA) is another on-board calibrator that also provides RSB radiometric calibration support. For this purpose, the SRCA is operated in a radiometric mode on a monthly basis. A complete SRCA radiometric calibration is performed using different lamp configurations, or different radiance levels, to cover the range of RSB gain. Two additional SRCA modes with slightly different configurations are designed and operated for sensor on-orbit spectral and spatial characterization. In addition to its on-board calibrators, each MODIS makes monthly lunar observations to monitor RSB radiometric calibration stability. The MODIS lunar observations are made through its space view (SV) port at nearly the same lunar phase angles via spacecraft roll maneuvers. The SD, SRCA, and lunar measurements are made at different scan angles and data samples are collected for all spectral bands and detectors using both sides of the scan mirror. Since launch, Terra and Aqua MODIS have operated successfully for more than 8 years and 6 years, respectively. Many SD/SDSM, SRCA, and lunar observations have been made by each instrument and used to derive RSB on-orbit calibration parameters, enabling corrections for sensor response changes and changes of the response versus scan angle (RVS). In general, the RSB calibration parameters are updated regularly into the MODIS Level 1B (LIB) code in support of continuous data processing for all MODIS science data products. This paper provides a brief description of MODIS RSB calibration methodologies and approaches, and summarizes on-orbit changes of their responses (gains), particularly for the VIS spectral bands.

Derived from text

MODIS (Radiometry); Terra Spacecraft; Aqua Spacecraft; Spectral Bands; Visible Spectrum

20080023439 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Atmospheric Correction at AERONET Locations: A New Science and Validation Data Set

Wang, Yujie; Lyapustin, Alexei; Privette, Jeffery L.; Morisette, Jeffery T.; Holben, Brent; [2008]; 33 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper describes an AERONET-based Surface Reflectance Validation Network (ASRVN) and its dataset of spectral surface bidirectional reflectance and albedo based on MODIS TERRA and AQUA data. The ASRVN is an operational data collection and processing system. It receives 50x50 square kilometer subsets of MODIS L1B data from MODAPS and AERONET aerosol and water vapor information. Then it performs an accurate atmospheric correction for about 100 AERONET sites based on accurate radiative transfer theory with high quality control of the input data. The ASRVN processing software consists of L1B data gridding algorithm, a new cloud mask algorithm based on a time series analysis, and an atmospheric correction algorithm. The atmospheric correction is achieved by fitting the MODIS top of atmosphere measurements, accumulated for 16-day interval, with theoretical reflectance parameterized in terms of coefficients of the LSRT BRF model. The ASRVN takes several steps to ensure high quality of results: 1) cloud mask algorithm filters opaque clouds; 2) an aerosol filter has been developed to filter residual semi-transparent and sub-pixel clouds, as well as cases with high inhomogeneity of aerosols in the processing area; 3) imposing requirement of consistency of the new solution with previously retrieved BRF and albedo; 4) rapid adjustment of the 16-day retrieval to the surface changes using the last day of measurements; and 5) development of seasonal back-up spectral BRF database to increase data coverage. The ASRVN provides a gapless or near-gapless coverage for the processing area. The gaps, caused by clouds, are filled most naturally with the latest solution for a given pixels. The ASRVN products include three parameters of LSRT model ($k(\text{sup } L)$, $k(\text{sup } G)$, $k(\text{sup } V)$), surface albedo, NBRF (a normalized BRF computed for a standard viewing geometry, $VZA=0$ deg., $SZA=45$ deg.), and IBRF (instantaneous, or one angle, BRF value derived from the last day of MODIS measurement for specific viewing geometry) for MODIS 500m bands 1-7. The results are produced daily at resolution of 1 km in gridded format. We also

provide cloud mask, quality flag and a browse bitmap image. The new dataset can be used for a wide range of applications including validation analysis and science research.

Author

Albedo; Atmospheric Correction; MODIS (Radiometry); Terra Spacecraft; Spectral Reflectance; Robotics; Communication Networks; Aerosols; Mathematical Models

20080023442 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Relating a Spectral Index from MODIS and Tower-based Measurements to Ecosystem Light Use Efficiency for a Fluxnet-Canada Coniferous Forest

Middleton, Elizabeth M.; Cheng, Yen-Ben; Hilker, Thomas; Huemmrich, Karl F.; Black, T. Andrew; Krishnan, Praveena; Coops, Nicholas C.; [2008]; 2 pp.; In English; IGARSS 2008, 6-11 Jul 2008, Boston, MA, USA; Copyright; Avail.:

CASI: [A01](#), Hardcopy

As part of the North American Carbon Program effort to quantify the terrestrial carbon budget of North America, we have been examining the possibility of retrieving ecosystem light use efficiency (LUE, the carbon sequestered per unit photosynthetically active radiation) directly from satellite observations. Our novel approach has been to compare LUE derived from tower fluxes with LUE estimated using spectral indices computed from MODIS satellite observations over forests in the Fluxnet-Canada Research Network, using the MODIS narrow ocean bands acquired over land. We matched carbon flux data collected around the time of the MODIS mid-day overpass for over one hundred relatively clear days in five years (2001-2006) from a mature Douglas fir forest in British Columbia. We also examined hyperspectral reflectance data collected diurnally from the tower in conjunction with the eddy correlation fluxes and meteorological measurements made throughout the 2006 growing season at this site. The tower-based flux data provided an opportunity to examine diurnal and seasonal LUE processes and their relationship to spectral indices at the scale of the forest stand. We evaluated LUE in conjunction with the Photochemical Reflectance Index (PRI), a normalized difference spectral index that uses 531 nm and a reference band to capture responses to high light induced stress afforded by the xanthophyll cycle. Canopy structure information, retrieved from airborne laser scanning radar (LiDAR) observations, was used to partition the forest canopy into sunlit and shaded fractions throughout the day, on numerous days during 2006. At each observation period throughout a day, the PRI was examined for the sunlit, shaded, and intermediate canopy segments defined by their instantaneous position relative to the solar principal plane (SPP). The sunlit sector was associated with the illumination 'hotspot' (the reflectance backscatter maximum), the shaded sector with the 'cold or dark spot' (the reflectance forward scatter minimum), while the intermediate, mixed sunlit/shade sector was located in the cross-plane to the SPP. The PRI indices clearly captured the differences in leaf groups, with sunlit foliage exhibiting the lowest values on sunny days throughout the 2006 season. When tower-based canopy-level LUE was recalculated to estimate foliage-based values (LUE(sub foliage) for the three foliage groups under their incident light environments, a strong linear relationship for PRI:LUE(sub foliage) was demonstrated (0.6 less than or equal to $r(\text{sup } 2)$ less than or equal to 0.8, $n=822$, $P<0.0001$). The MODIS data represent relatively large areas when acquired at nadir (approx. 1 sq km) or at variable off-nadir view angles (greater than or equal to 1 sq km) looking forward or aft. Nevertheless, a similar relationship between MODIS PRI and tower-based LUE was obtained from satellite observations ($r(\text{sup } 2) = 0.76$, $n=105$, $P=0.026$) when the azimuth offsets from the SPP for off-nadir observations were considered. At this relatively high latitude of 50 degrees, the MODIS directional observations were offset from the SPP by approximately 50 degrees, but still represented backscatter or forward scatter sectors of the bidirectional reflectance distribution function (BRDF). The backscatter observations sampled the sunlit forest and provided lower PRI values, in general, than the forward scatter observations from the shaded forest. Since the hotspot and darkspot were not typically directly observed, the dynamic range for MODIS PRI was less than that observed in the SPP at the canopy level; therefore, MODIS PRI values were more similar to those observed in situ in the BRDF cross-plane. While not ideal in terms of spatial resolution or optimal viewing configuration, the MODIS observations nevertheless provide a means to monitor forest under stress using narrow spectral band indices and off-nadir observations. This research has stimulated several spin-off studies for remote sensing LUE, and demonstrates the importance of the connection between ecosystem structure and physiological function.

Author

MODIS (Radiometry); Ecosystems; Forests; Foliage; Remote Sensing; Photosynthetically Active Radiation; Photochemical Reactions; Optical Radar; Bidirectional Reflectance

20080023443 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Laboratory and Airborne BRDF Analysis of Vegetation Leaves and Soil Samples

Georgiev, Georgi T.; Gatebe, Charles K.; Butler, James J.; King, Michael D.; [2008]; 36 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS5-02041; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023443>

Laboratory-based Bidirectional Reflectance Distribution Function (BRDF) analysis of vegetation leaves, soil, and leaf litter samples is presented. The leaf litter and soil samples, numbered 1 and 2, were obtained from a site located in the savanna biome of South Africa (Skukuza: 25.0degS, 31.5degE). A third soil sample, number 3, was obtained from Etosha Pan, Namibia (19.20degS, 15.93degE, alt. 1100 m). In addition, BRDF of local fresh and dry leaves from tulip tree (*Liriodendron tulipifera*) and acacia tree (*Acacia greggii*) were studied. It is shown how the BRDF depends on the incident and scatter angles, sample size (i.e. crushed versus whole leaf,) soil samples fraction size, sample status (i.e. fresh versus dry leaves), vegetation species (poplar versus acacia), and vegetation s biochemical composition. As a demonstration of the application of the results of this study, airborne BRDF measurements acquired with NASA's Cloud Absorption Radiometer (CAR) over the same general site where the soil and leaf litter samples were obtained are compared to the laboratory results. Good agreement between laboratory and airborne measured BRDF is reported.

Author

Soil Sampling; Biochemistry; Ecosystems; Functional Analysis; Soils; Vegetation; Grasslands

20080023482 National Inst. of Information and Communications Technology, Japan

Development and Ground Tests of Superconducting Submillimeter-Wave Limb-Emission Sounder (SMILES)

Ochiai, Satoshi; Kasai, Yasuko; Irimajiri, Yoshihisa; Seta, Masumichi; Manabe, Takeshi; Journal of the National Institute of Information and Communications Technology, Volume 54, Nos. 1/2. Special Issue on Middle and Upper Atmosphere Observation Techniques; March/June 2007, pp. 139-148; In English; See also [20080023475](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

Superconducting Submillimeter-wave Limb-Emission Sounder, SMILES is an Earth observation sensor aboard Exposure Facility of Japanese Experiment Module of the International Space Station. SMILES will be launched in 2009. SMILES has two superconducting receivers in 625 and 650 GHz bands. Height profiles of stratospheric chemical species will be retrieved from limb spectra taken by SMILES. SMILES are developed under cooperation of NICT and JAXA. The submillimeter-wave receiver will be integrated and tested in 2007. The flight model of SMILES will be integrated in 2008.

Author

Earth Observations (From Space); Submillimeter Waves; Superconductivity; Atmospheric Sounding; Atmospheric Composition; Atmospheric Chemistry; Remote Sensing; Earth Limb; Radiometers

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*.

20080023205 Defense Science Board, Washington, DC USA

Report of the Defense Science Board Task Force on DoD Energy Strategy, 'More Fight - Less Fuel'

Feb 2008; 136 pp.; In English

Report No.(s): AD-A477619; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477619>

On May 2, 2006 the Under Secretary of Defense for Acquisition, Technology and Logistics (USD(AT&L)) directed the Defense Science Board to create a Task Force to examine DoD Energy Strategy Citing significant risks to both our nation and our military forces, he challenged the Task Force to find opportunities to reduce DoD's energy demand, identify institutional obstacles to their implementation, and assess their potential commercial and security benefits to the nation Overview Based on its study and deliberations, the Task Force concluded that DoD faces two primary energy challenges: Unnecessarily high and growing battlespace fuel demand that: compromises operational capability and mission success; requires an excessive support force structure at the expense of operational forces; creates more risk for support operations than necessary; and increases life-cycle operations and support costs. Almost complete dependence of military installations on a fragile and

vulnerable commercial power grid and other critical national infrastructure places critical military and Homeland defense missions at an unacceptably high risk of extended disruption.

DTIC

Defense Program; Energy Consumption; Fuels

20080023213 Bechtel Corp., Oak Ridge, TN, USA

Safe Battery Solvents

Harrup, M. K., Inventor; Delmastro, J. R., Inventor; Stewart, F. F., Inventor; Luther, T. A., Inventor; 17 May 04; 19 pp.; In English

Contract(s)/Grant(s): DE-AC07-99ID-13727

Patent Info.: Filed 17 May 04; US-Patent-Appl-SN-10 848 480

Report No.(s): PB2007-109134; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An ion transporting solvent maintains very low vapor pressure, contains flame retarding elements, and is nontoxic. The solvent in combination with common battery electrolyte salts can be used to replace the current carbonate electrolyte solution, creating a safer battery. It can also be used in combination with polymer gels or solid polymer electrolytes to produce polymer batteries with enhanced conductivity characteristics. The solvents may comprise a class of cyclic and acyclic low molecular weight phosphazenes compounds, comprising repeating phosphorus and nitrogen units forming a core backbone and ion-carrying pendent groups bound to the phosphorus. In preferred embodiments, the cyclic phosphazene comprises at least 3 phosphorus and nitrogen units, and the pendent groups are polyethers, polythioethers, polyether/polythioethers or any combination thereof, and/or other groups preferably comprising other atoms from Group 6B of the periodic table of elements.

NTIS

Solvents; Electric Batteries; Electrolytes; Safety

20080023616 NEI Corp., Piscataway, NJ, USA

Method of making fine lithium iron phosphate/carbon-based powders with an olivine type structure

Singhal, Amit, Inventor; Dhamne, Abhijeet, Inventor; Skandan, Ganesh, Inventor; June 24, 2008; 12 pp.; In English

Contract(s)/Grant(s): NNG04CA24C

Patent Info.: Filed June 24, 2005; US-Patent-7,390,473; US-Patent-Appl-SN-11/165,926; No Copyright; Avail.: CASI:

[A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023616>

Processes for producing fine LiFePO_4/C and nanostructured $\text{LiFe}_x\text{M}_{1-x}\text{PO}_4/\text{C}$ composite powders, where $1.0 \leq x \leq 0.1$ and M is a metal cation. Electrodes made of either nanostructured $\text{LiFe}_x\text{M}_{1-x}\text{PO}_4/\text{C}$ powders or nanostructured $\text{LiFe}_x\text{M}_{1-x}\text{PO}_4/\text{C}$ composite powders exhibit excellent electrochemical properties. That will provide high power density, low cost and environmentally friendly rechargeable Li-ion batteries.

Official Gazette of the U.S. Patent and Trademark Office

Nanocrystals; Lithium Batteries; Lithium Compounds; Powder (Particles)

45

ENVIRONMENT POLLUTION

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

20080022363 Transportoekonomisk Inst., Oslo, Norway

Nordic Perspective on Noise Reduction at the Source

Amundsen, A. H.; Klaeboe, R.; Nov. 2005; 64 pp.; In English

Report No.(s): PB2007-108167; TOI-806/2005; Copyright; Avail.: National Technical Information Service (NTIS)

The European Commission has estimated that about 80 million Europeans are exposed to unacceptable noise levels. Road traffic is the main source to at-the-source-noise. The report provides an overview of what is known about different types of noise abatement efforts (on vehicles, tyres, road surface and speed). Some tentative suggestions on what to do under Nordic conditions are given.

NTIS

Noise Reduction; Traffic; Roads

20080023051 Istituto Superiore di Sanita, Rome, Italy

Microinquinanti Organici e Inorganici nell'area di Mantove: Studio dei Livelli Ambientali. (Organic and Inorganic Micropollutants within the Mantua Area (Italy): Study on Environmental Levels.)

Viviano, G.; Mazzoli, P.; Settimo, G.; January 2006; 95 pp.; In Italian

Report No.(s): PB2007-107839; ISTISAN-06/43; Copyright; Avail.: National Technical Information Service (NTIS)

The Istituto Superiore di Sanita (the National Institute of Health in Italy) and the Mantua Local Health Unit have carried out a research programme aimed at locating the highest exposure risk areas, and evaluating and assessing contamination levels in air and soil by both organic (Polychlorinated dibenzodioxins and Polychlorinated dibenzofurans, PCDD/F; Polycyclic Aromatic Hydrocarbons, PAH) and inorganic (arsenic, cadmium, nickel, lead, copper, vanadium) micropollutants within the surrounding Mantua industrial area. This report shows the results of environmental monitoring carried out in air, soil and sediment and the consequent comparison with the World Health Organization quality standards, reported into the Italian and European Community legislation.

NTIS

Arsenic; Cadmium; Nickel; Vanadium; Polycyclic Aromatic Hydrocarbons

20080023052 Istituto Superiore di Sanita, Rome, Italy

Metodi per la Determinazione di Arsenico, Cadmio, Nichel e Idrocarburi Policiclici Aromatici nelle Depositioni Atmosferiche. (Methods for the Determination of Arsenic, Cadmium, Nickel and Polycyclic Aromatic Hydrocarbons in Atmospheric Depositions)

Menichini, E.; Settimo, G.; January 2006; 32 pp.; In Italian

Report No.(s): PB2007-107837; ISTISAN-06/38; Copyright; Avail.: National Technical Information Service (NTIS)

These methods enable the determination of the deposition rates of some atmospheric pollutants whose measurement is required by the European Directive 2004/107/EC. The methods are applicable both at background stations, as required by the Directive, and at other measurement stations. Total depositions are analysed as sums of dry and wet fractions: they are collected by passive exposure of a bottle/cylindrical funnel system with standardised dimensions, for a period covering one week to one month. The deposited samples are filtrated, then both the particulate matter collected on filter and the filtrate are processed. After filter mineralisation and filtrate acidification, the metals are determined by GFAAS or ICP/MS. Polycyclic aromatic hydrocarbons are solvent extracted, cleaned up if necessary, and determined by GC/MS or HPLC/Fluorescence.

NTIS

Air Pollution; Arsenic; Cadmium; Deposition; Nickel; Polycyclic Aromatic Hydrocarbons

20080023120 Nevada Univ., Reno, NV, USA

Deployable Plume and Aerosol Release Prediction and Tracking System. Final Report

Kleppe, J.; Norris, W.; Etezadi, M.; January 2006; 84 pp.; In English

Contract(s)/Grant(s): DE-FC52-04NA25657

Report No.(s): DE2007-888516; No Copyright; Avail.: National Technical Information Service (NTIS)

This contract was awarded in response to a proposal in which a deployable plume and aerosol release prediction and tracking system would be designed, fabricated, and tested. The system would gather real time atmospheric data and input it into a real time atmospheric model that could be used for plume prediction and tracking. The system would be able to be quickly deployed by aircraft to points of interest or positioned for deployment by vehicles. The system would provide three dimensional (u, v, and w) wind vector data, inversion height measurements, surface wind information, classical weather station data, and solar radiation. The on-board real time computer model would provide the prediction of the behavior of plumes and released aerosols.

NTIS

Accidents; Aerosols; Atmospheric Models; Computerized Simulation; Plumes; Prediction Analysis Techniques

20080023253 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Global Model Simulation of Aerosol Effects of Surface Radiation Budget- Toward Understanding of the 'Dimming to Brightening' Transition

Chin, Mian; Diehl, Thomas; Bian, Huisheng; Yu, Hongbin; February 10, 2008; 1 pp.; In English; International Workshop on Global Dimming/Brightening, 10-24 Feb. 2008, Tel Aviv, Israel; Original contains black and white illustrations; No Copyright; Avail.: Other Sources; Abstract Only

We present a global model study on the role aerosols play in the change of solar radiation at Earth's surface that

transitioned from a decreasing (dimming) trend to an increasing (brightening) trend. Our primary objective is to understand the relationship between the long-term trends of aerosol emission, atmospheric burden, and surface solar radiation. More specifically, we use the recently compiled comprehensive global emission datasets of aerosols and precursors from fuel combustion, biomass burning, volcanic eruptions and other sources from 1980 to 2006 to simulate long-term variations of aerosol distributions and optical properties, and then calculate the multi-decadal changes of short-wave radiative fluxes at the surface and at the top of the atmosphere by coupling the GOCART model simulated aerosols with the Goddard radiative transfer model. The model results are compared with long-term observational records from ground-based networks and satellite data. We will address the following critical questions: To what extent can the observed surface solar radiation trends, known as the transition from dimming to brightening, be explained by the changes of anthropogenic and natural aerosol loading on global and regional scales? What are the relative contributions of local emission and long-range transport to the surface radiation budget and how do these contributions change with time?

Author

Aerosols; Dimming; Simulation; Solar Radiation; Earth Surface; Models

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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*.

20080023209 Arcon Corp., Waltham, MA USA

Anomalous Conditions in the Middle Atmosphere During Boreal Winters of 2004 and 2006

Wintersteiner, Peter P; Dec 31, 2007; 34 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8718-04-C-0031; Proj-2301

Report No.(s): AD-A477673; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477673>

An examination of SABER data for boreal winter reveals extraordinary conditions in the mesosphere early in 2004 and 2006. In portions of the polar region, during much but not all of the mid-January through mid-March period for which data are available in each of those years, the OH layer is unusually low and bright. The temperature structure is also greatly perturbed, from the stratosphere to the upper mesosphere. Specifically, the OH layer is found as much as 8 km below its nominal altitude of 87 km, and very high temperatures - occasionally exceeding 275 K - appear at altitudes where the layer exists. We use SABER data to quantify the anomalous effects, study their evolution, and contrast them with those of the 'normal' years 2003 and 2005. We also cite other observations and model studies of conditions in the stratosphere during those years, and enhanced downward transport within the polar vortex that has been inferred from them. Transport is the likely explanation for the anomalous properties of the OH layer seen in the SABER data.

DTIC

Anomalies; Information Retrieval; Mesosphere; Middle Atmosphere

20080023352 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Rapid Ice Mass Loss: Does It Have an Influence on Earthquake Occurrence in Southern Alaska?

Sauber, Jeanne M.; [2008]; 2 pp.; In English; International Geological Congress: STN-02, Neotectonics and Stress State in Formerly Glaciated Regions, 5-10 Aug. 2008, Oslo, Norway; No Copyright; Avail.: Other Sources; Abstract Only

The glaciers of southern Alaska are extensive, and many of them have undergone gigatons of ice wastage on time scales on the order of the seismic cycle. Since the ice loss occurs directly above a shallow main thrust zone associated with subduction of the Pacific-Yakutat plate beneath continental Alaska, the region between the Malaspina and Bering Glaciers is an excellent test site for evaluating the importance of recent ice wastage on earthquake faulting potential. We demonstrate the influence of cumulative glacial mass loss following the 1899 Yakataga earthquake ($M=8.1$) by using a two dimensional finite element model with a simple representation of ice fluctuations to calculate the incremental stresses and change in the fault stability margin (FSM) along the main thrust zone (MTZ) and on the surface. Along the MTZ, our results indicate a decrease in FSM between 1899 and the 1979 St. Elias earthquake ($M=7.4$) of 0.2 - 1.2 MPa over an 80 km region between the coast and the 1979 aftershock zone; at the surface, the estimated FSM was larger but more localized to the lower reaches of glacial ablation zones. The ice-induced stresses were large enough, in theory, to promote the occurrence of shallow thrust earthquakes. To empirically test the influence of short-term ice fluctuations on fault stability, we compared the seismic rate from a reference background time period (1988-1992) against other time periods (1993-2006) with variable ice or tectonic change

characteristics. We found that the frequency of small tectonic events in the Icy Bay region increased in 2002-2006 relative to the background seismic rate. We hypothesize that this was due to a significant increase in the rate of ice wastage in 2002-2006 instead of the M=7.9, 2002 Denali earthquake, located more than 100km away.

Author

Alaska; Glaciers; Melting; Earthquakes; Geological Faults; Plates (Tectonics)

20080023356 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Field Observations of Soil Moisture Variability across Scales

Famiglietti, James S.; Ryu, Dongryeol; Berg, Aaron A.; Rodell, Matthew; Jackson, Thomas J.; *Water Resources Research Journal*; January 19, 2008; ISSN 0043-1397; Volume 44; 16 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1029/2006WR005804>

In this study, over 36,000 ground-based soil moisture measurements collected during the SGP97, SGP99, SMEX02, and SMEX03 field campaigns were analyzed to characterize the behavior of soil moisture variability across scales. The field campaigns were conducted in Oklahoma and Iowa in the central USA. The Oklahoma study region is sub-humid with moderately rolling topography, while the Iowa study region is humid with low-relief topography. The relationship of soil moisture standard deviation, skewness and the coefficient of variation versus mean moisture content was explored at six distinct extent scales, ranging from 2.5 m to 50 km. Results showed that variability generally increases with extent scale. The standard deviation increased from 0.036 cm³/cm³ at the 2.5-m scale to 0.071 cm³/cm³ at the 50-km scale. The log standard deviation of soil moisture increased linearly with the log extent scale, from 16 m to 1.6 km, indicative of fractal scaling. The soil moisture standard deviation versus mean moisture content exhibited a convex upward relationship at the 800-m and 50-km scales, with maximum values at mean moisture contents of roughly 0.17 cm³/cm³ and 0.19 cm³/cm³, respectively. An empirical model derived from the observed behavior of soil moisture variability was used to estimate uncertainty in the mean moisture content for a fixed number of samples at the 800-m and 50-km scales, as well as the number of ground-truth samples needed to achieve 0.05 cm³/cm³ and 0.03 cm³/cm³ accuracies. The empirical relationships can also be used to parameterize surface soil moisture variations in land surface and hydrological models across a range of scales. To our knowledge, this is the first study to document the behavior of soil moisture variability over this range of extent scales using ground-based measurements. Our results will contribute not only to efficient and reliable satellite validation, but also to better utilization of remotely sensed soil moisture products for enhanced modeling and prediction.

Author

Soil Moisture; Moisture Content; Variability

20080023370 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Laboratory for Atmospheres 2007 Technical Highlights

Stewart, Richard W.; May 2008; 170 pp.; In English; Original contains color illustrations

Report No.(s): NASA/TM--2008-214160; Rept-200801240; No Copyright; Avail.: CASI: [A08](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023370>

The 2007 Technical Highlights describes the efforts of all members of the Laboratory for Atmospheres. Their dedication to advancing Earth Science through conducting research, developing and running models, designing instruments, managing projects, running field campaigns, and numerous other activities, is highlighted in this report.

Author

Earth Sciences; Geophysics; Earth Atmosphere; Atmospheric Chemistry; Climatology; Topex; MODIS (Radiometry)

20080023476 National Astronomical Observatory, Japan

The Laboratory Measurement of Pressure Broadening Parameter for Atmospheric Remote Sensing

Yamada, Masumi; Kasai, Yasuko; Amano, Takayoshi; *Journal of the National Institute of Information and Communications Technology*, Volume 54, Nos. 1/2. Special Issue on Middle and Upper Atmosphere Observation Techniques; March/June 2007, pp. 149-154; In English; See also [20080023475](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

The upcoming JEM/SMILES (Superconducting Submillimeter-wave Limb Emission Sounder) and EOS-MLS (Earth Observing System-Microwave Limb Sounder) missions are planned to continually monitor key atmospheric species that play a crucial role in the chemistry of the upper atmosphere. For reliable retrieval of spatial distributions of key species from

observational data, various types of spectroscopic parameters should be known very accurately. In this investigation, the pressure broadening parameters and their temperature dependences of BrO and O₃ have been critically examined.

Author

Pressure Broadening; Atmospheric Sounding; Atmospheric Chemistry; Molecular Spectroscopy; Gas Temperature; Remote Sensing

20080023477 National Inst. of Information and Communications Technology, Japan

BSMILES - A Balloon-Borne Superconducting Submillimeter-Wave Limb-Emission Sounder

Irimajiri, Yoshihisa; Ochiai, Satoshi; Baron, Philippe; Journal of the National Institute of Information and Communications Technology, Volume 54, Nos. 1/2. Special Issue on Middle and Upper Atmosphere Observation Techniques; March/June 2007, pp. 155-164; In English; See also [20080023475](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

The stratospheric ozone layer protects life on the Earth from harmful ultraviolet rays from the Sun. Since the Antarctic ozone hole was discovered in 1980, ozone destruction has become a serious global environmental problem, especially because it is caused by human activity. Although it is said that the ozone layer has been recovering in recent years due to international reductions of ozone-depleting substances such as designated chlorofluorocarbons, ozone recovery rates are still uncertain. Because catalyst reaction with the stratospheric minor constituents is related to the ozone destruction, observations of the molecules and clarifying of the photochemical processes are important in order to predict recovery of ozone concentrations. We have developed a balloon-borne highly-sensitive superconductive receiver system in order to measure stratospheric minor gases. Balloon flight experiments were successfully conducted in 2003, 2004, and 2006, and ozone and ozone-depleting substances and greenhouse gases were measured.

Author

Balloon-Borne Instruments; Superconductivity; Submillimeter Waves; Receivers; Atmospheric Sounding; Balloon Sounding; Stratosphere; Atmospheric Composition; Atmospheric Heating; Ozonosphere; Ozone Depletion; Greenhouse Effect

20080023478 Nagoya Univ., Japan

Space Weather Study Using the HF Radar in King Salmon, Alaska

Kikuchi, Takashi; Hashimoto, K. Kumiko; Shinohara, Manabu; Nozaki, Kenro; Bristow, Bill; Journal of the National Institute of Information and Communications Technology, Volume 54, Nos. 1/2. Special Issue on Middle and Upper Atmosphere Observation Techniques; March/June 2007, pp. 127-137; In English; See also [20080023475](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

Earth orbiting and geostationary satellites have often suffered from damages caused by space storms, of which energy is produced by the interaction between the solar wind and magnetosphere. In particular, the energy transmission to the inner magnetosphere and low latitude ionosphere is a critical issue in the study of space weather. To monitor the electromagnetic energy coming into the magnetosphere and ionosphere, we built an HF radar in King Salmon, Alaska, and operated it as a part of the SuperDARN radar network. Combining with magnetometer data from the low latitude and equator, we revealed new aspects of the energy transmission to the equatorial ionosphere. Here we report the radar system and initial results based on the radar and magnetometer observations.

Author

Space Weather; Meteorological Radar; Radar Networks; Electromagnetic Fields; Energy Transfer; Magnetometers; Earth Magnetosphere; Ionospheres; Geomagnetism

20080023480 Kibi International Univ., Okayama, Japan

Ionospheric Plasma Convection Observed by HF Radar Network in the Northern Polar Region

Hashimoto, K. Kumiko; Kikuchi, Takashi; Kunitake, Manabu; Ohtaka, Kazuhiro; Watari, Shin-ichi; Journal of the National Institute of Information and Communications Technology, Volume 54, Nos. 1/2. Special Issue on Middle and Upper Atmosphere Observation Techniques; March/June 2007, pp. 117-126; In English; See also [20080023475](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

The space weather forecast is becoming a more important issue for the operations of spacecrafts and telecommunication facilities. Among several important research subjects in space weather, we studied the transmission mechanism of electromagnetic energy into the inner magnetosphere and to the low latitude ionosphere, using radar and magnetometer networks. We report in this article that the ionospheric plasma convection in the polar region is closely related to magnetic

disturbances at the geomagnetic equator and in the inner magnetosphere. With these observational facts, we emphasize a crucial role of the ionosphere in transmitting electromagnetic energy to space.

Author

Space Weather; Weather Forecasting; Ionospheres; Plasma-Electromagnetic Interaction; Convection; Earth Magnetosphere; Magnetosphere-Ionosphere Coupling; Ionospheric Conductivity; Atmospheric Physics; Geomagnetism

20080023483 Komazawa Womens' Univ., Tokyo, Japan

Characteristics of Aerosol in the Polar Mesosphere Derived from Rayleigh Lidar Observations

Sakanoui, Kazuyo; Collins, Richard L.; Murayama, Yasuhiro; Mizutani, Kohei; Journal of the National Institute of Information and Communications Technology, Volume 54, Nos. 1/2. Special Issue on Middle and Upper Atmosphere Observation Techniques; March/June 2007, pp. 47-55; In English; See also [20080023475](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

In this paper, we present characteristics of aerosol in the polar mesosphere derived from Rayleigh lidar observations over Poker Flat Research Range, Univ. of Alaska, Fairbanks. There are two kinds of aerosol, noctilucent clouds and rocket plume. At first, we show that aerosol of noctilucent clouds are transported by background wind. Then extent of the rocket plume can be estimated from lidar data considering their transport by background wind. This kind of measurement is useful to new research in the mesosphere.

Author

Mesosphere; Polar Regions; Aerosols; Optical Radar; Remote Sensing

20080023484 Tsurumi Univ., Tsurumi, Japan

Intensive Ozonesonde Observation at Fairbanks and Comparison with Three-Dimensional Chemical Transport Model

Yamamori, Miho; Murayama, Yasuhiro; Shibasaki, Kazuo; Murata, Isao; Kagawa, Akiko; Kasai, Yasuko; Miyazaki, Kazuyuki; Journal of the National Institute of Information and Communications Technology, Volume 54, Nos. 1/2. Special Issue on Middle and Upper Atmosphere Observation Techniques; March/June 2007, pp. 39-45; In English; See also [20080023475](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

An observation campaign including intensive launches of ozonesondes was conducted at Fairbanks (64.8 N, 147.9 W), Alaska, during 23-30 August 2003. The objectives are validation of data from Improved Limb Atmospheric Spectrometer-II (ILAS-II) on board the Advanced Earth Observing Satellite-II (ADEOS-II) with Alaska Project ground-based instruments and examination of small-scale ozone variation in the upper troposphere and lower stratosphere. Observed small-scale structures in ozone are compared with high-resolution fields reconstructed from 3-dimensional chemical transport model using the reverse domain filling technique.

Author

Ozonesondes; Atmospheric Chemistry; Atmospheric Circulation; Three Dimensional Models; Troposphere; Stratosphere; Atmospheric Physics

20080023485 National Inst. of Information and Communications Technology, Japan

NICT Lidar Systems at Poker Flat Research Range

Mizutani, Kohei; Itabe, Toshikazu; Yasui, Motoaki; Aoki, Tetsuo; Ishii, Shoken; Muruyama, Yasuhiro; Sasano, Masahiko; Yoshioka, Kensuke; Ohtani, Yoshiko; Collins, Richard L.; Journal of the National Institute of Information and Communications Technology, Volume 54, Nos. 1/2. Special Issue on Middle and Upper Atmosphere Observation Techniques; March/June 2007, pp. 29-38; In English; See also [20080023475](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

We have developed three lidar instruments for the observations of the Arctic troposphere, stratosphere and mesosphere at Poker Flat Research Range near Fairbanks, Alaska (65.1 N, 147.5 W). A multi-wavelength lidar to observe clouds, aerosols and water vapor distribution in the arctic troposphere and stratosphere is operated from March 2003. A Rayleigh lidar system for temperature observations of the stratosphere and mesosphere is working after November 1997. A Rayleigh Doppler lidar for wind measurements of the middle atmosphere was installed at Poker Flat in August 2005. Here, we give descriptions of the multi-wavelength lidar, the Rayleigh lidar, and the Rayleigh Doppler lidar for the observations of the Arctic atmosphere in Alaska.

