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Space Administration
Langley Research Center

Scientific and Technical
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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.

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

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

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

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

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

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

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

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

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

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  7115 Standard Drive
  Hanover, MD 21076-1320

Introduction

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

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

STAR includes citations to R&D results reported in:

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

The NASA STI Program

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

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

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

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

NASA STI Availability Information

NASA Center for AeroSpace Information (CASI)

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

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

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

National Technical Information Service (NTIS)

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

The Federal Depository Library Program (FDLP)

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

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

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

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Subject Term Index

Personal Author Index

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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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.

20070031685 NASA Glenn Research Center, Cleveland, OH, USA

Reduced-Order Modeling and Wavelet Analysis of Turbofan Engine Structural Response Due to Foreign Object Damage 'FOD' Events

Turso, James A.; Lawrence, Charles; Litt, Jonathan S.; Journal of Engineering for Gas Turbines and Power; July 2007; Volume 129, Issue 3, pp. 814-826; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 457280.02.07.03.04.03; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1115/1.2718230

The development of a wavelet-based feature extraction technique specifically targeting FOD-event induced vibration signal changes in gas turbine engines is described. The technique performs wavelet analysis of accelerometer signals from specified locations on the engine and is shown to be robust in the presence of significant process and sensor noise. It is envisioned that the technique will be combined with Kalman filter thermal/ health parameter estimation for FOD-event detection via information fusion from these (and perhaps other) sources. Due to the lack of high-frequency FOD-event test data in the open literature, a reduced-order turbofan structural model (ROM) was synthesized from a finite-element model modal analysis to support the investigation. In addition to providing test data for algorithm development, the ROM is used to determine the optimal sensor location for FOD-event detection. In the presence of significant noise, precise location of the FOD event in time was obtained using the developed wavelet-based feature.

Author

Wavelet Analysis; Pattern Recognition; Aircraft Hazards; Damage; Automatic Control; Gas Turbine Engines; Mathematical Models

20070031703 NASA Langley Research Center, Hampton, VA, USA

Safety Performance of Airborne Separation: Preliminary Baseline Testing

Consiglio, Maria C.; Hoadley, Sherwood T.; Wing, David J.; Baxley, Brian T.; [2007]; 10 pp.; In English; 7th AIAA Aviation Technology, Integration and Operations Conference (ATIO), 18-20 Sep. 2007, Belfast, Ireland; Original contains color illustrations

Contract(s)/Grant(s): WBS 411931.02.051.07.01.03; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070031703

The Safety Performance of Airborne Separation (SPAS) study is a suite of Monte Carlo simulation experiments designed to analyze and quantify safety behavior of airborne separation. This paper presents results of preliminary baseline testing. The preliminary baseline scenario is designed to be very challenging, consisting of randomized routes in generic high-density airspace in which all aircraft are constrained to the same flight level. Sustained traffic density is varied from approximately 3 to 15 aircraft per 10,000 square miles, approximating up to about 5 times today s traffic density in a typical sector. Research at high traffic densities and at multiple flight levels are planned within the next two years. Basic safety metrics for aircraft separation are collected and analyzed. During the progression of experiments, various errors, uncertainties, delays, and other

variables potentially impacting system safety will be incrementally introduced to analyze the effect on safety of the individual factors as well as their interaction and collective effect. In this paper we report the results of the first experiment that addresses the preliminary baseline condition tested over a range of traffic densities. Early results at five times the typical traffic density in today s NAS indicate that, under the assumptions of this study, airborne separation can be safely performed. In addition, we report on initial observations from an exploration of four additional factors tested at a single traffic density: broadcast surveillance signal interference, extent of intent sharing, pilot delay, and wind prediction error.
Author
Safety Factors; Monte Carlo Method; Airspace; Systems Engineering

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.

20070031687 NASA Glenn Research Center, Cleveland, OH, USA
Gravity-Dependent Combustion and Fluids Research - From Drop Towers to Aircraft to the ISS
Urban, David L.; Singh, Bhim S.; Kohl, Fred J.; May 25, 2007; 27 pp.; In English; International Space Development Conference, 24 May 2007, Dallas, TX, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 732759.03.01.02.21; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031687

Driven by the need for knowledge related to the low-gravity environment behavior of fluids in liquid fuels management, thermal control systems and fire safety for spacecraft, NASA embarked on a decades long research program to understand, accommodate and utilize the relevant phenomena. Beginning in the 1950s, and continuing through to today, drop towers and aircraft were used to conduct an ever broadening and increasingly sophisticated suite of experiments designed to elucidate the underlying gravity-dependent physics that drive these processes. But the drop towers and aircraft afford only short time periods of continuous low gravity. Some of the earliest rocket test flights and manned space missions hosted longer duration experiments. The relatively longer duration low-g times available on the space shuttle during the 1980s and 1990s enabled many specialized experiments that provided unique data for a wide range of science and engineering disciplines. Indeed, a number of STS-based Spacelab missions were dedicated solely to basic and applied microgravity research in the biological, life and physical sciences. Between 1980 and 2000, NASA implemented a vigorous Microgravity Science Program wherein combustion science and fluid physics were major components. The current era of space stations from the MIR to the International Space Station have opened up a broad range of opportunities and facilities that are now available to support both applied research for technologies that will help to enable the future exploration missions and for a continuation of the non-exploration basic research that began over fifty years ago. The ISS-based facilities of particular value to the fluid physics and combustion/fire safety communities are the Fluids and Combustion Facility Combustion Integrated Rack and the Fluids Integrated Rack.
Author
Drop Towers; Fluid Dynamics; Gravitational Effects; International Space Station; Combustion; Research Projects; Combustion Chambers

20070031734 American Inst. of Aeronautics and Astronautics, Reston, VA, USA
UAV Worldwide Roundup 2007
Wilson, J. R.; Aerospace America; May 2007; ISSN 0740-722X; Volume 45, No. 5, pp. 30-37; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

Since Aerospace America's last UAV roundup, in September 2005, the number of nations with UAVs in development or production has grown slightly, as has the number of platforms (to over 500). But the actual players have changed dramatically. Given the speed with which they come and go, some of those in this discussion may well be gone or going by the time we go to press, while new companies, programs- and even nations-may have joined the ranks. This, of course, reflects the continued demand for UAVs by the world's militaries (and, increasingly, by civilian government and industry users). It also reveals the rapid changes in how that demand is manifested, and the relative ease, vis a vis other technologies, with which a new platform or company can enter the fray. For many, the term UAV evokes visions-of Predator or Global Hawk. But those are among the rare advanced technology systems in the highest classifications of the genre. Far more common are craft that

resemble powered model airplanes, but with greater range and endurance (at least in some cases). There are also flying discs, large and small airships (blimps, dirigibles, aerostats), and even powered boomerangs. UAVs are the easiest way for a company or nation to enter the aviation manufacturing field-and one of the hardest to survive. As with any developing technology, users become more demanding at all levels as the highest end vehicles grow in capability and complexity. Almost any company involved could produce something roughly equivalent-or even far superior-to the U.S. Pioneer, which proved itself so well during the first gulf war that UAVs became a standard part of the U.S. military by the time of Operation Enduring Freedom a decade later. But few are capable of replicating the hero of the second gulf war, the Predator, which became the first armed UAV. Even fewer could match the new Reaper (nee Predator B, which shares little but the name-since dropped by the Air Forcewith Predator A). And while a handful are attempting to duplicate Global Hawk, none has yet succeeded.
Derived from text
Pilotless Aircraft; Aircraft Models; Aerospace Engineering; Military Aircraft

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.

20070031729 NASA Marshall Space Flight Center, Huntsville, AL, USA
DART AVGS Performance
Howard, Richard T.; Bryan, Thomas C.; April 09, 2007; 11 pp.; In English; SPIE Defense and Security Symposium, 9-13 Apr. 2007, Orlando, FL, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031729

The Advanced Video Guidance Sensor (AVGS) was designed to be the proximity operations sensor for the Demonstration of Autonomous Rendezvous Technologies (DART). The DART mission flew in April of2005 and was a partial success. The AVGS did not get the opportunity to operate in every mode in orbit, but those modes in which it did operate were completely successful. This paper will detail the development, testing, and on-orbit performance of the AVGS.
Author
Autonomy; Guidance Sensors; Video Communication; Avionics; Space Rendezvous; Spacecraft Docking; Spacecraft Performance

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.

20070031718 NASA Glenn Research Center, Cleveland, OH, USA
Integration of On-Line and Off-Line Diagnostic Algorithms for Aircraft Engine Health Management
Kobayashi, Takahisa; Simon, Donald L.; September 2007; 17 pp.; In English; ASME/IGTI Turbo Expo 2007, 14-17 May 2007, Montreal, Canada; Original contains color illustrations
Contract(s)/Grant(s): NAS3-00145; 122711.03.11.03.04.01
Report No.(s): NASA/TM-2007-214980; E-16132; ARL-TR-4090; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031718

This paper investigates the integration of on-line and off-line diagnostic algorithms for aircraft gas turbine engines. The on-line diagnostic algorithm is designed for in-flight fault detection. It continuously monitors engine outputs for anomalous signatures induced by faults. The off-line diagnostic algorithm is designed to track engine health degradation over the lifetime of an engine. It estimates engine health degradation periodically over the course of the engine s life. The estimate generated

by the off-line algorithm is used to update the on-line algorithm. Through this integration, the on-line algorithm becomes aware of engine health degradation, and its effectiveness to detect faults can be maintained while the engine continues to degrade. The benefit of this integration is investigated in a simulation environment using a nonlinear engine model.
Author
Algorithms; Aircraft Engines; Systems Health Monitoring; On-Line Systems; Fault Detection; Gas Turbine Engines; Systems Integration

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*.