Author

Optical Radar; Arctic Regions; Troposphere; Stratosphere; Mesosphere; Alaska

20080023486 National Inst. of Information and Communications Technology, Japan

Optical Interferometry Techniques and Scientific Results for the Dynamics of the Upper Atmosphere in the Alaska Project

Ishii, Mamoru; Kubota, Minoru; Murayama, Yasuhiro; Conde, Mark; Smith, Roger W.; Okano, Shoichi; Sakanoi, Kazuyo; Journal of the National Institute of Information and Communications Technology, Volume 54, Nos. 1/2. Special Issue on Middle and Upper Atmosphere Observation Techniques; March/June 2007, pp. 87-96; In English; See also [20080023475](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

We developed the Fabry-Perot interferometer (FPI), referred to as the National Institute of Information and Communications Technology-FPI (NICT-FPI), during the Alaska Project and have made several observations, both domestic and overseas. We deployed the instruments at the Poker Flat research range and Eagle observatory, in Alaska in 1998 and started the observation of aurora optics for deducing neutral-ion coupling and vertical winds with active aurora. We can expect the technique to be widely applied in many fields, e.g., laser technology.

Author (revised)

Fabry-Perot Interferometers; Interferometry; Upper Atmosphere; Optical Measuring Instruments; Airglow; Auroras

20080023488 National Inst. of Information and Communications Technology, Japan

A Comparative Study of the Electron Density Estimated with MF Radar DAE Method and Cosmic Noise Absorption at Poker Flat, Alaska

Kawamura, Seiji; Mori, Hirotaka; Murayama, Yasuhiro; Journal of the National Institute of Information and Communications Technology, Volume 54, Nos. 1/2. Special Issue on Middle and Upper Atmosphere Observation Techniques; March/June 2007, pp. 57-65; In English; See also [20080023475](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

The method to estimate electron density from partial reflection of medium or high frequency radio waves from the ionospheric D-region was proposed in 1950s and established in 1970s. This method, which is applied for medium frequency (MF) radar observations, is called Differential Absorption Experiment (DAE), and is now used without significant improvements though many years have passed. In this paper, we compare the electron density from MF radar and Cosmic Noise Absorption (CNA) from imaging riometer, both instruments are installed at Poker Flat, Alaska. The accuracy and validity of electron density estimated with the MF radar are discussed.

Author

Ionospheric Electron Density; D Region; Radar Measurement; Radio Waves; Cosmic Noise; Atmospheric Attenuation

20080023489 National Inst. of Information and Communications Technology, Japan

Comprehensive Arctic Atmosphere Observing System and Observed Results for ‘System Performance Demonstration’

Murayama, Yasuhiro; Ishii, Mamoru; Kubota, Minoru; Mori, Hirotaka; Mizutani, Kohei; Ochiai, Satoshi; Kasai, Yasuko; Kawamura, Seiji; Tanaka, Yoshimasa; Masuko, Harunobu; Iguchi, Toshio; Kumagai, Hiroshi; Kikuchi, Takashi; Sato, Kaoru; Collins, Richard L.; Watkins, Brenton J.; Conde, Mark; Bristow, Bill; Smith, Roger W.; Journal of the National Institute of Information and Communications Technology, Volume 54, Nos. 1/2. Special Issue on Middle and Upper Atmosphere Observation Techniques; March/June 2007, pp. 5-16; In English; See also [20080023475](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

The ‘middle atmosphere’, defined as the atmospheric layer at altitudes from approximately 10 to 100 km, has been stressed as a region important in global environment and climate change studies; importance is also stressed on the Arctic region where the global warming is predicted to appear most predominantly. The ‘Alaska Project’, an international joint research project with National Institute of Information and Communications Technology (NICT) and Geophysical Institute of University of Alaska Fairbanks, developed radio/optical technology and instruments which are effective for global environment and related atmospheric/space science studies. Project overview and results are provided.

Author

Arctic Regions; Climate Change; Global Warming; Climatology; Geophysics; Information Systems

20080023490 National Inst. of Information and Communications Technology, Japan

The Impact of Cirrus Clouds on Retrieval of Ozone in the Upper Troposphere/Lower Stratosphere from SMILES Data
Mendrok, Jana; Baron, Philippe; Kasai, Yasuko; Journal of the National Institute of Information and Communications Technology, Volume 54, Nos. 1/2. Special Issue on Middle and Upper Atmosphere Observation Techniques; March/June 2007, pp. 179-192; In English; See also [20080023475](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

Characterized by an exceptionally low instrumental noise, tropospheric measurements of the Superconducting Submillimeter-Wave Limb Emission Sounder (SMILES), dedicated to the observation of atmospheric ozone chemistry, may noticeably be affected by cirrus clouds. When not taken into account in the retrieval, the change in broadband spectral signal caused by ice clouds introduces uncertainties in the derivation of trace gas profiles around the upper troposphere/lower stratosphere (UTLS). In this paper, we demonstrate cirrus effects on sub-mm limb spectra as well as on the measurement sensitivity concerning trace gas profile retrievals. We analyze the error budget in the retrieval of UTLS ozone (O₃) induced by neglecting the observed cirrus. Furthermore, possibilities to compensate for cloud effects by retrieving additional parameters like a measurement baseline and (pseudo) water vapor (H₂O) content are evaluated.

Author

Cirrus Clouds; Ice Clouds; Troposphere; Stratosphere; Ozone; Data Retrieval; Radiometers; Atmospheric Sounding

20080023493 Research Organization for Information Science Technology, Tokai, Japan

Cosmic Noise Absorption Observed with Imaging Riometer in Alaska: Use of CNA to Estimate Energy Spectra of Auroral Precipitating Electrons

Tanaka, Yoshimasa; Ishii, Mamoru; Kubota, Minoru; Monzen, Yoshizumi; Murayama, Yasuhiro; Mori, Hirotaka; Lummerzheim, Dirk; Journal of the National Institute of Information and Communications Technology, Volume 54, Nos. 1/2. Special Issue on Middle and Upper Atmosphere Observation Techniques; March/June 2007, pp. 97-105; In English; See also [20080023475](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

Since the National Institute of Information and Communication Technology's (NICT) 256-element imaging riometer was installed at Poker Flat, Alaska, in 1995 in cooperation with the Geophysical Institute at the University of Alaska Fairbanks, it has been recording high-spatial-resolution cosmic noise absorption (CNA) to study the effect of high-energy electron precipitation on the polar middle atmosphere. We examined how to use the CNA data to estimate the energy distribution of auroral precipitating electrons. In this paper, we describe the method to extract the information of the flux of high-energy precipitating electrons by combining CNA with the optical emissions observed at two wavelengths with the all-sky imager.

Author

Polar Regions; Solar Activity; Auroras; Electron Precipitation; Energy Spectra; High Energy Electrons; Riometers; Middle Atmosphere; Geophysics; Atmospheric Attenuation

20080023496 National Taiwan Univ. of Science and Technology, Taipei, Taiwan, Province of China

Modeling the Effect of Ground Improvement on Reducing Movement during Bermed Excavation in Clay

Liao, Hung-Jiun; Lin, Chih-Chen; Huang, Chi-Jui; Journal of the Chinese Institute of Engineers, Volume 31, No.1; January 2008, pp. 81-93; In English; See also [20080023495](#); Original contains black and white illustrations

Contract(s)/Grant(s): NSC93-2211-E-011-004; Copyright; Avail.: Other Sources

To evaluate the effect of ground improvement on bermed excavation induced soil movement in clay, a 1-g model test is proposed while keeping the base stability number ($= (\gamma H / s_u)$) equal to the full scale excavation in the field. The undrained shear strength of soil used in this model test is reduced according to size reduction from the prototype to the proposed model test. To verify the suitability of model test results, a three-dimensional explicit finite difference program is adopted to perform numerical analyses for deducing the relationship between prototype and the proposed model test. In addition, a field case is compared with this model test. By comparing ground surface settlement associated with different ground improvement layouts, the buttress type arrangement has shown a better effect on controlling bermed excavation induced surface settlement than the column type arrangement. It is found that an increase of improved zone dimension will show more significant impact on reducing soil movement than an increase of improved soil's shear strength. Finally, apparent shear strength of buttress or column type improvement is determined by an empirical equation in terms of the unconfined compressive strength of treated material and the undrained shear strength of in-situ clay.

Author

Excavation; Clays; Compressive Strength; Shear Strength; Mechanical Properties; Finite Difference Theory; Soils

METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20080022314 National Inst. of Standards and Technology, Gaithersburg, MD, USA; National Oceanic and Atmospheric Administration, Rockville, MD USA

Ferdinand Rudolph Hassler (1770-1843) A Twenty Year Retrospective, 1987-2007

Hassler, H.; Burroughs, C. A.; Mar. 2007; 186 pp.; In English

Report No.(s): PB2007-107336; NIST/SP-1068; No Copyright; Avail.: National Technical Information Service (NTIS)

This publication compiles remarks, papers, and photographs associated with several events held over the past twenty years honoring Ferdinand Rudolph Hassler, first Superintendent of the Survey of the Coast and first Superintendent of Weights and Measures. These related events begin with the 180th anniversary of the establishment of the 'Survey of the Coast,' celebrated in 1987, and continue with the renovation of the Hassler Memorial Monument on the outskirts of Philadelphia. Out of that monument renovation, completed in 1993, came two additional memorials, one at NOAA headquarters in Silver Spring, Maryland, in 1995, and another at NIST in Gaithersburg, Maryland, in 2004. This publication also presents materials previously unknown to earlier Hassler historians such as the recently uncovered Hassler correspondence to Admiral Adam J. von Krusenstern obtained from the Russian State Archive of the Navy in St. Petersburg. A comprehensive Hassler bibliography is also included.

NTIS

Histories; Bibliographies

20080022433 Colorado State Univ., Fort Collins, CO, USA

CIRA: Cooperative Institute for Research in the Atmosphere Newsletter, Volume 28, Fall 2007

McInnis-Efaw, Mary, Editor; Leinen, Laura, Editor; 2007; 28 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

The articles in this issue of the Cooperative Institute for Research in the Atmosphere (CIRA) Newsletter are: 'Unmanned Aerial Systems: An Overview of NOAA's Unmanned Aircraft System Program,' 'International Activities: Weather Briefings and Training Via the Internet,' 'Cloudsat's One-Year Anniversary: An Abundance of Exciting New Cloud Observations,' and 'The Migration of NCAR'S Auto-Nowcaster into NWS AWIPS.'

CASI

Weather; Meteorological Parameters; Climatology

20080022439 NASA Langley Research Center, Hampton, VA, USA

Statistical Analyses of Satellite Cloud Object Data From CERES, Part 4, Boundary-layer Cloud Objects During 1998 El Nino

Xu, Kuan-Man; Wong, Takmeng; Wielicki, Bruce A.; Parker, Lindsay; October 3, 2006; 51 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NSF ATM-0336762; WBS 509496.02.01.01.14; Copyright; Avail.: CASI: [A04](#), Hardcopy

Three boundary-layer cloud object types, stratus, stratocumulus and cumulus, that occurred over the Pacific Ocean during January-August 1998, are identified from the CERES (Clouds and the Earth's Radiant Energy System) single scanner footprint (SSF) data from the TRMM (Tropical Rainfall Measuring Mission) satellite. This study emphasizes the differences and similarities in the characteristics of each cloud-object type between the tropical and subtropical regions and among different size categories and among small geographic areas. Both the frequencies of occurrence and statistical distributions of cloud physical properties are analyzed. In terms of frequencies of occurrence, stratocumulus clouds dominate the entire boundary layer cloud population in all regions and among all size categories. Stratus clouds are more prevalent in the subtropics and near the coastal regions, while cumulus clouds are relatively prevalent over open ocean and the equatorial regions, particularly, within the small size categories. The largest size category of stratus cloud objects occurs more frequently in the subtropics than in the tropics and has much larger average size than its cumulus and stratocumulus counterparts. Each of the three cloud object types exhibits small differences in statistical distributions of cloud optical depth, liquid water path, TOA albedo and perhaps cloud-top height, but large differences in those of cloud-top temperature and OLR between the tropics and subtropics. Differences in the sea surface temperature (SST) distributions between the tropics and subtropics influence some of the cloud macrophysical properties, but cloud microphysical properties and albedo for each cloud object type are likely determined by (local) boundary-layer dynamics and structures. Systematic variations of cloud optical depth, TOA albedo, cloud-top height,

OLR and SST with cloud object sizes are pronounced for the stratocumulus and stratus types, which are related to systematic variations of the strength of inversion with cloud object sizes, produced by large-scale subsidence. The differences in cloud macrophysical properties over small regions are significantly larger than those of cloud microphysical properties and TOA albedo, suggesting a greater control of (local) large-scale dynamics and other factors on cloud object properties. When the three cloud object types are combined, the relative population among the three types is the most important factor for determining the cloud object properties in a Pacific transect where the transition of boundary-layer cloud types takes place.

Author

Cloud Physics; Boundary Layers; Statistical Analysis; Stratocumulus Clouds; Cumulus Clouds; El Nino; Radiant Flux Density; Sea Surface Temperature; TRMM Satellite; Clouds (Meteorology)

20080022971 NASA Langley Research Center, Hampton, VA, USA

Climate Model Evaluation using New Datasets from the Clouds and the Earth's Radiant Energy System (CERES)

Loeb, Norman G.; Wielicki, Bruce A.; Doelling, David R.; June 02, 2008; 1 pp.; In English; 4th Pan-GCSS Meeting, 2-6 Jun. 2008, Toulouse, France

Contract(s)/Grant(s): WBS 921266.04.07.07; No Copyright; Avail.: Other Sources; Abstract Only

There are some in the science community who believe that the response of the climate system to anthropogenic radiative forcing is unpredictable and we should therefore call off the quest. The key limitation in climate predictability is associated with cloud feedback. Narrowing the uncertainty in cloud feedback (and therefore climate sensitivity) requires optimal use of the best available observations to evaluate and improve climate model processes and constrain climate model simulations over longer time scales. The Clouds and the Earth's Radiant Energy System (CERES) is a satellite-based program that provides global cloud, aerosol and radiative flux observations for improving our understanding of cloud-aerosol-radiation feedbacks in the Earth's climate system. CERES is the successor to the Earth Radiation Budget Experiment (ERBE), which has widely been used to evaluate climate models both at short time scales (e.g., process studies) and at decadal time scales. A CERES instrument flew on the TRMM satellite and captured the dramatic 1998 El Nino, and four other CERES instruments are currently flying aboard the Terra and Aqua platforms. Plans are underway to fly the remaining copy of CERES on the upcoming NPP spacecraft (mid-2010 launch date). Every aspect of CERES represents a significant improvement over ERBE. While both CERES and ERBE measure broadband radiation, CERES calibration is a factor of 2 better than ERBE. In order to improve the characterization of clouds and aerosols within a CERES footprint, we use coincident higher-resolution imager observations (VIRS, MODIS or VIIRS) to provide a consistent cloud-aerosol-radiation dataset at climate accuracy. Improved radiative fluxes are obtained by using new CERES-derived Angular Distribution Models (ADMs) for converting measured radiances to fluxes. CERES radiative fluxes are a factor of 2 more accurate than ERBE overall, but the improvement by cloud type and at high latitudes can be as high as a factor of 5. Diurnal cycles are explicitly resolved by merging geostationary satellite observations with CERES and MODIS. Atmospheric state data are provided from a frozen version of the Global Modeling and Assimilation Office- Data Assimilation System at the NASA Goddard Space Flight Center. In addition to improving the accuracy of top-of-atmosphere (TOA) radiative fluxes, CERES also produces radiative fluxes at the surface and at several levels in the atmosphere using radiative transfer modeling, constrained at the TOA by CERES (ERBE was limited to the TOA). In all, CERES uses 11 instruments on 7 spacecraft all integrated to obtain climate accuracy in TOA to surface fluxes. This presentation will provide an overview of several new CERES datasets of interest to the climate community (including a new adjusted TOA flux dataset constrained by estimates of heat storage in the Earth system), show direct comparisons between CERES and ERBE, and provide a detailed error analysis of CERES fluxes at various time and space scales. We discuss how observations can be used to reduce uncertainties in cloud feedback and climate sensitivity and strongly argue why we should NOT 'call off the quest'

Author

Climate Models; MODIS (Radiometry); Diurnal Variations; Clouds (Meteorology); Radiant Flux Density; Earth Radiation Budget Experiment; Angular Distribution; Aerosols

20080023026 Civil Aerospace Medical Inst., Oklahoma City, OK, USA; Clemson Univ., SC, USA

Understanding the Human Factors Associated with Visual Flight Rules Flight into Instrument Meteorological Conditions

Detwiler, Cristy; Holcomb, Kali; Hackworth, Carla; Shappell, Scott; May 2008; 20 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): AM-B-06-HRR-521

Report No.(s): DOT/FAA/AM-08/12; No Copyright; Avail.: CASI: A03, Hardcopy

Visual Flight Rules (VFR) into Instrument Meteorological Conditions (IMC) accidents are a major concern in the aviation

industry. More than 70% of the fatal weather-related accidents involved General Aviation (GA) pilots operating under visual flight rules (VFR) that continued into IMC. The purpose of this study was to pair GA accident causal factors that had been classified with the Human Factors Analysis and Classification System (HFACS) categories and traditional demographic data in an effort to present a more complete picture of VFR flight into IMC accidents. To accomplish this, GA accidents associated with VFR flight into IMC were examined to determine if there were any causal factors that set these accidents apart from the rest of GA (RoGA) accidents. GA accident data (14 CFR Part 91) from 1990-2004 were analyzed. The dataset was divided into accidents that had VFR into IMC (VFR-IMC; N = 609) cited as a cause or factor versus the rest of the GA accidents (RoGA; N = 18,528). Analyses were performed examining the human error associated with these accidents. The results indicated that skill-based errors were more prevalent in RoGA than in VFR-IMC (odds ratio = 4.167, $\chi^2 = 332.531$, $p < .001$). VFR-IMC pilots were more likely to commit a decision error (odds ratio = 2.062, $\chi^2 = 77.961$, $p < .001$); experience a perceptual error (odds ratio = 3.179, $\chi^2 = 118.350$, $p < .001$); and commit a violation (odds ratio = 29.960, $\chi^2 = 2454.198$, $p < .001$) than RoGA. The injury severity for VFR-IMC accidents was much greater than for RoGA (80.3% vs. 18.8%). RoGA pilots held a higher number of multiple certificates and earned more flight hours across the board than the VFR-IMC pilots. These data provide a more detailed view of the VFR into IMC accidents and will facilitate the development of future data-driven intervention strategies. Current interventions include weather cameras and other pilot aids for decision making - with regard to weather.

Author

Human Factors Engineering; Visual Flight Rules; Weather; Aircraft Accidents; Civil Aviation; Aerospace Medicine

20080023238 Pennsylvania State Univ., University Park, PA, USA

Regional Ecosystem-Atmosphere CO₂ Exchanged Via Atmospheric Budgets (September 2002-August 2005)

Davis, K. J.; Richardson, S. J.; January 2005; 15 pp.; In English

Contract(s)/Grant(s): DE-FG02-02ER63475

Report No.(s): DE2007-900475; No Copyright; Avail.: Department of Energy Information Bridge

Inversions of atmospheric CO₂ mixing ratio measurements to determine CO₂ sources and sinks are typically limited to coarse spatial and temporal resolution. This limits our ability to evaluate efforts to upscale chamber- and stand-level CO₂ flux measurements to regional scales, where coherent climate and ecosystem mechanisms govern the carbon cycle. As a step towards the goal of implementing atmospheric budget or inversion methodology on a regional scale, a network of five relatively inexpensive CO₂ mixing ratio measurement systems was deployed on towers in northern Wisconsin. Four systems were distributed on a circle of roughly 150-km radius, surrounding one centrally located system at the WLEF tower near Park Falls, WI. All measurements were taken at a height of 76 m AGL. The systems used single-cell infrared CO₂ analyzers (Licor, model LI-820) rather than the significantly more costly two-cell models, and were calibrated every two hours using four samples known to within - 0.2 ppm CO₂.

NTIS

Carbon Cycle; Carbon Dioxide; Ecosystems; Mixing Ratios; Remote Sensing

20080023273 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Sample of What We Have Learned from A-Train Cloud Measurements

Joiner, Joanna; Vasilkov, Alexander; Ziemke, Jerry; Chandra, Sushil; Spurr, Robert; Bhartia, P. K.; Krotkov, Nick; Sneep, Maarten; Menzel, Paul; Platnick, Steve; Stephens, Graeme; Wennberg, Paul; Avery, Melody; Wentz, Frank; Vanbaunce, Claudine; Pilewski, Peter; Diskin, Glenn; Vay, Stephanie; March 2008; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

The A-train active sensors CloudSat and CALIPSO provide detailed information about cloud vertical structure. Coarse vertical information can also be obtained from a combination of passive sensors (e.g. cloud liquid water content from AMSR-E, cloud ice properties from MLS and HIRDLS, cloud-top pressure from MODIS and AIRS, and UVNIR Near IR absorption and scattering from OMI, MODIS, and POLDER). In addition, the wide swaths of instruments such as MODIS, AIRS, OMI, POLDER, and AMSR-E can be exploited to create estimates of the three-dimensional cloud extent. We will show how data fusion from A-train sensors can be used, e.g., to detect and map the presence of multiple layer/phase clouds. Ultimately, combined cloud information from A-train instruments will allow for estimates of heating and radiative flux at the surface as well as UV/VIS/Near IR trace-gas absorption at the overpass time on a near-global daily basis. CloudSat has also dramatically improved our interpretation of visible and UV passive measurements in complex cloudy situations such as deep convection and multiple cloud layers. This has led to new approaches for unique and accurate constituent retrievals from A-train instruments. For example, ozone mixing ratios inside tropical deep convective clouds have recently been estimated using the Aura Ozone Monitoring Instrument (OMI). Field campaign data from TC4 provide additional information about the

spatial variability and origin of trace-gases inside convective clouds. We will highlight some of the new applications of remote sensing in cloudy conditions that have been enabled by the synergy between the A-train active and passive sensors.

Author

CALIPSO (Pathfinder Satellite); Remote Sensing; Meteorological Satellites; Clouds (Meteorology)

20080023279 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Seeking Augmented Information Content Concerning Diurnal Precipitation Achieved by Combining TRMM-PR and CloudSat-CPR Radar Data Sets

Smith, Eric A.; Kuo, Kwo-Sen; Carty, Hezekiah; April 13, 2008; 1 pp.; In English; 2008 EGU General Assembly: Precipitation Science, 13-18 Apr. 2008, Vienna, Austria; Copyright; Avail.: Other Sources; Abstract Only

The CloudSat satellite's Cloud Profiling Radar (CPR) is a highly sensitive 94 GHz (W-band) nadir viewing radar system flown in retrograde sun synchronous orbit useful for determining the vertical structure of cloud hydrometeors down to sensitivity of approx. -30 dBZ reflectivity factor. Given this sensitivity, it is possible to unambiguously measure precipitation rates in clouds over a spectrum extending from approx. 0.08 - 3.0 mm hr (sup -1) down to altitudes of 0.5 km with approx. 0.25 km vertical binning. This enables an effective means to measure a great deal of the drizzle and light rain spectrum. However, because of its near-polar sunsynchronous orbit, CloudSat cannot sample the diurnal cycle of precipitation, nor with its nadir-only CPR view can it obtain a high duty cycle in sampling precipitation at fixed local times over fixed positions. On the other hand, the TRMM satellite, which is flown in a non-sunsynchronous 35-degree inclined orbit carrying the 13.8 GHz KU-band Precipitation Radar (PR) scanning through nadir over an approx. 225 km swath, can sample both the diurnal cycle and with a much improved duty cycle relative to CloudSat. Moreover, the PR and CPR have the same 0.25 km vertical binning capability. The PR's greatest shortcoming is its approx. +17 dBZ sensitivity, which eliminates the possibility of measuring rain rates below -0.3-0.5 mm hr (sup -1), which can involve rainfall accumulations of up to 50% of the total over some regions. This begs the question of whether by combining CPR and PR data sets, whether it is possible to obtain an augmented measurement of the diurnal precipitation cycle. By collecting complimentary datasets during CloudSat and TRMM satellite orbit crossings within a delta t = 45-min proximity window, it is possible to demonstrate that whenever TRMM detects a precipitation signal, the correlations along the vertical axis between the reflectivities acquired from the CPR and PR are in inverse proportion to the magnitude of the delta t proximity window. By taking advantage of these underlying correlations, it is possible to develop a functional which can be used to broaden the reflectivity spectrum, concomitantly the rain rate spectrum, of the PR measurements based on the inherently broader reflectivity spectrum of the CPR at the lower reflectivity end of the spectrum, concomitantly at lighter rain rates. With the functional in place, it is then possible to produce synthetic CloudSat precipitation imagery over the PR track and thus over the diurnal time period. These augmented data are then used to study the spectral-vertical diurnal properties of precipitation over oceanic regions observed by TRMM.

Author

Diurnal Variations; Precipitation (Meteorology); TRMM Satellite; Radar Data; Clouds (Meteorology); Meteorological Radar

20080023282 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Persistent Nature of Secondary Diurnal Modes of Precipitation over Oceanic and Continental Regimes

Yang, S.; Kuo, K.-S.; Smith, E.; January 2007; 44 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

This investigation seeks a better understanding of the assorted mechanisms controlling the global distribution of precipitation diurnal variability based on the use of Tropical Rainfall Measuring Mission (TRMM) microwave radiometer and radar data. The horizontal distributions of precipitation's diurnal cycle are derived from eight years of TRMM Microwave Imager (TMI) and Precipitation Radar (PR) measurements involving three TRMM standard rain rate retrieval algorithms -- the resultant distributions analyzed at various spatiotemporal scales. The results reveal the prominent and expected late-evening to early-morning (LE-EM) precipitation maxima over oceans and the counterpart prominent and expected mid-to late-afternoon (MLA) maxima over continents. Moreover, and not generally recognized, the results reveal a widespread distribution of secondary maxima occurring over both oceans and continents -- maxima which generally mirror their counterpart regime's behavior. That is, many ocean regions exhibit clearcut secondary MLA precipitation maxima while many continental regions exhibit just as evident secondary LE-EM maxima. This investigation is the first comprehensive study of these globally prevalent secondary maxima and their widespread nature, a type of study only made possible when the analysis procedure is applied to a high-quality global-scale precipitation dataset. The characteristics of the secondary maxima are mapped and described on global grids using an innovative clock-face format, while a current study to be published at a later

date provides physically-based explanations of the seasonal-regional distributions of the secondary maxima. In addition to an 'explicit' maxima identification scheme, a 'Fourier decomposition' maxima identification scheme is used to examine the amplitude and phase properties of the primary and secondary maxima -- as well as tertiary and quaternary maxima. Accordingly, the advantages, ambiguities, and pitfalls resulting from use of Fourier harmonic analysis are explained.

Author

Diurnal Variations; Oceans; Precipitation (Meteorology); Radar Measurement; TRMM Satellite; Radar Data

20080023283 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Convective-Stratiform Precipitation Variability at Seasonal Scale from Eight Years of TRMM Observations: Implications for Multiple Modes of Diurnal Variability

Yang, Song; Smith, Eric A.; [2007]; 66 pp.; In English; Original contains black and white illustrations; No Copyright;

Avail.: CASI: [A04](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023283>

This study investigated the variability of convective and stratiform rainfall from eight years (1998-2005) of Tropical Rainfall Measuring Mission (TRMM) Precipitation Radar (PR) and TRMM Microwave Imager (TMI) measurements--focusing on seasonal diurnal variability. The main scientific goals are: (1) to understand the climatological variability of these two dominant forms of precipitation across the four cardinal seasons and over continents and oceans separately, and (2) to understand how differences in convective and stratiform rainfall variations ultimately determine how diurnal variability of total rainfall is modulated into multiple modes. There are distinct day-night differences for both convective and stratiform rainfall. Oceanic (continental) convective rainfall is up to 25% (50%) greater during nighttime (daytime) than daytime (nighttime). Seasonal variability of convective rainfall's day-night difference is relatively small, while stratiform rainfall exhibits very apparent day-night variations with a seasonal variability of these variations. There are consistent late evening diurnal peaks without obvious seasonal variations over ocean for convective, stratiform, and total rainfall. Over continents, convective and total rainfall exhibit a consistent dominant afternoon peak with little seasonal variability--with a late evening secondary peak exhibiting seasonal variation. Stratiform rainfall over continents shows a consistent strong late evening peak with a weak afternoon peak--with the afternoon mode undergoing seasonal variability. Therefore, the diurnal characteristics of stratiform rainfall control the afternoon secondary maximum of oceanic rainfall and the late evening secondary peak of continental rainfall. Even at seasonal-regional scale spatially or an interannual global scale temporally, the secondary mode can become very pronounced, but on an intermittent basis. Overall, the results demonstrate the importance of partitioning total rainfall into convective and stratiform components and that diurnal modes largely arise from distinct diurnal stratiform variations modulating convective variations.

Author

Rain; Precipitation (Meteorology); TRMM Satellite; Diurnal Variations; Annual Variations

20080023285 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Cloud-System Resolving Models: Status and Prospects

Tao, Wei-Kuo; Moncreiff, Mitch; [2008]; 76 pp.; In English; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A05](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023285>

Cloud-system resolving models (CRM), which are based on the nonhydrostatic equations of motion and typically have a grid-spacing of about a kilometer, originated as cloud-process models in the 1970s. This paper reviews the status and prospects of CRMs across a wide range of issues, such as microphysics and precipitation; interaction between clouds and radiation; and the effects of boundary-layer and surface-processes on cloud systems. Since CRMs resolve organized convection, tropical waves and the large-scale circulation, there is the prospect for several advances in both basic knowledge of scale-interaction requisite to parameterizing mesoscale processes in climate models. In superparameterization, CRMs represent convection, explicitly replacing many of the assumptions necessary in contemporary parameterization. Global CRMs have been run on an experimental basis, giving prospect to a new generation of climate weather prediction in a decade, and climate models due course. CRMs play a major role in the retrieval of surface-rain and latent heating from satellite measurements. Finally, enormous wide dynamic ranges of CRM simulations present new challenges for model validation against observations.

Author

Cloud Physics; Clouds (Meteorology); Atmospheric Models; Climate Models; Hydrological Cycle; Weather Forecasting

20080023296 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Global Precipitation Measurement

Hou, Arthur Y.; Skofronick-Jackson, Gail; Kummerow, Christian D.; Shepherd, James Marshall; [2008]; 39 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

This chapter begins with a brief history and background of microwave precipitation sensors, with a discussion of the sensitivity of both passive and active instruments, to trace the evolution of satellite-based rainfall techniques from an era of inference to an era of physical measurement. Next, the highly successful Tropical Rainfall Measuring Mission will be described, followed by the goals and plans for the Global Precipitation Measurement (GPM) Mission and the status of precipitation retrieval algorithm development. The chapter concludes with a summary of the need for space-based precipitation measurement, current technological capabilities, near-term algorithm advancements and anticipated new sciences and societal benefits in the GPM era.

Author

Precipitation Measurement; Microwave Sensors; Passive Satellites; Active Satellites; Meteorological Radar; Rain

20080023298 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Finite Volume Scheme on the Cubed Sphere Grid

Putman, William M.; Lin, S. J.; June 08, 2008; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

The performance of a multidimensional finite-volume scheme for global atmospheric dynamics is evaluated on the cubed-sphere geometry. We will explore the properties of the finite volume scheme through traditional advection and shallow water test cases. Baroclinic evaluations performed via a recently developed deterministic initial value baroclinic test case from Jablonowski and Williamson that assesses the evolution of an idealized baroclinic wave in the Northern Hemisphere for a global 3-dimensional atmospheric dynamical core. Comparisons will be made when available to the traditional latitude longitude discretization of the finite-volume dynamical core, as well as other traditional gridpoint and spectral formulations for atmospheric dynamical cores.

Author

Finite Volume Method; Spheres; Atmospheric Physics; Cores; Longitude; Latitude; Northern Hemisphere

20080023301 NASA Langley Research Center, Hampton, VA, USA

The Evolution of the Stratopause during the 2006 Major Warming: Satellite Data and Assimilated Meteorological Analyses

Manney, Gloria L.; Krueger, Kirstin; Pawson, Steven; Minschwaner, Ken; Schwartz, Michael J.; Daffer, William H.; Livesey, Nathaniel J.; Mlynchak, Martin G.; Remsberg, Ellis E.; Russell, James M., III; Waters, Joe W.; Journal of Geophysical Research; June 12, 2008; ISSN 0148-0227; Volume 113; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 370544.04.12; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1029/2007JD009097>

Microwave Limb Sounder and Sounding of the Atmosphere with Broadband Emission Radiometry data provide the first opportunity to characterize the four-dimensional stratopause evolution throughout the life-cycle of a major stratospheric sudden warming (SSW). The polar stratopause, usually higher than that at midlatitudes, dropped by 30 km and warmed during development of a major 'wave 1' SSW in January 2006, with accompanying mesospheric cooling. When the polar vortex broke down, the stratopause cooled and became ill-defined, with a nearly isothermal stratosphere. After the polar vortex started to recover in the upper stratosphere/lower mesosphere (USLM), a cool stratopause reformed above 75 km, then dropped and warmed; both the mesosphere above and the stratosphere below cooled at this time. The polar stratopause remained separated from that at midlatitudes across the core of the polar night jet. In the early stages of the SSW, the strongly tilted (westward with increasing altitude) polar vortex extended into the mesosphere, and enclosed a secondary temperature maximum extending westward and slightly equatorward from the highest altitude part of the polar stratopause over the cool stratopause near the vortex edge. The temperature evolution in the USLM resulted in strongly enhanced radiative cooling in the mesosphere during the recovery from the SSW, but significantly reduced radiative cooling in the upper stratosphere. Assimilated meteorological analyses from the European Centre for Medium-Range weather Forecasts (ECMWF) and Goddard Earth Observing System Version 5.0.1 (GEOS-5), which are not constrained by data at polar stratopause altitudes and have model tops near 80 km, could not capture the secondary temperature maximum or the high stratopause after the SSW; they also misrepresent polar temperature structure during and after the stratopause breakdown, leading to large biases in their radiative heating rates. ECMWF analyses represent the stratospheric temperature structure more accurately, suggesting a better representation of vertical motion; GEOS-5 analyses more faithfully describe stratopause level wind and wave amplitudes. The

high-quality satellite temperature data used here provide the first daily, global, multiannual data sets suitable for assessing and, eventually, improving representation of the USLM in models and assimilation systems.

Author

Microwave Sounding; Stratopause; Meteorology; Stratospheric Warming; Geophysics; Weather Forecasting

20080023315 NASA Marshall Space Flight Center, Huntsville, AL, USA

Potential Use of a Bayesian Network for Discriminating Flash Type from Future GOES-R Geostationary Lightning Mapper (GLM) data

Solakiewiz, Richard; Koshak, William; April 21, 2008; 1 pp.; In English; 20th International Lightning Detection Conference, 21-25 Apr. 2008, Tucson, AZ, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources; Abstract Only

Continuous monitoring of the ratio of cloud flashes to ground flashes may provide a better understanding of thunderstorm dynamics, intensification, and evolution, and it may be useful in severe weather warning. The National Lightning Detection Network TM (NLDN) senses ground flashes with exceptional detection efficiency and accuracy over most of the continental USA. A proposed Geostationary Lightning Mapper (GLM) aboard the Geostationary Operational Environmental Satellite (GOES-R) will look at the western hemisphere, and among the lightning data products to be made available will be the fundamental optical flash parameters for both cloud and ground flashes: radiance, area, duration, number of optical groups, and number of optical events. Previous studies have demonstrated that the optical flash parameter statistics of ground and cloud lightning, which are observable from space, are significantly different. This study investigates a Bayesian network methodology for discriminating lightning flash type (ground or cloud) using the lightning optical data and ancillary GOES-R data. A Directed Acyclic Graph (DAG) is set up with lightning as a 'root' and data observed by GLM as the 'leaves.' This allows for a direct calculation of the joint probability distribution function for the lightning type and radiance, area, etc. Initially, the conditional probabilities that will be required can be estimated from the Lightning Imaging Sensor (LIS) and the Optical Transient Detector (OTD) together with NLDN data. Directly manipulating the joint distribution will yield the conditional probability that a lightning flash is a ground flash given the evidence, which consists of the observed lightning optical data [and possibly cloud data retrieved from the GOES-R Advanced Baseline Imager (ABI) in a more mature Bayesian network configuration]. Later, actual GLM and NLDN data can be used to refine the estimates of the conditional probabilities used in the model; i.e., the Bayesian network is a learning network. Methods for efficient calculation of the conditional probabilities (e.g., an algorithm using junction trees), finding data conflicts, goodness of fit, and dealing with missing data will also be addressed.

Author

Cloud-to-Ground Discharges; Thunderstorms; Lightning; GOES Satellites; Bayes Theorem; Distribution Functions; Imaging Techniques

20080023348 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Laser Sounder for Global Measurement of CO₂ Concentrations in the Troposphere from Space

Riris, Haris; Abshire, James B.; Allan, Graham; Sun, Xiaoli; Kawa, S. Randy; Mao, Jian-Ping; Stephen, Mark; Wilson, Emily; Krainak, Michael A.; [2008]; 3 pp.; In English; IGARSS Conference, 9 Jul. 2008, Boston, MA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

We report progress in assessing the feasibility of a new satellite-based laser-sounding instrument to measure CO₂ concentrations in the lower troposphere from space.

Author

Carbon Dioxide Concentration; Laser Applications; Troposphere; Altimetry; Atmospheric Sounding

20080023358 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Warming of the Indian Ocean Threatens Eastern and Southern Africa, but could be Mitigated by Agricultural Development

Funk, Chris; Dettinger, Michael D.; Brown, Molly E.; Michaelsen, Joel C.; Verdin, James P.; Barlow, Mathew; Howell, Andrew; [2008]; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NNX07AG26G; 04HQAG0001; Copyright; Avail.: CASI: [A03](#), Hardcopy

Since 1980, the number of undernourished people in eastern and southern Africa has more than doubled. Rural development stalled and rural poverty expanded during the 1990s. Population growth remains very high and declining per capita agricultural capacity retards progress towards Millennium Development goals. Analyses of in situ station data and

satellite observations of precipitation identify another problematic trend. Main growing season rainfall receipts have diminished by approximately 15% in food insecure countries clustered along the western rim of the Indian Ocean. Occurring during the main growing seasons in poor countries dependent on rain fed agriculture, these declines are societally dangerous. Will they persist or intensify? Tracing moisture deficits upstream to an anthropogenically warming Indian Ocean leads us to conclude that further rainfall declines are likely. We present analyses suggesting that warming in the central Indian Ocean disrupts onshore moisture transports, reducing continental rainfall. Thus late 20th century anthropogenic Indian Ocean warming has probably already produced societally dangerous climate change by creating drought and social disruption in some of the world's most fragile food economies. We quantify the potential impacts of the observed precipitation and agricultural capacity trends by modeling millions of undernourished people as a function of rainfall, population, cultivated area, seed and fertilizer use. Persistence of current tendencies may result in a 50% increase in undernourished people. On the other hand, modest increases in per capita agricultural productivity could more than offset the observed precipitation declines. Investing in agricultural development can help mitigate climate change while decreasing rural poverty and vulnerability.

Author

Indian Ocean; Ocean Temperature; Global Warming; Africa; Rural Land Use; Agriculture; Precipitation (Meteorology); Rain; Climate Change

20080023362 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Forward-looking Assimilation of MODIS-derived Snow Covered Area into a Land Surface Model

Zaitchik, Benjamin F.; Rodell, Matthew; [2008]; 47 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Snow cover over land has a significant impact on the surface radiation budget, turbulent energy fluxes to the atmosphere, and local hydrological fluxes. For this reason, inaccuracies in the representation of snow covered area (SCA) within a land surface model (LSM) can lead to substantial errors in both offline and coupled simulations. Data assimilation algorithms have the potential to address this problem. However, the assimilation of SCA observations is complicated by an information deficit in the observation SCA indicates only the presence or absence of snow, and not snow volume and by the fact that assimilated SCA observations can introduce inconsistencies with atmospheric forcing data, leading to non-physical artifacts in the local water balance. In this paper we present a novel assimilation algorithm that introduces MODIS SCA observations to the Noah LSM in global, uncoupled simulations. The algorithm utilizes observations from up to 72 hours ahead of the model simulation in order to correct against emerging errors in the simulation of snow cover while preserving the local hydrologic balance. This is accomplished by using future snow observations to adjust air temperature and, when necessary, precipitation within the LSM. In global, offline integrations, this new assimilation algorithm provided improved simulation of SCA and snow water equivalent relative to open loop integrations and integrations that used an earlier SCA assimilation algorithm. These improvements, in turn, influenced the simulation of surface water and energy fluxes both during the snow season and, in some regions, on into the following spring.

Author

MODIS (Radiometry); Earth Surface; Snow Cover; Data Acquisition; Data Integration; Algorithms; Hydrology Models

20080023366 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Spring Snow Melt Timing and Changes over Arctic Lands

Foster, J. L.; Robinson, D. A.; Hall, D. K.; Estilow, T. W.; [2006]; 20 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): EA133E05SE6044; NA040AR4310170; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Spring snow cover over Arctic lands has, on average, melted approximately 4-7 days earlier since the late 1980s compared to the previous 20 years. The earlier disappearance of snow has been identified in non-mountainous regions at the 60 deg and 70 deg N parallels over Eurasia and North America using visible satellite observations of continental snow cover extent (SCE) mapped by the National Oceanic and Atmospheric Administration. The change was greater in the farthest north continental locations. Northern hemisphere SCE declined by almost 10% (May) to 20% (June) between the two intervals. At latitude 70 deg N, eight segments of longitude (each 10 deg in width) show significant (negative) trends. However, only two longitudinal segments at 60 deg N show significant trends, (one positive and one negative). SCE changes coincide with increasing spring warmth and the earlier diminution of sea ice in the last several decades. However, while sea ice has continued to decrease during this recent interval, snowmelt dates in the Arctic changed in a step-like fashion during the mid to late 1980s and have remained much the same since that time.

Author

Spring (Season); Snow; Melting; Annual Variations; Arctic Regions; Global Warming; Climate Change

20080023393 NASA Goddard Space Flight Center, Greenbelt, MD, USA

New Developments for Physically-based Falling Snow Retrievals over Land in Preparation for GPM

Jackson, Gail S.; Tokay, Ali; Kramer, Anne W.; Hudak, David; May 27, 2008; 1 pp.; In English; AGU Spring Joint Assembly, 27-28 May 2008, Fort Lauderdale, FL, USA; Copyright; Avail.: Other Sources; Abstract Only

The NASA Global Precipitation Measurement mission (GPM) concept centers on deploying a Core spacecraft carrying a dual-frequency precipitation radar and a microwave radiometric imager with channels from 10 to 183 GHz to serve as a precipitation physics observatory and a calibration reference to unify a constellation of dedicated and operational passive microwave sensors. Because of the extended orbit of the Core (plus or minus 65 deg) and the enhanced dual frequency radar and high frequency radiometer, GPM will be able to sense falling snow precipitation and light rain over land. Accordingly, GPM has partnered with the Canadian CloudSat/CALIPSO Validation Project (C3VP) to obtain observations to provide one of several important ground-based validation data sets around which the falling snow models and retrieval algorithms can be further developed and tested. In this work we compare and correlate the long time series (Nov.'06 - March '07) measurements of precipitation rate from parsivels to the passive (89, 150, 183 plus or minus 1, plus or minus 3, plus or minus 7 GHz) observations of NOAA's AMSU-B radiometer. We separate the comparisons into categories of no precipitation, liquid rain and falling snow precipitation. We found that there are similar TBs (especially at 89 and 150 GHz) for cases with falling snow and for non-precipitating cases. The comparisons indicate that surface emissivity contributions to the satellite observed TB over land can add uncertainty in detecting and estimating falling snow. The newest results show that by computing brightness temperatures based on CARE radiosonde data and a rough estimate of surface emissivity show that the cloud ice scattering signal in the AMSU-B data is detected. That is the differences in computed TB and AMSU-B TB for precipitating and non-precipitating cases are unique such that the precipitating and non-precipitating cases can be identified. These results require that the radiosonde releases are within an hour of the AMSU-B data. Forest fraction, snow cover, and measured emissivities were combined to calculate the surface emissivities.

Author

Precipitation Measurement; Multispectral Radar; Snow; Microwave Radiometers

20080023395 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Titan's Atmospheric Dynamics and Meteorology

Flasar, F. M.; Baines, K. H.; Bird, M. K.; Tokano, T.; West, R. A.; [2008]; 1 pp.; In English; The 'Titan after Cassini-Huygens' Symposium, 7-11 Jul. 2008, Corpus Christi, TX, USA; Copyright; Avail.: Other Sources; Abstract Only

Titan, after Venus, is the second example of an atmosphere with a global cyclostrophic circulation in the solar system, but a circulation that has a strong seasonal modulation in the middle atmosphere. Direct measurement of Titan's winds, particularly observations tracking the Huygens probe at 10degS, indicate that the zonal winds are generally in the sense of the satellites rotation. They become cyclostrophic approx. 35 km above the surface and generally increase with altitude, with the exception of a sharp minimum centered near 75 km, where the wind velocity decreases to nearly zero. Zonal winds derived from the temperature field retrieved from Cassini measurements, using the thermal wind equation, indicate a strong winter circumpolar vortex, with maximum winds at mid northern latitudes of 190 ms⁻¹ near 300 km. Above this level, the vortex decays. Curiously, the zonal winds and temperatures are symmetric about a pole that is offset from the surface pole by approx.4 degrees. The cause of this is not well understood, but it may reflect the response of a cyclostrophic circulation to the offset between the equator, where the distance to the rotation axis is greatest, and the solar equator. The mean meridional circulation can be inferred from the temperature field and the meridional distribution of organic molecules and condensates and hazes. Both the warm temperatures in the north polar region near 400 km and the enhanced concentration of several organic molecules suggests subsidence there during winter and early spring. Stratospheric condensates are localized at high northern latitudes, with a sharp cut-off near 50degN. Titan's winter polar vortex appears to share many of the same characteristics of winter vortices on Earth-the ozone holes. Global mapping of temperatures, winds, and composition in the troposphere, by contrast, is incomplete. The few suitable discrete clouds that have been found for tracking indicate smaller velocities than aloft, consistent with the Huygens measurements. At low latitudes the zonal winds near the surface appear not to be westward as on Earth, but eastward. Because the net zonal-mean time-averaged torque exerted by the surface on the atmosphere should vanish, this implies westward flow of part of the surface; the question is where. The latitude contrast in tropospheric temperatures, deduced from radio occultations at low, mid, and high latitudes, is small approx.5 K at the tropopause and approx.3 K at the surface.

Author

Titan; Atmospheric Circulation; Temperature Distribution; Troposphere; Middle Atmosphere; Meteorology; Huygens Probe; Atmospheric Temperature

20080023396 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Differences and Similarities between Summer and Winter Temperatures and Winds during MaCWAVE

Schmidlin, F. J.; Goldberg, R. A.; [2008]; 1 pp.; In English; Committee on Space Research (COSPAR) Scientific Assembly, 13-19 Jul. 2008, Montreal, Canada; No Copyright; Avail.: Other Sources; Abstract Only

The Mountain and Convective Waves Ascending Vertically Experiment (MaCWAVE) was carried out in two sequences: one during the summer from the Andoya Rocket Range (69N) during July 2002 to examine convective initiation of gravity waves. The second was a winter sequence from ESRANGE (68N) during January 2003 to examine mountain-initiated waves. Inflatable falling spheres released from small meteorological rockets provided significant information about the variation of temperature and wind from 50 km and higher. The small rocket launch activity was restricted to 12-hour periods that inhibited observing a full diurnal cycle, nonetheless, the time-history of the measurements have provided information about tidal motion. During summer, temperature variation was smaller than observed during winter when peak differences reached 15-20 K at 80-85 km. variation in zonal winds varied up to more than 100 mps in summer and winter. Times of wind vs. altitude showed that the peak zonal component occurred approximately two hours ahead of the peak meridional wind. Measurement details and the observed variations are discussed.

Author

Convection; Mountains; Summer; Winter; Zonal Flow (Meteorology); Atmospheric Temperature

20080023438 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Standardizing Interfaces for External Access to Data and Processing for the NASA Ozone Product Evaluation and Test Element (PEATE)

Tilmes, Curt A.; Fleig, Albert J.; June 09, 2008; 2 pp.; In English; Geoinformatics 2008 Conference/GeoForschungsZentrum, 9-14 Jun. 2008, Potsdam, Germany; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023438>

NASA's traditional science data processing systems have focused on specific missions, and providing data access, processing and services to the funded science teams of those specific missions. Recently NASA has been modifying this stance, changing the focus from Missions to Measurements. Where a specific Mission has a discrete beginning and end, the Measurement considers long term data continuity across multiple missions. Total Column Ozone, a critical measurement of atmospheric composition, has been monitored for decades on a series of Total Ozone Mapping Spectrometer (TOMS) instruments. Some important European missions also monitor ozone, including the Global Ozone Monitoring Experiment (GOME) and SCIAMACHY. With the U.S./European cooperative launch of the Dutch Ozone Monitoring Instrument (OMI) on NASA Aura satellite, and the GOME-2 instrumental on MetOp, the ozone monitoring record has been further extended. In conjunction with the U.S. Department of Defense (DoD) and the National Oceanic and Atmospheric Administration (NOAA), NASA is now preparing to evaluate data and algorithms for the next generation Ozone Mapping and Profiler Suite (OMPS) which will launch on the National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP) in 2010. NASA is constructing the Science Data Segment (SDS) which is comprised of several elements to evaluate the various NPP data products and algorithms. The NPP SDS Ozone Product Evaluation and Test Element (PEATE) will build on the heritage of the TOMS and OMI mission based processing systems. The overall measurement based system that will encompass these efforts is the Atmospheric Composition Processing System (ACPS). We have extended the system to include access to publically available data sets from other instruments where feasible, including non-NASA missions as appropriate. The heritage system was largely monolithic providing a very controlled processing flow from data.ingest of satellite data to the ultimate archive of specific operational data products. The ACPS allows more open access with standard protocols including HTTP, SOAP/XML, RSS and various REST incarnations. External entities can be granted access to various modules within the system, including an extended data archive, metadata searching, production planning and processing. Data access is provided with very fine grained access control. It is possible to easily designate certain datasets as being available to the public, or restricted to groups of researchers, or limited strictly to the originator. This can be used, for example, to release one's best validated data to the public, but restrict the 'new version' of data processed with a new, unproven algorithm until it is ready. Similarly, the system can provide access to algorithms, both as modifiable source code (where possible) and fully integrated executable Algorithm Plugin Packages (APPs). This enables researchers to download publically released versions of the processing algorithms and easily reproduce the processing remotely, while interacting with the ACPS. The algorithms can be modified allowing better experimentation and rapid improvement. The modified algorithms can be easily integrated back into the production system for large scale bulk processing to evaluate improvements. The system includes complete provenance tracking of algorithms, data and the entire processing environment. The origin of any data or

algorithms is recorded and the entire history of the processing chains are stored such that a researcher can understand the entire data flow. Provenance is captured in a form suitable for the system to guarantee scientific reproducibility of any data product it distributes even in cases where the physical data products themselves have been deleted due to space constraints. We are currently working on Semantic Web ontologies for representing the various provenance information. A new web site focusing on consolidating information about the measurement, processing system, and data access has been established to encourage interaction with the overall scientific community. We will describe the system, its data processing capabilities, and the methods the community can use to interact with the standard interfaces of the system.

Author

Data Processing; Ozone; Standardization; Access Control; Performance Tests; NASA Programs

20080023466 NASA Langley Research Center, Hampton, VA, USA

CALIPSO Satellite Lidar Identification Of Elevated Dust Over Australia Compared With Air Quality Model PM60 Forecasts

Young, Stuart A.; Vaughan, Mark; Omar, Ali; Liu, Zhaoyan; Lee, Sunhee; Hu, Youngxiang; Cope, Martin; June 23, 2008; 4 pp.; In English; 24th International Laser Radar Conference, 23-27 Jun. 2008, Boulder, CO, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 653967.04.12.01

Report No.(s): L-6626; Copyright; Avail.: CASI: [A01](#), Hardcopy

Global measurements of the vertical distribution of clouds and aerosols have been recorded by the lidar on board the CALIPSO (Cloud Aerosol Lidar Infrared Pathfinder Satellite Observations) satellite since June 2006. Such extensive, height-resolved measurements provide a rare and valuable opportunity for developing, testing and validating various atmospheric models, including global climate, numerical weather prediction, chemical transport and air quality models. Here we report on the initial results of an investigation into the performance of the Australian Air Quality Forecast System (AAQFS) model in forecasting the distribution of elevated dust over the Australian region. The model forecasts of PM60 dust distribution are compared with the CALIPSO lidar Vertical Feature Mask (VFM) data product. The VFM classifies contiguous atmospheric regions of enhanced backscatter as either cloud or aerosols. Aerosols are further classified into six subtypes. By comparing forecast PM60 concentration profiles to the spatial distribution of dust reported in the CALIPSO VFM, we can assess the model's ability to predict the occurrence and the vertical and horizontal extents of dust events within the study area.

Author

Satellite Observation; Infrared Astronomy; Dust; Optical Radar; Atmospheric Models; Climatology

20080023467 NASA Langley Research Center, Hampton, VA, USA

LASE Measurements of Water Vapor, Aerosol, and Cloud Distributions in Saharan Air Layers and Tropical Disturbances

Ismail, Syed; Ferrare, Richard; Browell, Edward; Kooi, Susan; Notari, Anthony; Butler, Carolyn; Burton, Sharon; Fenn, Marta; Krishnamurti, T. N.; Dunion, Jason; Heymsfield, Gerry; Anderson, Bruce; June 19, 2008; 4 pp.; In English; 24th International Laser Radar Conference, 23-27 Jun. 2008, Boulder, Co, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 478643.02.05.04.07; Copyright; Avail.: CASI: [A01](#), Hardcopy

LASE (Lidar Atmospheric Sensing Experiment) onboard the NASA DC-8 was used to measure high resolution profiles of water vapor and aerosols, and cloud distributions in 14 flights over the eastern Atlantic region during the NAMMA (NASA African Monsoon Multidisciplinary Analyses) field experiment, which was conducted from August 15 to September 12, 2006. These measurements were made in conjunction with flights designed to study African Easterly Waves (AEW), Tropical Disturbances (TD), and Saharan Aerosol Layers (SALs) as well as flights performed in clear air and convective regions. As a consequence of their unique radiative properties and dynamics, SAL layers have a significant influence in the development of organized convection associated with TD. Interactions of the SAL with tropical air during early stages of the development of TD were observed. These LASE measurements represent the first simultaneous water vapor and aerosol lidar measurements to study the SAL and its impact on TDs and hurricanes. Seven AEWs were studied and four of these evolved into tropical storms and three did not. Three out of the four tropical storms evolved into hurricanes.

Author

Optical Radar; Radar Measurement; Atmospheric Sounding; High Resolution; Tropical Storms; Water Vapor; Aerosols

20080023475 National Inst. of Information and Communications Technology, Tokyo, Japan

Journal of the National Institute of Information and Communications Technology, Volume 54, Nos. 1/2. Special Issue on Middle and Upper Atmosphere Observation Techniques

Kurihara, Noriyuki, Editor; Okano, Naoki, Editor; Kadowaki, Naoto, Editor; Murayama, Yashuhiro, Editor; March/June 2007; ISSN 1349-3205; 203 pp.; In English; See also 20080023476 - 20080023493; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

NICT has received high acclaim from the international research community for its achievements in radio science and in practical applications involving electromagnetic wave propagation in space, particularly its remote sensing technologies aimed at acquiring information from targets. These technologies can be aimed at targets in the global environment, an essential focus that will help ensure greater safety and security for all. The present issue will present the results of R&D projects on observation technologies for the middle and upper atmosphere (i.e., an altitude range of approximately ten to several hundred kilometers), as part of our R&D efforts into these basic technologies. The present report generally describes our achievements from the perspective of a wide range of technology developments, and thus includes overviews on the know-how involved in system use, as well as results of validation experiments on the application of our systems in the earth sciences, examining the effectiveness of the device, component, and system/system design technologies developed under the auspices of the present projects.

Derived from text

Earth Sciences; Information Systems; Middle Atmosphere; Remote Sensing; Upper Atmosphere; Communication

20080023481 National Inst. of Information and Communications Technology, Japan

Wind Estimations with Meteor Observations by MF Radars at Poker Flat, Alaska and Wakkanai, Japan

Kawamura, Seiji; Tsutsumi, Masaki; Murayama, Yasuhiro; Journal of the National Institute of Information and Communications Technology, Volume 54, Nos. 1/2. Special Issue on Middle and Upper Atmosphere Observation Techniques; March/June 2007, pp. 67-75; In English; See also [20080023475](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

A new measurement mode is introduced into two MF (medium frequency) radars of the National Institute of Information and Communications Technology (NICT) at Wakkanai and Poker Flat, Alaska in August 2004. In this method, meteor trails are used to estimate wind velocities. The positions of meteor trails are determined by the interferometry technique, and horizontal wind velocities are estimated by their line-of-sight Doppler velocities. The height coverage of this technique by MF radars is from about 80 to 120 km. Wind velocities by meteors show quite good agreement with those by Full Correlation Analysis (FCA; a traditional method to estimate winds by MF radar). In this paper, a method and observed results are reported.

Author

Meteorological Radar; Wind Velocity; Meteor Trails; Radar Measurement; Wind Measurement

20080023491 Alaska Univ., Fairbanks, AK, USA

Predicting and Validating the Motion of an Ash Cloud during the 2006 Eruption of Mount Augustine Volcano, Alaska, USA

Collins, Richard L.; Fochesatto, Javier; Sassen, Kenneth; Webley, Peter W.; Atkinson, David E.; Dean, Kenneson G.; Cahill, Catherine F.; Mizutani, Kohei; Journal of the National Institute of Information and Communications Technology, Volume 54, Nos. 1/2. Special Issue on Middle and Upper Atmosphere Observation Techniques; March/June 2007, pp. 17-28; In English; See also [20080023475](#); Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

On 11 January 2006, Mount Augustine volcano in southern Alaska began erupting after 20-year repose. The Anchorage Forecast Office of the National Weather Service (NWS) issued an advisory on 28 January for Kodiak City. On 31 January, Alaska Airlines cancelled all flights to and from Anchorage after multiple advisories from the NWS for Anchorage and the surrounding region. The Alaska Volcano Observatory (AVO) had reported the onset of the continuous eruption. AVO monitors the approximately 100 active volcanoes in the Northern Pacific. Ash clouds from these volcanoes can cause serious damage to an aircraft and pose a serious threat to the local communities, and to transcontinental air traffic throughout the Arctic and sub-Arctic region. Within AVO, a dispersion model has been developed to track the dispersion of volcanic ash clouds. The model, Puff, was used operationally by AVO during the Augustine eruptive period. Here, we examine the dispersion of a volcanic ash (or aerosol) cloud from Mount Augustine across Alaska from 29 January through the 2 February 2006. We present

the synoptic meteorology, the Puff predictions, and measurements from aerosol samplers, laser radar (or lidar) systems, and satellites. Aerosol samplers revealed the presence of volcanic aerosols at the surface at sites where Puff predicted the ash clouds movement. Remote sensing satellite data showed the development of the ash cloud in close proximity to the volcano consistent with the Puff predictions. Two lidars showed the presence of volcanic aerosol with consistent characteristics aloft over Alaska and were capable of detecting the aerosol, even in the presence of scattered clouds and where the ash cloud is too thin/disperse to be detected by remote sensing satellite data. The lidar measurements revealed the different trajectories of ash consistent with the Puff predictions. Dispersion models provide a forecast of volcanic ash cloud movement that might be undetectable by any other means but are still a significant hazard. Validation is the key to assessing the accuracy of any predictions. The study highlights the use of multiple and complementary observations used in detecting the trajectory ash cloud, both at the surface and aloft in the atmosphere.

Author

Volcanic Eruptions; Satellite Observation; Radar Measurement; Remote Sensing; Ashes; Clouds (Meteorology); Detection; Predictions; Synoptic Meteorology

48

OCEANOGRAPHY

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

20080023287 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Arctic Sea Ice Variability and Trends, 1979-2006

Parkinson, Claire L.; Cavalieri, Donald J.; [2008]; 30 pp.; In English; No Copyright; Avail.: CASI: **A03**, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023287>

Analysis of Arctic sea ice extents derived from satellite passive-microwave data for the 28 years, 1979-2006 yields an overall negative trend of $-45,100 \pm 4,600$ km²/yr ($-3.7 \pm 0.4\%$ /decade) in the yearly averages, with negative ice-extent trends also occurring for each of the four seasons and each of the 12 months. For the yearly averages the largest decreases occur in the Kara and Barents Seas and the Arctic Ocean, with linear least squares slopes of $-10,600 \pm 2,800$ km²/yr ($-7.4 \pm 2.0\%$ /decade) and $-10,100 \pm 2,200$ km²/yr ($-1.5 \pm 0.3\%$ /decade), respectively, followed by Baffin Bay/Labrador Sea, with a slope of $-8,000 \pm 2,000$ km²/yr ($-9.0 \pm 2.3\%$ /decade), the Greenland Sea, with a slope of $-7,000 \pm 1,400$ km²/yr ($-9.3 \pm 1.9\%$ /decade), and Hudson Bay, with a slope of $-4,500 \pm 900$ km²/yr ($-5.3 \pm 1.1\%$ /decade). These are all statistically significant decreases at a 99% confidence level. The Seas of Okhotsk and Japan also have a statistically significant ice decrease, although at a 95% confidence level, and the three remaining regions, the Bering Sea, Canadian Archipelago, and Gulf of St. Lawrence, have negative slopes that are not statistically significant. The 28-year trends in ice areas for the Northern Hemisphere total are also statistically significant and negative in each season, each month, and for the yearly averages.

Author

Sea Ice; Arctic Ocean; Northern Hemisphere; Climatology; Satellite Observation; Trends; Annual Variations; Global Warming; Air Sea Ice Interactions

20080023334 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Energetic Consistency and Coupling of the Mean and Covariance Dynamics

Cohn, Stephen E.; March 29, 2008; 37 pp.; In English; Prepared for Handbook of Numerical Analysis: Special Volume on Computational Methods for the Ocean and the Atmosphere, R. Temam and J. Tribbia, eds., Elsevier; No Copyright;

Avail.: CASI: **A03**, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023334>

The dynamical state of the ocean and atmosphere is taken to be a large dimensional random vector in a range of large-scale computational applications, including data assimilation, ensemble prediction, sensitivity analysis, and predictability studies. In each of these applications, numerical evolution of the covariance matrix of the random state plays a central role, because this matrix is used to quantify uncertainty in the state of the dynamical system. Since atmospheric and ocean dynamics are nonlinear, there is no closed evolution equation for the covariance matrix, nor for the mean state. Therefore approximate evolution equations must be used. This article studies theoretical properties of the evolution equations for the mean state and covariance matrix that arise in the second-moment closure approximation (third- and higher-order

moment discard). This approximation was introduced by EPSTEIN [1969] in an early effort to introduce a stochastic element into deterministic weather forecasting, and was studied further by FLEMING [1971a,b], EPSTEIN and PITCHER [1972], and PITCHER [1977], also in the context of atmospheric predictability. It has since fallen into disuse, with a simpler one being used in current large-scale applications. The theoretical results of this article make a case that this approximation should be reconsidered for use in large-scale applications, however, because the second moment closure equations possess a property of energetic consistency that the approximate equations now in common use do not possess. A number of properties of solutions of the second-moment closure equations that result from this energetic consistency will be established.

Derived from text

Covariance; Ocean Dynamics; Mean; Coupling; Mathematical Models; Dynamical Systems

20080023345 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Tide Corrections for Coastal Altimetry: Status and Prospects

Ray, Richard D.; Egbert, Gary D.; [2008]; 2 pp.; In English; IGARRS 2008, 9 Jul. 2008, Boston, MA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

Knowledge of global oceanic tides has markedly advanced over the last two decades, in no small part because of the near-global measurements provided by satellite altimeters, and especially the long and precise Topex/Poseidon time series e.g. [2]. Satellite altimetry in turn places very severe demands on the accuracy of tidal models. The reason is clear: tides are by far the largest contributor to the variance of sea-surface elevation, so any study of non-tidal ocean signals requires removal of this dominant tidal component. Efforts toward improving models for altimetric tide corrections have understandably focused on deep-water, open-ocean regions. These efforts have produced models thought to be generally accurate to about 2 cm rms. Corresponding tide predictions in shelf and near-coastal regions, however, are far less accurate. This paper discusses the status of our current abilities to provide near-global tidal predictions in shelf and near-coastal waters, highlights some of the difficulties that must be overcome, and attempts to divine a path toward some degree of progress. There are, of course, many groups worldwide who model tides over fairly localized shallow-water regions, and such work is extremely valuable for any altimeter study limited to those regions, but this paper considers the more global models necessary for the general user. There have indeed been efforts to patch local and global models together, but such work is difficult to maintain over many updates and can often encounter problems of proprietary or political nature. Such a path, however, might yet prove the most fruitful, and there are now new plans afoot to try again. As is well known, tides in shallow waters tend to be large, possibly nonlinear, and high wavenumber. The short spatial scales mean that current mapping capabilities with (multiple) nadir-oriented altimeters often yield inadequate coverage. This necessitates added reliance on numerical hydrodynamic models and data assimilation, which in turn necessitates very accurate bathymetry with high spatial resolution. Nonlinearity means that many additional compound tides and overtides must be accounted for in our predictions, which increases the degree of modeling effort and increases the amounts of data required to disentangle closely aliased tides.

Derived from text

Altimeters; Mathematical Models; Oceans; Tides; Satellite Altimetry; Ocean Surface

20080023492 Nagoya Univ., Aichi, Japan

Tides in the Polar Mesosphere Derived from Two MF Radar Measurements at Poker Flat and Tromsø

Nozawa, Satonori; Iwahashi, Hiroyuki; Tsuda, Takuo; Ohshima, Shin-ichiro; Fujii, Ryoichi; Hall, Chris M.; Manson, Alan; Meek, Chris; Brekke, Ageir; Kawamura, Seiji; Murayama, Yasuhiro; Journal of the National Institute of Information and Communications Technology, Volume 54, Nos. 1/2. Special Issue on Middle and Upper Atmosphere Observation Techniques; March/June 2007, pp. 77-86; In English; See also [20080023475](#); Original contains color illustrations; Copyright; Avail.: Other Sources

We have investigated diurnal and semidiurnal tides in the polar mesosphere based on wind data obtained from November 1998 to December 2002 with two MF radars located at Tromsø (69.58 deg N, 19.22 deg E) and Poker Flat (65.1 deg N, 147.5 deg W). We have investigated characteristics of diurnal and semidiurnal amplitudes and phases between 70 and 91 km. Also, we have compared amplitudes and phases of the diurnal and semidiurnal tides at two sites, and investigated contributions of the non-migrating tide of the semidiurnal tide.

Author

Mesosphere; Tides; Diurnal Variations; Polar Regions; Radar Measurement

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*.

20080023280 Naval Medical Research Inst., Bethesda, MD USA

Cast Study: National Naval Medical Center, A Graduate Management Project

Peale, Melody S; Jun 10, 2002; 112 pp.; In English

Report No.(s): AD-A477757; AMDCS-32-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477757>

The National Naval Medical Center (NNMC), Bethesda, MD reinvented itself on July 3, 2000 when it transformed from a traditional stovepipe organization into a service line health care delivery system. In less than six months, beginning shortly after the new commander took the helm in November 1999, the Board of Directors resigned their positions as the initial step to make way for the incoming leadership of the new service line concept. Constant communication was a critical ingredient in gaining the support of the NNMC staff and patients as the stress of change gained momentum in direct relation to the speed of the Transformation. The Information Technology Service (ITS) Line at NNMC supported the Transformation from its inception. ITS staff provided technical support to staff relocating to new positions and workspaces, while at the same time improving their own efficiencies as they responded to the daily calls for technical computer assistance. However, the ITS Line was not without its own organizational stresses; it faced similar organizational behavior concerns experienced by any workplace in the midst of major change. This case study attempts to identify, question and analyze various situations that occurred within NNMC and specifically within the ITS Line.

DTIC

Medical Services; Patients; Health

20080023373 Fudan Univ., Shanghai, China

Integrated Simulation and Analysis of Electric-Field Distribution under Transthoracic Defibrillation Based on Finite Element Method

Fang, Zu-xiang; Lai, Da-kun; Space Medicine and Medical Engineering, Volume 21, No. 1; February 2008, pp. 50-55; In Chinese; See also [20080023372](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

To explore an integrated solution method to model and simulate electric-field distribution under transthoracic defibrillation and promote the pertinent clinical research based on bioelectric field theory. The conductivity properties of bioelectric conductors of the human torso were firstly analyzed. As a typical example of bioelectric field in the human torso, the electric field produced by an applied defibrillation current on the torso was then formulated mathematically. Furthermore, through the software package of SCIRun, based on the finite element method, an integrated solution approach was presented to numerically model and simulate the electric-field distribution in the human torso. Multiform results of the electric-field distribution, such as the potential values, the potential gradient streamlines and the potential isosurface etc., were achieved and depicted spatially in the whole torso using the integrated solution method. The results of the myocardial potential density distributions were analyzed especially. The preliminary results indicate that the proposed integrated method to model and simulate the electric-field distribution of the complex torso is feasible, which can provide the practicable approach for clinic research of transthoracic defibrillation.