20070031201 NASA Johnson Space Center, Houston, TX, USA
Exploration Blueprint Data Book
Drake, Bret G.; July 2007; 608 pp.; In English; See also 20070025041; See also JSC-63724; Original contains color and black and white illustrations
Report No.(s): NASA/TM-2007-214763; JSC 63724; S-1013; No Copyright; Avail.: CASI: A99, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031201

The material contained in this report was compiled to capture the work performed by the National Aeronautics and Space Administration's (NASA's) Exploration study team in the late 2002 timeframe. The Exploration Blueprint Data Book documents the analyses and findings of the 90-day Agency-wide study conducted from September November 2002. The NASA Deputy Administrator requested that a study be performed with the following objectives: Develop the rationale for exploration beyond low-Earth orbit, roadmaps for how to accomplish the first steps through humans to Mars, design reference missions as a basis for the roadmaps and make recommendations on what can be done now to effect this future. This planning team performed architecture analyses to develop roadmaps for how to accomplish the first steps beyond LEO through the human exploration of Mars. The reference missions resulting from the analysis performed by the Exploration Blueprint team formed the basis for requirement definition, systems development, technology roadmapping, and risk assessments for future human exploration beyond low-Earth orbit. Emphasis was placed on developing recommendations on what could be done now to effect future exploration activities. The team embraced the Stepping Stone approach to exploration where human and robotic activities are conducted through progressive expansion outward beyond low-Earth orbit. Results from this study produced a long-term strategy for exploration with near-term implementation plans, program recommendations, and technology investments.
Author
Manned Mars Missions; Space Exploration; Mission Planning; Systems Integration; Space Transportation; Space Missions; Data Processing

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*.

20070031124 NASA Langley Research Center, Hampton, VA, USA
Crew Exploration Vehicle Ascent Abort Overview
Davidson, John B., Jr.; Madsen, Jennifer M.; Proud, Ryan W.; Merritt, Deborah S.; Sparks, Dean W., Jr.; Kenyon, Paul R.; Burt, Richard; McFarland, Mike; August 20, 2007; 15 pp.; In English; AIAA Guidance, Navigation, and Control Conference and Exhibit, 20-23 Aug. 2007, Hilton Head, SC, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 644423.12; Copyright; Avail.: CASI: A03, Hardcopy

One of the primary design drivers for NASA's Crew Exploration Vehicle (CEV) is to ensure crew safety. Aborts during the critical ascent flight phase require the design and operation of CEV systems to escape from the Crew Launch Vehicle and return the crew safely to the Earth. To accomplish this requirement of continuous abort coverage, CEV ascent abort modes are being designed and analyzed to accommodate the velocity, altitude, atmospheric, and vehicle configuration changes that

occur during ascent. The analysis involves an evaluation of the feasibility and survivability of each abort mode and an assessment of the abort mode coverage. These studies and design trades are being conducted so that more informed decisions can be made regarding the vehicle abort requirements, design, and operation. This paper presents an overview of the CEV, driving requirements for abort scenarios, and an overview of current ascent abort modes. Example analysis results are then discussed. Finally, future areas for abort analysis are addressed.
Author
Crew Exploration Vehicle; Ascent; Aborted Missions; General Overviews; Spacecraft Launching

20070031693 ATK Launch Systems, Brigham City, UT, USA
ATK Launch Systems Engineering NASA Programs Engineering Examples
Richardson, David; [2007]; 42 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAS8-97238; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031693

This presentation provides an overview of the work done at ATK Launch Systems with and indication of how engineering knowledge can be applied to several real world problems. All material in the presentation has been screened to meet ITAR restrictions. The information provided is a compilation of general engineering knowledge and material available in the public domain. The presentation provides an overview of ATK Launch Systems and NASA programs. Some discussion is provided about the types of engineering conducted at the Promontory plant with added detail about RSRM nozzle engineering. Some brief examples of examples of nozzle technical issues with regard to adhesives and phenolics are shared. These technical issue discussions are based on material available in the public domain.
Author
NASA Programs; Systems Engineering; Launch Vehicle Configurations; General Overviews; Aerospace Systems

20070031695 NASA Marshall Space Flight Center, Huntsville, AL, USA
Risk Assessment Challenges in the Ares I Upper Stage
Stott, James E.; Ring, Robert W.; Elrada, Hassan A.; Hark, Frank; May 14, 2007; 6 pp.; In English; 2nd IAASS Conference: Space Safety in a Global World, 14-17 May 2007, Chicago, IL, USA; Original contains color illustrations; Copyright; Avail.: CASI: A02, Hardcopy

NASA Marshall Space Flight Center (MSFC) is currently at work developing hardware and systems for the Ares I rocket that will send future astronauts into orbit. Built on cutting-edge launch technologies, evolved powerful Apollo and Space Shuttle propulsion elements, and decades of NASA spaceflight experience, Ares I is the essential core of a safe, reliable, cost-effective space transportation system -- one that will carry crewed missions back to the moon, on to Mars and out into the solar system. Ares I is an in-line, two-stage rocket configuration topped by the Orion crew vehicle and its launch abort system. In addition to the vehicle's primary mission -carrying crews of four to six astronauts to Earth orbit --Ares I may also use its 25-ton payload capacity to deliver resources and supplies to the International Space Station, or to 'park' payloads in orbit for retrieval by other spacecraft bound for the moon or other destinations. Crew transportation to the International Space Station is planned to begin no later than 2014. The first lunar excursion is scheduled for the 2020 timeframe. This paper presents the challenges in designing the Ares I upper stage for reliability and safety while minimizing weight and maximizing performance.
Author
Ares 1 Upper Stage; Risk; International Space Station; Launch Vehicle Configurations; Systems Integration

20070031700 NASA Marshall Space Flight Center, Huntsville, AL, USA
Design for Reliability and Safety Approach for the New NASA Launch Vehicle
Safie, Fayssal M.; Weldon, Danny M.; May 14, 2007; 6 pp.; In English; 2nd IAASS Conference: Space Safety in a Global World, 14-17 May 2007, Chicago, IL, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031700

The USA National Aeronautics and Space Administration (NASA) is in the midst of a space exploration program intended for sending crew and cargo to the international Space Station (ISS), to the moon, and beyond. This program is called Constellation. As part of the Constellation program, NASA is developing new launch vehicles aimed at significantly increase safety and reliability, reduce the cost of accessing space, and provide a growth path for manned space exploration. Achieving these goals requires a rigorous process that addresses reliability, safety, and cost upfront and throughout all the phases of the

life cycle of the program. This paper discusses the 'Design for Reliability and Safety' approach for the NASA new launch vehicles, the ARES I and ARES V. Specifically, the paper addresses the use of an integrated probabilistic functional analysis to support the design analysis cycle and a probabilistic risk assessment (PRA) to support the preliminary design and beyond. Author

Constellation Program; International Space Station; Launch Vehicles; Reliability; NASA Space Programs; Aerospace Safety; Launch Vehicle Configurations

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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*.

20070031699 NASA Marshall Space Flight Center, Huntsville, AL, USA

Engineering and Safety Partnership Enhances Safety of the Space Shuttle Program (SSP)

Duarte, Alberto; May 14, 2007; 9 pp.; In English; 2nd IAASS Conference: Space Safety in a Global World, 14-16 May 2007, Chicago, IL, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070031699

Project Management must use the risk assessment documents (RADs) as tools to support their decision making process. Therefore, these documents have to be initiated, developed, and evolved parallel to the life of the project. Technical preparation and safety compliance of these documents require a great deal of resources. Updating these documents after-the-fact not only requires substantial increase in resources - Project Cost -, but this task is also not useful and perhaps an unnecessary expense. Hazard Reports (HRs), Failure Modes and Effects Analysis (FMEAs), Critical Item Lists (CILs), Risk Management process are, among others, within this category. A positive action resulting from a strong partnership between interested parties is one way to get these documents and related processes and requirements, released and updated in useful time. The Space Shuttle Program (SSP) at the Marshall Space Flight Center has implemented a process which is having positive results and gaining acceptance within the Agency. A hybrid Panel, with equal interest and responsibilities for the two larger organizations, Safety and Engineering, is the focal point of this process. Called the Marshall Safety and Engineering Review Panel (MSERP), its charter (Space Shuttle Program Directive 110 F, April 15, 2005), and its Operating Control Plan emphasizes the technical and safety responsibilities over the program risk documents: HRs; FMEA/CILs; Engineering Changes; anomalies/problem resolutions and corrective action implementations, and trend analysis. The MSERP has undertaken its responsibilities with objectivity, assertiveness, dedication, has operated with focus, and has shown significant results and promising perspectives. The MSERP has been deeply involved in propulsion systems and integration, real time technical issues and other relevant reviews, since its conception. These activities have transformed the propulsion MSERP in a truly participative and value added panel, making a difference for the safety of the Space Shuttle Vehicle, its crew, and personnel. Because of the MSERP's valuable contribution to the assessment of safety risk for the SSP, this paper also proposes an enhanced Panel concept that takes this successful partnership concept to a higher level of 'true partnership'. The proposed panel is aimed to be responsible for the review and assessment of all risk relative to Safety for new and future aerospace and related programs.