Author

Thorax; Fibrillation; Electric Fields; Current Distribution; Finite Element Method

20080023377 Zhejiang Univ., China

An ERP Study on Visual Illusory Motion

Ding, Xiao-pan; Yu, Xiu-mei; Ma, Jian-hong; Hu, Hua-min; Fu, Gen-yue; Space Medicine and Medical Engineering, Volume 21, No. 1; February 2008, pp. 70-72; In Chinese; See also [20080023372](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

To explore the neural basis of the visual illusory motion using the event-related potential (ERP). One hundred trials (each duration 2000 ms) of a visual illusory motion figure, rippling wheat pattern made by Akiyoshi Kitaoka, and a visual static figure made of modified rippling wheat pattern were randomly presented with equal probability. Ten healthy right handed

undergraduate students as subjects were asked to judge the stimulus whether motional or not. The EEG was recorded from 128 scalp sites using with electrodes mounted in HydroCel GSN cap (Electrical Geodesics Incorporated, Oregon, USA). 1) The C1 component of ERP could be evoked by both visual illusory motion pattern and static pattern in POz. The peak of C1 component was presented about 75 ms after each stimulus. C1 component evoked with visual illusory motion was negative, but it's static pattern was positive. 2) P100 and P200 components could be obviously evoked by both kinds of stimuli, but in O2 the amplitudes of P100 evoked by different stimuli were significantly different and in T3 the amplitudes of P200 were significantly different too. The visual illusory motion is formed at the primary visual cortex. It may be related to the organized mode of perception.

Author

Neurology; Visual Perception; Illusions; Motion Perception; Bioelectric Potential; Evoked Response (Psychophysiology); Cerebral Cortex

20080023378 Jiaotong Univ., Xian, China

Effects of Simulated Microgravity on the Gap Junction Protein Expression Spectrum in Rat Myocardium

Zheng, Qi; Liu, Zhao-xia; Huang, Wei-fen; Wang, De-sheng; Jiang, Ziao-ying; Wu, Da-wei.; Li, Zhi-li.; Yuan, Ming; Gao, Guang-dao; Space Medicine and Medical Engineering, Volume 21, No. 1; February 2008, pp. 6-10; In Chinese; See also [20080023372](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

To investigate the effect of simulated microgravity on subtype expression spectra of connexins in rat myocardium, so as to provide new experimental bases for exploring the partial mechanism of cardiac arrhythmia under simulated microgravity. Twenty male Wistar rats were equally and randomly assigned to either tail-suspension group (SUS) or control group (Con). Electro microscope was used to observe the rat myocardium ultra structure. RT-PCR was used to detect the mRNA of CX37, CX40, CX43 and CX45 in rat myocardium of the two groups, and Western blotting was used to detect the protein expression levels of CX40, CX43 and CX45. Contrast with Con, after tail suspension, there were some fiber degeneration, chondrosome degeneration, chondrosome reduce and collagen increase in partial myocardium. The gap between cardiac cells widened and the normal gap structure disappeared in some junctions. The mRNA expression levels of all four subtype connexins decreased significantly after tail suspension. The protein expression levels of CX43 and CX45 reduced too. But CX40 could not be detected by Western blotting method. The results show that the heterogeneous change of gap junction ultra structure of rat myocardium can be induced and the level of connexin expression can be reduced significantly after 2 wk tail suspension. These changes may affect the electric transfer velocity and direction of myocardium, and then the electric conduction block and micro-reentry may occur. These might be the partial mechanism of cardiac arrhythmia under simulated microgravity.

Author

Weightlessness Simulation; Microgravity; Gravitational Effects; Proteins; Gene Expression; Myocardium; Arrhythmia; Ribonucleic Acids

20080023379 West China Univ. of Medical Sciences, Chengdu, China

Chronotherapy by Ribozyme Targeted to Telomerase in Nude Mice with a Transplanted Tumor: Model for Human Hepatic Cancer

Qu, Yi; Wan, Chao-min; Huang, Xiang; Cornelissen, Germaine; Halberg, Franz; Space Medicine and Medical Engineering, Volume 21, No. 1; February 2008, pp. 1-5; In English; See also [20080023372](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

To investigate therapeutic outcomes of using telomerase inhibitors to treat cancer at the presumably most and least opportune circadian stages based on our earlier study. Twenty-four BALB/C nude mice were synchronized to a regimen of LD12:12 for 4 wks. Hepatic cancer cells (SMMC-7721) were implanted into both flanks of each mouse. Two weeks after transplantation, the hTERT-5'RZ was used to treat the hepatic cancer transplanted into the nude mice daily for two weeks, the injection times being either 9 or 21 HALO. The tumor inhibition ratio of mice treated at 21 HALO (65%) was statistically significantly higher than that of mice treated at 9 HALO (48%). Telomerase activity was also reduced to a greater extent in mice treated with hTERT-5'RZ at 21 than at 9 HALO, that was at the time of maximal circadian telomerase activity. Injection of ribozyme targeted to telomerase during the tumor's DNA synthesis is associated with a better inhibition of tumor growth and a better therapeutic outcome in hepatic cancer.

Author

Circadian Rhythms; Enzyme Inhibitors; Neoplasms; Ribonucleic Acids; Molecules; Gene Therapy

20080023381 Sichuan Univ., Chengdu, China

Effects of Circadian Gene of Tumor Cells on Its Drug Sensitivity

Wang, Zheng-rong; Duan, Zhi-qing; Yao, Ran; Xue, Jian-xin; Zhu, Xiao-yun; Zhao, Jing-hui; Space Medicine and Medical Engineering, Volume 21, No. 1; February 2008, pp. 76-78; In Chinese; See also [20080023372](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

To investigate the effects of rhythm gene of tumor cells on its drug sensitivity through induced circadian genes expression in vitro. The circadian gene expression of cultured EMT6 mouse mammary carcinoma cells was induced with phorbol 12-myristate 13-acetate (PMA) in vitro and examined the expression of mPerl genes, considered the representation of circadian rhythm genes, at different times with reverse transcription-polymerase chain reaction (RT-PCR). EMT6 cells were dealt with adriamycin (ADM, 2 microns g/ml) at the maximum and the minimum of mPerl genes, respectively. The effects of ADM on proliferation of EMT6 cells was detected with 3-(4, 5-dimethylthiazolyl-2)-2, 5-diphenyltetrazolium bromide (MTT) and flow cytometry (FCM). It was shown that circadian oscillation of mPerl existed in EMT6 cells induced with PMA and that the inhibition ratio of ADM to tumor cells at the maximum of mPerl gene was higher than that at the minimum of it. The rhythm gene of tumor cells has effect on its drug sensitivity

Author

Circadian Rhythms; Genes; Tumors; Cells (Biology); Drugs; Sensitivity

20080023383 Sichuan Univ., Chengdu, China

Detecting, Controlling and Driving System for a New Kind of Tissue Engineering Bioreactor

Huang, Hua; Zhong, Peng; Yang, Cheng-kai; Zhang, Ting-fang; Space Medicine and Medical Engineering, Volume 21, No. 1; February 2008, pp. 61-65; In Chinese; See also [20080023372](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

A horizontal rotating bioreactor is a kind of advanced bioreactor, which is a basic and important facility in tissue engineering. In this paper, we developed a controllable horizontal rotating bioreactor system, which can supply choiceness environment condition for cell culture. Pulse-width modulation (PWM) modulation was used to drive the DC-motor, a sensor was used to detect and control the temperature of bioreactor reactor, and the system was connected to a PC to remotely watch, test and control. The system primarily achieved distributed control. The biological characteristics of the cells that were cultivated by this system improved greatly. This practice of realization of a controllable, horizontal, rotating bioreactor system can be applied to multiple applications.

Author

Tissue Engineering; Bioreactors; Rotation; Remote Control; Temperature Sensors

20080023384 China Astronaut Research and Training Center, Beijing, China

Effects of Simulated Microgravity on Cytokine Gene Expression Spectrum in Rat Myocardium

Liu, Zhao-xia; Zheng, Qi; Huang, Wei-fen; Wang, De-sheng; Jiang, Xiao-ying; Wu, Da-wei; Li, Zhi-li; Yuan, Ming; Gao, Guang-dao; Space Medicine and Medical Engineering, Volume 21, No. 1; February 2008, pp. 11-15; In Chinese; See also [20080023372](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

To investigate the effect of simulated microgravity on partial cytokine gene expression spectrum in rat myocardium and to explore the possible mechanism of cardiac function and structural changes under simulated microgravity. Male Wistar rats were randomly divided into either simulated microgravity, tail-suspended group (SUS) or control group (Con). The cytokines gene expression levels in rat myocardium were detected with 96 kinds of cytokine gene chips. Part of the results were determined with Real time-polymerase chain reaction (PCR). Compared with the Con group, 17 of 96 cytokine genes of the SUS group were changed after simulated microgravity. Five of them (IF-NA4, IL-15, IL-1b, LT-b, FGF7) were regulated upward and 12 (IGF-1, IGF-2, FGF5, VEGF-D, VEGF-C, IFN r, IL-II, IL-12B, IL-13, IL-17, IL-18, CD40L) were regulated downward. Expression of most growth factors presented a down trend, but the expression levels of the inflammatory cytokines had different trends. It is suggested that 2 wk simulated microgravity can induce expression changes of many cytokine genes and induced unbalanced regulation in the cytokine net of rat myocardium. The promoting growth and protecting cytokines are generally regulated downward, but parts of pathogenic and inflammatory cytokines are obviously regulated upward. It is shown that cytokines gene expression may play an important role in the cardiac remodeling mechanism under weightlessness.

Author

Microgravity; Weightlessness Simulation; Gravitational Effects; Gene Expression; Proteins; Myocardium; Heart Function

20080023385 China Astronaut Research and Training Center, Beijing, China

The First Step of Launching a Biological Rocket Experiment in China--The Integral Results on Four Physiological Parameters of Dogs

Zhang, Jing-xue; Wei, Xi-ping; Space Medicine and Medical Engineering, Volume 21, No. 1; February 2008, pp. 16-21; In Chinese; See also [20080023372](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

The effects of flight factors on dogs and rats are observed to accumulate the elementary data and experiences for space biology research and development of life support systems. It will be the first basic step for manned space flight in the future. Female dogs, Xiao-Bao and Shan-Shan were on board two Model T-7A (S2) rockets separately. Duration of the flight was about 25 min and height about 70 km. Four physiological parameters: electrocardiogram, blood pressure, breath and skin temperature were recorded. Both dogs were returned safe and healthy. The physiological parameters of Xiao-Bao were successfully recorded on the first rocket. On the second one, partial data of Shan-Shan experienced interference from the strong vibrations during the separation of rocket body and cone. The obvious changes of heart rate, ECG and blood pressure were recorded for Xiao-Bao and it was determined whether they were affected by the effects of hyper-gravity and microgravity factors. These changes were normal, temporal and reversible physiological stress responses. The dog can tolerate the action of variable factors during the T-7A (S2) flight and no pathological after-effects were observed.

Author

Rockets; Flight Tests; Bioastronautics; Dogs; Exobiology; Manned Space Flight; Physiological Responses

20080023386 West China Univ. of Medical Sciences, Chengdu, China

Function of Circadian Gene mClock on Tumor Experiment Chemotherapy

Wang, Zheng-rong; Yao, Ran; Dian, Zhi-qing; Zhang, Tai-ming; Gan, Lu; Lin, Li; Liu, Yan-you; Wang, Yu-hui; Wang, Zheng-rong; Space Medicine and Medical Engineering, Volume 21, No. 1; February 2008, pp. 73-75; In Chinese; See also [20080023372](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

To investigate the function of circadian gene mClock on the apoptosis of Lewis lung cancer (LLC) cells in mouse induced by cisplatin (CDDP). The circadian gene expression in LLC was induced with Phorbol 12-Myristate 13-acetate (PMA) in vitro and detected by real-time polymerase chain reaction (PCR). Lipofectamine-mediated gene transfection method was used to transfect mClock into LLC. After LLCs treated with PMA or transfected with mClock cisplatin was added to LLC at the indicated time. LLCs were incubated with cisplatin for 24 h. The cell proliferation and apoptosis were analyzed by mean transit time (MTT) and flow cytometric (FCM), respectively. After induced with PMA the expression of mClock gene was presented circadian pattern, whose peak and nadir were at 12 h and 24 h, respectively. The sensitivity of LLC to cisplatin was different at different times; at 24 h it was higher than that at 12 h according to the results of MTT and FCM. LLC of circadian mClock gene over-expression revealed decreased rate of apoptosis and increased cell proliferation. The circadian gene mClock may participate in the regulation of cisplatin reducing apoptosis.

Author

Circadian Rhythms; Genes; Cancer; Cells (Biology); Apoptosis; Chemotherapy; Drugs; Platinum Compounds; Metabolism

20080023387 Shanghai Univ., Shanghai, China

A New Method for Monitoring the Status of Central Nervous System during General Anesthesia

Zhang, Lian-yi; Zheng, Chong-xun; Space Medicine and Medical Engineering, Volume 21, No. 1; February 2008, pp. 40-44; In Chinese; See also [20080023372](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

To investigate the status of the central nervous system (CNS) during general anesthesia using a new method of monitor. Eighteen patients during general anesthesia were randomly chosen as the subjects. EEG signals of the patients were recorded as the subject was undergoing a surgical operation. The status of CNS of the patients during general anesthesia was monitored through the changes of Kolmogorov entropy (KE) of the EEG signals. Under the same kind of anesthesia measures most patients' CNS presented roughly the same status, but important differences were found in individual cases. Some presented depressed CNS status, some presented excited CNS status and others presented epileptic status. The same general anesthesia may have different effects on different subjects. KE can reflect the status of the prefrontal cortex during general anesthesia. KE may be a new tool for monitoring the status of CNS during general anesthesia.

Author

Central Nervous System; Anesthesia; Electroencephalography; Kolmogorov Theory; Entropy

20080023388 Xian Jiaotong Univ., China

Analysis of Mental Fatigue Basing On Power Spectrum Features of EEG

Zheng, Chong-xun; Zhang, Chong; Ouyang, Yi; Yu, Xiao-lin; Space Medicine and Medical Engineering, Volume 21, No. 1; February 2008, pp. 35-39; In Chinese; See also [20080023372](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

To investigate the relationship between mental fatigue and power spectrum features of electroencephalogram (EEG) in order to find feasible objective indexes for analyzing mental fatigue level. Gravity frequency and power spectral entropy of EEG were extracted to analyze the state of mental fatigue at three epoches: BT, before continuous mental arithmetic task; AT, immediately after continuous mental arithmetic task; and REST, 60 min after task. For comparison, subjective measurements and behavior analyses were made to evaluate mental fatigue state at the three epoches. The gravity frequency and power spectral entropy of EEG decreased, the scale of subjective perceived fatigue and mean response times (RT) of mental arithmetic task and psychomotor vigilance test increased at AT as compared with that at BT, while gravity frequency and power spectral entropy of EEG increase after rest, the scale of subjective perceived fatigue and the mean RT decreased as compared with that at AT. Gravity frequency and power spectral entropy of EEG are strongly correlated with mental fatigue level. They decrease as the mental fatigue level increases. Meanwhile the results of gravity frequency and power spectral entropy analysis of EEG are consistent with that of subjective measurements and behavior analyses. Gravity frequency and power spectral entropy of EEG are expected to serve as the index for detecting mental fatigue level.

Author

Mental Performance; Fatigue (Biology); Electroencephalography; Power Spectra; Entropy; Electrophysiology; Psychophysiology

20080023389 BeiHang Univ., Beijing, China

Biomechanical Analysis of Wrist under Axial Static Compressive Force on Metacarpals

Fan, Yu-bo; Guo, Xin; Li, Zong-ming; Space Medicine and Medical Engineering, Volume 21, No. 1; February 2008, pp. 45-49; In Chinese; See also [20080023372](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

To study the force and pressure transmission through normal wrist, and the effect of transverse carpal ligament release on the biomechanics of carpal tunnel. A 3-D finite element model of the wrist based on CT scan images was established. The load transmission of carpus and the distribution of contact stress on radiocarpal joint under axial compressive force on metacarpals as well as the effect of transverse carpal ligament (TCL) release on the displacement of carpal bones were computed and analyzed. The computational results of force and pressure transmission through normal carpus matched well with previous studies. The release of TCL resulted in radial and palmar displacement of the scaphoid, flexion and radial rotation of radiocarpal joint as well as a further radial deviation of the whole carpal tunnel. A 3-D finite element model of the wrist that includes the carpal tunnel, distal radius and ulna, and proximal metacarpals is developed. This model may simulate the load transmission better and contact stress distribution of carpal tunnel and radiocarpal joint, as well as provide an operational platform for further research on biomechanical behavior of carpal structure. The computed and analyzed results of the effect of TCL release on the displacements of carpal bones can be served as related theoretic base on carpal tunnel syndrome, carpal tunnel release surgery and recovery after operation.

Author

Biodynamics; Wrist; Axial Compression Loads; Contact Resistance; Load Distribution (Forces); Bones; Ligaments; Joints (Anatomy); Displacement

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*.

20080022376 NASA Glenn Research Center, Cleveland, OH, USA

Medical Grade Water Generation for Intravenous Fluid Production on Exploration Missions

Niederhaus, Charles E.; Barlow, Karen L.; Griffin, DeVon W.; Miller, Fletcher J.; May 2008; 63 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 444543.01.02.01

Report No.(s): NASA/TP--2008-214999; E-16207; Copyright; Avail.: CASI: [A04](#), Hardcopy

This document describes the intravenous (IV) fluids requirements for medical care during NASA's future Exploration

class missions. It further discusses potential methods for generating such fluids and the challenges associated with different fluid generation technologies. The current Exploration baseline mission profiles are introduced, potential medical conditions described and evaluated for fluidic needs, and operational issues assessed. Conclusions on the fluid volume requirements are presented, and the feasibility of various fluid generation options are discussed. A separate report will document a more complete trade study on the options to provide the required fluids. At the time this document was developed, NASA had not yet determined requirements for medical care during Exploration missions. As a result, this study was based on the current requirements for care onboard the International Space Station (ISS). While we expect that medical requirements will be different for Exploration missions, this document will provide a useful baseline for not only developing hardware to generate medical water for injection (WFI), but as a foundation for meeting future requirements. As a final note, we expect WFI requirements for Exploration will be higher than for ISS care, and system capacity may well need to be higher than currently specified.

Author

Aerospace Medicine; International Space Station; Fluidics; Intravenous Procedures; Water Injection

20080023027 Civil Aerospace Medical Inst., Oklahoma City, OK, USA

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

Botch, Sabra R.; Chaturvedi, Arvind K.; Canfield, Dennis V.; Forster, Estrella M.; May 2008; 14 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): AM-B-08-TOX-202

Report No.(s): DOT/FAA/M-08/11; No Copyright; Avail.: CASI: [A03](#), Hardcopy

For aviation accident investigations at the Civil Aerospace Medical Institute (CAMI), vitreous fluid and urine samples from pilot fatalities are analyzed for glucose, and in those cases wherein glucose levels are elevated, blood hemoglobin A(sub lc) (HbA(sub lc)) is measured. These analyses are conducted to monitor diabetic pilots to ensure that their disease was in control at the time of accidents and to discover other pilots with undiagnosed and unreported diabetes. In this study, the prevalence of elevated glucose concentrations in fatally injured civilian pilots is evaluated. Glucose and HbA1c are measured by hexokinase and latex immunoagglutination inhibition methodologies, respectively. The former was adopted at the beginning of 1998, while the latter in the middle of 2001. The analytical results are electronically stored in the CAMI Toxicology Database. This database was searched for pilots from whom samples were received during 1998-2005 and whose vitreous fluid and/or urine glucose concentrations were measured. HbA1c levels and information on diabetic pilots were also retrieved. The probable cause and contributing factors of the associated accidents were obtained from the National Transportation Safety Board's (NTSB's) Aviation Accident Database. Out of 1,335 pilots involving 363 vitreous fluid, 365 urine, and 607 vitreous fluid and urine analyses, 43 pilots had elevated glucose in vitreous fluid (> 125 mg/dL) and/or in urine (> 100 mg/dL). Of the 20 pilots whose blood samples were analyzed, 14 had > 6% HbA1c--4 were known diabetics (HbA(sub lc): 7.1; 8.3; 10.8; and 12.4%), and 5 were not known diabetics (HbA(sub lc): 6.2; 8.2; 8.3; 8.6; and 13.0%). Urinary glucose levels were elevated in all 13 known hyperglycemic pilots. One pilot had a history of renal glycosuria (low renal threshold). The disease of the 13 diabetic pilots was not in control at the time of accidents. Additionally, there were a considerable number of pilots with elevated glucose (30 of 43) and HbA(sub lc) (5 of 20), suggesting undiagnosed and unreported diabetic conditions. However, health, medical condition(s), and use of medications (authorized or unauthorized) by pilots were determined by the NTSB to be the cause or a factor in 5 accidents: elevated glucose level of the pilot was a factor in 1 and incapacitation/impairment of the pilot was a cause and/or factor in 4. Greater attention is necessary in controlling diabetes by aviators in coordination with Aviation Medical Examiners.

Author

Aerospace Medicine; Aircraft Accidents; Glucose; Metabolic Diseases; Diabetes Mellitus

20080023372 Institute of Space Medico-Engineering, Beijing, China

Space Medicine and Medical Engineering, Volume 21, No. 1

Wang, Yong-zhi, Editor; Grigoriev, A. I., Editor; White, Ronald J., Editor; Wang, Xi--ji, Editor; Yu, Meng-sun, Editor; Qi, Fa-ren, Editor; Wei, Jin-he, Editor; 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; Jiang, Shi-zhong, Editor; February 2008; ISSN 1002-0837; 84 pp.; In Chinese; See also 20080023373 - 20080023389; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Topics covered include: Chronotherapy by Ribozyme Targeted to Telomerase in Nude Mice with a Transplanted Tumor:

Model for Human Hepatic Cancer; Effects of Simulated Microgravity on the Gap Junction Protein Expression Spectrum in Rat Myocardium; Effects of Simulated Microgravity on Cytokine Gene Expression Spectrum in Rat Myocardium; The First Step of Launching Biological Rocket Experiment in China--The Integral Results on Four Physiological Parameters of Dog; Effects of Taikong Yangxin Prescription on Heart Function in Tail-Suspension Rats; Effects of Tail Suspension on Dielectric Properties of Cells in Isolated Rat Sural Muscle; Establishment of a Carrying System for Space Cellular Experiment on Shenzhou-6 Spacecraft; Analysis of Mental Fatigue Basing On Power Spectrum Features of EEG; A New Method for Monitoring the Status of Central Nervous System during General Anesthesia; Biomechanical Analysis of Wrist under Axial Static Compressive Force on Metacarpals; Integrated Simulation and Analysis of Electric-Field Distribution under Transthoracic Defibrillation Based on Finite Element Method; Image Reconstruction Based on an Inhomogeneous Skull Model for Electrical Impedance Tomography; Detecting Controlling and Driving System for a New Kind Tissue Engineering Bioreactor; Wearable Concurrent Monitoring System for Physiological Parameters; An ERP Study on Visual Illusory Motion; Function of Circadian Gene mClock on Tumor Experiment Chemotherapy; and Effects of Circadian Gene of Tumor Cells on Its Drug Sensitivity.

Derived from text

Biodynamics; Spaceborne Experiments; Tissue Engineering; Microgravity; Electroencephalography; Bioreactors; Cancer; Cells (Biology); Gene Expression; Heart Function

20080023374 China Astronaut Research and Training Center, Beijing, China

Effects of Taikong Yangxin Prescription on Heart Function in Tail-Suspension Rats

Li, Yong-Zhhi; Mi, Tao; Fan, Quan-chun; Zhao, Shuang; Bai, Gui-e; Zhou, Liang-zhong; Space Medicine and Medical Engineering, Volume 21, No. 1; February 2008, pp. 22-25; In Chinese; See also [20080023372](#); Copyright; Avail.: Other Sources

To investigate the effects of Taikong Yangxin Prescription on left ventricular pump and contract function in rats after tail suspension. Twenty-four male Sprague-Dawley (SD) rats were randomly selected and divided into three groups: (A) normal control group, (B) tail-suspension group and (C) Chinese herb compound group (taking Taikong Yangxin Prescription and tail suspension). The left ventricular functions in rats were examined by echocardiography separately after 7 d and 28 d tail-suspension. After 28 d of tail-suspension, as compared with the tail-suspension group, LVDD in Chinese herb compound group increased significantly ($P<0.05$), LVDV, SV and their relevant indices all increased significantly ($P<0.05$). Taikong Yangxin Prescription may protect heart pump function in rats after simulated weightlessness.

Author

Weightlessness Simulation; Heart Function; Cardiac Ventricles; China; Drugs; Gravitational Effects; Biodynamics; Stress (Physiology)

20080023376 China Astronaut Research and Training Center, Beijing, China

Establishment of a Carrying System for Space Cellular Experiment on Shenzhou-6 Spacecraft

Li, Ying-hui; Wang, Hong-Hui; Ding, Bai; Nie, Jie-lin; Tan, Ying-jun; Wan, Yu-min; Ling, Shu-kuan; Space Medicine and Medical Engineering, Volume 21, No. 1; February 2008, pp. 30-34; In Chinese; See also [20080023372](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

To establish a carrying system for space cellular experiment suitable for astronaut to carry out cellular experiments on Shenzhou-6 mission. The cell carrying sample bag, sample box and sample box integrated package were designed. Primary cardiomyocytes and osteoblasts culture and ground model experiment in the simulated environment of space cabin were performed. While manned, the cellular experiment was carried out on the orbit. After 5 d space flight, the returned cell samples were analyzed. The results demonstrated that the system was of good safety, reliability and applicability, as well as satisfied the demands of analyzed samples. After Shenzhou-6 space flight, it is shows that this system fits for small loading, multi-cells and manned carrying missions, and can satisfy the demand of the first manned space cellular experiments carried out on the Shenzhou-6 spacecraft.

Author

Chinese Spacecraft; Manned Spacecraft; Spaceborne Experiments; Cell Culturing; Reliability Analysis; Safety Management; Samples

20080023380 Fourth Military Medical Univ., Xi'an, China

Image Reconstruction Based on an Inhomogeneous Skull Model for Electrical Impedance Tomography

Dong, Xiu-zhen; Ni, An-Sheng; Yang, Huo-sheng; Fu, Feng; Tang, Chi; Space Medicine and Medical Engineering, Volume 21, No. 1; February 2008, pp. 56-60; In Chinese; See also [20080023372](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

To study the effects of the inhomogeneous skull on electrical impedance tomography (EIT) of the human brain in order to improve the quality of reconstructed images. A two-dimensional (2-D) dynamic EIT algorithm based on the inhomogeneous skull model (ISM) was suggested and applied to reconstruct images of cerebral hemorrhages. According to the evaluating criteria of the image quality suggested in this paper, the reconstructed image was compared with those based on the homogeneous circle model (HCM) and the four-concentric circle model (FCCM). Both the correlation and the localization accuracy of the reconstructed image were improved significantly when ISM was used. To incorporate the skull inhomogeneity into image reconstruction is an effective way to improve the image quality of brain EIT.

Author

Image Reconstruction; Homogeneity; Electrical Impedance; Computer Aided Tomography; Hemorrhages; Brain; Skull

20080023382 Ningbo Univ., Ningbo Zhejiang, China

Effects of Tail Suspension on Dielectric Properties of Cells in Isolated Rat Sural Muscle

He, Xue-ying; Zhang, Hong-bo; Ma, Qing; Space Medicine and Medical Engineering, Volume 21, No. 1; February 2008, pp. 26-29; In Chinese; See also [20080023372](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

To study changes of dielectric properties of gastrocnemius caused by simulated weightlessness. Male Sprague-Dawley rats tail suspended for 10 wks were observed together with its normal control. AC impedance of isolated gastrocnemius was measured with an impedance analyzer (Agilent 4294A). Effects of simulated weightlessness on electric properties of cells in isolated rat sural muscle were also observed by analyzing the dielectric numerical characters of the dielectric spectra, the Cole-Cole plots, spectrum of loss factor and loss tangent, as well as spectrum of conductivity imaginary part. It was found that simulated weightlessness could induce certain changes: both relative permittivity at low frequency $\sigma(\text{sub } L)$, and relative permittivity increment $\Delta(\text{sub } \epsilon)$, as well as conductivity at high frequency $\kappa(\text{sub } h)$, and conductivity increment $\Delta(\text{sub } \kappa)$ were all reduced. The first characteristic frequency $f(\text{sub } c_1)$ decreased, while the second characteristic frequency $f(\text{sub } c_2)$ increased. Peak of loss factor, peak of loss tangent and the maximum of conductivity imaginary part were also reduced. Changes of dielectric property of gastrocnemius induced by simulated weightlessness can be observed effectively by frequency domain impedance technique.

Author

Weightlessness Simulation; Leg (Anatomy); Muscle Cells; Dielectric Properties; Electrical Impedance; Electrical Resistivity; Gravitational Effects

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*.

20080023274 Army Research Development and Engineering Command, Warren, MI USA

TARDEC Intelligent Ground Systems

Smuda, Bill; Oct 31, 2007; 23 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477958; 18375-RC; No Copyright; Avail.: Defense Technical Information Center (DTIC)

IGS HAS A DUAL ROLE: * Furthering Unmanned Systems Autonomy (1) Unmanned ground vehicle platforms, (2) Vehicle intelligence and control, (3) Mission payload integration, (4) Embedded simulation. * Increasing Soldier-Robot Interaction (1) Human-robot interaction, (2) Soldier-machine interface, (3) Embedded simulation.

DTIC

Unmanned Ground Vehicles; Intelligence; Payload Integration

20080023375 Institute of Aviation Medicine, Beijing, China

Wearable Concurrent Monitoring System for Physiological Parameters

Yu, Meng-sun; Zhang, Zheng-bo; Zhao, Xian-liang; Wu, Tai-hu; Zheng, Jie-wen; Space Medicine and Medical Engineering, Volume 21, No. 1; February 2008, pp. 66-69; In Chinese; See also [20080023372](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

To design a wearable physiological monitoring system for acquiring and monitoring vital signs non-intrusively and concurrently. All bio-sensors were embedded in an elastic shirt for detecting physiological parameters with wearable technology. A patented respiratory inductive plethysmography technology was used to measure respiratory function, two sensors were woven into the jerkin around the patient's chest and abdomen. A three-lead, single channel ECG measures heart rate, and a three-axis accelerometer records posture and activity level. An NTC thermometer embedded in the shirt measures the body temperature. An elastic jerkin with embedded sensors that collects and continuously monitors respiration, cardiac, temperature, posture and activity signals was fabricated. This wearable physiological monitoring system can record multiple parameters non-intrusively and concurrently. It can act as a useful platform for further research.

Author

Bioinstrumentation; Physiology; Biometrics; Medical Equipment; Portable Equipment

55

EXO BIOLOGY

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see *52 Aerospace Medicine*; on animals and plants see *51 Life Sciences*. For psychological and behavioral effects of aerospace environments see *53 Behavioral Sciences*.

20080023405 NASA Marshall Space Flight Center, Huntsville, AL, USA

Lab-on-a-Chip: From Astrobiology to the International Space Station

Maule, Jake; Wainwright, Nor; Steele, Andrew; Gunter, Dan; Monaco, Lisa A.; Wells, Mark E.; Morris, Heather C.; Boudreaux, Mark E.; April 16, 2008; 11 pp.; In English; Astrobiology Science Conference 2008 -- SETI Institute, 14-17 Apr. 2008, Santa Clara, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The continual and long-term habitation of enclosed environments, such as Antarctic stations, nuclear submarines and space stations, raises unique engineering, medical and operational challenges. There is no easy way out and no easy way to get supplies in. This situation elevates the importance of monitoring technology that can rapidly detect events within the habitat that affect crew safety such as fire, release of toxic chemicals and hazardous microorganisms. Traditional methods to monitor microorganisms on the International Space Station (ISS) have consisted of culturing samples for 3-5 days and eventual sample return to Earth. To augment these culture methods with new, rapid molecular techniques, we developed the Lab-on-a-Chip Application Development - Portable Test System (LOCAD-PTS). The system consists of a hand-held spectrophotometer, a series of interchangeable cartridges and a surface sampling/dilution kit that enables crew to collect samples and detect a range of biological molecules, all within 15 minutes. LOCAD-PTS was launched to the ISS aboard Space Shuttle Discovery in December 2006, where it was operated for the first time during March-May 2007. The surfaces of five separate sites in the US Lab and Node 1 of ISS were analyzed for endotoxin, using cartridges that employ the Limulus Amebocyte Lysate (LAL) assay; results of these tests will be presented. LOCAD-PTS will remain permanently onboard ISS with new cartridges scheduled for launch in February and October of 2008 for the detection of fungi (Beta-glucan) and Gram-positive bacteria (lipoteichoic acid), respectively.

Author

Exobiology; Bacteria; International Space Station; Microorganisms; Microfluidic Devices; Endotoxins; Assaying

20080023569 Ljubljana Univ., Ljubljana, Slovenia

A Thermal Torso Manikin Incorporating Physiological Characteristics of Sweating and Heating

Candas, Victor; Babic, Mitja; Lenarcic, Jadran; Tomsic, Martin; Mekjavic, Igor B.; Electrotechnical Review, Volume 75, Nos. 1-2; January 2008, pp. 56-63; In English; See also [20080023568](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

Prevention of thermal injury in extreme ambient conditions involves selection of appropriate protective clothing based on biophysical evaluation [1,2,3,4,5]. Inappropriate clothing may cause freezing or nonfreezing cold injury. We developed a sweating thermal torso manikin for evaluation of the thermal and evaporative resistance of clothes. The temporal regulation

of simulated sweating may be controlled by algorithms derived from human experiments, whereby the onset and gain of the simulated sweating response are a function of the manikin core and skin temperatures. The spatial pattern of the simulated sweating may be regulated according to the observed pattern of sweating on the torso in human subjects. The manikin system (Figure 2) is composed of a personal computer, electrical control system, sweating simulator and a thermal torso manikin. The manikin is composed of 16 segments arranged in two rows. Each segment has a core and a skin element. The core element is a 12,5cm x 25cm x 1,5mm copper plate on which eight heaters (RTO 20), two artificial sweat glands and a core temperature sensor (PT 1000), are mounted. The skin element is a 0,5 cm thick layer of resin, with similar thermal characteristics as skin. Each skin element has a distributed temperature (PT 100) sensor embedded in its surface. The measurement and control process treat each segment as an autonomous part. Two segments on the top and bottom of the torso minimize the heat loss in the longitudinal direction, thus enhancing measurement accuracy.

Author

Thermal Resistance; Torso; Skin Temperature (Biology); Temperature Sensors; Sweat; Body Temperature; Biophysics; Physiology; Heating

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*.

20080022275 Lumen Intellectual Property Services, Inc., Palo Alto, CA, USA

Method to Identify Arterial and Venous Vessels

Raman, R., Inventor; Napel, S. A., Inventor; Rubin, G. D., Inventor; 2 Dec 04; 12 pp.; In English

Contract(s)/Grant(s): NIH-5R01HL58915; NIH-1R01HL67194

Patent Info.: Filed Filed 2 Dec 04; US-Patent-Appl-SN-11-003-584

Report No.(s): PB2007-109165; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method for identifying arteries and veins in a medical image is provided. A start point and endpoints of branches of a segmented tubular tree are identified. Distance maps for each of the endpoints relative to the startpoint are created. Then voxels in between the furthest of the endpoints and the startpoint are identified. This last step is iterated for the subsequent furthest of the endpoints. For each set of identified voxels parameters are identified. Examples of such parameters are cross sectional areas of the branches. The parameters for at least one each set of identified voxels are then used to anatomically label branches the segmented tubular tree, optionally with position information obtained from the image.

NTIS

Arteries; Imaging Techniques; Patent Applications; Veins

20080022277 Chicago Univ., Chicago, IL USA

Method for Detection of Abnormalities in Three-Dimensional Imaging Data

Arimura, H., Inventor; Li, Q., Inventor; Doi, K., Inventor; 21 May 04; 34 pp.; In English

Contract(s)/Grant(s): NIH-PHS-CA62635; NIH-PHS-CA98119

Patent Info.: Filed Filed 21 May 04; US-Patent-Appl-SN-10-849-807

Report No.(s): PB2007-109198; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method, system, and computer program product for determining existence of an abnormality in a medical image, including (1) obtaining volume image data corresponding to the medical image; (2) filtering the volume image data using an enhancement filter to produce a filtered image in which a predetermined pattern is enhanced; (3) detecting, in the filtered image, a first plurality of abnormality candidates using multiple gray-level thresholding; (4) grouping, based on size and local structures, the first plurality of abnormality candidates into a plurality of abnormality classes; (5) removing false positive candidates from each abnormality class based on class-specific image features to produce a second plurality of abnormality candidates; and (6) applying at least one abnormality to a classifier and classifying each candidate in the second plurality of abnormality candidates as a false positive candidate or an abnormality.

NTIS

Abnormalities; Computer Programs; Imaging Techniques; Patent Applications; Data Systems

20080022278 Weingarten, Schurgin, Gagnebin and Lebovici. LLP, Boston, MA, USA

Providing Soft Bandwidth Guarantees Using Elastic TCP-Based Tunnels

Bestavros, A., Inventor; Matta, A. I., Inventor; 1 Apr 05; 13 pp.; In English

Contract(s)/Grant(s): NFS-9886397; NSF-0095988

Patent Info.: Filed 1 Apr 05; US-Patent-Appl-SN-11-096-735

Report No.(s): PB2007-109197; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Method and apparatus for providing enhanced utilization of an existing network of paths between nodes allocated to customer traffic where the paths also carry cross traffic. The system monitors the quality of the network bandwidth utilized by customer data flows over a set of managed paths in a time interval and allocates network resources to customers as a function of measured bandwidth and a desired target thereof by acquiring additional paths or abandoning existing paths. A scheduling function controls the use of the set of managed paths to more nearly achieve the desired quality of network bandwidth delivered to customer traffic.

NTIS

Bandwidth; Patent Applications; Traffic

20080022306 Gates and Cooper, Los Angeles, CA, USA

Automatic Visual Recognition of Biological Particles

Perona, P., Inventor; Ranzato, M., Inventor; Flagan, R. C., Inventor; 5 May 05; 82 pp.; In English

Contract(s)/Grant(s): NSF-ERC EEC-9402726

Patent Info.: Filed 5 May 05; US-Patent-Appl-SN-11-122-575

Report No.(s): PB2007-109078; No Copyright; Avail.: CASI: [A05](#), Hardcopy

A method and system provide the ability to automatically recognize biological particles. An image of biological particles (e.g., airborne pollen or urine) is obtained. One or more parts of the image are detected as containing one or more particles of interest. Feature vector(s) are extracted from each detected part of the image. Non-linearities are applied to each feature vector. Each part of the image is then classified into a category of biological particle based on the one or more feature vectors for each part of the image.

NTIS

Image Processing; Patent Applications

20080022310 Ansys CFX Germany, Bavaria, Germany

A Correlation-Based Transition Model using Local Variables, Part 1, Model Formation

Menter, F. R.; Langtry, R. B.; Likki, S. R.; Suzen, Y. B.; Huang, P. G.; Volker, S.; Journal of Turbomachinery; June 2006; Volume 128, Issue 3, pp. 413-422; In English; International Gas Turbine and Aeroengine Congress and Exhibition; Original contains black and white illustrations

Contract(s)/Grant(s): NCC3-1040; NCC3-590

Report No.(s): Paper No. 2004-GT-53452; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1115/1.2184352>

A new correlation-based transition model has been developed, which is based strictly on local variables. As a result, the transition model is compatible with modern computational fluid dynamics (CFD) approaches, such as unstructured grids and massive parallel execution. The model is based on two transport equations, one for intermittency and one for the transition onset criteria in terms of momentum thickness Reynolds number. The proposed transport equations do not attempt to model the physics of the transition process (unlike, e.g., turbulence models) but from a framework for the implementation of correlation-based models into general-purpose CFD methods.

Author

Unstructured Grids (Mathematics); Turbulence Models; Computational Fluid Dynamics; Intermittency

20080022316 Syracuse Research Corp., NY, USA

Risk Analysis Approach for Insider Threat Situational Awareness

DeZoppo, R.; January 2007; 74 pp.; In English

Report No.(s): PB2007-107321; SRC-TR-07-1518; No Copyright; Avail.: National Technical Information Service (NTIS)

This final technical report characterizes the phase II research and development work for 'A Risk Analysis Approach for Insider Threat Situational Awareness.' A unique risk analysis approach and prototype system is presented. The system utilizes available non-cyber data sources from personnel security files, background investigation reports and public records on

individuals to assess insider risk of by focusing on vulnerabilities, impact to the organization and exposure to a threat environment. The risk policy used for the approach is the DCID 6-4 Adjudicative Guidelines, approved and in use today by the IC. A unique approach to extracting facts from unstructured text is also described. The approach features natural language processing (NLP)-based Guideline Models that are based on the predictable text structure present in security investigation reports. The facts extracted are then mapped onto the risk ontology. The approach and system described is applicable to 'real-time' organizational monitoring, or forensic analysis of large populations and insider situations. The user interface developed allows users to visualize risk in detail, at the insider level, or at organizational-levels, making it a very effective tool for high-value security and assurance resources. The technology is thus well-suited to situational awareness, Adjudicative QC, Investigations and Counter-Intelligence applications.

NTIS

Risk; Security; Situational Awareness

20080022346 Sparkman (Klarquist), LLP, Portland, OR, USA

Analyzing User-Activity Data Using a Heuristic-Based Approach

Littlefield, R. J., Inventor; Littlefield, J. S., Inventor; Cheney, B. J., Inventor; Clowley, P. J., Inventor; Adams, D. R., Inventor; 13 Oct 04; 36 pp.; In English

Patent Info.: Filed Filed 13 Oct 04; US-Patent-Appl-SN-10-965-473

Report No.(s): PB2007-109168; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Methods, apparatus, and systems for analyzing user-activity data are disclosed. In one disclosed embodiment, for example, two or more data streams of low-level, user-activity data are detected at a computer workstation via two or more respective sensors. The two or more respective sensors may comprise a first sensor configured to detect network-access requests and a second sensor configured to detect at least one of the following events: file-activity events, window-title-change events, or user-interface events. Targeted user activity is identified from at least one of the data streams. The targeted user activity can comprise, for example, a user initiating a network access; performing a search on a search engine; creating, opening, or modifying a file; or initiating a network access that causes a window title to change. Computer-readable media containing computer-executable instructions for causing a computer system to perform any of the described methods or for storing lists created or modified by any of the disclosed methods are also disclosed.

NTIS

Heuristic Methods; Patent Applications

20080022361 Rives [Stoel] LLP, Portland, OR, USA

Navigation System Applications of Sigma-Point Kalman Filters for Nonlinear Estimation and Sensor Fusion

van der Merwe, R., Inventor; Wan, E. A., Inventor; Julier, S. J., Inventor; 4 Apr 05; 30 pp.; In English

Contract(s)/Grant(s): DARPA-F33615-98-C-3516; ONR-N00014-02-C-0248

Patent Info.: Filed Filed 4 Apr 05; US-Patent-Appl-SN-11-099-433

Report No.(s): PB2007-109077; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A method of estimating the navigational state of a system entails acquiring observation data produced by noisy measurement sensors and providing a probabilistic inference system to combine the observation data with prediction values of the system state space model to estimate the navigational state of the system. The probabilistic inference system is implemented to include a realization of a Gaussian approximate random variable propagation technique performing deterministic sampling without analytic derivative calculations. This technique achieves for the navigational state of the system an estimation accuracy that is greater than that achievable with an extended Kalman filter-based probabilistic inference system.

NTIS

Global Positioning System; Kalman Filters; Multisensor Fusion; Navigation; Nonlinearity; Patent Applications

20080022934 NASA Langley Research Center, Hampton, VA, USA

Forces Associated with Nonlinear Nonholonomic Constraint Equations

Roithmayr, Carlos M.; Hodges, Dewey H.; June 2008; 37 pp.; In English; 12th Conference on Nonlinear Vibrations, Dynamics, and Multibody Systems, 1-5 Jun. 2008, Blacksburg, VA, USA

Contract(s)/Grant(s): WBS 992858.13.07.02; Copyright; Avail.: CASI: [A03](#), Hardcopy

A concise method has been formulated for identifying a set of forces needed to constrain the behavior of a mechanical system, modeled as a set of particles and rigid bodies, when it is subject to motion constraints described by nonholonomic

equations that are inherently nonlinear in velocity. An expression in vector form is obtained for each force; a direction is determined, together with the point of application. This result is a consequence of expressing constraint equations with dot products of vectors rather than entirely in terms of scalars and matrices in the usual way. The constraint forces in vector form are used together with two new analytical approaches for deriving equations governing motion of a system subject to such constraints. If constraint forces are of interest they can be brought into evidence in explicit dynamical equations by employing the well-known nonholonomic partial velocities associated with Kane's method; if they are not of interest, equations can be formed instead with the aid of vectors introduced here as nonholonomic partial accelerations.

Author

Nonlinear Equations; Nonholonomic Equations; Rigid Structures; Scalars

20080023031 Turku Univ., Finland

On the Mean Square of Quadratic Dirichlet L-Functions at 1

Virtanen, Henri; *Annales Academiae Scientiarum Fennicae: Mathematica*; January 2008; ISSN 1239-6303; Dissertations 150; 54 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

The aim of this dissertation is to study the mean square of quadratic Dirichlet L-function, proving in particular the asymptotic formula described within. The result of which is to be exactly formulated in Theorem 4.13, which improves the mean value result proved by M. Jutila in 1973. The Dirichlet class number formula provides a connection between the value of $L(1, \chi)$ and the number of classes of quadratic forms for a given discriminant. Particularly, in the case of imaginary quadratic fields or positive definite quadratic forms, this connection almost directly provides the corresponding moments for the class numbers. The dissertation addresses the mean square of quadratic Dirichlet L-functions at 1 and the mean square of primitive quadratic Dirichlet L-functions at 1, and provides an application to algebraic number theory.

Derived from text

Dirichlet Problem; Mean Square Values; Quadratic Equations; Asymptotes

20080023058 Indiana Univ., Bloomington, IN, USA

Center for Component Technology for Terascale Software Simulation (CCTSS) at Indiana University

Gannon, D.; January 2006; 15 pp.; In English

Contract(s)/Grant(s): DE-FC02-01ER25492-A002

Report No.(s): DE2007-908042; No Copyright; Avail.: National Technical Information Service (NTIS)

Final report for the Indiana University portion of the CCTSS project.

NTIS

Computerized Simulation; Architecture (Computers)

20080023122 Cermak and Kenealy, LLP, Alexandria, VA, USA

Disease Risk Evaluation Tool and Method

Eaton, C. B., Inventor; Ahern, D. K., Inventor; 15 Apr 05; 16 pp.; In English

Contract(s)/Grant(s): NIH-RO1HL70804

Patent Info.: Filed Filed 15 Apr 05; US-Patent-Appl-SN-11-106-449

Report No.(s): PB2007-109268; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A disease risk evaluation and education tool, preferably implemented in logic on a computing device such as a Personal Digital Assistant, permits a user to input patient-specific data relevant to evaluating that patient's risk for a particular disease, e.g., coronary heart disease. The tool's logic calculates the equivalent age of the patient, based on the Framingham data set and on the input data, and presents one or more treatment recommendations.

NTIS

Risk; Heart Diseases

20080023219 Naval Surface Warfare Center, Bethesda, MD, USA

Portable Data Acquisition System

Daniels, J. A., Inventor; Mellick, D. A., Inventor; 21 Apr 05; 31 pp.; In English

Patent Info.: Filed Filed 21 Apr 05; US-Patent-Appl-SN-11-116-164

Report No.(s): PB2007-109263; No Copyright; Avail.: CASI: [A03](#), Hardcopy

According to typical inventive embodiments, a compact data acquisition unit is modularly assembled of COT components, based on a PC-104 or other form factor of relatively small size. Inside a durable casing, a dc-dc converter

increases battery-generated dc voltage for a computer processor that communicates with storage/memory and collects sensory information via an a-to-d converter. The inventive data acquisition unit can be implemented in either handheld (e.g., so as to include touchscreen interactivity) or situate (e.g., so as to be combined with sensory instrumentation) fashion. Especially propitious inventive practice involves wireless communication with an inventive 'podded' device, remotely placed, that includes an inventive data acquisition unit, one or more sensors, and a pod containing the unit and the sensor(s). For underwater applications, a preferred embodiment of an inventive podded device is planoconvex, having a flat side for mounting on vehicular structure and an outwardly curved/rounded side for mitigating hydrodynamic penalties.

NTIS

Commercial Off-the-Shelf Products; Data Acquisition; Patent Applications; Voltage Converters (DC to DC); Electric Batteries

20080023318 NASA Marshall Space Flight Center, Huntsville, AL, USA

Development of X-TOOLSS: Preliminary Design of Space Systems Using Evolutionary Computation

Schnell, Andrew R.; Hull, Patrick V.; Turner, Mike L.; Dozier, Gerry; Alverson, Lauren; Garrett, Aaron; Reneau, Jarred; April 07, 2008; 6 pp.; In English; 49th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 7-10 Apr. 2008, Schaumburg, IL, USA; Original contains black and white illustrations

Report No.(s): AIAA-Paper-2008-2140; Copyright; Avail.: CASI: [C01](#), CD-ROM: [A02](#), Hardcopy

Evolutionary computational (EC) techniques such as genetic algorithms (GA) have been identified as promising methods to explore the design space of mechanical and electrical systems at the earliest stages of design. In this paper the authors summarize their research in the use of evolutionary computation to develop preliminary designs for various space systems. An evolutionary computational solver developed over the course of the research, X-TOOLSS (Exploration Toolset for the Optimization of Launch and Space Systems) is discussed. With the success of early, low-fidelity example problems, an outline of work involving more computationally complex models is discussed.

Author

Genetic Algorithms; Aerospace Systems; Complex Systems; Deployment; Launching; Nuclear Electric Propulsion

20080023321 NASA Marshall Space Flight Center, Huntsville, AL, USA

Notional Scoring for Technical Review Weighting As Applied to Simulation Credibility Assessment

Hale, Joseph Peter; Hartway, Bobby; Thomas, Danny; April 14, 2008; 4 pp.; In English; 2008 Spring Simulation Interoperability Workshop (SIW)/Simulation Interoperability Standards Organization (SISO), 14-18 Apr. 2008, Providence, RI, USA; Original contains color illustrations

Contract(s)/Grant(s): NAS8-02060; Copyright; Avail.: CASI: [C01](#), CD-ROM: [A01](#), Hardcopy

NASA's Modeling and Simulation Standard requires a credibility assessment for critical engineering data produced by models and simulations. Credibility assessment is thus a 'qualifying factor' in reporting results from simulation-based analysis. The degree to which assessors should be independent of the simulation developers, users and decision makers is a recurring question. This paper provides alternative 'weighting algorithms' for calculating the value-added for independence of the levels of technical review defined for the NASA Modeling and Simulation Standard.

Author

Mathematical Models; Systems Simulation; Classifications; Design Analysis; System Effectiveness; Systems Integration

20080023500 National Central Univ., Chung-Li, Taiwan, Province of China

Robust Stability of Discrete Singular Systems with Delayed State

Juang, Yau-Tarn; Huang, Chih-Peng; Lin, Hui-Ling; Journal of the Chinese Institute of Engineers, Volume 31, No.1; January 2008, pp. 149-155; In English; See also [20080023495](#); Copyright; Avail.: Other Sources

In this paper, the stability of linear discrete-time singular systems with delay state and parameter uncertainties is investigated. When the nominal discrete singular delay system is regular, causal and stable, sufficient conditions are derived to ensure the considered system with perturbed parameters remains regular, causal, and stable. The criteria are formulated in the complex linear matrix inequality (LMI), and the projection method is involved for numerical verification. A numerical example is given to demonstrate the validity of the proposed method. In recent years, there has been a growing interest in system-theoretic problems of singular systems, because their physical structures are integrated by both dynamic equations and algebraic equations and they are the generalized form of standard state space system. They exist in miscellaneous applications such as control systems (see, for example, Verghese et al., 1981 ; Lewis, 1986; Dai, 1989), electrical networks (Newcomb, 1981), chemical processes (Kumar and Daoutidis, 1995) etc. Singular systems are also called descriptor systems, implicit systems, semistate systems, or generalized systems. Several results for singular systems have been established in the past few

years (e.g., Bender and Laub, 1987; Bunse-Gerstner et al., 1994; Fang et al., 1994; Yu and Muller, 1994; Tarbouriech and Castelan, 1995; Tsai et al., 1995; Tornambe 1996; Xi, 1997; Chou and Liao 1999). Parametric uncertainties and delay states are constantly encountered in physical and engineering systems. Corresponding author. (Tel: 886-4-23892088 ext.3722; Fax: 886-4-23895293; Email: ponytony@seed.net.tw) C. P. Huang is with the Department of Information Technology, Ling Tung University, Taichung City, Taiwan 408, R.O.C. Y. T. Juang and H. L. Li are with the Department of Electrical Engineering, National Central University, Chung-Li, Taiwan 32054, R.O.C. systems. Since they both may cause instability or the degrading of performance, so considerable work has discussed the stability of uncertain systems with delay states over the years (e.g., Dugard and Verriest, 1997; Kharitonov, 1999). Recently, uncertain discrete singular systems with delay have been discussed (Xu et al., 2002; Chen and Chou, 2003; Chen and Lin, 2004). It is especially pointed out that the stability of uncertain time-delay singular systems is much more complicated than normal state space systems because one is required to consider not only robust stability but also regularity and impulse immunity (continuous descriptor systems) or causality (discrete singular systems). In this paper, we address the stability of discrete singular systems with disturbed parameters and delay states. A sufficient condition for ensuring the regularity, causality and stability of the considered systems is first presented. For facilitating verification, the criteria are then expressed in complex LMI. Since the existing LMI solver (Gahinet et al., 1995; Chilali and Gahinet, 1996) can not directly deal with the complex matrices, we thus involve the projection method (Higham, 1988; Huang et al., 2005) for numerical verification. The remainder of the content is organized as follows. Section II presents the problem formulation and preliminaries. A sufficient condition for the stability assurance of the considered systems

Author

Robustness (Mathematics); Discrete Functions; Delay; Matrices (Mathematics); Aerospace Systems; Uncertain Systems; Inequalities; Time Lag; Stability

20080023501 National Central Univ., Jung-Li, Taiwan, Province of China

Computer-Aided Evolution for Solving the Analytic Kronig-Penny Model

Ho, Chi-Hon; Li, Szu-Ju; Liao, Chien-nan; Chien, Feng-Tso; Tsai, Yao-Tsung; Journal of the Chinese Institute of Engineers, Volume 31, No.1; January 2008, pp. 121-125; In English; See also [20080023495](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

The Kronig-Penney model consists of a periodic potential function, which is used to derive the concepts of allowed and forbidden energy bands. Here, to circumvent the tedious evolution, it is helpful to use computer methods to derive the textbook equation of the analytic Kronig-Penney model. The hierarchical methodology with the shorter symbols can effectively reduce the complication in the expression of the 4×4 matrix. By defining the symbol sequence, we can easily reduce terms by cancellation. With these methods and computer-aided evolution, we can derive the Kronig-Penney model from the matrix expression to the textbook form without the extremely laborious evolution.

Author

Mathematical Models; Computer Techniques; Energy Bands; Periodic Functions; Computer Programs; Cancellation

20080023504 Nan-Kai Coll. of Technology, Nantou, Taiwan, Province of China

Discrete-Time Variable Structure Control for Robust Tracking and Model Following

Pai, Ming-Chang; Journal of the Chinese Institute of Engineers, Volume 31, No.1; January 2008, pp. 167-172; In English; See also [20080023495](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

This paper presents a discrete-time variable structure controller for a class of uncertain linear systems to track dynamic outputs of a non-delay reference model. The selection of switching surface and the existence of sliding mode are two important issues, which have been addressed. It is shown that the proposed approach guarantees closed-loop system stability and asymptotically achieves zero-tracking error in the presence of parameter uncertainties and external disturbances. Also, this scheme assures robustness against system uncertainties and disturbances, and the chattering phenomenon is eliminated. Finally, simulation results demonstrate the efficacy of the proposed control methodology.

Author

Feedback Control; Robustness (Mathematics); Switching; Systems Engineering; Uncertain Systems; Controllers

20080023509 National Taiwan Univ., Taipei, Taiwan, Province of China

Statistical Tests for Discerning Differences of Robustness of Horizontal Geodetic Networks due to Different Approaches

Hsu, Ronghin; Lee, Hsu-Chih; Kao, Szu-Pyng; Journal of the Chinese Institute of Engineers, Volume 31, No.1; January 2008, pp. 71-80; In English; See also [20080023495](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

In addition to VaniEek's original approach to network robustness, Tao's approach is introduced. Two sets of three

deformation measures at each point of the network are then created due to the two approaches. To differentiate one approach from the other, three statistical tests are proposed: (1). Displacement tests examine the network as a whole: to what extent are the displacement vectors due to the two approaches different? These are referred to as global tests of the network's robustness between approaches. (2). Deformation tests, on the other hand, investigate to what extent the deformation vectors at individual points are different. These are referred to as local tests of the network's robustness between approaches. (3). Equivalence tests examine the network as a whole for the statistical equalities between the corresponding deformation measures generated by the two approaches. Furthermore, the spatial distribution of the influential observables, the observations which cause the largest deformations at individual points, between approaches is discussed.

Author

Statistical Tests; Robustness (Mathematics); Displacement; Equivalence; Spatial Distribution

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COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware and data processing. For components see 33 *Electronics and Electrical Engineering*. For computer vision see 63 *Cybernetics, Artificial Intelligence and Robotics*.

20080023288 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Impacts of the IBM Cell Processor to Support Climate Models

Zhou, Shujia; Duffy, Daniel; Clune, Tom; Suarez, Max; Williams, Samuel; Halem, Milt; June 18, 2008; 1 pp.; In English; ISC08 Conference, 18-20 Jun. 2008, Dresden, Germany

Contract(s)/Grant(s): NNG06HN01D; Copyright; Avail.: Other Sources; Abstract Only

NASA is interested in the performance and cost benefits for adapting its applications to the IBM Cell processor. However, its 256KB local memory per SPE and the new communication mechanism, make it very challenging to port an application. We selected the solar radiation component of the NASA GEOS-5 climate model, which: (1) is representative of column physics (approximately 50% computational time), (2) has a high computational load relative to transferring data from and to main memory, (3) performs independent calculations across multiple columns. We converted the baseline code (single-precision, Fortran) to C and ported it with manually SIMDizing 4 independent columns and found that a Cell with 8 SPEs can process 2274 columns per second. Compared with the baseline results, the Cell is approximately 5.2X, approximately 8.2X, approximately 15.1X faster than a core on Intel Woodcrest, Dempsey, and Itanium2, respectively. We believe this dramatic performance improvement makes a hybrid cluster with Cell and traditional nodes competitive.

Author

Climate Models; Microprocessors; Computer Systems Performance

20080023346 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The NPOESS Preparatory Project Science Data Segment (SDS) Data Depository and Distribution Element (SD3E) System Architecture

Ho, Evelyn L.; Schweiss, Robert J.; [2008]; 4 pp.; In English; Institute of Electrical and Electronics Engineers (IEEE) Geoscience and Remote Sensing Symposium (IGARSS) 2008, 10 Jul. 2008, Boston, MA, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023346>

The National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP) Science Data Segment (SDS) will make daily data requests for approximately six terabytes of NPP science products for each of its six environmental assessment elements from the operational data providers. As a result, issues associated with duplicate data requests, data transfers of large volumes of diverse products, and data transfer failures raised concerns with respect to the network traffic and bandwidth consumption. The NPP SDS Data Depository and Distribution Element (SD3E) was developed to provide a mechanism for efficient data exchange, alleviate duplicate network traffic, and reduce operational costs.

Author

NOESS; Polar Orbits; Environmental Monitoring; Data Acquisition; Data Storage; Data Retrieval; Architecture (Computers); Computer Programs; Computer Networks

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.

20080022929 Army Research Development and Engineering Command, Warren, MI USA

Electrical Modeling and Simulation With Matlab/Simulink and Graphical User Interface Software

Ueda, Jason; Daniszewski, David; Monroe, John; Masrur, Abul; Charbeneau, Eric; Jochum, Eric; Patel, Rakesh; Jun 30, 2006; 4 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477756; TACOM/TARDEC-15987; TACOM-PO-06PSC-51; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477756>

This paper describes modeling and simulation technologies used to simulate the electrical systems of Army vehicles using Matlab/Simulink coupled with graphical user interface software. The models were built using Mathworks' Matlab/Simulink software in conjunction with the SimPowerSystems Toolbox, a toolkit provided by Mathworks that provides models of basic electrical components such as capacitors and inductors in addition to more advanced components such as diodes and IGBT's. The current results of this ongoing effort are presented and discussed.

DTIC

Computer Systems Programs; Graphical User Interface; Kits; Simulation

20080022933 NASA Langley Research Center, Hampton, VA, USA

Status of the AIAA Modeling and Simulation Format Standard

Jackson, E. Bruce; Hildreth, Bruce L.; June 04, 2008; 13 pp.; In English; Royal Aeronautical Society Spring 2008 Flight Simulation Conference, 4-5 Jun. 2008, London, UK; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.07.21.03; Copyright; Avail.: CASI: A03, Hardcopy

The current draft AIAA Standard for flight simulation models represents an on-going effort to improve the productivity of practitioners of the art of digital flight simulation (one of the original digital computer applications). This initial release provides the capability for the efficient representation and exchange of an aerodynamic model in full fidelity; the DAVE-ML format can be easily imported (with development of site-specific import tools) in an unambiguous way with automatic verification. An attractive feature of the standard is the ability to coexist with existing legacy software or tools. The draft Standard is currently limited in scope to static elements of dynamic flight simulations; however, these static elements represent the bulk of typical flight simulation mathematical models. It is already seeing application within U.S. and Australian government agencies in an effort to improve productivity and reduce model rehosting overhead. An existing tool allows import of DAVE-ML models into a popular simulation modeling and analysis tool, and other community-contributed tools and libraries can simplify the use of DAVE-ML compliant models at compile- or run-time of high-fidelity flight simulation.

Derived from text

Digital Simulation; Aerodynamic Characteristics; Mathematical Models; Digital Computers; Computer Techniques

20080023164 Naval Research Lab., Bay Saint Louis, MS USA

Validation Test Report for Delft3D

Hsu, Y L; Dykes, James D; Allard, Richard A; Wang, David W; Feb 29, 2008; 47 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478177; NRL/MR/7320--08-9079; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes the model setup, parameter selection and model validation of the Delft3D modeling system in nearshore applications. Delft3D, developed by Delft Hydraulics, is a complete coastal hydrodynamic modeling system, capable of simulating hydrodynamic processes due to waves, tides, river flow, and winds. Three high-fidelity observation data sets are used for validation tests. The first data set is from the Nearshore Sediment Transport Study (NSTS) data at Santa Barbara, CA (straight and steeper slope beach profile). The second data set uses data from the Duck 94 field experiment conducted at Duck, NC (barred beach profile). The third data set is from the SandyDuck97 field experiment. In general, Delft3D has been shown to be robust and accurate in predicting nearshore wave height and flows. A sample comparison between Delft3D and NSSM (Navy Standard Surf Model) is also included.

DTIC

Hydrodynamics; Sediment Transport

20080023206 Army Research Development and Engineering Command, Redstone Arsenal, AL USA

A Procedure for Analyzing the Software and Operational Impact of Software/Hardware Interface Anomalies

Loesh, Robert E; Fitzpatrick, Jr , Willie J; Wyskida, Richard M; Apr 2, 2003; 29 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477662; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477662>

Software Failure Modes, Effects, and Criticality Analysis Special Assessment Procedure (FMASAP:1-1) is one of the 16 Procedures that make up the SED Software Engineering Evaluation System (SEES). The purpose of FMASAP is to determine: 1) Potential system failures and criticality. 2) Root causes for critical hardware and interface failures. 3) Software resilience to hardware interface anomalies. 4) Operational impacts of software responses to hardware failures. When System Modes exist, perform the FMASAP procedures as a separate set of analyses (i.e., each System mode requires a unique set of RRLF and SFMECAF forms). This brief discusses use of FMASAP.

DTIC

Anomalies; Computer Programs; Computers; Program Verification (Computers)

20080023210 Army War Coll., Carlisle Barracks, PA USA

A View of Command, Control, Communications and Computer Architectures at the Dawn of Network Centric Warfare

Cogan, Kevin J; Mar 2007; 5 pp.; In English

Report No.(s): AD-A477697; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477697>

In March 2004, the U.S. Army War College (USAWC) in cooperation with the Office of the Secretary of Defense (OSD) Office of Force Transformation (OFT) initiated a study focusing on the U.S. Army V Corps and 3rd Infantry Division's major combat operations during Operation Iraqi Freedom (OIF). This study, entitled Network Centric Warfare Case Study: U.S. V Corps and 3rd Infantry Division (Mechanized) during Operation Iraqi Freedom Combat Operations (March-April 2003) is one of several case studies commissioned by OFT to determine the military's ability to conduct operations in accordance with network centric warfare (NCW) concepts. The March 2004 study culminated in the first of three volumes entitled Operations. In March 2006, the study was expanded to include both the communications architecture for OIF combat operations (Volume II) as well as NCW insights (Volume III). This issue paper focuses on Volume II, which analyzes command, control, communications, and computer architectures to ascertain the potential strategic and operational implications of net-centric operations from an acquisition perspective. Volume II critically analyzes the history of communications architecture acquisition before OIF and the inadequacy of current acquisition cycle times to keep pace with the rapid advances in technology. It provides the reader with three insights: (1) a historical view of advances in technology which ultimately enabled a computer communications network; (2) an encapsulation of the Army command, control, communications, and computer (C4) architecture for two specific time frames of Operation Iraqi Freedom (OIF) referred to as pre-OIF and OIF- 1; and (3) examines future communications programs that are underway for next generation C4 architectures with respect to the ability of the Department of Defense (DoD) acquisition process to keep pace with the rapid advances in technology.

DTIC

Architecture (Computers); Command and Control; Communication Networks; Interprocessor Communication; Warfare

20080023243 Rhode Island Univ., Kingston, RI USA

Real-Time CORBA

Fay-Wolfe, Victor; DiPippo, Lisa C; Cooper, Gregory; Johnston, Russell; Kortmann, Peter; Thuraisingham, Bhavani; Oct 2000; 34 pp.; In English

Contract(s)/Grant(s): N00014-96-1-0401

Report No.(s): AD-A478181; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper presents a survey of results in developing Real-Time CORBA, a standard for real-time management of distributed objects. The paper includes background on two areas that have been combined to realize Real-Time CORBA: the CORBA standards that have been produced by the international Object Management Group; and techniques for distributed real-time computing that have been produced in the research community. The survey describes major RT CORBA research efforts, commercial development efforts, and standardization efforts by the Object Management Group.

DTIC

Real Time Operation; Distributed Processing; Architecture (Computers)

20080023268 Army Tank-Automotive Command, Warren, MI USA

Processing the Output of TOSOM

Jackson, William; Hicks, Dan; Reed, Jack; Mar 2, 2007; 10 pp.; In English

Report No.(s): AD-A477632; TARDEC 15003; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477632>

The Threat Oriented Survivability Optimization Model (TOSOM) is a simple to use, first order model that permits the user to tradeoff various countermeasure technologies for the purpose of finding a countermeasure suite with enhanced survivability. The model postulates a threat environment, defines burdens (that is, constraints on any proposed solution), and also inputs various countermeasures that may improve the survivability in the given threat environment. The model then outputs various combinations of countermeasures, where each suite of countermeasures output by the model must satisfy the constraints placed upon any suite by the various burdens. Most importantly, associated with each suite of countermeasures is a level of survivability. The goal of this paper is to examine the various methods for processing the output from a TOSOM run. The approach taken in processing TOSOM output depends to a great extent upon the philosophical position one takes toward the role of the burdens input while designing a particular study. This paper will examine two plausible but different philosophical positions together with their associated methods for processing the TOSOM output data.

DTIC

Countermeasures; Threat Evaluation; Optimization

20080023276 Automotive Research Center, Ann Arbor, MI USA

A Comprehensive Simulation-Based Framework for Design of Army Ground Vehicles

Hulbert, G M; Ma, Z; Hahn, Y; Ryu, G; Apr 16, 2007; 40 pp.; In English; Original contains color illustrations

Report No.(s): AD-A478025; TARDEC-BC-17054; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Automotive Research Center briefing discusses new modeling software, Distributed Simulation & Design Platform (D-Sim), to aid in the engineering of variants of the Army's High Mobility Multipurpose Wheeled Vehicle (HMMWV) and Future Tactical Truck System (FTTS). This is a multi-domain simulation program.