Author

Aerospace Safety; Project Management; Space Shuttles; NASA Space Programs; Systems Engineering

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*.

20070031740 NASA Marshall Space Flight Center, Huntsville, AL, USA

Development of a Deployable Nonmetallic Boom for Reconfigurable Systems of Small Modular Spacecraft

Rehnmark, Fredrik; April 23, 2007; 5 pp.; In English; 48th AIAA Structures, Structural Dynamics and Materials Conference, 23 - 26 Apr. 2007, Waikiki, Hawaii, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NNM05AA99C; Copyright; Avail.: CASI: A01, Hardcopy

Launch vehicle payload capacity and the launch environment represent two of the most operationally limiting constraints

on space system mass, volume, and configuration. Large-scale space science and power platforms as well as transit vehicles have been proposed that greatly exceed single-launch capabilities. Reconfigurable systems launched as multiple small modular spacecraft with the ability to rendezvous, approach, mate, and conduct coordinated operations have the potential to make these designs feasible. A key characteristic of these proposed systems is their ability to assemble into desired geometric (spatial) configurations. While flexible and sparse formations may be realized by groups of spacecraft flying in close proximity, flyers physically connected by active structural elements could continuously exchange power, fluids, and heat (via fluids). Configurations of small modular spacecraft temporarily linked together could be sustained as long as needed with minimal propellant use and reconfigured as often as needed over extended missions with changing requirements. For example, these vehicles could operate in extremely compact configurations during boost phases of a mission and then redeploy to generate power or communicate while coasting and upon reaching orbit. In 2005, NASA funded Phase 1 of a program called Modular Reconfigurable High-Energy Technology Demonstrator Assembly Testbed (MRHE) to investigate reconfigurable systems of small spacecraft. The MRHE team was led by NASA's Marshall Space Flight Center and included Lockheed Martin's Advanced Technology Center (ATC) in Palo Alto and its subcontractor, ATK. One of the goals of Phase 1 was to develop an MRHE concept demonstration in a relevant 1-g environment to highlight a number of requisite technologies. In Phase 1 of the MRHE program, Lockheed Martin devised and conducted an automated space system assembly demonstration featuring multipurpose free-floating robots representing Spacecraft in the newly built Controls and Automation Laboratory (CAL) at the ATC. The CAL lab features a 12' x 24' granite air-bearing table and an overhead simulated starfield. Among the technologies needed for the concept demo were mating interfaces allowing the spacecraft to dock and deployable structures allowing for adjustable separation between spacecraft after a rigid connection had been established. The decision to use a nonmetallic deployable boom for this purpose was driven by the MRHE concept demo requirements reproduced in Table 1.
Author
Modularity; Booms (Equipment); Space Erectable Structures; Automation; Composite Materials; Spacecraft Configurations

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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*.

20070031692 NASA Marshall Space Flight Center, Huntsville, AL, USA
Gravity Probe B Timing System and Roll Phase Determination
Jie, Li; Kolodziejczak, Jeffery; April 14, 2007; 12 pp.; In English; American Physical Society Annual 2007 Meeting, 14-17 Apr. 2007, Jacksonville, FL, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NAS8-39225
Report No.(s): APR07-2007-000863; Copyright; Avail.: CASI: A03, Hardcopy

An oven-controlled crystal oscillator at 16.368 MHz provides clock signals to all GP-B components and synchronizes the data collection, transmission and processing. The sampled science data signals are stamped with the vehicle time, a counter of the 10Hz data strobe divided down from the clock. The GPS receiver supplies an external reference for time transfer between the vehicle time and coordinated universal time. Ground and space flight tests show the time transfer error is within 1 microsecond. The time latency between the effective sample time of science signals and the stamped vehicle time is verified to 1 ms in the ground tests. The GP-B satellite is controlled to roll with a period of 77.5 sec about an axis along the direction to the guide star to average out the disturbance torques fixed to the body of the satellite and reduce the gyroscope readout noise. The roll phase is determined on the ground to high accuracy with the telemetry data from two star trackers and used in the data analysis to separate the drifts of gyroscope spin axes in the orbital plane and perpendicular to the orbital plane. The flight data shows that the roll phase is controlled to within 40 arcsec with a measurement uncertainty of 7 arcsec.
Author
Crystal Oscillators; Gravity Probe B; Roll; Telemetry; Time Signals; Phase Error

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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*.

20070031690 NASA Glenn Research Center, Cleveland, OH, USA

Electric Propulsion Requirements and Mission Analysis Under NASA's In-Space Propulsion Technology Project

Dudzinski, Leonard a.; Pencil, Eric J.; Dankanich, John W.; September 17, 2007; 7 pp.; In English; 30th International Electric Propulsion Conference, 17-20 Sep. 2007, Florence, Italy; Original contains color illustrations

Contract(s)/Grant(s): WBS 346620.01.03.01

Report No.(s): IEPC-2007-354; Copyright; Avail.: CASI: A02, Hardcopy

The In-Space Propulsion Technology Project (ISPT) is currently NASA's sole investment in electric propulsion technologies. This project is managed at NASA Glenn Research Center (GRC) for the NASA Headquarters Science Mission Directorate (SMD). The objective of the electric propulsion project area is to develop near-term and midterm electric propulsion technologies to enhance or enable future NASA science missions while minimizing risk and cost to the end user. Systems analysis activities sponsored by ISPT seek to identify future mission applications in order to quantify mission requirements, as well as develop analytical capability in order to facilitate greater understanding and application of electric propulsion and other propulsion technologies in the ISPT portfolio. These analyses guide technology investments by informing decisions and defining metrics for technology development to meet identified mission requirements. This paper discusses the missions currently being studied for electric propulsion by the ISPT project, and presents the results of recent electric propulsion (EP) mission trades. Recent ISPT systems analysis activities include: an initiative to standardize life qualification methods for various electric propulsion systems in order to retire perceived risk to proposed EP missions; mission analysis to identify EP requirements from Discovery, New Frontiers, and Flagship classes of missions; and an evaluation of system requirements for radioisotope-powered electric propulsion. Progress and early results of these activities is discussed where available.

Author

Technology Utilization; Systems Analysis; Mission Planning; NASA Programs; Electric Propulsion

20070031728 NASA Marshall Space Flight Center, Huntsville, AL, USA

Development of a Deployable Nonmetallic Boom for Reconfigurable Systems of Small Spacecraft

Rehnmark, Fredrik; Pryor, Mark; Holmes, Buck; Schaechter, David; Pedreiro, Nelson; Carrington, Connie; April 23, 2007; 19 pp.; In English; 48th AIAA Structures, Structural Dynamics, and Materials Conference, 23-26 Apr. 2007, Waikiki, HI, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NNM05AA99C; Copyright; Avail.: CASI: A03, Hardcopy

In 2005, NASA commenced Phase 1 of the Modular Reconfigurable High Energy Technology Demonstrator (MRHE) program to investigate reconfigurable systems of small spacecraft. During that year, Lockheed Martin's Advanced Technology Center (ATC) led an accelerated effort to develop a 1-g MRHE concept demonstration featuring robotic spacecraft simulators equipped with docking mechanisms and deployable booms. The deployable boom built for MRHE was the result of a joint effort in which ATK was primarily responsible for developing and fabricating the Collapsible Rollable Tube (CRT patent pending) boom while Lockheed Martin designed and built the motorized Boom Deployment Mechanism (BDM) under a concurrent but separate IR&D program. Tight coordination was necessary to meet testbed integration and functionality requirements. This paper provides an overview of the CRT boom and BDM designs and presents preliminary results of integration and testing to support the MRHE demonstration.

Author

Fabrication; Booms (Equipment); Space Erectable Structures; Modularity; Solar Power Satellites; Technology Utilization; Spacecraft Design

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*.

20070031175 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Extraction of Lead Compounds for Remediation of Lead-Based Paints
Quinn, Jacqueline; Center Director's Discretionary Fund 2005 Annual Report; 2007, pp. 33-38; In English; See also 20070031172; Original contains color illustrations; Copyright; Avail.: CASI: A02, Hardcopy

The research described herein sought to develop a wipe-on, wipe-off chemical process to remove lead oxides found in paint. Lead is a toxic substance that can cause a variety of health problems, including such diverse conditions as brain damage in children and digestive and nervous disorders in adults. Lead poisoning can also affect wildlife in areas where the metal has contaminated natural media. Lead can be found in paint, soil, household dust, and even in drinking water from lead plumbing or lead solder. Considerable amounts of lead contamination exist today as a direct result of the use of lead in paint prior to its ban in 1978. Formerly, lead paint was chosen as a coating for steel structures because of its superior durability, adhesion capabilities, and rust prevention characteristics, but it was also used prolifically in houses built before 1978. Old chipping paint can contaminate areas surrounding the structure and create concerns for human health and the environment. Removing lead, especially from lead paint, is of great importance to prevent this dangerous potential, which still exists today. The removal or elimination of lead-containing paint remains a costly and hazardous process. Unsafe removal of lead by dry abrasive blasting, the leading technology attacking the problem today, can initiate release large amounts of contaminated particulate matter that also pose health risks.
Derived from text
Extraction; Paints; Lead Compounds; Lead Poisoning; Chemical Reactions; Toxicity

20070031178 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Formulation of Specialty Polymeric Materials for Electrostatic Dissipation and Flame Retardancy
Williams, Martha; Smith, Trent; Roberson, Luke; Clayton, LaNetra; Quinn, Jacqueline; Center Director's Discretionary Fund 2005 Annual Report; 2007, pp. 89-102; In English; See also 20070031172; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

This project addresses the formulation and use of advanced materials to meet system safety needs to minimize electrostatic charges, flammability, and radiation exposure for future spaceport technologies such as spaceport personnel protective systems, human/robotic exploration missions, and homeland security applications. The research includes enhanced polymer feasibility studies on the addition of metallic nanoscale particles into polymers for enhanced electrostatic dissipative properties and for possible radiation shielding applications. Unique materials that have both electrostatic dissipation and flammability properties will be specifically formulated and engineered. Unique formulations will include the investigation of new flame-retardant additives, inorganic nanomaterials, conductive polymers, metallic nanoparticles, and other constituent materials.
Derived from text
Flame Retardants; Electrostatic Charge; Electrostatics; Dissipation; Safety Factors; Radiation Shielding; Flammability

20070031570 NASA Glenn Research Center, Cleveland, OH, USA
Tribological Performance of PM300 Solid Lubricant Bushings for High Temperature Applications
Striebing, Donald R.; Stanford, Malcolm K.; DellaCorte, Christopher; Rossi, Anne M.; August 2007; 21 pp.; In English; 2003 Annual Meeting and Exhibition, 28-1 May 2003, New York, NY, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 661681.02.07.03.03.02
Report No.(s): NASA/TM2007-214819; ARL-TR-4222; E-15977; Copyright; Avail.: CASI: A03, Hardcopy

PM300 is a high temperature solid lubricant material produced through conventional powder metallurgy processing. PM300 is a combination of metal binder (NiCr), hardener (Cr2O3) and lubricant (Ag and BaF2/CaF2) phases and is in commercial use in high temperature furnace conveyors. In this paper, the tribological characteristics of PM300 are evaluated using a newly developed bushing test rig in which PM300 bushings are loaded against rotating steel shafts at temperatures

from 25 to 650 C. The data shows that friction and wear are low to moderate and that the lubrication performance (friction) improves with increasing temperature. Several alternative PM300 compositions are evaluated which do not contain silver and are targeted at aircraft gas turbine applications in which environmental compatibility of silver is a concern. It is expected that the data resulting from this research will further the commercialization of this technology.
Author
High Temperature Lubricants; Powder Metallurgy; Solid Lubricants; Tribology; Bushings

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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*.

20070031180 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Smart Coatings for Corrosion Sensing and Protection
Calle, Luz Marina; Li, Wenyan; Center Director's Discretionary Fund 2005 Annual Report; 2007, pp. 65-82; In English; See also 20070031172; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

This research is aimed at developing 'smart coatings' to detect and control corrosion at an early stage to prevent further corrosion. NASA began corrosion studies at Kennedy Space Center (KSC) in 1966 during the Gemini and Apollo programs with the evaluation of coatings for long-term atmospheric protection of carbon steel. The environment near the KSC launch pads has been documented by the American Society of Materials (ASM) as one of the most corrosive naturally occurring environments in the world [1]. With the introduction of the Space Shuttle in 1981, the already highly corrosive conditions at the launch pads were rendered even more severe by the acidic exhaust from the Solid Rocket Boosters. In the years that followed, numerous studies have identified materials, coatings, and maintenance procedures for launch hardware and equipment exposed to the highly corrosive environment at the launch pads. The results obtained to date indicate that this project has been successful in developing microcapsules that respond to the basic pH conditions present when localized corrosion occurs by delivering an indicator that changes color. The results also indicate that the microcapsules have the ability to deliver a corrosion inhibitor under the same conditions.
Derived from text
Corrosion; Corrosion Prevention; Coatings; Detection; Carbon Steels; Acidity; Space Shuttle Boosters

20070031626 NASA Johnson Space Center, Houston, TX, USA
STS 117 Return Samples: Assessment of Air Quality aboard the Shuttle (STS-117) and International Space Station
James, John T.; [2007]; 2 pp.; In English; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031626

The toxicological assessments of 2 grab sample canisters (GSCs) and one pair of formaldehyde badges from the Shuttle are reported. Analytical methods have not changed from earlier reports. The recoveries of the 3 surrogates (C-13-acetone, fluorobenzene, and chlorobenzene) from the 2 GSCs averaged 109, 95, and 97%, respectively. Three formaldehyde controls averaged 93% recovery. The Shuttle atmosphere was acceptable for human respiration.
Derived from text
Air Quality; International Space Station; Space Shuttles; Toxicology

26
METALS AND METALLIC MATERIALS

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

20070031684 NASA Glenn Research Center, Cleveland, OH, USA
A Microfabricated Involute-Foil Regenerator for Stirling Engines
Tew, Roy; Ibrahim, Mounir; Danila, Daniel; Simon, Terry; Mantell, Susan; Sun, Liyong; Gedeon, David; Kelly, Kevin; McLean, Jeffrey; Wood, Gary; Qiu, Songgang; June 25, 2007; 21 pp.; In English; 5th International Energy Conversion Engineering Conference and Exhibit (IECES), 25-27 Jun. 2007, Saint Louis, MO, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 138494.04.01.01; Copyright; Avail.: CASI: A03, Hardcopy

A segmented involute-foil regenerator has been designed, microfabricated and tested in an oscillating-flow rig with

excellent results. During the Phase I effort, several approximations of parallel-plate regenerator geometry were chosen as potential candidates for a new microfabrication concept. Potential manufacturers and processes were surveyed. The selected concept consisted of stacked segmented-involute-foil disks (or annular portions of disks), originally to be microfabricated from stainless-steel via the LiGA (lithography, electroplating, and molding) process and EDM (electric discharge machining). During Phase II, re-planning of the effort led to test plans based on nickel disks, microfabricated via the LiGA process, only. A stack of nickel segmented-involute-foil disks was tested in an oscillating-flow test rig. These test results yielded a performance figure of merit (roughly the ratio of heat transfer to pressure drop) of about twice that of the 90% random fiber currently used in small ~ 100 W Stirling space-power convertors in the Reynolds Number range of interest (50-100). A Phase III effort is now underway to fabricate and test a segmented-involute-foil regenerator in a Stirling convertor. Though funding limitations prevent optimization of the Stirling engine geometry for use with this regenerator, the Sage computer code will be used to help evaluate the engine test results. Previous Sage Stirling model projections have indicated that a segmented-involute-foil regenerator is capable of improving the performance of an optimized involute-foil engine by 6-9%; it is also anticipated that such involute-foil geometries will be more reliable and easier to manufacture with tight-tolerance characteristics, than random-fiber or wire-screen regenerators. Beyond the near-term Phase III regenerator fabrication and engine testing, other goals are (1) fabrication from a material suitable for high temperature Stirling operation (up to 850 C for current engines; up to 1200 C for a potential engine-cooler for a Venus mission), and (2) reduction of the cost of the fabrication process to make it more suitable for terrestrial applications of segmented involute foils. Past attempts have been made to use wrapped foils to approximate the large theoretical figures of merit projected for parallel plates. Such metal wrapped foils have never proved very successful, apparently due to the difficulties of fabricating wrapped-foils with uniform gaps and maintaining the gaps under the stress of time-varying temperature gradients during start-up and shut-down, and relatively-steady temperature gradients during normal operation. In contrast, stacks of involute-foil disks, with each disk consisting of multiple involute-foil segments held between concentric circular ribs, have relatively robust structures. The oscillating-flow rig tests of the segmented-involute-foil regenerator have demonstrated a shift in regenerator performance strongly in the direction of the theoretical performance of ideal parallel-plate regenerators.
Author
Fabrication; Metal Foils; Regenerators; Stirling Engines; Computational Fluid Dynamics; Nickel

20070031720 Lockheed Martin Space Systems Co., USA
ET Toxic Metals Replacement Review SEA Spring Face to Face
Pratz, Earl; May 15, 2007; 8 pp.; In English; Aerospace Chromium Elimination Team Meeting, 15-16 May 2007, Colorado Springs, CO, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NAS8-00016; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031720

The information contained in the presentation covers development work carried out under SDS projects. The intent of the effort is to find chrome(VI) free alternates to our current chromated processing solutions. The information presented reports progress in work aimed to replace our alkaline cleaner (Turco 4215), conversion coat (Iridite 14-2) and chrome (VI) compounds used in LOx tank hydrostatic proof test solution. To date we have found candidates for use in the proof test solution and alkaline cleaner. These candidates are in the final stages of testing. Lab data is reported in the presentation.
Author
Metals; Toxicity; Cleaners; Replacing

27
NONMETALLIC MATERIALS

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

20070031691 ATK Launch Systems, Brigham City, UT, USA
Pressure Sensitive Tape in the Manufacture of Reusable Solid Rocket Motors
Champneys, Jeff; May 14, 2007; 41 pp.; In English; Pressure Sensitive Tape Council/Intertape Polymer Group, 14-19 May 2007, Orlando, FL, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAS8-97238; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031691

ATK Launch Systems Inc. manufactures the reusable solid rocket motor (RSRM) for NASA's Space Shuttle program.