DTIC

Simulation; Computerized Simulation; Mechanical Engineering

20080023293 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Visualizing the Heliosphere

Bridgman, William T.; Sirah, Greg W.; Mitchell, Horace G.; May 27, 2008; 1 pp.; In English; American Geophysical Union Conference, 27-30 May 2008, Fort Lauderdale, FL, USA

Contract(s)/Grant(s): NNG06HN01D; No Copyright; Avail.: Other Sources; Abstract Only

Today, scientific data and models can combine with modern animation tools to produce compelling visualizations to inform and educate. The Scientific Visualization Studio at Goddard Space Flight Center merges these techniques from the very different worlds of entertainment and science to enable scientists and the general public to 'see the unseeable' in new ways.

Author

Heliosphere; Scientific Visualization; Computerized Simulation; Computer Graphics

20080023295 NASA Goddard Space Flight Center, Greenbelt, MD, USA

'Towers in the Tempest' Computer Animation Submission

Sirah, Greg; August 11, 2008; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

The following describes a computer animation that has been submitted to the ACM/SIGGRAPH 2008 computer graphics conference: 'Towers in the Tempest' clearly communicates recent scientific research into how hurricanes intensify. This intensification can be caused by a phenomenon called a 'hot tower.' For the first time, research meteorologists have run complex atmospheric simulations at a very fine temporal resolution of 3 minutes. Combining this simulation data with satellite observations enables detailed study of 'hot towers.' The science of 'hot towers' is described using: satellite observation data, conceptual illustrations, and a volumetric atmospheric simulation data. The movie starts by showing a 'hot tower' observed by NASA's Tropical Rainfall Measuring Mission (TRMM) spacecraft's three dimensional precipitation radar data of

Hurricane Bonnie. Next, the dynamics of a hurricane and the formation of 'hot towers' are briefly explained using conceptual illustrations. Finally, volumetric cloud, wind, and vorticity data from a supercomputer simulation of Hurricane Bonnie are shown using volume techniques such as ray marching.

Author

Computer Animation; Hurricanes; Computerized Simulation; Cumulonimbus Clouds; Data Simulation

20080023572 Ljubljana Univ., Ljubljana, Slovenia

An Approach to Create Project-Specific Software Development Process

Zrnec, Aljaz; Vavpotic, Damjan; *Electrotechnical Review*, Volume 75, Nos. 1-2; January 2008, pp. 44-49; In English; See also [20080023568](#); Original contains black and white illustrations; Copyright; Avail.: Other Sources

In the paper we discuss an approach to software process adaptation to project specific needs. As the proposed approach is much simpler than any known approach suggested by the situational method engineering, it can be easily applied in practice as a special software tool used by method engineers. The ability of the software process to adapt to project-specific needs is one of the most important factors for assuring software development methodology suitability and acceptance by software engineers in particular organization. The idea of software development methodology adaptation is not new. Inability of traditional methodologies to adapt to particular situational needs or particular needs of the project, their rigidity and technical unsuitability has led to development of a special scientific field, called situational method engineering (SME). The field of SME is very complex, because it focuses mainly on theoretical aspects of methodology construction and adaptation, and uses rather complex mathematical formalisms for the method construction description and method fragments inquiry from method fragment repository. This is also the main reason why SME has never been widely acknowledged or practiced by software engineers. Also SME also doesn't deal with social suitability and acceptance of the methodology by its users. That has been another reason why the field hasn't been accepted by the engineers. The key to successful introduction of software development methodologies into organizations, their later use and acceptance, is the ability of its prescribed software process to be adaptable to project-specific needs. The methodology has to define a flexible software process, capable of adapting to specific situations in which new projects emerge. The aim of this paper is to combine theoretical knowledge from SME and practical knowledge from organizations for software development. On this basis we formally define a new approach for software development process adaptation to projects specific needs. The approach serves as a basis for definition of the decision model which supports software process adaptation.

Author

Software Engineering; Computer Programming; Adaptation; Project Management; Engineers

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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*.

20080022956 NASA Langley Research Center, Hampton, VA, USA

NASA NDE Applications for Mobile MEMS Devices and Sensors

Wilson, William C.; Atkinson, Gary M.; Barclay, R. O.; June 2008; 4 pp.; In English; Modeling and Simulation of Microsystems 2008, 1-8 Jun. 2008, Boston, MA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 645846.02.07.07

Report No.(s): Paper 1142; Copyright; Avail.: CASI: [A01](#), Hardcopy

NASA would like new devices and sensors for performing nondestructive evaluation (NDE) of aerospace vehicles. These devices must be small in size/volume, mass, and power consumption. The devices must be autonomous and mobile so they can access the internal structures of aircraft and spacecraft and adequately monitor the structural health of these craft. The platforms must be mobile in order to transport NDE sensors for evaluating structural integrity and determining whether further investigations will be required. Microelectromechanical systems (MEMS) technology is crucial to the development of the mobile platforms and sensor systems. This paper presents NASA's needs for micro mobile platforms and MEMS sensors that will enable NDE to be performed on aerospace vehicles.

Author

Aerospace Vehicles; Nondestructive Tests; Microelectromechanical Systems; Structural Failure; Sensors

20080023267 Army Tank-Automotive Research and Development Command, Warren, MI USA

Testing and Modeling Capabilities

Mason, James; Feb 2006; 6 pp.; In English; Original contains color illustrations

Report No.(s): AD-A477805; TARDEC-BC-15540; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477805>

This briefing looks at the modeling capabilities in the CAMEO-SIM for visual properties and MuSES for thermal properties. CAMEO-SIM predictive software creates physics based synthetic scenes. MuSES allows thermal analysis.

DTIC

Scene Generation; Models

20080023487 National Inst. of Information and Communications Technology, Japan

Implementation of a Neural Network for Retrieving Atmospheric Parameters from Remote Sensing

Baron, Philippe; Mendrok, Jana; Kasai, Yasuko; Journal of the National Institute of Information and Communications Technology, Volume 54, Nos. 1/2. Special Issue on Middle and Upper Atmosphere Observation Techniques; March/June 2007, pp. 165-178; In English; See also [20080023475](#); Original contains color and black and white illustrations; Copyright;

Avail.: Other Sources

A numerical model of a supervised feedforward Neural Network (NN) has been implemented. The purpose is to study the capabilities of a NN based retrieval algorithm to inverse the measurements performed by the future JEM/SMILES limb sounder. The model has been designed for research purpose with a special care given to its flexibility and extension facility, but keeping in mind that the computational performances must allow the use of a network with the size of those commonly used for satellite data inversion. The code is written in the Python language. The procedure to create and use a NN is presented and the algorithms of the training procedure are described in detail. The MultiLayer Perception (MLP) is trained using either the Levenberg-Marquardt or the steepest descent method to find the optimal value of the model parameters according to some examples of the inputs and outputs. The model also provides a set of functions to scale the data or to use their principal components. In order to prevent the MLP to overfit the training data, several solutions are available. A regularization term can be added to the cost function with the possibility to optimize the hyperparameters using a Bayesian method. Also, an early stopping procedure can be set using a cross-validation data set. The correctness of the algorithms implementation is demonstrated with simulations and the results are discussed.

Author

Neural Nets; Data Retrieval; Algorithms; Remote Sensing; Meteorological Parameters; Atmospheric Sounding; Radiometers

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NUMERICAL ANALYSIS

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

20080023176 Human Resources Research Organization, Alexandria, VA USA

Future-Oriented Experimental Army Enlisted Personnel Selection and Classification Project (Select21) Summary Report

Knapp, Deidre J; Tremble, Trueman R; Sellman, Teresa L Russell; ayne S; Feb 2008; 42 pp.; In English

Contract(s)/Grant(s): DASW01-03-D-0015-006; Proj-A792

Report No.(s): AD-A478167; TR-1224; No Copyright; Avail.: Defense Technical Information Center (DTIC)

New Predictors for Selecting and Assigning Future Force Soldiers (Select21) is concerned with Soldier accession and personnel classification. The Select21 goal was to ensure the Army acquires Soldiers with the knowledge, skills, and attributes (KSAs) needed for performing well and fitting well in a transformed Army. The objectives of the project were to (1) identify future job demands and the pre-enlistment KSAs required to meet them, (2) develop measures of job performance and critical KSAs, and (3) validate the experimental predictor measures using a concurrent criterion-related paradigm. The predictor set included measures of cognitive ability, temperament, psychomotor skills, values, expectations, and experience. Performance criteria included rating scales completed by supervisors and peers, technical knowledge tests, a situational judgment test, and indicators of person-environment fit (e.g., job satisfaction). Analyses indicated that scores from the Armed Services Vocational Aptitude Battery (ASVAB) predicted both current and future performance (as assessed by future-oriented rating scales) and that the experimental predictors provided incremental validity, particularly in regard to attitudinal criteria. The present report

summarizes the Select21 research at a high, relatively non-technical, level and discusses issues associated with further study and implementation of new measures.

DTIC

Classifications; Military Personnel; Personnel; Personnel Selection

20080023342 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Generalized Linear Covariance Analysis

Carpenter, J. Russell; Markley, F. Landis; June 29, 2008; 20 pp.; In English; F. Landis Markley Astrodynamics Symposium, 29 Jun. - 2 Jul. 2008, Cambridge, MD, USA; Original contains color illustrations

Report No.(s): AAS 08-273; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023342>

We review and extend in two directions the results of prior work on generalized covariance analysis methods. This prior work allowed for partitioning of the state space into ‘solve-for’ and ‘consider’ parameters, allowed for differences between the formal values and the true values of the measurement noise, process noise, and a priori solve-for and consider covariances, and explicitly partitioned the errors into subspaces containing only the influence of the measurement noise, process noise, and a priori solve-for and consider covariances. In this work, we explicitly add sensitivity analysis to this prior work, and relax an implicit assumption that the batch estimator’s anchor time occurs prior to the definitive span. We also apply the method to an integrated orbit and attitude problem, in which gyro and accelerometer errors, though not estimated, influence the orbit determination performance. We illustrate our results using two graphical presentations, which we call the ‘variance sandpile’ and the ‘sensitivity mosaic,’ and we compare the linear covariance results to confidence intervals associated with ensemble statistics from a Monte Carlo analysis.

Author

Covariance; Monte Carlo Method; Attitude (Inclination); Accelerometers; Orbit Determination; Gyroscopes

65

STATISTICS AND PROBABILITY

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

20080023470 NASA Marshall Space Flight Center, Huntsville, AL, USA; Universities Space Research Association, Huntsville, AL, USA

Projecting Future Urbanization with Prescott College’s Spatial Growth Model to Promote Environmental Sustainability and Smart Growth, A Case Study in Atlanta, Georgia

Estes, Maurice G., Jr.; Crosson, William; Limaye, Ashutosh; Johnson, Hoyt; Quattrochi, Dale; Lapenta, William; Khan, Maudood; April 23, 2006; 2 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

Planning is an integral element of good management and necessary to anticipate events not merely respond to them. Projecting the quantity and spatial distribution of urban growth is essential to effectively plan for the delivery of city services and to evaluate potential environmental impacts. The major drivers of growth in large urban areas are increasing population, employment opportunities, and quality of life attractors such as a favorable climate and recreation opportunities. The spatial distribution of urban growth is dictated by the amount and location of developable land, topography, energy and water resources, transportation network, climate change, and the existing land use configuration. The Atlanta region is growing very rapidly both in population and the consumption of forestland or low-density residential development. Air pollution and water availability are significant ongoing environmental issues. The Prescott Spatial Growth Model (SGM) was used to make growth projections for the metropolitan Atlanta region to 2010, 2020 and 2030 and results used for environmental assessment in both business as usual and smart growth scenarios. The Prescott SGM is a tool that uses an ESRI ArcView extension and can be applied at the parcel level or more coarse spatial scales and can accommodate a wide range of user inputs to develop any number of growth rules each of which can be weighted depending on growth assumptions. These projections were used in conjunction with meteorological and air quality models to evaluate future environmental impacts. This presentation will focus on the application of the SGM to the 13-County Atlanta Regional Commission planning jurisdiction as a case study. The SGM will be described, including how rule sets are developed and the decision process for allocation of future development to

available land use categories. Data inputs required to effectively run the model will be discussed. Spatial growth projections for ten, twenty, and thirty year planning horizons will be presented and results discussed, including regional climate and air quality impacts.

Author

Urban Development; Land Use; Regional Planning; Forecasting; Environment Models

66

SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

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

20080023015 Louisiana Tech Univ., Ruston, LA, USA

Real-Time Implementation of Intelligent Actuator Control with a Transducer Health Monitoring Capability

Jethwa, Dipan; Selmic, Rastko R.; Figueroa, Fernando; June 25, 2008; 7 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): 32-0967-58208

Report No.(s): SSTI-2200-0094; Copyright; Avail.: CASI: [A02](#), Hardcopy

This paper presents a concept of feedback control for smart actuators that are compatible with smart sensors, communication protocols, and a hierarchical Integrated System Health Management (ISHM) architecture developed by NASA's Stennis Space Center. Smart sensors and actuators typically provide functionalities such as automatic configuration, system condition awareness and self-diagnosis. Spacecraft and rocket test facilities are in the early stages of adopting these concepts. The paper presents a concept combining the IEEE 1451-based ISHM architecture with a transducer health monitoring capability to enhance the control process. A control system testbed for intelligent actuator control, with on-board ISHM capabilities, has been developed and implemented. Overviews of the IEEE 1451 standard, the smart actuator architecture, and control based on this architecture are presented.

Author

Actuators; Systems Integration; Feedback Control; Architecture (Computers); Transducers; Real Time Operation; Diagnosis; Communication Networks

20080023275 Naval Postgraduate School, Monterey, CA USA

Gap Analysis: Rethinking the Conceptual Foundations

Langford, Gary O; Franck, Raymond; Huynh, Tom; Lewis, Ira; Jan 30, 2008; 55 pp.; In English

Report No.(s): AD-A477978; NPS-GSBPP-08-008; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Gap Analysis is widely regarded as a useful tool to facilitate commercial and defense system acquisitions. This paper is a rethinking of the theoretical foundations and systematics of Gap Analysis with practical extensions to illustrate its utility and limitations. It also provides a new perspective on those theoretical foundations from the perspectives of systems and value engineering. The growing sophistication and complexity of new systems or system of systems have resulted in a dramatic increase in time and money to reach operational capability. Gap Analysis, properly defined and enacted, clarifies goals, appropriate investment and the end-use.

DTIC

Systems Analysis; Systems Engineering; System Effectiveness

20080023612 NASA, Washington, DC USA

Inductive monitoring system constructed from nominal system data and its use in real-time system monitoring

Iverson, David L., Inventor; June 3, 2008; 25 pp.; In English

Patent Info.: Filed February 24, 2004; US-Patent-7,383,238; US-Patent-Appl-SN-10/789,029; No Copyright; Avail.: CASI:

[A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023612>

The present invention relates to an Inductive Monitoring System (IMS), its software implementations, hardware embodiments and applications. Training data is received, typically nominal system data acquired from sensors in normally operating systems or from detailed system simulations. The training data is formed into vectors that are used to generate a knowledge database having clusters of nominal operating regions therein. IMS monitors a system's performance or health by comparing cluster parameters in the knowledge database with incoming sensor data from a monitored-system formed into vectors. Nominal performance is concluded when a monitored-system vector is determined to lie within a nominal operating

region cluster or lies sufficiently close to a such a cluster as determined by a threshold value and a distance metric. Some embodiments of IMS include cluster indexing and retrieval methods that increase the execution speed of IMS.

Official Gazette of the U.S. Patent and Trademark Office

Systems Health Monitoring; Data Systems

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*.

20080022280 California Univ., Berkeley, CA, USA; Lawrence Livermore National Lab., Livermore, CA USA

Compact Catadioptric Imaging Spectrometer Utilizing Reflective Grating

Lerner, S. A., Inventor; 6 Oct 03; 11 pp.; In English

Patent Info.: Filed 6 Oct 03; US-Patent-Appl-SN-10-680-788

Report No.(s): PB2007-109194; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An imaging spectrometer apparatus comprising an entrance slit for directing light, a light means for receiving the light and directing the light, a grating that receives the light from the light means and diffracts the light back onto the light means which focuses the light, and a detector that receives the focused light. In one embodiment the light means is a rotationally symmetric ZNSE aspheric lens. In another embodiment the light means comprises two ZNSE aspheric lenses that are coaxial. In another embodiment the light means comprises an aspheric mirror and a ZNSE aspheric lens.

NTIS

Imaging Spectrometers; Patent Applications; Reflectance

20080022282 Lumen Intellectual Property Services, Inc., Palo Alto, CA, USA

Magnetic Sensor Array Having an Analog Frequency-Division Multiplexed Output

Wang, S. X., Inventor; Han, S. J., Inventor; 11 May 05; 12 pp.; In English

Contract(s)/Grant(s): DARPA-N00014-02-1-0807

Patent Info.: Filed 11 May 05; US-Patent-Appl-SN-11-128-105

Report No.(s): PB2007-109190; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A magnetic sensor array including magnetoresistive sensor elements having outputs combined by frequency division multiplexing (FDM) is provided. Each sensor element provides an input to a mixer which provides a distinct frequency shift. Preferably, time division multiplexing is also used to combine sensor element outputs. Each sensor element is typically in proximity to a corresponding sample. The sensor elements are preferably subarrays having row and column addressable sensor element pixels. This arrangement provides multiple sensor pixels for each sample under test. Multiplexing of sensor element outputs advantageously reduces readout time. A modulated external magnetic field is preferably applied during operation, to reduce the effect of 1/f noise on the sensor element signals. The effect of electromagnetic interference (EMI) induced by the magnetic field on sensor element signals is advantageously reduced by the mixing required for FDM.

NTIS

Frequencies; Frequency Division Multiplexing; Magnetoresistivity; Patent Applications; Time Division Multiplexing

20080022285 Kushman (Brooks), P.C., Southfield, MI, USA

High-Efficiency Neutron Detectors and Methods of Making Same

McGregor, D. S., Inventor; Klann, R., Inventor; 29 Oct 03; 23 pp.; In English

Contract(s)/Grant(s): DE-W-31-109-ENG-38

Patent Info.: Filed 29 Oct 03; US-Patent-Appl-SN-10-695-019

Report No.(s): PB2007-109186; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Neutron detectors, advanced detector process techniques and advanced compound film designs have greatly increased neutron-detection efficiency. One embodiment of the detectors utilizes a semiconductor wafer with a matrix of spaced cavities filled with one or more types of neutron reactive material such as ¹⁰B or ⁶LiF. The cavities are etched into both the front and back surfaces of the device such that the cavities from one side surround the cavities from the other side. The cavities may be etched via holes or etched slots or trenches. In another embodiment, the cavities are different-sized and the smaller cavities extend into the wafer from the lower surfaces of the larger cavities. In a third embodiment, multiple layers of different

neutron-responsive material are formed on one or more sides of the wafer. The new devices operate at room temperature, are compact, rugged, and reliable in design.

NTIS

Neutron Counters; Patent Applications; Detection

20080022287 Army Aviation and Missile Command, Redstone Arsenal, AL, USA

Polarized Semi-Active Laser Last Pulse Logic Seeker using a Staring Focal Plane Array

English, J. E., Inventor; Pittman, W. C., Inventor; 24 May 04; 8 pp.; In English

Patent Info.: Filed 24 May 04; US-Patent-Appl-SN-10-853-748

Report No.(s): PB2007-109184; No Copyright; Avail.: CASI: [A02](#), Hardcopy

An improvement in a semi-active laser last pulse logic missile seeker is disclosed and claimed. In one embodiment, the improvement includes a first polarizer disposed in the detection field of view of the PIN photodiode detector and a second polarizer disposed in the detection field of view of the staring imaging infrared focal plane array. Each of the first and second polarizers has an identically configured plurality of segments. Each segment allows transmission of a different polarization than other segments and is sized to completely cover the fields of view of both the PIN photodiode detector and the staring imaging infrared focal plane array. First and second actuators are connected to the first and second polarizers, respectively, to synchronously and simultaneously step identical and corresponding segments in a plurality of discrete steps within the fields of view in response to incoming temporal and spatial laser returns.

NTIS

Focal Plane Devices; Homing Devices; Laser Applications; Patent Applications; Pulsed Lasers

20080022289 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA

Combined Panofsky Quadrupole and Corrector Dipole

Biallas, G. H.; Belcher, N.; Douglas, D.; Hiatt, T.; Jordan, K.; January 2007; 3 pp.; In English

Contract(s)/Grant(s): DE-AC05-06OR23177

Report No.(s): DE2007-909321; No Copyright; Avail.: National Technical Information Service (NTIS)

Two styles of Panofsky Quadrupoles with integral corrector dipole windings are in use in the electron beam line of the Free Electron Laser at Jefferson Lab. We combined steering and focusing functions into single magnets, adding hundreds of Gauss-cm dipole corrector capability to existing quadrupoles because space is at a premium along the beam line. Superposing a one part in 100 dipole corrector field on a 1 part in 1000, weak (600 to 1000 Gauss) quadrupole is possible because the parallel slab iron yoke of the Panofsky Quadrupole acts as a window frame style dipole yoke. The dipole field is formed when two electrically floating current sources, designed and made at JLab, add and subtract current from the two opposite quadrupole current sheet windings parallel to the dipole field direction. The current sources also drive auxiliary coils at the yoke's inner corners that improve the dipole field. Magnet measurements yielded the control system field maps that characterize the two types of fields. Field analysis using TOSCA, construction and wiring details, magnet measurements and reference for the current source are presented.

NTIS

Quadrupoles; Electron Beams

20080022290 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA

Performance of the First Refurbished CEBAF Cryomodule

Drury, M.; Daly, E. F.; Davis, G. K.; Fischer, J.; Grenoble, C.; January 2007; 3 pp.; In English

Contract(s)/Grant(s): DE-AC05-06OR23177

Report No.(s): DE2007-909320; No Copyright; Avail.: National Technical Information Service (NTIS)

The Thomas Jefferson National Accelerator Facility has begun a cryomodule refurbishment project. The goal of this project is robust 6 GeV, 5 pass operation of the Continuous Electron Beam Accelerator Facility (CEBAF). The scope of the project includes removing, refurbishing and replacing 10 CEBAF cryomodules at a rate of three per year. Refurbishment includes reprocessing of SRF cavities to eliminate field emission and increase the nominal gradient from the original 5 MV/m to 12.5 MV/m. New dogleg couplers between the cavity and helium vessel flanges will intercept secondary electrons that produce arcing on the 2 K ceramic window in the Fundamental Power Coupler (FPC). Modification of the Qext of the FPC will allow higher gradient operations. Other changes include new ceramic RF windows for the air to vacuum interface of the FPC and improvements to the mechanical tuners. Any damaged or worn components will be replaced as well. Currently, the

first of the refurbished cryomodules has been installed and tested both in the Cryomodule Test Facility and in place in the North Linac of CEBAF. This paper will summarize the results of these tests.

NTIS

Cryogenics; Linear Accelerators; Cavities; Modules

20080022291 Thomas Jefferson National Accelerator Facility, Newport News, VA, USA

Simulations and Measurements of a Heavily Hom-Damped Multi-Cell SRF Cavity

Wang, H.; Rimmer, R.; Marhauser, F.; January 2007; 3 pp.; In English

Contract(s)/Grant(s): DE-AC05-06OR23177

Report No.(s): DE2007-909319; No Copyright; Avail.: National Technical Information Service (NTIS)

After an initial cavity shape optimization and cryomodule development for an Ampere-class FEL ERL, we have simulated a complete 5-cell high-current (HC) cavity structure with six waveguide (WG) couplers for Higher Order Mode (HOM) damping and fundamental power coupling. The time-domain wakefield simulations of the MAFIA codes have been used to calculate the cavities broadband HOM impedance spectrum. Microwave Studio (MWS) has also been used to evaluate the external Q of the fundamental power coupler (FPC) and the R/Qs of the HOMs. A half scale 1497MHz singlecell model cavity and a 5-cell copper cavity including dummy HOM WG loads were fabricated to bench measure and confirm the design performance. Details of the multi-beam wakefield simulations, the HOM damping measurements and multi-peak data fitting analysis techniques are presented.

NTIS

Cavities; Damping; Simulation; Superconducting Cavity Resonators

20080022293 Stanford Linear Accelerator Center, Menlo Park, CA, USA

Measurement of the Total Hadronic Cross-Section Below the Upsilon(4S) Resonance at BaBar Using Initial-State Radiation

Berger, N. J. P.; Jun. 2007; 421 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-909316; SLAC-R-874; No Copyright; Avail.: Department of Energy Information Bridge

No abstract available

Hadrons; Cross Sections; Radiation Measurement

20080022294 Stanford Linear Accelerator Center, Menlo Park, CA, USA

Emittance Preservation in the International Linear Collider Ring to Main Linac Transfer Line

Tenenbaum, P.; Latina, A.; Smith, J. C.; Kubo, K.; Jun. 2007; 3 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-909306; SLAC-PUB-12585; No Copyright; Avail.: National Technical Information Service (NTIS)

The very small vertical beam emittance in the International Linear Collider (ILC) can be degraded by dispersion, xy coupling, transverse wakefields, and time-varying transverse fields introduced by elements with misalignments, strength errors, xy rotation errors, or yz rotation errors in the Ring to Main Linac (RTML) transfer line. We present a plan for emittance preservation in this beamline which uses local, quasi-local, and global correction schemes. Results of simulations of the emittance preservation algorithm are also presented and discussed.

NTIS

Emittance; Linear Accelerators; Preserving

20080022295; Stanford Linear Accelerator Center, Menlo Park, CA, USA

Investigations of the Wideband Spectrum of Higher Order Modes Measured on TESLA-style Cavities at the FLASH Linac

Molloy, S.; Adolphsen, C.; Frisch, J.; Bane, K.; Li, Z.; Jun. 2007; 3 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-909305; SLAC-PUB-12595; No Copyright; Avail.: National Technical Information Service (NTIS)

Higher Order Modes (HOMs) excited by the passage of the beam through an accelerating cavity depend on the properties of both the cavity and the beam. It is possible, therefore, to draw conclusions on the inner geometry of the cavities based on observations of the properties of the HOM spectrum. A data acquisition system based on two 20 GS/s, 6 GHz scopes has been set up at the FLASH facility, DESY, in order to measure a significant fraction of the HOM spectrum predicted to be generated

by the TESLA cavities used for the acceleration of its beam. The HOMs from a particular cavity at FLASH were measured under a range of known beam conditions. The dipole modes have been identified in the data. 3D simulations of different manufacturing errors have been made, and it has been shown that these simulations can predict the measured modes.

NTIS

Broadband; Cavities; Linear Accelerators; Superconducting Cavity Resonators

20080022296 Stanford Linear Accelerator Center, Menlo Park, CA, USA; Lawrence Livermore National Lab., Livermore, CA USA

Picosecond Bunch Length and Energy-z Correlation Measurements at SLAC's A-Line and End Station A

Molloy, S.; Emma, P.; Frisch, J.; Iverson, R.; Ross, M.; Jun. 2007; 3 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-909304; SLAC-PUB-12598; No Copyright; Avail.: National Technical Information Service (NTIS)

We report on measurements of picosecond bunch lengths and the energy-z correlation of the bunch with a high energy electron test beam to the A-line and End Station A (ESA) facilities at SLAC. The bunch length and the energy-z correlation of the bunch are measured at the end of the linac using a synchrotron light monitor diagnostic at a high dispersion point in the A-line and a transverse RF deflecting cavity at the end of the linac. Measurements of the bunch length in ESA were made using high frequency diodes (up to 100 GHz) and pyroelectric detectors at a ceramic gap in the beamline. Modelling of the beams longitudinal phase space through the linac and A-line to ESA is done using the 2-dimensional tracking program LiTrack, and LiTrack simulation results are compared with data. High frequency diode and pyroelectric detectors are planned to be used as part of a bunch length feedback system for the LCLS FEL at SLAC. The LCLS also plans precise bunch length and energy-z correlation measurements using transverse RF deflecting cavities.

NTIS

Bunching; Correlation

20080022297 Stanford Linear Accelerator Center, Menlo Park, CA, USA

Measurements of the CKM Angle ϕ_3/γ

Tisserand, V.; Jun. 2007; 11 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-909303; SLAC-PUB-12599; No Copyright; Avail.: National Technical Information Service (NTIS)

We present the results of the measurements performed by the BABAR and Belle collaborations, to determine the value of the Cabibbo-Kobayashi-Maskawa (CKM) CP violating phase (γ) ($\arg(-V_{ub}V_{cb}^*/V_{ub}V_{cb}^*)$).

NTIS

Joints (Junctions); Particle Decay

20080022299 Stanford Linear Accelerator Center, Menlo Park, CA, USA

Correlation of Beam Parameters to Decelerating Gradient in the E-167 Plasma Wakefield Acceleration Experiment

Blumenfeld, I.; Berry, M.; Decker, F. J.; Hogan, M. J.; Jun. 2007; 3 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-909302; SLAC-PUB-12600; No Copyright; Avail.: National Technical Information Service (NTIS)

Recent experiments at SLAC have shown that high gradient acceleration of electrons is achievable in meter scale plasmas. Results from these experiments show that the wakefield is sensitive to parameters in the electron beam which drives it. In the experiment the bunch length and beam waist location were varied systematically at constant charge. Here we investigate the correlation of peak beam current to the decelerating gradient. Limits on the transformer ratio will also be discussed. The results are compared to simulation.

NTIS

Deceleration; Gradients; Plasma Acceleration; Plasma Waves

20080022300 Stanford Linear Accelerator Center, Menlo Park, CA, USA

Comparative Study of Various Algorithms for the Merging of Parton Showers and Matrix Elements in Hadronic Collisions

Alwall, J.; Hoche, S.; Krauss, F.; Lavesson, N.; Jun. 2007; 45 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-909301; SLAC-PUB-12604; No Copyright; Avail.: National Technical Information Service (NTIS)

We compare different procedures for combining fixed-order tree-level matrix-element generators with parton showers.

We use the case of W-production at the Tevatron and the LHC to compare different implementations of the so-called CKKW and MLM schemes using different matrix-element generators and different parton cascades. We find that although similar results are obtained in all cases, there are important differences.

NTIS

Collisions; Hadrons; Partons

20080022301 Stanford Linear Accelerator Center, Menlo Park, CA, USA

Availability and Reliability Issues for ILC

Himel, T.; Nelson, J.; Phinney, N.; Ross, M.; Jun. 2007; 4 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-909300; SLAC-PUB-12606; No Copyright; Avail.: National Technical Information Service (NTIS)

The International Linear Collider (ILC) will be the largest most complicated accelerator ever built. For this reason extensive work is being done early in the design phase to ensure that it will be reliable enough. This includes gathering failure mode data from existing accelerators and simulating the failures and repair times of the ILC. This simulation has been written in a general fashion using MATLAB and could be used for other accelerators. Results from the simulation tool have been used in making some of the major ILC design decisions and an unavailability budget has been developed.

NTIS

Reliability; Accelerators; Design Analysis

20080022302 Stanford Linear Accelerator Center, Menlo Park, CA, USA

Disruption of Particle Detector Electronics by Beam Generated EMI

Bower, G.; Sugimoto, Y.; Sinev, N.; Arnold, R.; Jun. 2007; 3 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-909299; SLAC-PUB-12613; No Copyright; Avail.: National Technical Information Service (NTIS)

The possibility that radio frequency beam generated electromagnetic interference (EMI) could disrupt the operation of particle detector electronics has been of some concern since the inception of short pulse electron colliders more than 30 years ago. Some instances have been reported where this may have occurred but convincing evidence has not been available. This possibility is of concern for the International Linear Collider (ILC). We have conducted test beam studies demonstrating that electronics disruption does occur using the vertex detector electronics (VXD) from the SLD detector which took data at the SLC at SLAC. We present the results of those tests, and we describe the need for EMI standards for beam and detector instrumentation in the IR region at the ILC.

NTIS

Particle Beams; Radiation Counters

20080022303 Stanford Linear Accelerator Center, Menlo Park, CA, USA

Emittance Growth from Multiple Coulomb Scattering in a Plasma Wakefield Accelerator

Kirby, N.; Berry, M.; Blumenfeld, I.; Hogan, M. J.; Ischebeck, R.; Jun. 2007; 3 pp.; In English

Contract(s)/Grant(s): DE-AC02-76SF00515

Report No.(s): DE2007-909298; SLAC-PUB-12617; No Copyright; Avail.: National Technical Information Service (NTIS)

Emittance growth is an important issue for plasma wakefield accelerators (PWFAs). Multiple Coulomb scattering (MCS) is one factor that contributes to this growth. Here, the MCS emittance growth of an electron beam traveling through a PWFA in the blow out regime is calculated. The calculation uses well established formulas for angular scatter in a neutral vapor and then extends the range of Coulomb interaction to include the effects of traveling through an ion column. Emittance growth is negligible for low Z materials; however, becomes important for high Z materials.

NTIS

Coulomb Collisions; Emittance; Plasma Accelerators; Plasma Waves

20080022320 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA

Lifetime Measurements of High Polarization Strained-Superlattice Gallium Arsenide at Beam Current less than 1 Milliamp Using a New 100KV Load Lock Photogun

Grames, J.; Adderley, P.; Brittan, J.; Clark, J.; Hansknecht, J.; January 2007; 3 pp.; In English

Contract(s)/Grant(s): DE-AC05-06OR23177

Report No.(s): DE2007-909345; No Copyright; Avail.: National Technical Information Service (NTIS)

A new GaAs DC high voltage load lock photogun has been constructed at Jefferson Laboratory (JLab), with improved

vacuum and photocathode preparation capabilities. As reported previously, this gun was used to study photocathode lifetime with bulk GaAs at DC beam currents between 1 and 10 mA. In this submission, lifetime measurements were performed using high polarization strained-superlattice GaAs photocathode material at beam currents up to 1 mA, with near bandgap light from a fiber based drive laser having picosecond optical pulses and RF time structure.

NTIS

Beam Currents; Gallium Arsenides; Loads (Forces); Superlattices

20080022442 NASA Langley Research Center, Hampton, VA, USA

Nonstandard Analysis and Jump Conditions for Converging Shock Waves

Baty, Roy S.; Farassat, Fereidoun; Tucker, Don H.; January 2008; 50 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 568158.02.08.07.18.02; Copyright; Avail.: CASI: [A03](#), Hardcopy

Nonstandard analysis is an area of modern mathematics which studies abstract number systems containing both infinitesimal and infinite numbers. This article applies nonstandard analysis to derive jump conditions for one-dimensional, converging shock waves in a compressible, inviscid, perfect gas. It is assumed that the shock thickness occurs on an infinitesimal interval and the jump functions in the thermodynamic and fluid dynamic parameters occur smoothly across this interval. Predistributions of the Heaviside function and the Dirac delta measure are introduced to model the flow parameters across a shock wave. The equations of motion expressed in nonconservative form are then applied to derive unambiguous relationships between the jump functions for the flow parameters.