They are used in pairs to launch the Space Shuttle. Pressure sensitive tape (PST) is used throughout the RSRM manufacturing process. A few PST functions are: 1) Secure labels; 2) Provide security seals; and 3) Protect tooling and flight hardware during various inert and live operations. Some of the PSTs used are: Cloth, Paper, Reinforced Teflon, Double face, Masking, and Vinyl. Factors given consideration for determining the type of tape to be used are: 1) Ability to hold fast; 2) Ability to release easily; 3) Ability to endure abuse; 4) Strength; and 5) Absence of adhesive residue after removal.
Author
Manufacturing; Reusable Rocket Engines; Solid Propellant Rocket Engines; Pressure; Sensitivity; Aerospace Systems; Plastic Tapes

28
PROPELLANTS AND FUELS

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

20070031548 NASA Glenn Research Center, Cleveland, OH, USA
Radio Frequency Mass Gauging of Propellants
Zimmerli, Gregory A.; Vaden, Karl R.; Herlacher, Michael D.; Buchanan, David A.; VanDresar, Neil T.; August 2007; 14 pp.; In English; 45th AIAA Aerospace Sciences Meeting and Exhibit, 8-11 Jan. 2007, Reno, NV, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 253225.04.01.02.05.03.03
Report No.(s): NASA/TM-2007-214907; AIAA 2007-1198; E-16068; Copyright; Avail.: CASI: A03, Hardcopy

A combined experimental and computer simulation effort was conducted to measure radio frequency (RF) tank resonance modes in a dewar partially filled with liquid oxygen, and compare the measurements with numerical simulations. The goal of the effort was to demonstrate that computer simulations of a tank's electromagnetic eigenmodes can be used to accurately predict ground-based measurements, thereby providing a computational tool for predicting tank modes in a low-gravity environment. Matching the measured resonant frequencies of several tank modes with computer simulations can be used to gauge the amount of liquid in a tank, thus providing a possible method to gauge cryogenic propellant tanks in low-gravity. Using a handheld RF spectrum analyzer and a small antenna in a 46 liter capacity dewar for experimental measurements, we have verified that the four lowest transverse magnetic eigenmodes can be accurately predicted as a function of liquid oxygen fill level using computer simulations. The input to the computer simulations consisted of tank dimensions, and the dielectric constant of the fluid. Without using any adjustable parameters, the calculated and measured frequencies agree such that the liquid oxygen fill level was gauged to within 2 percent full scale uncertainty. These results demonstrate the utility of using electromagnetic simulations to form the basis of an RF mass gauging technology with the power to simulate tank resonance frequencies from arbitrary fluid configurations.
Author
Computerized Simulation; Propellant Tanks; Radio Frequencies; Resonant Frequencies; Cryogenics; Measuring Instruments

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*.

20070031129 NASA Johnson Space Center, Houston, TX, USA
On the Determination of Poisson Statistics for Haystack Radar Observations of Orbital Debris
Stokely, Christopher L.; Benbrook, James R.; Horstman, Matt; September 24, 2007; 8 pp.; In English; International Astronomical Conference, 24-27 Sep. 2007, Hyderabad, India; Original contains black and white illustrations
Contract(s)/Grant(s): NNJ05HI05C
Report No.(s): IAC-07-6.2.03; Copyright; Avail.: CASI: A02, Hardcopy

A convenient and powerful method is used to determine if radar detections of orbital debris are observed according to Poisson statistics. This is done by analyzing the time interval between detection events. For Poisson statistics, the probability distribution of the time interval between events is shown to be an exponential distribution. This distribution is a special case

of the Erlang distribution that is used in estimating traffic loads on telecommunication networks. Poisson statistics form the basis of many orbital debris models but the statistical basis of these models has not been clearly demonstrated empirically until now. Interestingly, during the fiscal year 2003 observations with the Haystack radar in a fixed staring mode, there are no statistically significant deviations observed from that expected with Poisson statistics, either independent or dependent of altitude or inclination. One would potentially expect some significant clustering of events in time as a result of satellite breakups, but the presence of Poisson statistics indicates that such debris disperse rapidly with respect to Haystack's very narrow radar beam. An exception to Poisson statistics is observed in the months following the intentional breakup of the Fengyun satellite in January 2007.
Author
Debris; Poisson Density Functions; Radar Tracking; Mathematical Models

33
ELECTRONICS AND ELECTRICAL ENGINEERING

Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment; and microelectronics and integrated circuitry. for related information see also *60 Computer Operations and Hardware*; and *76 Solid-State Physics*. For communications equipment and devices see *32 Communications and Radar*.

20070031176 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Electrostatic Method for Surface Charge Measurement
Arens, Ellen; Center Director's Discretionary Fund 2005 Annual Report; 2007, pp. 103-108; In English; See also 20070031172; Original contains color illustrations; Copyright; Avail.: CASI: A02, Hardcopy

The project objective is to design and develop a lab-based instrument that uses the electro-optic Pockels effect to make static electric fields visible. When completed, this system will be used to monitor charge accumulation and decay on the surfaces of materials. This instrument will help determine the suitability of materials used in environments where an electrostatic discharge created by accumulated charge could pose a threat to personnel or equipment.
Derived from text
Electrostatic Charge; Electric Fields; Electro-Optics; Birefringence; Electrostatics

20070031183 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Application of Glow Discharge Plasma To Alter Surface Properties of Materials
Calle, Carlos; Center Director's Discretionary Fund 2005 Annual Report; 2007, pp. 23-32; In English; See also 20070031172; Original contains color illustrations; Copyright; Avail.: CASI: A02, Hardcopy

Several materials that are considered important for spaceport operations are rendered noncompliant when subjected to the Kennedy Space Center (KSC) standard electrostatic testing (Standard Test method for Evaluating Triboelectric Charge Generation and Decay MMA-1985-79, Rev. 4). Treating materials that fail electrostatic testing and altering their surface properties so they become compliant would result in considerable cost savings and improve safety for the Space Shuttle, International Space Station, and Launch Services programs, as well as the Constellation program. These materials have excellent bulk and physical properties, are easy to process, and are relatively inexpensive. The bulk material often lacks certain required surface properties, such as hydrophilicity, roughness, and conductivity. Therefore, the surface of a polymer must be modified, without affecting the bulk property. However, changing the surface characteristics of these materials allows microbes to survive the cleaning and sterilization procedures required for NASA s planetary protection program. The goals of this project are to use atmospheric plasma glow discharge (APGD) to alter the surface properties of polymers for improved electrostatic dissipation characteristics and to determine if this surface modification enhanced or diminished microbial survival.
Derived from text
Glow Discharges; Plasmas (Physics); Surface Properties; Electrostatics; Surface Roughness

20070031644 Old Dominion Univ., Norfolk, VA, USA
A Black-Scholes Approach to Satisfying the Demand in a Failure-Prone Manufacturing System
Chavez-Fuentes, Jorge R.; Gonzalex, Oscar R.; Gray, W. Steven; March 04, 2007; 5 pp.; In English; 39th Southeastern Symposium on System Theory, 4-6 Mar. 2007, Macon, GA, USA
Contract(s)/Grant(s): NNL04AA03A; NCC1-03026
Report No.(s): MB3.5; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1109/SSST.2007.352338

The goal of this paper is to use a financial model and a hedging strategy in a systems application. In particular, the

classical Black-Scholes model, which was developed in 1973 to find the fair price of a financial contract, is adapted to satisfy an uncertain demand in a manufacturing system when one of two production machines is unreliable. This financial model together with a hedging strategy are used to develop a closed formula for the production strategies of each machine. The strategy guarantees that the uncertain demand will be met in probability at the final time of the production process. It is assumed that the production efficiency of the unreliable machine can be modeled as a continuous-time stochastic process. Two simple examples illustrate the result.
Author
Manufacturing; Mathematical Models; Failure Analysis; Finance

20070031662 Science Applications International Corp., Cleveland, OH, USA
Software Process Assurance for Complex Electronics
Plastow, Richard A.; September 25, 2007; 32 pp.; In English; Software Assurance Symposium, 25-27 Sep. 2007, Morgantown, WV, USA; Original contains color illustrations
Contract(s)/Grant(s): NAS3-03140; 981155.03.03.01; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031662

Complex Electronics (CE) now perform tasks that were previously handled in software, such as communication protocols. Many methods used to develop software bare a close resemblance to CE development. Field Programmable Gate Arrays (FPGAs) can have over a million logic gates while system-on-chip (SOC) devices can combine a microprocessor, input and output channels, and sometimes an FPGA for programmability. With this increased intricacy, the possibility of software-like bugs such as incorrect design, logic, and unexpected interactions within the logic is great. With CE devices obscuring the hardware/software boundary, we propose that mature software methodologies may be utilized with slight modifications in the development of these devices. Software Process Assurance for Complex Electronics (SPACE) is a research project that used standardized S/W Assurance/Engineering practices to provide an assurance framework for development activities. Tools such as checklists, best practices and techniques were used to detect missing requirements and bugs earlier in the development cycle creating a development process for CE that was more easily maintained, consistent and configurable based on the device used.
Author
Computer Programs; Electronics; Software Engineering; Software Reliability

20070031663 NASA Glenn Research Center, Cleveland, OH, USA
Characteristics of Coplanar Waveguide on Sapphire for High Temperature Applications (25 to 400 degrees C)
Ponchak, George E.; Jordan, Jennifer L.; Scardelletti, Maximilian; Stalker, Amy R.; October 08, 2007; 4 pp.; In English; European Microwave Conference, 8-12 Oct. 2007, Munich, Germany; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 645846.02.07.03.03.03.02; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031663

This paper presents the characteristics of coplanar waveguide transmission lines fabricated on R-plane sapphire substrates as a function of temperature across the temperature range of 25 to 400 C. Effective permittivity and attenuation are measured on a high temperature probe station. Two techniques are used to obtain the transmission line characteristics, a Thru-Reflect-Line calibration technique that yields the propagation coefficient and resonant stubs. To a first order fit of the data, the effective permittivity and the attenuation increase linearly with temperature.
Author
High Temperature; Sapphire; Waveguides; Microwaves; Substrates; Coplanarity; Fabrication; Wireless Communication

20070031664 Sest, Inc., Middleburgh Heights, OH, USA
Development of a Linear Stirling Model with Varying Heat Inputs
Regan, Timothy F.; Lewandowski, Edward J.; June 25, 2007; 19 pp.; In English; 5th International Energy Conversion Engineering Conference (IECES-2007), 25-27 Jun. 2007, Saint Louis, MO, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NCC07TA38T; 138494.04.01.01; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031664

The linear model of the Stirling system developed by NASA Glenn Research Center (GRC) has been extended to include a user-specified heat input. Previously developed linear models were limited to the Stirling convertor and electrical load. They represented the thermodynamic cycle with pressure factors that remained constant. The numerical values of the pressure factors were generated by linearizing GRC s non-linear System Dynamic Model (SDM) of the convertor at a chosen operating

point. The pressure factors were fixed for that operating point, thus, the model lost accuracy if a transition to a different operating point were simulated. Although the previous linear model was used in developing controllers that manipulated current, voltage, and piston position, it could not be used in the development of control algorithms that regulated hot-end temperature. This basic model was extended to include the thermal dynamics associated with a hot-end temperature that varies over time in response to external changes as well as to changes in the Stirling cycle. The linear model described herein includes not only dynamics of the piston, displacer, gas, and electrical circuit, but also the transient effects of the heater head thermal inertia. The linear version algebraically couples two separate linear dynamic models, one model of the Stirling convertor and one model of the thermal system, through the pressure factors. The thermal system model includes heat flow of heat transfer fluid, insulation loss, and temperature drops from the heat source to the Stirling convertor expansion space. The linear model was compared to a nonlinear model, and performance was very similar. The resulting linear model can be implemented in a variety of computing environments, and is suitable for analysis with classical and state space controls analysis techniques. Author

Stirling Cycle; Dynamic Models; Linearity; Electromechanics; Heat Sources; Algorithms

20070031738 American Inst. of Aeronautics and Astronautics, Reston, VA, USA

Future Trends in Airborne Electronics

Rockwell, David L.; Aerospace America; May 2007; Volume 45, No. 5, pp. 22-25; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

In more than five years, this column has never looked at the overall airborne defense electronics market top to bottom, to place all market sectors in a forecast value perspective. This month, we will look at the total market over the next 10 years, including trends in programs and manufacturer market shares. We will see that some traditional markets have come back since the beginning of the Iraq war, regaining their Cold War importance in terms of value, growth, and availability. Our forecasts are built from the bottom up, from dozens of cumulative individual program forecasts in each market sector (hundreds in the overall market), not top down from Pentagon RDT&E or procurement lines, which offer little precision or discrimination, especially for electronics programs. All funding is for U.S. and/or international markets available to U.S. manufacturers. Thus, for example, we have not included funding for Russian or Chinese markets, and very little for French markets. Programs included are primarily U.S. systems. Sales of international systems (such as the Ericsson fighter radar for Gripen) are not included unless there is a significant U.S. component, which is rare. International systems that have made major sales in U.S. markets, such as the Saab/BAE Systems BOL chaff/flare dispenser, and the Rafael/Northrop Grumman Litening targeting pod will be found here; however, there are not many examples of these either. Manufacturer share funding for most programs is allocated in full to the prime, not split among subcontractors, as this is usually difficult or impossible to break out. For really big programs, such as AWACS, a certain percentage is allocated to 'other' and 'available.' Uncontracted programs, as well as speculative programs in the out years, are allocated as 'available.' Out years of forecasts may be slight underestimates; we do forecast 'undetermined' future programs, but try to be conservative.

Derived from text

Airborne Equipment; Electronics; Electro-Optics; Trends; Market Research

34
FLUID MECHANICS AND THERMODYNAMICS

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

20070031549 NASA Glenn Research Center, Cleveland, OH, USA

Unsteady Turbine Blade and Tip Heat Transfer Due to Wake Passing

Ameri, Ali A.; Rigby, David L.; Steinthorsson, Erlendur; Heidmann, James; Fabian, John C.; September 2007; 16 pp.; In English; Turbo Expo 2007, 14-17 May 2007, Montreal, Canada; Original contains color illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.16.06

Report No.(s): NASA/TM-2007-214942; E-16116; Copyright; Avail.: CASI: A03, Hardcopy

The geometry and the flow conditions of the first stage turbine blade of GE s E3 engine have been used to obtain the unsteady three-dimensional blade and tip heat transfer. The isothermal wall boundary condition was used. The effect of the upstream wake of the first stage vane was of interest and was simulated by provision of a gust type boundary condition upstream of the blades. A one blade periodic domain was used. The consequence of this choice was explored in a preliminary study which showed little difference in the time mean heat transfer between 1:1 and 2:3 vane/blade domains. The full

three-dimensional computations are of the blade having a clearance gap of 2 percent the span. Comparison between the time averaged unsteady and steady heat transfer is provided. It is shown that there is a significant difference between the steady and time mean of unsteady blade heat transfer in localized regions. The differences on the suction side of the blade in the near hub and near tip regions were found to be rather significant. Steady analysis underestimated the blade heat transfer by as much as 20 percent as compared to the time average obtained from the unsteady analysis. As for the blade tip, the steady analysis and the unsteady analysis gave results to within 2 percent.
Author
Heat Transfer; Turbine Blades; Turbulent Heat Transfer; Wakes; Unsteady Flow; Blade Tips

20070031696 National Space Science and Technology Center, Huntsville, AL, USA
3D Relativistic MHD Simulations of Magnetized Spine-Sheath Relativistic Jets
Mizuno, Yosuke; Hardee, Philip E.; Nishikawa, Ken-Ichi; May 21, 2007; 1 pp.; In English; Extragalactic Jets, 21-24 May 2007, Girdwood, AK, USA; Copyright; Avail.: Other Sources; Abstract Only

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

20070031701 NASA Marshall Space Flight Center, Huntsville, AL, USA
Density and Cavitating Flow Results from a Full-Scale Optical Multiphase Cryogenic Flowmeter
Korman, Valentin; May 14, 2007; 14 pp.; In English; JANNAF Conference, 14-17 May 2007, Denver, CO, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NNM05AD02D; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031701

Liquid propulsion systems are hampered by poor flow measurements. The measurement of flow directly impacts safe motor operations, performance parameters as well as providing feedback from ground testing and developmental work. NASA Marshall Space Flight Center, in an effort to improve propulsion sensor technology, has developed an all optical flow meter that directly measures the density of the fluid. The full-scale sensor was tested in a transient, multiphase liquid nitrogen fluid environment. Comparison with traditional density models shows excellent agreement with fluid density with an error of approximately 0.8%. Further evaluation shows the sensor is able to detect cavitation or bubbles in the flow stream and separate out their resulting effects in fluid density.
Author
Cavitation Flow; Flow Measurement; Cryogenics; Fluid Flow; Optical Density; Optical Measuring Instruments

20070031702 NASA Langley Research Center, Hampton, VA, USA
Optical Fiber Distributed Sensing Structural Health Monitoring (SHM) Strain Measurements Taken During Cryotank Y-Joint Test Article Load Cycling at Liquid Helium Temperatures
Allison, Sidney G.; Prosser, William H.; Hare, David A.; Moore, Thomas C.; Kenner, Winfred S.; [2007]; 12 pp.; In English; SPIE Optics East 2007, 9-12 Sep. 2007, Boston, MA, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 524238.08.02.04.03; Copyright; Avail.: CASI: A03, Hardcopy

This paper outlines cryogenic Y-joint testing at Langley Research Center (LaRC) to validate the performance of optical fiber Bragg grating strain sensors for measuring strain at liquid helium temperature (-240 C). This testing also verified survivability of fiber sensors after experiencing 10 thermal cool-down, warm-up cycles and 400 limit load cycles. Graphite composite skins bonded to a honeycomb substrate in a sandwich configuration comprised the Y-joint specimens. To enable SHM of composite cryotanks for consideration to future spacecraft, a light-weight, durable monitoring technology is needed. The fiber optic distributed Bragg grating strain sensing system developed at LaRC is a viable substitute for conventional strain gauges which are not practical for SHM. This distributed sensing technology uses an Optical Frequency Domain Reflectometer

(OFDR). This measurement approach has the advantage that it can measure hundreds of Bragg grating sensors per fiber and the sensors are all written at one frequency, greatly simplifying fiber manufacturing. Fiber optic strain measurements compared well to conventional strain gauge measurements obtained during these tests. These results demonstrated a high potential for a successful implementation of a SHM system incorporating LaRC's fiber optic sensing system on the composite cryotank and other future cryogenic applications.
Author
Cryogenics; Structural Strain; Strain Measurement; Liquid Helium; Fiber Optics; Optical Fibers; Loads (Forces); Detection; Fuel Tanks

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*.