Author

Thermodynamic Properties; Shock Waves; Inviscid Flow; Flow Characteristics; Equations of Motion; Ideal Gas

20080022930 Army Research Development and Engineering Command, Warren, MI USA

Crack Detection in Armor Plates Using Ultrasonic Techniques (PREPRINT)

Meitzler, Thomas J; Smith, Gregory; Charbeneau, Michelle; Sohn, Euijung; Bienkowski, Mary; Wong, Ivan; Meitzler, Allen H; Mar 1, 2007; 7 pp.; In English

Report No.(s): AD-A477861; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477861>

A method of using piezoelectric lead zirconate titanate (PZT) transducers to characterize the vibrational modes of Vehicle Body Armor Support System (VBASS) plates and its preliminary results are presented. The amplitude of the vibrational modes of undamaged plates are compared to the vibrational mode amplitudes of damaged plates and shown to be clearly different. Plates for testing are damaged either by a blunt impact to the ceramic plate surface or cracked using a machine shop press. Data from these tests will be used to design prototype hand-held devices for the nondestructive testing (NDT) of plate structural in the field. VBASS plates are used as proof-of-principle samples in the absence of vest body armor samples.

DTIC

Armor; Crack Propagation; Cracks; Detection; Ultrasonic Tests

20080023056 Fermi National Accelerator Lab., Batavia, IL, USA

Test Stand System for the PHENIX iFVTX Silicon Detector

Rivera, R. A.; Turqueti, M. A.; January 2007; 5 pp.; In English

Report No.(s): DE2007-908361; FERMILAB-CON-07-098-CD; No Copyright; Avail.: Department of Energy Information Bridge

PHENIX is the largest of the four experiments currently taking data at the Relativistic Heavy Ion Collider (RHIC), and the iFVTX is a new pixel tracker which will be installed in the forward tracker region of PHENIX. Fermilab has developed a complete test stand system for the examination of FPix2.1 modules, hybrids, and pixel chips that will be installed in the iFVTX. The system is currently in use for chip, module, and wafer testing at Fermilab. The test stand architecture is flexible and can be adapted to new requirements. In this paper, the software and hardware integration will be discussed followed by an analysis of the advantages of choosing a modular approach for the system. Finally, a selection of tests supported by the system, along with sample results, will be presented and explained.

NTIS

Chips (Electronics); Data Acquisition; Pixels; Silicon; Test Stands; Chips

20080023057 Fermi National Accelerator Lab., Batavia, IL, USA; Arizona Univ., Tucson, AZ, USA
Measurement of the Top-Antitop Production Cross Section in the Dimuon Final State with the D0 Detector for Proton-Antiproton Collisions at $\sqrt{s}=1.96$ TeV

Burke, S. E.; Dec. 01, 2006; 184 pp.; In English

Report No.(s): DE2007-908358; FERMILAB-THESIS-2006-52; No Copyright; Avail.: National Technical Information Service (NTIS)

This dissertation presents a measurement of the top quark pair production cross section in the dimuon decay channel. The measurement was performed at the Fermi National Accelerator Laboratory in Batavia, Illinois where top quarks were first discovered in 1995. Heavy particles, such as top quarks, can be produced in a laboratory setting by colliding lighter particles at very high energies. At Fermilab's Tevatron accelerator, these lighter particles are protons and antiprotons (particles with the same mass as protons, but with opposite charges). The protons and antiprotons are accelerated to nearly the speed of light, giving them a combined energy at collision on the order of 10(sup 12) eV. To date, the Fermilab Tevatron is the world's only accelerator operating at a high enough energy to produce top quarks.

NTIS

Particle Collisions; Proton-Antiproton Interactions

20080023236 Georgia Tech Research Inst., Atlanta, GA, USA
Development and Test of a GEM-Based TEPC System for In-Phantom Dose Measurements (Final Report for August 9, 2004-January 31, 2007)

Wang, C. K.; Mar. 13, 2007; 111 pp.; In English

Contract(s)/Grant(s): DE-FG07-041ID14614

Report No.(s): DE2007-902535; No Copyright; Avail.: National Technical Information Service (NTIS)

The objectives of this project include: (1) to construct a miniature tissue equivalent proportional counter (TEPC) using a gas-electron-multiplier (GEM) foil, and (2) to conduct neutron and gamma-ray dose measurements with the detector embedded in a phantom.

NTIS

Dosage; Dosimeters; Gamma Rays; Neutrons

20080023239 Pisa Univ., Italy
Thermo-magnetic Instabilities in Nb(sub3)Sn Superconducting Accelerator Magnets

Fineschi, F.; Montagnini, B.; Feher, S.; January 2007; 205 pp.; In English

Report No.(s): DE2007-900365; No Copyright; Avail.: National Technical Information Service (NTIS)

This thesis work focused on superconducting accelerator magnet and superconductor instability studies. The work was performed in the Technical Division of Fermi National Accelerator Laboratory within the High Field Magnet program (HFM). Several Nb3Sn high field dipoles and several different Nb3Sn strands were tested and analyzed.

NTIS

Stability; Superconducting Magnets; Accelerators; Thermomagnetic Effects

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*.

20080022677 NASA Langley Research Center, Hampton, VA, USA

Realism Assessment of Sonic Boom Simulators

Sullivan, Brenda M.; Davies, Patricia; Hodgdon, Kathleen K.; Salamone, Joseph A., III; Pilon, Anthony; January 2008; 17 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

Developments in small supersonic aircraft design are predicted to result in low-intensity sonic booms. Booms generated by current aircraft are similar to those that led to the ban on commercial supersonic flight over the US, so are unsuitable for parametric studies of psychoacoustic response to low-intensity booms. Therefore, simulators have been used to study the impact of predicted low-intensity sonic booms. However, simulators have been criticized because, when simulating conventional-level booms, the sounds were observed to be unrealistic by people experienced in listening to sonic booms. Thus, two studies were conducted to measure the perceived realism of three sonic boom simulators. Experienced listeners rated the

realism of conventional sonic boom signatures when played in these simulators. The effects on perceived realism of factors such as duration of post-boom noise, exclusion of very low frequency components, inclusion of ground reflections, and type of simulator were examined. Duration of post-boom noise was found to have a strong effect on perceived realism, while type of simulator had a weak effect. It was determined that post-boom noise had to be at least 1.5 seconds long for the sound to be rated very realistic. Loudness level did not affect realism for the range of sounds played in the tests (80-93 dB ASEL).

Author

Supersonic Flight; Sonic Booms; Simulators; Loudness

20080023303 NASA Glenn Research Center, Cleveland, OH, USA

Spectral Separation of the Turbofan Engine Coherent Combustion Noise Component

Miles, Jeffrey Hilton; May 2008; 54 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 561581.02.08.03.18.03

Report No.(s): NASA/TM-2008-215157; AIAA-2008-50; E-16398; No Copyright; Avail.: CASI: [A04](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023303>

The core noise components of a dual spool turbofan engine (Honeywell TECH977) were separated by the use of a coherence function. A source location technique based on adjusting the time delay between the combustor pressure sensor signal and the far-field microphone signal to maximize the coherence and remove as much variation of the phase angle with frequency as possible was used. While adjusting the time delay to maximize the coherence and minimize the cross spectrum phase angle variation with frequency, the discovery was made that for the 130 microphone a 90.027 ms time shift worked best for the frequency band from 0 to 200 Hz while a 86.975 ms time shift worked best for the frequency band from 200 to 400 Hz. Since the 0 to 200 Hz band signal took more time to travel the same distance, it is slower than the 200 to 400 Hz band signal. This suggests the 0 to 200 Hz coherent cross spectral density band is partly due to indirect combustion noise attributed to hot spots interacting with the turbine. The signal in the 200 to 400 Hz frequency band is attributed mostly to direct combustion noise.

Author

Turbofan Engines; Engine Noise; Acoustic Measurement; Relativistic Effects; Pressure Sensors; Time Lag

20080023403 Honeywell Aerospace, Phoenix, AZ, USA

Engine Validation of Noise and Emission Reduction Technology Phase I

Weir, Don, Editor; May 2008; 759 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS3-01136; WBS 561581.02.08.03.18.02

Report No.(s): NASA/CR-2008-215225; Honeywell Report No. 21-13843A; E-16521; No Copyright; Avail.: CASI: [A99](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023403>

This final report has been prepared by Honeywell Aerospace, Phoenix, Arizona, a unit of Honeywell International, Inc., documenting work performed during the period December 2004 through August 2007 for the NASA Glenn Research Center, Cleveland, Ohio, under the Revolutionary Aero-Space Engine Research (RASER) Program, Contract No. NAS3-01136, Task Order 8, Engine Validation of Noise and Emission Reduction Technology Phase I. The NASA Task Manager was Dr. Joe Grady of the NASA Glenn Research Center. The NASA Contract Officer was Mr. Albert Spence of the NASA Glenn Research Center. This report is for a test program in which NASA funded engine validations of integrated technologies that reduce aircraft engine noise. These technologies address the reduction of engine fan and jet noise, and noise associated with propulsion/airframe integration. The results of these tests will be used by NASA to identify the engineering tradeoffs associated with the technologies that are needed to enable advanced engine systems to meet stringent goals for the reduction of noise. The objectives of this program are to (1) conduct system engineering and integration efforts to define the engine test-bed configuration; (2) develop selected noise reduction technologies to a technical maturity sufficient to enable engine testing and validation of those technologies in the FY06-07 time frame; (3) conduct engine tests designed to gain insight into the sources, mechanisms and characteristics of noise in the engines; and (4) establish baseline engine noise measurements for subsequent use in the evaluation of noise reduction.

Author

Aerodynamic Noise; Engine Noise; Engine Tests; Systems Integration; Jet Aircraft Noise

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*.

20080022276 California Inst. of Tech., Pasadena, CA USA

Method and System for Ultrafast Photoelectron Microscope

Zewail, A., Inventor; Lobastov, V., Inventor; 1 Apr 05; 50 pp.; In English

Contract(s)/Grant(s): NSF-CHE-0117850

Patent Info.: Filed Filed 1 Apr 05; US-Patent-Appl-SN-11-097-837

Report No.(s): PB2007-109093; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An ultrafast system (and methods) for characterizing one or more samples. The system includes a stage assembly, which has a sample to be characterized. The system has a laser source that is capable of emitting an optical pulse of less than 1 ps in duration. The system has a cathode coupled to the laser source. In a specific embodiment, the cathode is capable of emitting an electron pulse less than 1 ps in duration. The system has an electron lens assembly adapted to focus the electron pulse onto the sample disposed on the stage. The system has a detector adapted to capture one or more electrons passing through the sample. The one or more electrons passing through the sample is representative of the structure of the sample. The detector provides a signal (e.g., data signal) associated with the one or more electrons passing through the sample that represents the structure of the sample. The system has a processor coupled to the detector. The processor is adapted to process the data signal associated with the one or more electrons passing through the sample to output information associated with the structure of the sample. The system has an output device coupled to the processor. The output device is adapted to output the information associated with the structure of the sample.

NTIS

Electron Microscopes; Imaging Techniques; Patent Applications; Photoelectrons

20080022281 Peabody (Nixon), LLP, Rochester, NY, USA

Nonlinear Optical Detection of Fast Cellular Electrical Activity

Dombeck, D. A., Inventor; Webb, W. W., Inventor; Blanchard-Desce, M., Inventor; Mongin, O., Inventor; Mallegol, T., Inventor; 27 Jan 05; 28 pp.; In English

Contract(s)/Grant(s): NIH-GM 08367; NIH-GM 07509

Patent Info.: Filed Filed 27 Jan 05; US-Patent-Appl-SN-11-044-889

Report No.(s): PB2007-109193; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The present invention is directed to various methods involving nonlinear microscopy and dyes that are sensitive to fast cellular membrane potential signals and capable of generating nonlinear optical signals. The present invention includes methods of producing high spatiotemporal resolution images of electrical activity in cellular tissue, as well as methods of detecting and investigating disease within a particular cellular tissue of a living organism. The present invention further relates to methods of detecting membrane potential signal changes in a neuron or a part of a neuron, as well as in a population of cells.

NTIS

Cytology; Detection; Optical Measurement; Patent Applications

20080022318 Swedish Defence Research Establishment, Linköping, Sweden

Registration Approaches for Noisy 3D Representing Natural Scenes (Registration Approaches for Noisy 3D Data Representing Natural Scenes)

Wiklund, A.; Apr. 2006; 62 pp.; In English

Report No.(s): PB2007-106505; FOI-R-1994-SE; No Copyright; Avail.: National Technical Information Service (NTIS)

Registration of 3D data, in order to obtain 3D models, has been an area where much research has been done. Several different approaches and algorithms have been proposed during the years but the Iterative Closest Point algorithm is still, even though it has been almost 15 years since it was presented, one of the most popular approaches for solving registration problems. Most of the applications of the ICP algorithm have assumed static scenes as statues, toys, buildings and cultural heritage. An interesting scenario, that not has been as frequently treated, is how the ICP algorithm deals with non-static scenes containing mostly forest and vegetation where some parts in the scene might move, due to wind, between different views. The main purpose with this thesis is to evaluate how the ICP algorithm deals with data representing noisy natural scenes. Some

extensions of the ICP algorithm are implemented as well as a key point extraction approach. The keypoint extraction aims to find static points, which are reliable for registration, in the non-static scenes. A brief discussion about change detection, and whether the ICP algorithm can be used for change detection purposes, will also be held.

NTIS

Lasers; Three Dimensional Models

20080022321 Plevy, Howard, and Dracy, P.C., Fort Washington, PA, USA

Low Optical Overlap Mode (LOOM) Waveguiding System and Method of Making Same

Whaley, R. D., Inventor; Abeles, J. H., Inventor; Kwakernaak, M. H., Inventor; Khalfin, V. B., Inventor; Chan, W. K., Inventor; 28 Mar 05; 15 pp.; In English

Contract(s)/Grant(s): DAAD17-07C-0089

Patent Info.: Filed Filed 28 Mar 05; US-Patent-Appl-SN-11-091-186

Report No.(s): PB2007-109199; No Copyright; Avail.: CASI: [A03](#), Hardcopy

An optical system including: a substrate having a recess; and, a substantially planar, semiconductor waveguiding membrane suspended over the recess and having a thickness less than about 200 nm; wherein, the optical system supports a propagating optical mode having a majority of its energy external to the semiconductor waveguiding membrane.

NTIS

Patent Applications; Optical Waveguides

20080022322 Jenkins, Wilson, Taylor and Hunt, P.A., Durham, NC, USA; North Carolina Univ., Chapel Hill, NC, USA
Methods, Systems, and Computer Program Products for Imperceptibly Embedding Structured Light Patterns in Projected Color Images for Display on Planar and Non-Planar Surfaces

Fuchs, H., Inventor; Cotting, D., Inventor; Naef, M., Inventor; Gross, M., Inventor; 25 Feb 05; 34 pp.; In English

Contract(s)/Grant(s): N00014-03-1-0589

Patent Info.: Filed Filed 25 Feb 05; US-Patent-Appl-SN-11-066 629

Report No.(s): PB2007-109118; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Methods, systems, and computer program products for imperceptibly embedding structured light patterns in projected color images for display on planar and non-planar surfaces are disclosed. According to one method, an image exposure period for detecting an embedded structured light patterns in a projected image is selected based on analysis of pixel polarities for different pixel intensities of a pixel color. Pixel intensities for the color are varied in the user image so that pixel polarities encode the structured light patterns during image exposure period. The user image is projected with the structured light patterns onto the surface. Depth information is continuously acquired and used to adjust display of the user image.

NTIS

Color; Computer Programs; Embedding; Patent Applications

20080022358 Cooley, Godward, LLP, Palo Alto, CA, USA

Apparatus, System, and Method for Generating Phase-Locked Harmonic RF Source from an Optical Pulse Train

Loewen, R. J., Inventor; Ruth, R. D., Inventor; 8 Apr 05; 11 pp.; In English

Contract(s)/Grant(s): R44 GM066511-02

Patent Info.: Filed Filed 8 Apr 05; US-Patent-Appl-SN-11-102 597

Report No.(s): PB2007-109112; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A mode-locked laser is frequency stabilized to generate phase-locked harmonic RF signals. In one embodiment a first feedback system stabilizes a laser frequency to an optical cavity frequency of the external cavity. A second feedback system may be used to stabilize the optical cavity to a reference frequency source.

NTIS

Laser Mode Locking; Lasers; Patent Applications; Phase Locked Systems; Radio Frequencies

20080022359 Lawrence Livermore National Lab., Livermore, CA USA; California Univ., Berkeley, CA, USA

Gain Media Edge Treatment to Suppress Amplified Spontaneous Emission in a High Power Laser

Hackel, L. A., Inventor; Soules, T. F., Inventor; Fochs, S. N., Inventor; Rotter, M. D., Inventor; Letts, S. A., Inventor; 8 Nov 04; 12 pp.; In English

Contract(s)/Grant(s): W-7405-ENG-48

Patent Info.: Filed 8 Nov 04; US-Patent-Appl-SN-10-984 565

Report No.(s): PB2007-109113; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A novel method and apparatus for suppressing ASE and parasitic oscillation modes in a high average power laser is introduced. By roughening one or more peripheral edges of a solid-state crystal or ceramic laser gain media and by bonding such edges using a substantially high index bonding elastomer or epoxy to a predetermined electromagnetic absorbing arranged adjacent to the entire outer surface of the peripheral edges of the roughened laser gain media, ASE and parasitic oscillation modes can be effectively suppressed.

NTIS

High Power Lasers; Lasers; Oscillations; Patent Applications; Spontaneous Emission

20080022362 Center for Night Vision and Electro-Optics, Fort Belvoir, VA, USA

End Pumped Slab Laser Cavity

Nettleton, J. E., Inventor; Barr, D. N., Inventor; Trussell, C. W., Inventor; 13 May 04; 6 pp.; In English

Patent Info.: Filed 13 May 04; US-Patent-Appl-SN-10-844 446

Report No.(s): PB2007-109114; No Copyright; Avail.: CASI: [A02](#), Hardcopy

The 'End Pumped Slab' Laser Cavity incorporates all optical components required for a short-pulse laser. These optical components are 'locked' into alignment forming an optical laser cavity for diode laser or flash lamp pumping. The optical laser cavity never needs optical alignment after it is fabricated. The cavity is configured for optimal absorption for diode laser end-pumping over broad temperature ranges.

NTIS

Laser Cavities; Laser Pumping; Lasers; Masers; Patent Applications; Slabs

20080022366 Gauthier and Connors, LLP, Boston, MA, USA

CMOS-Compatible Light Emitting Aperiodic Photonic Structures

Negro, L. D., Inventor; Yi, J. H., Inventor; Michel, J., Inventor; Yi, Y., Inventor; Nguyen, V. T., Inventor; 25 Apr 05; 17 pp.; In English

Contract(s)/Grant(s): DMR-02-13282

Patent Info.: Filed 25 Apr 05; US-Patent-Appl-SN-11 113 624

Report No.(s): PB2007-109149; No Copyright; Avail.: CASI: [A03](#), Hardcopy

A fabrication method and materials produce high quality aperiodic photonic structures. Light emission can be activated by thermal annealing post growth treatments when thin film layers of SiO₂ and SiN_x or Si-rich oxide are used. From these aperiodic structures, that can be obtained in different vertical and planar device geometries, the presence of aperiodic order in a photonic device provides strong group velocity reduction (slow photons), enhanced light-matter interaction, light emission enhancement, gain enhancement, and/or nonlinear optical properties enhancement.

NTIS

CMOS; Light Emission; Patent Applications

20080023054 Istituto Superiore di Sanita, Rome, Italy

Modifications and Home-Built Accessories of a Commercial Microdensitometer to Obtain 3D Dose Maps of Fricke Gel Dosimeter (Modifiche e Accessori Apportati ad un Microdensitometro Commerciale per Ottenere Mappe della Distribuzione di Dose Trimensionale nel Dosimetro Fricke Gel)

Palma, A.; Luciani, A. M.; Sordi, P.; Adorante, N.; Grande, S.; January 2006; 23 pp.; In English

Report No.(s): PB2007-107521; ISTISAN-06/40; Copyright; Avail.: National Technical Information Service (NTIS)

The modifications of a commercial microdensitometer are described in order to obtain dose maps in small Fricke gel dosimeters. The accessories prepared to irradiate the gel for performing laboratory tests as well as tests with clinical beams (pre-clinical tests) are also described. These technical modifications have allowed to perform a series of laboratory and pre-clinical tests on Fricke gel dosimeters to evaluate accuracy and precision of optically detected 3D dose distribution. The measurements have shown that the optically detected 3D dose distribution in Fricke gel have the standards required for the evaluation of radiotherapy treatments. An optical scanner especially devoted to the reading of Fricke gel dosimeters in 3D is in preparation.

NTIS

Dosage; Dosimeters; Gels; Microdensitometers

20080023087 MicroE Systems, Natick, MA, USA

A Radiation-Hardened, High-Resolution Optical Encoder for Use in Aerospace Applications

Kreckie, Pat; 39th Aerospace Mechanisms Symposium; May 2008, pp. 191-198; In English; See also [20080023060](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

Advances in aerospace applications have created a demand for the development of higher precision, higher accuracy, radiation-hardened encoders. Historically, encoder products have proved somewhat deficient due to precision, accuracy, weight, and alignment concerns. MicroE Systems Mercury II aerospace encoder design provides the precision and accuracy required by these applications while also addressing radiation, weight, and alignment concerns. The encoder is a grating-based, reflective, interferometric encoder consisting of three major components: a scale, a readhead, and processing electronics. The system is a kit design that is easily configured and forgiving of misalignments. Its large tolerance of tilts and translations during setup and operation, make this design ideal for aerospace requirements. The system is small in footprint and weight and requires minimal power for operation. The ability to attach multiple readheads to one processing electronics unit, as well as its alignment tolerances, makes it versatile enough to meet the most demanding applications.

Author

Aerospace Engineering; Coders; Accuracy; Interferometry; High Resolution

20080023221 California Univ., Berkeley, CA, USA

Wide Field Image for Quantitative Analysis of Microarrays

Albertson, D. G., Inventor; Pinkel, D., Inventor; 20 May 04; 22 pp.; In English

Contract(s)/Grant(s): NIH-CA83040; NIH-CA94118

Patent Info.: Filed 20 May 04; US-Patent-Appl-SN-10-850-986

Report No.(s): PB2007-109236; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This invention provides an imaging system for high-accuracy quantitative analysis of a microarray. In certain embodiments, the system comprises a broad band excitation light source that provides Kohler illumination of said microarray at an incident angle that ranges from about 30 degrees to about 75 degrees from the normal to the microarray, and that has less than about +/-25 percent variation in intensity over the array at all wavelengths ranging from 400 to 800 nm; a support for holding a microarray; a detection lens system that is chromatically corrected so the apparent position of the microarray or a feature comprising the microarray varies by less than 10 micrometers as the detection wavelength varies from about 400 to about 800 nm; and a detection device for detecting and optionally recording an image produced by said detection lens system.

NTIS

Image Analysis; Arrays; Quantitative Analysis; Wide Angle Lenses

20080023277 Rochester Univ., NY USA

Slow and Fast Light

Boyd, Robert W; Gauthier, Daniel J; Sep 24, 2001; 41 pp.; In English

Contract(s)/Grant(s): N00014-99-1-0539

Report No.(s): AD-A478138; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Recent research has established that it is possible to exercise extraordinary control of the velocity of propagation of light pulses through a material system. Both extremely slow propagation (much slower than the velocity of light in vacuum) and fast propagation (exceeding the velocity of light in vacuum) have been observed. This article summarizes this recent research, placing special emphasis on the description of the underlying physical processes leading to the modification of the velocity of light. To understand these new results, it is crucial to recall the distinction between the phase velocity and the group velocity of a light field. These concepts will be defined more precisely below; for the present we note that the group velocity gives the velocity with which a pulse of light propagates through a material system. One thus speaks of 'fast' or 'slow' light depending on the value of the group velocity v_g in comparison to the velocity of light c in vacuum.

DTIC

Group Velocity; Propagation Velocity; Nonlinear Optics

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20080023234 Cornell Univ., Ithaca, NY, USA

Center for Pulsed Power Driven High Energy Density Plasma Studies. (Annual Report, October 1, 2005-September 30, 2006)

Kusse, B. R.; Hammer, D. A.; January 2006; 15 pp.; In English

Report No.(s): DE2007-903295; No Copyright; Avail.: Department of Energy Information Bridge

This annual report summarizes the activities of the Cornell Center for Pulsed Power-Driven High-Energy-Density Plasma Studies, for the 12-month period October 1, 2005-September 30, 2006. This period corresponds to the first year of the two-year extension (awarded in October, 2005) to the original 3-year NNSA/DOE Cooperative Agreement with Cornell, DE-FC03-02NA00057. The founding of our Center was predicated on bringing the skill sets of the major non-government pulsed-power-based high-energy-density plasma (HEDP) research groups in the world together in a single collaborative HEDP research center based at Cornell University. At the time (2002), Cornell's expertise in single-wire explosion phenomenology and dynamics was well known, and Cornell was also known as an innovative developer of x-ray diagnostic tools for HEDP experiments because of many years of scientifically productive studies of X-pinch plasmas. Imperial College (IC) had developed a substantial level of qualitative understanding of the dynamics of wire-array z-pinch implosions based upon such diagnostic methods as laser-based imaging, extreme-ultra-violet time-gated imaging and visible-light streak photography. The IC group also began to investigate the possibility of using plasmas generated by wire-array z-pinches to help understand high-energy astrophysical phenomena in collaboration with scientists in the process of developing large-scale computer codes for the same purpose. As such, a theoretical plasma astrophysicist at the University of Rochester who was working on such a code and was already collaborating with the IC group was asked to participate in our Center. The University of Nevada, Reno (UNR), group with which we were collaborating at the time, had expertise in x-ray diagnostic devices and x-ray spectroscopy modeling that complemented the expertise at Cornell.

NTIS

Plasmas (Physics); Implosions; Astrophysics

20080023479 Nagoya Univ., Japan

Artificial Ionospheric Irregularities Measured with MUIR (Modular UHF Ionospheric Radar) at HAARP (High Frequency Active Auroral Research Program)

Ohyama, Shin-ichiro; Watkins, Brenton J.; Journal of the National Institute of Information and Communications Technology, Volume 54, Nos. 1/2. Special Issue on Middle and Upper Atmosphere Observation Techniques; March/June 2007, pp. 107-115; In English; See also [20080023475](#); Original contains color and black and white illustrations; Copyright;

Avail.: Other Sources

Plasma physics is widely applied in space research, and has become a fundamental field of study, much like the fields of thermodynamics and electromagnetism. As natural phenomena, the ionosphere and magnetosphere generate and absorb plasma waves. While the science of naturally enhanced plasma waves is important to understand ionospheric/magnetospheric phenomena, artificially enhanced plasma waves also provide notable information that can help advance our understanding of both space physics and plasma physics. Many experiments on the modification of the ionosphere with high-power, high-frequency (HF) radio waves have been conducted since the 1970s. HAARP (High Frequency Active Auroral Research Program) facility in Gakona, Alaska has played important roles in this field. MUIR (Modular UHF Ionospheric Radar; 446 MHz) began operation at HAARP in February 2005. The main advantage of this radar is that its phased array system allows the beam direction to be quickly changed. The radar has been used to obtain important data sets during many HF ionospheric modification experiments. In this paper we present our findings regarding (1) HF-induced ion lines and plasma lines, (2) overshoot, and (3) Langmuir wave generation in the first 100 ms after HF turn-on.

Author

Ionospheric Disturbances; Ultrahigh Frequencies; Plasma Physics; Wave Generation; Phased Arrays; Electromagnetism; Plasma Waves

ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20080023133 ISRO Satellite Centre, Peenya, Bangalore, India

Critical Chain Project Management - A New Project Management Philosophy for Multi Project Environment

Jagathipriya; Byali, Rajendrasingh; Kannan, M. V.; Journal of Spacecraft Technology, Volume 18, No. 1; January 2008, pp. 30-36; In English; See also [20080023129](#); Original contains color illustrations; Copyright; Avail.: Other Sources

Traditional project management has been concentrating mainly on single project optimization based upon task dependency constraints. The Critical Chain Project management (CCPM) provides a substantial improvement in the PM methodology by incorporating resource dependency and buffer management. CCPM improves the project scheduling by protecting it from common cause variation (uncertainty, multi-tasking). For a multi-project environment CCPM is best suitable since critical chain is calculated based upon both resource dependencies and task dependencies and the constraint of multi-tasking is also dealt with. Buffer management enhances measurement and decision making for project control. This paper provides an insight to the CCPM concept with a practical example of scheduling multiple satellite projects using this technique

Author

Project Management; Resources Management; Decision Making

20080023311 NASA Marshall Space Flight Center, Huntsville, AL, USA

UID....Now That's Gonna Leave A Mark

Schramm, Harry F., Jr.; April 04, 2008; 32 pp.; In English; Department of Defense for Unique Identification and eBusiness Forum, 8-9 Apr. 2008, Huntsville, AL, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023311>

Since 1975 bar codes on products at the retail counter have been accepted as the standard for entering product identity for price determination. Since the beginning of the 21st century, the Data Matrix symbol has become accepted as the bar code format that is marked directly on a part, assembly or product that is durable enough to identify that item for its lifetime. NASA began the studies for direct part marking Data Matrix symbols on parts during the Return to Flight activities after the Challenger Accident. Over the 20 year period that has elapsed since Challenger, a mountain of studies, analyses and focused problem solutions developed by and for NASA have brought about world changing results. NASA Technical Standard 6002 and NASA Handbook 6003 for Direct Part Marking Data Matrix Symbols on Aerospace Parts have formed the basis for most other standards on part marking internationally. NASA and its commercial partners have developed numerous products and methods that addressed the difficulties of collecting part identification in aerospace operations. These products enabled the marking of Data Matrix symbols in virtually every situation and the reading of symbols at great distances, severe angles, under paint and in the dark without a light. Even unmarkable delicate parts now have a process to apply a chemical mixture, recently trademarked as Nanocodes, that can be converted to Data Matrix information through software. The accompanying intellectual property is protected by ten patents, several of which are licensed. Direct marking Data Matrix on NASA parts dramatically decreases data entry errors and the number of parts that go through their life cycle unmarked, two major threats to sound configuration management and flight safety. NASA is said to only have people and stuff with information connecting them. Data Matrix is one of the most significant improvements since Challenger to the safety and reliability of that connection.

Author

Aerospace Systems; Configuration Management; Identities; Handbooks; Life (Durability); Flight Safety

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*.

20080022274 Williams, Morgan and Ameron, P.C., Houston, TX, USA

Agent Reactive Scheduling in an Automated Manufacturing Environment

Mata, G., Inventor; Nettle, S. C., Inventor; Barton, L. D., Inventor; Li, Y., Inventor; 13 Jun 05; 30 pp.; In English
Contract(s)/Grant(s): NIST-70NANB7H3041

Patent Info.: Filed 13 Jun 05; US-Patent-Appl-SN-11-151-098

Report No.(s): PB2007-109166; No Copyright; Avail.: CASI: A03, Hardcopy

A method and apparatus for scheduling in an automated manufacturing environment, are disclosed. The method includes detecting an occurrence of a predetermined event in a process flow; notifying a software scheduling agent of the occurrence; and reactively scheduling an action from the software scheduling agent responsive to the detection of the predetermined event. The apparatus is automated manufacturing environment including a process flow and a computing system. The computing system further includes a plurality of software scheduling agents residing thereon, the software scheduling agents being capable of reactively scheduling appointments for activities in the process flow responsive to a plurality of predetermined events.

NTIS

Automatic Control; Manufacturing; Patent Applications; Reactivity

20080023119 Deep Web Technologies, Santa Fe, Mexico

DOE/SBIR Phase II Final Report: Distributed Relevance Ranking in Heterogeneous Document Collections

Lederman, A.; Sep. 26, 2006; 11 pp.; In English

Report No.(s): DE2007-896967; No Copyright; Avail.: Department of Energy Information Bridge

This report contains the comprehensive summary of the work performed on the SBIR Phase II project (Distributed Relevance Ranking in Heterogeneous Document Collections) at Deep Web Technologies (<http://www.deepwebtech.com>). We have successfully completed all of the tasks defined in our SBIR Proposal work plan (See Table 1 - Phase II Tasks Status). The project was completed on schedule and we have successfully deployed an initial production release of the software architecture at DOE-OSTI for the Science.gov Alliance's search portal (<http://www.science.gov>). We have implemented a set of grid services that supports the extraction, filtering, aggregation, and presentation of search results from numerous heterogeneous document collections.

NTIS

Collection; Heterogeneity; Information Retrieval; Ranking

20080023272 Army War Coll., Carlisle Barracks, PA USA

The Trouble With Strategic Communication(s)

Murphy, Dennis M; Jan 2008; 5 pp.; In English

Report No.(s): AD-A477745; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA477745>

There is no military doctrine for strategic communication, leaving both its definition and the process associated with it open to interpretation. The trouble with an emerging (and important) concept sans doctrine is that the terminology (i.e. the lexicon) can act to define that concept. There is no overarching U.S. government definition of strategic communication. There is, however, a Department of Defense definition as a result of the most recent Quadrennial Defense Review (QDR) which produced a Strategic Communication Roadmap. Strategic communication is 'focused USG (USA Government) processes and efforts to understand and engage key audiences in order to create, strengthen, or preserve conditions favorable to advance national interests and objectives through the use of coordinated information, themes, plans, programs and actions synchronized with other elements of national power.' Interpretation of the definition itself must serve as the basis of understanding by educators who teach strategic communication and by practitioners who plan and implement it. Effective strategic communication requires an organizational culture attuned to the information environment and a recognition that strategic communication, as a way to achieve information effects, consists of many capabilities (means) that are an integral part of the commander's arsenal.

DTIC

Communication; Strategy; Military Technology

20080023278 Massachusetts Univ., Amherst, MA USA

Passage Retrieval and Evaluation

Wade, Courtney; Allan, James; Feb 2005; 9 pp.; In English

Contract(s)/Grant(s): N66001-02-1-8903

Report No.(s): AD-A478017; UMA-CIIR-IR-396; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Information retrieval researchers have studied passage retrieval extensively, yet there is no consensus within the community about how to evaluate the results of passage retrieval experiments. This paper describes five character-level

passage evaluation measures and tasks for which they may be appropriate. In the second half of the paper we compare several passage retrieval models, including a new generative mixture model that outperforms strong baselines on many of the evaluation measures discussed in part one.