20070031200 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Optimizing RHESSI X-ray Imaging
Dennis, Brian R.; Liu, Chang; Schwartz, Richard A.; Tolbert, A. Kimberley; May 26, 2007; 1 pp.; In English; American Astronautical Society 210th Meeting, 26-31 May 2007, Honolulu, HI, USA; Copyright; Avail.: Other Sources; Abstract Only

RHESSI X-ray imaging is possible with angular resolution as fine as 2 arcsec (FWHM) at energies from as low as 3 keV to >100 keV. However, taking full advantage of this capability has proven to be challenging given the Fourier-transform imaging technique that is used, specific instrumental considerations that must be taken into account, and the many different options of the available image reconstruction algorithms. Such considerations as the best reconstruction algorithm to use, the optimal weighting of the different Fourier components, deciding between short image integration times and rapid imaging cadence, the different energy ranges covered by the 9 detectors, the effect of pulse pile-up and albedo, etc. must all be taken into account in obtaining and interpreting RHESSI X-ray images. This poster describes different techniques for optimizing the image reconstruction depending on the science objectives - identifying compact or extended sources, searching for source motion, obtaining the best photometry, determining the believability of different features in an image, etc. The emphasis is on making full use of data from all the RHESSI detectors, including the ones behind the finest grids when warranted by the source structure. This is the case for the hard X-ray emission along the ribbons of the flare on 2005 May 13 reported by Liu et al. (2007) and this event will be used as an example.
Author
Image Reconstruction; Imaging Techniques; X Ray Imagery; Solar Activity

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*.

20070031550 NASA Glenn Research Center, Cleveland, OH, USA
Benefits Derived From Laser Ranging Measurements for Orbit Determination of the GPS Satellite Orbit
Welch, Bryan W.; August 2007; 17 pp.; In English; ION 63rd Annual Meeting, 23-25 Apr. 2007, Cambridge, MA, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 439432.07.04.03.01
Report No.(s): NASA/TM-2007-214971; E-16125; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031550

While navigation systems for the determination of the orbit of the Global Position System (GPS) have proven to be very effective, the current research is examining methods to lower the error in the GPS satellite ephemerides below their current level. Two GPS satellites that are currently in orbit carry retro-reflectors onboard. One notion to reduce the error in the satellite ephemerides is to utilize the retro-reflectors via laser ranging measurements taken from multiple Earth ground stations. Analysis has been performed to determine the level of reduction in the semi-major axis covariance of the GPS satellites, when

laser ranging measurements are supplemented to the radiometric station keeping, which the satellites undergo. Six ground tracking systems are studied to estimate the performance of the satellite. The first system is the baseline current system approach which provides pseudo-range and integrated Doppler measurements from six ground stations. The remaining five ground tracking systems utilize all measurements from the current system and laser ranging measurements from the additional ground stations utilized within those systems. Station locations for the additional ground sites were taken from a listing of laser ranging ground stations from the International Laser Ranging Service. Results show reductions in state covariance estimates when utilizing laser ranging measurements to solve for the satellite s position component of the state vector. Results also show dependency on the number of ground stations providing laser ranging measurements, orientation of the satellite to the ground stations, and the initial covariance of the satellite's state vector.
Author
Global Positioning System; Ground Stations; Orbit Determination; Satellite Orbits; Satellite Laser Ranging

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*.

20070031205 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Calibration of High Temperature Thermal Conductivity System: New Algorithm to Measure Heat Capacity Using Flash Thermal Diffusivity in Thermoelectric Materials
Deb, Rahul; Snyder, Jeff G.; November 19, 2005; 25 pp.; In English; Southern California Conference for Undergraduate Research, 19 Nov. 2005, Riverside, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40147

A viewgraph presentation describing thermoelectric materials, an algorithm for heat capacity measurements and the process of flash thermal diffusivity. The contents include: 1) What are Thermoelectrics?; 2) Thermoelectric Applications; 3) Improving Thermoelectrics; 4) Research Goal; 5) Flash Thermal Diffusivity; 6) Background Effects; 7) Stainless Steel Comparison; 8) Pulse Max Integral; and 9) Graphite Comparison Algorithm.
CASI
Algorithms; High Temperature; Specific Heat; Thermal Conductivity; Thermal Diffusivity; Thermoelectric Materials; Calibrating

20070031552 NASA Glenn Research Center, Cleveland, OH, USA
The Effect of Variable End of Charge Battery Management on Small-Cell Batteries
Neubauer, Jeremy; Simmons, Nick; Bennetti, Andrea; Pearson, Chris; Reid, Concha; April 26, 2007; 22 pp.; In English; Space Power Workshop, 24-26 Apr. 2007, Los Angeles, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 038957.04.01.02.03; Copyright; Avail.: CASI: A03, Hardcopy

ABSL Space Products is the world leading supplier of Lithium-ion batteries for space applications and has pioneered the use of small capacity COTS cells within large arrays. This small-cell approach has provided many benefits to space application designers through increased flexibility and reliability over more traditional battery designs. The ABSL 18650HC cell has been used in most ABSL space battery applications to date and has a recommended End Of Charge Voltage (EOCV) of 4.2V per cell. For all space applications using the ABSL 18650HC so far, this EOCV has been used at all stages of battery life from ground checkout to in orbit operations. ABSL and NASA have identified that, by using a lower EOCV for the same equivalent Depth Of Discharge (DOD), battery capacity fade could be reduced. The intention of this paper is to compare battery performance for systems with fixed and variable EOCV. In particular, the effect of employing the blanket value of 4.2V per cell versus utilizing a lower EOCV at Beginning Of Life (BOL) before gradually increasing it (as the effects of capacity fade drive the End Of Discharge Voltage closer to the acceptable system level minimum) is analyzed. Data is compared from ABSL in-house and NASA GRC tests that have been run under fixed and variable EOCV conditions. Differences in capacity fade are discussed and projections are made as to potential life extension capability by utilizing a variable EOCV strategy.
Author
Electric Potential; Lithium Batteries; Technology Utilization; Aerospace Engineering; Electrochemical Cells

20070031553 NASA Glenn Research Center, Cleveland, OH, USA

Advanced Stirling Convertor Testing at NASA Glenn Research Center

Oriti, Salvatore; June 25, 2007; 26 pp.; In English; 5th International Energy Conversion Engineering Conference and Exhibit (IECEC), 25-27 Jun. 2007, Saint Louis, MO, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 138494.04.01.01; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070031553

The U.S. Department of Energy (DOE), Lockheed Martin Space Systems (LMSS), Sunpower Inc., and NASA Glenn Research Center (GRC) have been developing an Advanced Stirling Radioisotope Generator (ASRG) for use as a power system on space science and exploration missions. This generator will make use of the free-piston Stirling convertors to achieve higher conversion efficiency than currently available alternatives. The ASRG will utilize two Advanced Stirling Convertors (ASC) to convert thermal energy from a radioisotope heat source to electricity. NASA GRC has initiated several experiments to demonstrate the functionality of the ASC, including: in-air extended operation, thermal vacuum extended operation, and ASRG simulation for mobile applications. The in-air and thermal vacuum test articles are intended to provide convertor performance data over an extended operating time. These test articles mimic some features of the ASRG without the requirement of low system mass. Operation in thermal vacuum adds the element of simulating deep space. This test article is being used to gather convertor performance and thermal data in a relevant environment. The ASRG simulator was designed to incorporate a minimum amount of support equipment, allowing integration onto devices powered directly by the convertors, such as a rover. This paper discusses the design, fabrication, and implementation of these experiments.

Author

Fabrication; Radioisotope Heat Sources; Stirling Engines; Aerospace Systems; Thermal Energy; Mechanical Engineering

20070031661 NASA Glenn Research Center, Cleveland, OH, USA

Status of the Space-Rated Lithium-Ion Battery Advanced Development Project in Support of the Exploration Vision

Miller, Thomas; February 13, 2007; 22 pp.; In English; 2007 STAIF Conference: Advanced Materials, Structures, and Mechanisms, 13 Feb. 2007, Albuquerque, NM, USA; Original contains color illustrations

Contract(s)/Grant(s): 038957.04.15.01.01.05; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070031661

The NASA Glenn Research Center (GRC), along with the Goddard Space Flight Center (GSFC), Jet Propulsion Laboratory (JPL), Johnson Space Center (JSC), Marshall Space Flight Center (MSFC), and industry partners, is leading a space-rated lithium-ion advanced development battery effort to support the vision for Exploration. This effort addresses the lithium-ion battery portion of the Energy Storage Project under the Exploration Technology Development Program. Key discussions focus on the lithium-ion cell component development activities, a common lithium-ion battery module, test and demonstration of charge/discharge cycle life performance and safety characterization. A review of the space-rated lithium-ion battery project will be presented highlighting the technical accomplishments during the past year.