DTIC

Information Retrieval; Data Processing; Linguistics

83

ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

20080022349 NASA Dryden Flight Research Center, Edwards, CA, USA

Civil Service Workforce Market Supply and the Effect on the Cost Estimating Relationships (CERs) that may effect the Productivity Factors for Future NASA Missions

Sterk, Steve; Chesley, Stephen; May 14, 2008; 42 pp.; In English; European Space Agency International Society Parametric Analysis, 12-16 May 2008, Noordwijk, Netherlands; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080022349>

The upcoming retirement of the Baby Boomers on the horizon will leave a performance gap between younger generation (the future NASA decision makers) and the gray beards. This paper will reflect on the average age of workforce across NASA Centers, the Aerospace Industry and other Government Agencies, like DoD. This papers will dig into Productivity and Realization Factors and how they get applied to bimonthly (payroll data) for true FTE calculations that could be used at each of the NASA Centers and other business systems that are on the forefront in being implemented. This paper offers some comparative costs solutions, from simple - full time equivalent (FTE) cost estimating relationships CERs, to complex - CERs for monthly time-phasing activities for small research projects that start and get completed within a government fiscal year. This paper will present the results of a parametric study investigating the cost-effectiveness of different alternatives performance based cost estimating relationships (CERs) and how they get applied into the Center s forward pricing rate proposals (FPRP). True CERs based on the relationship of a younger aged workforce will have some effects on labor rates used in both commercial cost models and internal home-grown cost models which may impact the productivity factors for future NASA missions.

Author

NASA Programs; Productivity; Retirement; Labor; Cost Estimates; Cost Effectiveness; Cost Analysis; Aerospace Industry

20080023016 Government Accountability Office, Washington, DC, USA

Polar-orbiting Satellite Acquisition Faces Delays; Decisions Needed on Whether and How to Ensure Climate Data Continuity

June 19, 2008; 34 pp.; In English; Original contains black and white illustrations

Report No.(s): GAO-08-899T; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The National Polar-orbiting Operational Environmental Satellite System (NPOESS) is a tri-agency acquisition--managed by the Department of Commerce s National Oceanic and Atmospheric Administration (NOAA), the Department of Defense (DOD), and the National Aeronautics and Space Administration (NASA)--which has experienced escalating costs, schedule delays, and technical difficulties. These factors led to a June 2006 decision to restructure the program thereby decreasing its complexity, increasing its estimated cost to \$12.5 billion, and delaying the first two satellites by 3 to 5 years. GAO was asked to summarize a report being released today that evaluates progress in restructuring the acquisition, assesses the status of key program components and risks, and assesses the agencies plans for obtaining the data originally planned to be collected by NPOESS sensors, but eliminated by the restructuring. In its report, GAO recommends that Commerce, DOD, and NASA coordinate to develop plans on whether and how to restore climate and space weather sensors removed from the NPOESS program. GAO also reemphasizes that the appropriate executives finalize and approve key acquisition documents. Agency officials agreed with both recommendations.

Derived from text

Cost Estimates; NASA Programs; NOAA Satellites; Meteorological Satellites

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.

20080023471 NASA Johnson Space Center, Houston, TX, USA

Technological Innovations from NASA

Pellis, Neal R.; September 12, 2006; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

The challenge of human space exploration places demands on technology that push concepts and development to the leading edge. In biotechnology and biomedical equipment development, NASA science has been the seed for numerous innovations, many of which are in the commercial arena. The biotechnology effort has led to rational drug design, analytical equipment, and cell culture and tissue engineering strategies. Biomedical research and development has resulted in medical devices that enable diagnosis and treatment advances. NASA Biomedical developments are exemplified in the new laser light scattering analysis for cataracts, the axial flow left ventricular-assist device, non contact electrocardiography, and the guidance system for LASIK surgery. Many more developments are in progress. NASA will continue to advance technologies, incorporating new approaches from basic and applied research, nanotechnology, computational modeling, and database analyses.

Author

Research and Development; Technology Utilization; Aerospace Technology Transfer; Technologies; NASA Programs; Space Programs

SPACE SCIENCES (GENERAL)

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through 93*.

20080023421 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Titan's Surface Temperatures Measured by Cassini CIRS

Jennings, Donald E.; Flasar, F. M.; Kundle, V. G.; Samuelson, R. E.; Pearl, J. C.; Nixon, C. A.; Carlson, R. C.; Mamoutkine, A. A.; Brasunas, J. C.; Guandique, E.; Arhterberg, R. K.; Bjoraker, G. L.; Romani, P. N.; Segura, M. E.; Albright, S. A.; Elliott, M. H.; Tingley, J. S.; Calcutt, S.; Coustenis, A.; Bezard, B.; Courtin, R.; [2008]; 1 pp.; In English; Western Pacific Geophysics Meeting, 29 Jul. - 1 Aug. 2008, Cairns, Australia; Copyright; Avail.: Other Sources; Abstract Only

A large fraction of 19-micron thermal radiation from the surface of Titan reaches space through a spectral window of low atmospheric opacity. The emergent radiance, after removing the effect of the atmosphere, gives the brightness temperature of the surface. This atmospheric window is covered by the far-infrared channel of the Composite Infrared spectrometer1 (CIRS) on Cassini. In mapping Titan surface temperatures, CIRS is able to improve upon results of Voyager IRIS, by taking advantage of improved latitude coverage and a much larger dataset. Observations are from a wide range of emission angles and thereby provide constraints on the atmospheric opacity and radiance that are used to derive the surface temperature. CIRS finds an average equatorial surface brightness temperature of 93.7+/-0.6 K, virtually identical to the HASI temperature at the Huygens landing site. Mapping in latitude shows that the surface temperature decreases toward the poles by about 2 K in the south and 3 K in the north. This surface temperature distribution is consistent with the formation of lakes seen at high latitudes on Titan.

Author

Titan; Surface Temperature; Infrared Radiation; Satellite Surfaces; Voyager Project; Temperature Distribution; Infrared Spectrometers; Brightness Temperature; Atmospheric Effects; Atmospheric Optics

20080023448 NASA Marshall Space Flight Center, Huntsville, AL, USA

Next Generation LOCAD-PTS Cartridge Development

Morris, H.; Nutter, D.; Weite, E.; Wells, M.; Maule, J.; Damon, M.; Monaco, L.; Steele, A.; Wainwright, N.; April 14, 2008; 1 pp.; In English; Astrobiology Science Conference 2008, 14-17 Apr. 2008, Santa Clara, CA, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: [C01](#), CD-ROM: [A01](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023448>

Future astrobiology exploration missions will require rapid, point-of-use techniques for surface science experiments and

contamination monitoring. The Lab-On-a-Chip Application Development (LOCAD) team is developing operational instruments that advance spaceflight technologies to molecular-based methods. Currently, LOCAD-Portable Test System (PTS) is quantifying levels of the bacterial molecule endotoxin onboard the International Space Station. Future research and development will focus on more sensitive molecular techniques that expand the number of compounds detected to include beta-glucan from fungal cell walls.

Derived from text

Portable Equipment; Space Missions; Cartridges; International Space Station; Exobiology

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ASTRONOMY

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

20080023299 NASA Goddard Space Flight Center, Greenbelt, MD, USA

James Webb Space Telescope - Applying Lessons Learned to I&

Johns, Alan; Seaton, Bonita; Gal-Edd, Jonathan; Jones, Ronald; Fatig, Curtis; Wasiak, Francis; June 22, 2008; 7 pp.; In English; Original contains color illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

The James Webb Space Telescope (JWST) is part of a new generation of spacecraft acquiring large data volumes from remote regions in space. To support a mission such as the JWST, it is imperative that lessons learned from the development of previous missions such as the Hubble Space Telescope and the Earth Observing System mission set be applied throughout the development and operational lifecycles. One example of a key lesson that should be applied is that core components, such as the command and telemetry system and the project database, should be developed early, used throughout development and testing, and evolved into the operational system. The purpose of applying lessons learned is to reap benefits in programmatic or technical parameters such as risk reduction, end product quality, cost efficiency, and schedule optimization. In the cited example, the early development and use of the operational command and telemetry system as well as the establishment of the intended operational database will allow these components to be used by the developers of various spacecraft components such that development, testing, and operations will all use the same core components. This will reduce risk through the elimination of transitions between development and operational components and improve end product quality by extending the verification of those components through continual use. This paper will discuss key lessons learned that have been or are being applied to the JWST Ground Segment integration and test program.

Author

James Webb Space Telescope; Hubble Space Telescope; Earth Observing System (EOS); Lessons Learned; Ground Tests

20080023313 NASA Marshall Space Flight Center, Huntsville, AL, USA

ART: Surveying the Local Universe at 2-11 keV

O'Dell, S. L.; Ramsey, B. D.; Adams, M. L.; Brandt, W. N.; Bubarev, M. V.; Hassinger, G.; Pravlinski, M.; Predehl, P.; Romaine, S. E.; Swartz, D. A.; Urry, C. M.; Vikhlinin, A.; Weisskopf, M. C.; March 31, 2008; 1 pp.; In English; HEAD 2008: High-Energy Astrophysics Division Head of the American Astronomical Society, 31 Mar. - 3 Apr. 2008, Los Angeles, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources; Abstract Only

The Astronomical Rontgen Telescope (ART) is a medium-energy x-ray telescope system proposed for the Russian-led mission Spectrum Rontgen-Gamma (SRG). Optimized for performance over the 2-11-keV band, ART complements the softer response of the SRG prime instrument-the German eROSITA x-ray telescope system. The anticipated number of ART detections is 50,000-with 1,000 heavily-obscured ($N(\text{sub H}) > 3 \times 10^{23} / \text{sq cm}$) AGN-in the SRG 4-year all-sky survey, plus a comparable number in deeper wide-field (500 deg² total) surveys. ART's surveys will provide a minimally-biased, nearly-complete census of the local Universe in the medium-energy x-ray band (including Fe-K lines), at CCD spectral resolution. During long (approx. 100-ks) pointed observations, ART can obtain statistically significant spectral data up to about 15 keV for bright sources and medium-energy x-ray continuum and Fe-K-line spectra of AGN detected with the contemporaneous NuSTAR hard-x-ray mission.

Author

X Ray Telescopes; Emission Spectra; X Ray Sources; Line Spectra; Charge Coupled Devices

20080023314 NASA Marshall Space Flight Center, Huntsville, AL, USA

Xenia: A Probe of Cosmic Chemical Evolution

Kouveliotou, Chryssa; Piro, L.; March 31, 2008; 1 pp.; In English; Meeting of the High Energy Astrophysics Division of the American Astronomical Society (HEAD), 31 Mar, - 3 Apr. 2008, Los Angeles, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources; Abstract Only

Xenia is a concept study for a medium-size astrophysical cosmology mission addressing the Cosmic Origins key objective of NASA's Science Plan. The fundamental goal of this objective is to understand the formation and evolution of structures on various scales from the early Universe to the present time (stars, galaxies and the cosmic web). Xenia will use X- and y-ray monitoring and wide field X-ray imaging and high-resolution spectroscopy to collect essential information from three major tracers of these cosmic structures: the Warm Hot Intergalactic Medium (WHIM), Galaxy Clusters and Gamma Ray Bursts (GRBs). Our goal is to trace the chemo-dynamical history of the ubiquitous warm hot diffuse baryon component in the Universe residing in cosmic filaments and clusters of galaxies up to its formation epoch (at $z=0-2$) and to map star formation and galaxy metal enrichment into the re-ionization era beyond $z \sim 6$. The concept of Xenia (Greek for 'hospitality') evolved in parallel with the Explorer of Diffuse Emission and GRB Explosions (EDGE), a mission proposed by a multinational collaboration to the ESA Cosmic Vision 2015. Xenia incorporates the European and Japanese collaborators into a U.S. led mission that builds on the scientific objectives and technological readiness of EDGE.

Author

Cosmology; Chemical Evolution; X Ray Imagery; Star Formation; Intergalactic Media; Galactic Clusters; Gamma Ray Bursts

20080023333 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Aberrations for Grazing Incidence Optics

Saha, Timo T.; [2008]; 10 pp.; In English; Original contains black and white illustrations; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023333>

Large number of grazing incidence telescope configurations have been designed and studied. Wolter telescopes are commonly used in astronomical applications. Wolter telescopes consist of a paraboloidal primary mirror and a hyperboloidal or an ellipsoidal secondary mirror. There are 8 possible combinations of Wolter telescopes. Out of these possible designs only type 1 and type 2 telescopes are widely used. Type 1 telescope is typically used for x-ray applications and type 2 telescopes are used for EUV applications. Wolter-Schwarzschild (WS) telescopes offer improved image quality over a small field of view. The WS designs are stigmatic and free of third order coma and, therefore, the PSF is significantly better over a small field of view. Typically the image is more symmetric about its centroid. As for the Wolter telescopes there are 8 possible combinations of WS telescopes. These designs have not been widely used because the surface equations are complex parametric equations complicating the analysis and typically the resolution requirements are too low to take full advantage of the WS designs. There are several other design options. Most notable are wide field x-ray telescope designs. Polynomial designs were originally suggested by Burrows⁴ and hyperboloid-hyperboloid designs for solar physics applications were designed by Harvey⁵. No general aberration theory exists for grazing incidence telescopes that would cover all the design options. Several authors have studied the aberrations of grazing incidence telescopes. A comprehensive theory of Wolter type 1 and 2 telescopes has been developed. Later this theory was expanded to include all possible combinations of grazing incidence and also normal incidence paraboloid-hyperboloid and paraboloid-ellipsoid telescopes. In this article the aberration theory of Wolter type telescopes is briefly reviewed.

Author

Grazing Incidence Telescopes; Parabolic Bodies; Centroids; Design Analysis; Ellipsoids; Field of View; X Ray Telescopes; Mirrors

20080023341 NASA Goddard Space Flight Center, Greenbelt, MD, USA

System Definition of the James Webb Space Telescope (JWST) Integrated Science Instrument Module (ISIM)

Lundquist, Ray; Aymergen, Cagatay; VanCampen, Julie; Abell, James; Smith, Miles; Driggers, Phillip; June 23, 2008; 12 pp.; In English; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

The Integrated Science Instrument Module (ISIM) for the James Webb Space Telescope (JWST) provides the critical functions and the environment for the four science instruments on JWST. This complex system development across many international organizations presents unique challenges and unique solutions. Here we describe how the requirement flow has been coordinated through the documentation system, how the tools and processes are used to minimize impact to the development of the affected interfaces, how the system design has matured, how the design review process operates, and how

the system implementation is managed through reporting to ensure a truly world class scientific instrument compliment is created as the final product.

Author

James Webb Space Telescope; Systems Engineering; Systems Analysis; Complex Systems; Design Analysis

20080023406 NASA Marshall Space Flight Center, Huntsville, AL, USA

Resolving the Crab Nebula with Direct Hard X-Ray Imaging

Swartz, Douglas A.; Ramsey, Brian D.; Tennant, Allyn F.; Dietz, Kurtis L.; Apple, Jeff A.; Gaskin, Jessica A.; Weisskopf, Martin; March 31, 2008; 1 pp.; In English; High Energy Astrophysics Division (HEAD) Meeting of the American Astronomical Society, 31 Mar. - 3 Apr. 2008, Los Angeles, CA, USA; Original contains black and white illustrations; No Copyright; Avail.: Other Sources; Abstract Only

We report the first direct hard (25--60 keV) X-ray imaging observation of the Crab Nebula that resolves structure to approximately 0.25 pc. The observation was performed over a 1.4 hour period during a balloon flight from Ft. Sumner, NM, on 2007 May 27. The source was detected in the energy band above the atmospheric cutoff at approx.25 keV and below the mirror graze angle cutoff at approx.60 keV. The image shows elongation about 25 degrees E of N in the direction along the plane of the torus (and perpendicular to the jet axis) with a slight surface-brightness enhancement NE of the pulsar. The spectrum within a 1.7 arcminute radius region centered on the Crab pulsar can be fitted with a $\Gamma=2$ power law absorbed by an atmospheric column consistent with the balloon altitude at the time of observation.

Author

Crab Nebula; X Ray Imagery; Pulsars; Toruses; Resolution; Energy Bands

20080023469 NASA Marshall Space Flight Center, Huntsville, AL, USA

Chandra Observations of Isolated Neutron Stars

Weisskopf, Martin; April 24, 2006; 1 pp.; In English; Isolated Neutron Stars: From the Interior to the Surface, 24-28 Apr. 2006, London, UK; No Copyright; Avail.: Other Sources; Abstract Only

We present a review of the first six years of Chandra X-ray Observatory observations of isolated neutron stars. The outstanding spatial and spectral resolution of this great observatory have allowed for observations of unprecedented clarity and accuracy. Many of these observations have provided new insights into neutron star physics. We present a (biased) overview of six years of these observations, highlighting new discoveries made possible by the Observatory's unique capabilities.

Author

Neutron Stars; Observatories; X Ray Astrophysics Facility

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ASTROPHYSICS

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

20080023312 NASA Marshall Space Flight Center, Huntsville, AL, USA

Relativistic Particle-In-Cell Simulation Studies of Prompt and Early Afterglows from GRBs

Nishikawa, Ken-Ichi; Hardee, Philip; Mizuno, Yosuke; Fishman, Gerald; April 12, 2008; 1 pp.; In English; 2008 American Physical Society (APS) Meeting, 12-15 Apr. 2008, Saint Louis, MO, USA; Original contains black and white illustrations; No Copyright; Avail.: Other Sources; Abstract Only

Nonthermal radiation observed from astrophysical systems containing relativistic jets and shocks, e.g., gamma-ray bursts (GRBs), active galactic nuclei (AGNs), and Galactic microquasar systems usually have power-law emission spectra. Recent PIC simulations of relativistic electron-ion (electro-positron) jets injected into a stationary medium show that particle acceleration occurs within the downstream jet. In the collisionless relativistic shock particle acceleration is due to plasma waves and their associated instabilities {e.g., the Weibel (filamentation) instability) created in the shocks are responsible for particle (electron, positron, and ion) acceleration. The simulation results show that the Weibel instability is responsible for generating and amplifying highly nonuniform, small-scale magnetic fields. These magnetic fields contribute to the electron's transverse deflection behind the jet head. The 'jitter' radiation from deflected electrons has different properties than synchrotron radiation which is calculated in a uniform magnetic field. This jitter radiation may be important to understanding

the complex time evolution and/or spectral structure in gamma-ray bursts, relativistic jets, and supernova remnants.-/

Author

Gamma Ray Bursts; Afterglows; Nonthermal Radiation; Active Galactic Nuclei; Electrons; Positrons; Synchrotron Radiation; Emission Spectra

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*.

20080022983 NASA Langley Research Center, Hampton, VA, USA

Titan Flagship Mission 3-Degree-of-Freedom Simulation Analysis

Prince, Jill L.; Powell, R. W.; Lockwood, Mary Kae; June 02, 2008; 12 pp.; In English; 7th International ESA Conference on Guidance, Navigation and Control Systems, 2-5 Jun. 2008, Tralee, Ireland; Original contains color illustrations

Contract(s)/Grant(s): WBS 526282; Copyright; Avail.: CASI: [A03](#), Hardcopy

A NASA flagship mission to Titan, the largest moon of Saturn and the only moon in the solar system with a significant atmosphere, has been designed that uses three separate spacecraft, each requiring significant interaction with the atmosphere. The first vehicle is a Titan lander for lower-atmosphere and surface science. The second is an aerial vehicle for aerial science at approximately 10 km altitude with an expected lifetime of one year. This spacecraft will use the natural winds of Titan to cover a large area over its lifetime. The third vehicle is a Titan orbiter that will interact with the atmosphere in two respects. The first atmospheric interaction is the orbital insertion maneuver that will be accomplished using aerocapture, during which time the hyperbolic approach of 6.5 km/s will be reduced to 1.6 km/s over 41 minutes with an exit periapsis altitude of 130 km. The second atmospheric interaction occurs after a propulsive maneuver has raised the periapsis after aerocapture to 1170 km, where the atmosphere will be sampled over several months. This is the first phase of aerosampling that covers southern latitudes. After a 3.3-year circular science phase at an altitude of 1700 km, a second phase of additional aerosampling is performed sampling northern latitudes. The atmospheric trajectory analysis for these three spacecraft will be discussed throughout this paper.

Derived from text

Orbit Insertion; Titan; Trajectory Analysis; Mathematical Models; Computerized Simulation

20080023141 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Ion Escape from the Ionosphere of Titan

Hartle, R.; Sittler, E.; Lipatov, A.; April 14, 2008; 1 pp.; In English; European Geosciences Union Annual Meeting, 14-18 Apr. 2008, Vienna, Austria; Copyright; Avail.: Other Sources; Abstract Only

Ions have been observed to flow away from Titan along its induced magnetic tail by the Plasma Science Instrument (PLS) on Voyager 1 and the Cassini Plasma Spectrometer (CAPS) on Cassini. In both cases, the ions have been inferred to be of ionospheric origin. Recent plasma measurements made at another unmagnetized body, Venus, have also observed similar flow in its magnetic tail. Much earlier, the possibility of such flow was inferred when ionospheric measurements made from the Pioneer Venus Orbiter (PVO) were used to derive upward flow and acceleration of H(+), D(+) and O(+) within the nightside ionosphere of Venus. The measurements revealed that the polarization electric field in the ionosphere produced the principal upward force on these light ions. The resulting vertical flow of H(+) and D(+) was found to be the dominant escape mechanism of hydrogen and deuterium, corresponding to loss rates consistent with large oceans in early Venus. Other electrodynamic forces were unimportant because the plasma beta in the nightside ionosphere of Venus is much greater than one. Although the plasma beta is also greater than one on Titan, ion acceleration is expected to be more complex, especially because the subsolar point and the subflow points can be 180 degrees apart. Following what we learned at Venus, upward acceleration of light ions by the polarization electric field opposing gravity in the ionosphere of Titan will be described. Additional electrodynamic forces resulting from the interaction of Saturn's magnetosphere with Titan's ionosphere will be examined using a recent hybrid model.

Author

Planetary Ionospheres; Titan; Light Ions; Geophysics; Electrodynamics

20080023349 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Volatile Analysis by Pyrolysis of Regolith (Vapor) on the Moon using Mass Spectrometry

Glavin, D. P.; Kate, I. L. ten; Brinckerhoff, W.; Cardiff, E.; Dworkin, J. P.; Feng, S.; Getty, S.; Gorevan, S.; Harpold, D.; Jones, A. L.; King, T.; Mahaffy, P. R.; Martin, D.; Moore, M.; Roberts, D.; Robman, P.; Simmons, C.; Stephenson, T.; Swindle, T.; July 20, 2008; 2 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): 06-LSSO06-0002; Copyright; Avail.: CASI: [A01](#), Hardcopy

The identification of lunar resources such as water is a fundamental component of the the NASA Vision for Space Exploration. The Lunar Prospector mission detected high concentrations of hydrogen at the lunar poles that may indicate the presence of water or other volatiles in the lunar regolith [1]. One explanation for the presence of enhanced hydrogen in permanently shadowed crater regions is long term trapping of water-ice delivered by comets, asteroids, and other meteoritic material that have bombarded the Moon over the last 4 billion years [2]. It is also possible that the hydrogen signal at the lunar poles is due to hydrogen implanted by the solar wind which is delayed from diffusing out of the regolith by the cold temperatures [3]. Previous measurements of the lunar atmosphere by the LACE experiment on Apollo 17, suggested the presence of cold trapped volatiles that were expelled by solar heating [4]. In situ composition and isotopic analyses of the lunar regolith will be required to establish the abundance, origin, and distribution of water-ice and other volatiles at the lunar poles. Volatile Analysis by Pyrolysis of Regolith (VAPoR) on the Moon using mass spectrometry is one technique that should be considered. The VAPoR pyrolysis-mass spectrometer (pyr-MS) instrument concept study was selected for funding in 2007 by the NASA Lunar Sortie Science Opportunities (LSSO) Program. VAPoR is a miniature version of the Sample Analysis at Mars (SAM) instrument suite currently being developed at NASA Goddard for the 2009 Mars Science Laboratory mission (Fig. 1).

Derived from text

Mass Spectroscopy; Moon; Pyrolysis; Regolith; Vapors; Volatility; Lunar Geology

20080023350 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Jurassic Diabase from Leesburg, VA: A Proposed Lunar Simulant

Taylor, P. T.; Lowman, P. D.; Nagihara, Seiichi; Milam, M. B.; Nakamura, Yosio; [2008]; 2 pp.; In English; NASA Lunar Science Institute meeting, 20-23 Jul. 2008, Moffett Field, CA, USA; Original contains black and white illustrations

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ONLINE: <http://hdl.handle.net/2060/20080023350>

A study of future lunar seismology and heat flow is being carried out as part of the NASA Lunar Sortie Science Program [1]. This study will include new lunar drilling techniques, using a regolith simulant, for emplacement of instruments. Previous lunar simulants, such as JSC-I and MLS-I, were not available when the study began, so a local simulant source was required. Diabase from a quarry at Leesburg, Virginia, was obtained from the Luck Stone Corporation. We report here initial results of a petrographic examination of this rock, GSC-1 henceforth.

Derived from text

Lunar Programs; Seismology; Petrography; Sedimentary Rocks; Regolith; Lunar Geology

20080023397 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Temporally Varying Ethylene Emission on Jupiter

Romani, Paul N.; Jennings, Donald E.; Bjoraker, Gordon L.; Sada, Pedro V.; McCabe, Geprge; Boyle, Robert J.; [2008]; 2 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

Ethylene (C₂H₄) emission has been measured in the poles and equator of Jupiter. The 949 cm(sup -1) spectra were recorded with a high resolution spectrometer at the McMath-Pierce telescope at Kitt Peak in October-November 1998 and at the Infrared Telescope Facility at Mauna Kea in June 2000. C₂H₄ is an important product of methane chemistry in the outer planets. Knowledge of its abundance can help discriminate among the various proposed sets of CH₄ photolysis branching ratios at Ly-alpha, and determine the relative importance of the reaction pathways that produce C₂H₂ and C₂H₆. In the equatorial region the C₂H₄ emission is weak, and we were only able to detect it at high air-mass, near the limb. We derive a peak equatorial molar abundance of C₂H₄ of 4.5 x 10(exp -7) - 1.7 x 10(exp -6) near 2.2 x 10(exp -3) mbar, with a total column of 5.7 x 10(exp 14) - 2.2 x 10(exp 15) molecules cm(exp -2) above 10 mbar depending upon choice of thermal profile. We observed enhanced C₂H₄ emission from the poles in the regions where auroras are seen in X-ray, UV, and near infrared

images. In 2000 we measured a short-term change in the distribution of polar C₂H₄ emission; the emission in the north IR auroral ‘hot spot’ decreased by a factor of three over a two-day interval. This transient its contribution peak at 5-10 microbar suggests that the polar e is primarily a thermal effect coupled with vertical transport. Comparing our observations from Kitt Peak and Mauna Kea shows that the C₂H₄ emission of the northern non-‘hot spot’ auroral regions did not change over the three-year period while that in the southern polar regions decreased.

Author

Ethylene; Jupiter Atmosphere; Equatorial Regions; Astrophysics; Emission Spectra

20080023407 NASA Marshall Space Flight Center, Huntsville, AL, USA

The Ares Project: Building an Exploration Culture from the Inside Up

Cook, Stephan A.; April 17, 2008; 18 pp.; In English; In2InThinking Network 2008 Forum, 17-22 Apr. 2008, Los Angeles, CA, USA; DVD, Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [C01](#), DVD: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023407>

NASA is building its first new human-rated space exploration vehicles in nearly 40 years. This marks an important operational and cultural change from the Space Shuttle. In the wake of the Columbia disaster, the agency and the nation realized that NASA’s goals and culture needed to change. The Ares Project, which is building the launch vehicles that will power human beings to the Moon, Mars, and beyond, is taking a page from the Saturn playbook by having NASA lead both the overall integration and the development of the Ares I upper stage. Ares is also creating a new culture of cooperation, openness, and informed risk taking as we set our sights on other worlds. Ares has established a team environment where issues can be discussed, information is shared, fun and teamwork are encouraged, and constructive conflict and accountability are expected. Following a ‘One NASA’ philosophy, Ares is taking steps to strengthen cooperation among space centers, contractor partners, engineering and scientific communities, and headquarters personnel. As we learn lessons from things that went wrong with the Space Shuttle, we are also borrowing best practices from what has gone right with that program and others. All of these cultural elements will be necessary as we take the next steps beyond Earth orbit.

Author

Ares I Upper Stage; Space Exploration; NASA Programs; Launch Vehicles; Earth Orbits; Space Shuttles; Procedures

20080023437 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The New Horizons Mission to Pluto and Flyby of Jupiter

Stern, Alan; Weaver, Hal; Young, Leslie; Bagenal, Fran; Binzel, Richard; Buratti, Bonnie; Cheng, andy; Cruikshank, Dale; Gladstone, Randy; Grundy, Will; Hinson, David; Horanyi, Mihaly; Jennings, Don; Linscott, Ivan; McComas, Dave; McKinnon, William; McNutt, Ralph; Moore, Jeffrey; Murchie, Scott; Olkin, Cathy; Porco, Carolyn; Reitsema, Harold; Reuter, Dennis; Slater, Dave; Spencer, John; [2008]; 1 pp.; In English; Western Pacific Geophysics Meeting, 29 Jul. - 1 Aug. 2008, Cairns, Australia; Copyright; Avail.: Other Sources; Abstract Only

New Horizons (NH) is NASA’s mission to provide the first in situ reconnaissance of Pluto and its moons Charon, Nix, and Hydra. The NH spacecraft will reach Pluto in July 2015 and will then, if approved for an extended mission phase, continue on to a flyby encounter with one or more Kuiper belt objects (KBOs). NH was launched on 19 January 2006 and received a gravity assist during a flyby encounter with Jupiter (with closest approach at -32 RJ on 28 February 2007) that reduced its flight time to Pluto by 3 years. During the Jupiter flyby, NH collected a trove of multi-wavelength imaging and fields-and-particles measurements. Among the many science results at Jupiter were a detection of planet-wide mesoscale waves, eruptions of atmospheric ammonia clouds, unprecedented views of Io’s volcanic plumes and Jupiter’s tenuous ring system, a first close-up of the Little Red Spot (LRS), first sightings of polar lightning, and a trip down the tail of the magnetosphere. In 2015, NH will conduct a seven-month investigation of the Pluto system culminating in a closest approach some 12,500 km from Pluto’s surface. Planning is presently underway for the Pluto encounter with special emphasis on longidentified science goals of studying the terrain, geology, and composition of the surfaces of Pluto and Charon, examining the composition and structure of Pluto’s atmosphere, searching for an atmosphere on Charon, and characterizing Pluto’s ionosphere and solar wind interaction. Detailed inspections will also be performed of the newly discovered satellites Nix and Hydra. Additionally, NH will characterize energetic particles in Pluto’s environment, refine the bulk properties of Pluto and Charon, and search for additional satellites and rings.

Author

Flyby Missions; Jupiter (Planet); New Horizons Mission; Pluto (Planet); NASA Space Programs; Pluto Satellites

20080023447 NASA Marshall Space Flight Center, Huntsville, AL, USA

Launching to the Moon, Mars, and Beyond

Shivers, C. Herbert; April 08, 2008; 31 pp.; In English; American Society for Quality Section 1503 Meeting, 8 Apr. 2008, Huntsville, AL, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: **C01**, CD-ROM: **A03**, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080023447>

This viewgraph presentation discusses NASA's mission and addresses the following questions: 1) What is NASA's mission? 2) Why do we explore? 3) What is our timeline? 4) why the Moon first? 5) What will the vehicles look like? 6) What progress have we made? who will be doing the work? and 7) What are the benefits of space exploration?

CASI

Moon; Space Missions; NASA Space Programs; Flight Tests; Launch Vehicles; Mars (Planet)

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SOLAR PHYSICS

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

20080022945 NASA Marshall Space Flight Center, Huntsville, AL, USA

On the Relationship Between Solar Wind Speed, Geomagnetic Activity, and the Solar Cycle Using Annual Values

Wilson, Robert M.; Hathaway, David H.; February 2008; 24 pp.; In English; Original contains black and white illustrations Report No.(s): NASA/TP-2008-215249; M-1222; No Copyright; Avail.: CASI: **A03**, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080022945>

The aa index can be decomposed into two separate components: the leading sporadic component due to solar activity as measured by sunspot number and the residual or recurrent component due to interplanetary disturbances, such as coronal holes. For the interval 1964-2006, a highly statistically important correlation ($r = 0.749$) is found between annual averages of the aa index and the solar wind speed (especially between the residual component of aa and the solar wind speed, $r = 0.865$). Because cyclic averages of aa (and the residual component) have trended upward during cycles 11-23, cyclic averages of solar wind speed are inferred to have also trended upward.

Author

Wind Velocity; Solar Wind; Geomagnetism; Solar Cycles; Coronal Holes

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SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *51 Life Sciences*; on human beings see *52 Aerospace Medicine*. For theory see *73 Nuclear Physics*.

20080023455 NASA Langley Research Center, Hampton, VA, USA

The Influence of Ablation on Radiative Heating for Earth Entry

Johnston, Christopher O.; Gnoffo, Peter A.; Sutton, Kenneth; June 20, 2008; 16 pp.; In English; 40th AIAA Thermophysics Conference, 23-26 Jun. 2008, Seattle, WA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): 092837.04.01.03.06.04; Copyright; Avail.: CASI: **A03**, Hardcopy

Using the coupled ablation and radiation capability recently included in the LAURA flowfield solver, this paper investigates the influence of ablation on the shock-layer radiative heating for Earth entry. The extension of the HARA radiation model, which provides the radiation predictions in LAURA, to treat a gas consisting of the elements C, H, O, and N is discussed. It is shown that the absorption coefficient of air is increased with the introduction of the C and H elements. A simplified shock layer model is studied to show the impact of temperature, as well as the abundance of C and H, on the net absorption or emission from an ablation contaminated boundary layer. It is found that the ablation species reduce the radiative flux in the vacuum ultraviolet, through increased absorption, for all temperatures. However, in the infrared region of the spectrum, the ablation species increase the radiative flux, through strong emission, for temperatures above 3,000 K. Thus, depending on the temperature and abundance of ablation species, the contaminated boundary layer may either provide a net

increase or decrease in the radiative flux reaching the wall. To assess the validity of the coupled ablation and radiation LAURA analysis, a previously analyzed Mars-return case (15.24 km/s), which contains significant ablation and radiation coupling, is studied. Exceptional agreement with previous viscous shock-layer results is obtained. A 40% decrease in the radiative flux is predicted for ablation rates equal to 20% of the free-stream mass flux. The Apollo 4 peak-heating case (10.24 km/s) is also studied. For ablation rates up to 3.4% of the free-stream mass flux, the radiative heating is reduced by up to 19%, while the convective heating is reduced by up to 87%. Good agreement with the Apollo 4 radiometer data is obtained by considering absorption in the radiometer cavity. For both the Mars return and the Apollo 4 cases, coupled radiation alone is found to reduce the radiative heating by 30-60% and the convective heating by less than 5%.

Author

Ablation; Far Ultraviolet Radiation; Atmospheric Entry; Shock Layers; Flow Distribution; Infrared Spectra; Convective Heat Transfer

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