Author

Metal Ions; Technology Utilization; Space Missions; Space Exploration; Lithium Batteries

20070031686 NASA Glenn Research Center, Cleveland, OH, USA

Particle and Smoke Detection on ISS for Next Generation Smoke Detectors

Urban, David L.; Ruff, Gary; Yuan, Zeng-guang; Sheredy, William; Funk, Greg; May 25, 2007; 31 pp.; In English; International Space Development Conference, 24 May 2007, Dallas, TX, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 732759.03.01.02.21; Copyright; Avail.: CASI: A03, Hardcopy

Rapid fire detection requires the ability to differentiate fire signatures from background conditions and nuisance sources. Proper design of a fire detector requires detailed knowledge of all of these signal sources so that a discriminating detector can be designed. Owing to the absence of microgravity smoke data, all current spacecraft smoke detectors were designed based upon normal-g conditions. The removal of buoyancy reduces the velocities in the high temperature zones in flames, increasing the residence time of smoke particles and consequently allowing longer growth time for the particles. Recent space shuttle experiments confirmed that, in some cases, increased particles sizes are seen in low-gravity and that the relative performance of the ISS (International Space Station) and space-shuttle smoke-detectors changes in low-gravity; however, sufficient particle size information to design new detectors was not obtained. To address this issue, the SAME (Smoke Aerosol Measurement Experiment) experiment is manifested to fly on the ISS in 2007. The SAME experiment will make measurements of the particle size distribution of the smoke particulate from several typical spacecraft materials providing quantitative design data for spacecraft smoke detectors. A precursor experiment (DAFT: Dust Aerosol measurement Feasibility Test) flew recently on

the ISS and provided the first measurement of the background smoke particulate levels on the ISS. These background levels are critical to the design of future smoke detectors. The ISS cabin was found to be a very clean environment with particulate levels substantially below the space shuttle and typical ground-based environments.
Author
Detection; International Space Station; Particulates; Smoke Detectors; Space Shuttles; Aerosols

20070031688 NASA Glenn Research Center, Cleveland, OH, USA
Novel Thin Film Sensor Technology for Turbine Engine Hot Section Components
Wrbanek, John D.; Fralick, Gustave C.; June 26, 2007; 25 pp.; In English; 18th Advanced Aerospace Materials and Processes (AeroMat) Conference and Exposition, 25-28 Jun. 2007, Baltimore, MD; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 698259.02.07.03.02; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031688

Degradation and damage that develops over time in hot section components can lead to catastrophic failure of the turbine section of aircraft engines. A range of thin film sensor technology has been demonstrated enabling on-component measurement of multiple parameters either individually or in sensor arrays including temperature, strain, heat flux, and flow. Conductive ceramics are beginning to be investigated as new materials for use as thin film sensors in the hot section, leveraging expertise in thin films and high temperature materials. The current challenges are to develop new sensor and insulation materials capable of withstanding the extreme hot section environment, and to develop techniques for applying sensors onto complex high temperature structures for aging studies of hot propulsion materials. The technology research and development ongoing at NASA Glenn Research Center for applications to future aircraft, launch vehicles, space vehicles, and ground systems is outlined.
Author
Engine Parts; Thin Films; Turbine Engines; Fabrication; Sensors; Technology Utilization

42
GEOSCIENCES (GENERAL)

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

20070031566 Michigan State Univ., East Lansing, MI, USA
Amazon Land Wars in the South of Para
Simmons, Cynthia S.; Walker, Robert T.; Arima, Eugenio Y.; Aldrich, Stephen P.; Caldas, Marcellus M.; Annals of the Association of American Geographers; [2007]; Volume 97, Issue 3, pp. 567-592; In English
Contract(s)/Grant(s): NCC5-694; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1111/j.1467-8306.2007.00564.x

The South of Para, located in the heart of the Brazilian Amazon, has become notorious for violent land struggle. Although land conflict has a long history in Brazil, and today impacts many parts of the country, violence is most severe and persistent here. The purpose of this article is to examine why. Specifically, we consider how a particular Amazonian place, the so-called South of Para has come to be known as Brazil's most dangerous badland. We begin by considering the predominant literature, which attributes land conflict to the frontier expansion process with intensified struggle emerging in the face of rising property values and demand for private property associated with capitalist development. From this discussion, we distill a concept of the frontier, based on notions of property rights evolution and locational rents. We then empirically test the persistence of place-based violence in the region, and assess the frontier movement through an analysis of transportation costs. The findings from the analyses indicate that the prevalent theorization of frontier violence in Amazonia does little to explain its persistent and pervasive nature in the South of Para. To fill this gap in understanding, we develop an explanation based the geographic conception of place, and we use contentious politics theory heuristically to elucidate the ways in which general processes interact with place specific history to engender a landscape of violence. In so doing, we focus on environmental, cognitive, and relational mechanisms (and implicated structures), and attempt to deploy them in an explanatory framework that allows direct observation of the accumulating layers of the region's tragic history. We end by placing our discussion within a political ecological context, and consider the implications of the Amazon Land War for the environment.
Author
Amazon Region (South America); Warfare; Land; Ecology; Topography

20070031587 Desert Research Inst., Reno, NV, USA

Shear Stress Partitioning in Large Patches of Roughness in the Atmospheric Inertial Sublayer

Gillies, John A.; Nickling, William G.; King, James; Boundary-Layer Meteorology; Feb. 2007; Volume 122, No. 2, pp. 367-396; In English

Contract(s)/Grant(s): NAG5-12759; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1007/s10546-006-9101-5

Drag partition measurements were made in the atmospheric inertial sublayer for six roughness configurations made up of solid elements in staggered arrays of different roughness densities. The roughness was in the form of a patch within a large open area and in the shape of an equilateral triangle with 60 m long sides. Measurements were obtained of the total shear stress (tau) acting on the surfaces, the surface shear stress on the ground between the elements (tau(sub S)) and the drag force on the elements for each roughness array. The measurements indicated that tau(sub S) quickly reduced near the leading edge of the roughness compared with tau, and a tau(sub S) minimum occurs at a normalized distance (x/h, where h is element height) of approx. -42 (downwind of the roughness leading edge is negative), then recovers to a relatively stable value. The location of the minimum appears to scale with element height and not roughness density. The force on the elements decreases exponentially with normalized downwind distance and this rate of change scales with the roughness density, with the rate of change increasing as roughness density increases. Average tau(sub S): tau values for the six roughness surfaces scale predictably as a function of roughness density and in accordance with a shear stress partitioning model. The shear stress partitioning model performed very well in predicting the amount of surface shear stress, given knowledge of the stated input parameters for these patches of roughness. As the shear stress partitioning relationship within the roughness appears to come into equilibrium faster for smaller roughness element sizes it would also appear the shear stress partitioning model can be applied with confidence for smaller patches of smaller roughness elements than those used in this experiment.

Author

Shear Stress; Surface Roughness; Inertia; Substrates; Partitions (Structures); Earth Atmosphere

20070031588 Desert Research Inst., Reno, NV, USA

Aeolian Sediment Transport through Large Patches of Roughness in the Atmospheric Inertial Sublayer

Gillies, John A.; Nickling, Willilam G.; King, James; Journal of Geophysical Research; May 05, 2006; Volume 111; 2 pp.; In English

Contract(s)/Grant(s): NAG5-12759; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1029/2005JF000434

Roughness influences the flux of wind driven sand transport. In this paper, we report on sediment transport measurements for four different surface roughness configurations composed of the same size (solid) roughness elements in the atmospheric inertial sublayer (ISL). Results of these tests indicate that sediment transport rates through patches of roughness in the atmospheric inertial sublayer are to a large extent controlled and scale proportionally with the roughness density (lambda = n b h/S, where n is number of elements of breadth b and height h in area S) of the surface. However, element size apparently increases the magnitude of the reduction beyond that attributable to lambda. A sediment transport model that incorporates the effect of shear stress partitioning appears to predict reasonably well the effect of roughness on sand transport in the cases where the roughness elements are less than or equal to 0.10 m in height. However, when the dimensions of the roughness itself are equivalent to or are greater than the range of saltation lengths (vertical and horizontal), additional interactions of the elements with the saltation cloud appear to reduce the transport efficiency.

Author

Sediment Transport; Substrates; Wind (Meteorology); Earth Atmosphere; Geography

20070031589 Guelph Univ., Ontario, Canada

Representation of Vegetation and Other Nonerodible Elements in Aeolian Shear Stress Partitioning Models for Predicting Transport Threshold

King, James; Nickling, William G.; Gillies, John A.; Journal of Geophysical Research; December 2005; Volume 110; 1 pp.; In English

Contract(s)/Grant(s): NAG5-12759; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1029/2004JF000281

The presence of nonerodible elements is well understood to be a reducing factor for soil erosion by wind, but the limits of its protection of the surface and erosion threshold prediction are complicated by the varying geometry, spatial organization, and density of the elements. The predictive capabilities of the most recent models for estimating wind driven particle fluxes are reduced because of the poor representation of the effectiveness of vegetation to reduce wind erosion. Two approaches have

been taken to account for roughness effects on sediment transport thresholds. Marticorena and Bergametti (1995) in their dust emission model parameterize the effect of roughness on threshold with the assumption that there is a relationship between roughness density and the aerodynamic roughness length of a surface. Raupach et al. (1993) offer a different approach based on physical modeling of wake development behind individual roughness elements and the partition of the surface stress and the total stress over a roughened surface. A comparison between the models shows the partitioning approach to be a good framework to explain the effect of roughness on entrainment of sediment by wind. Both models provided very good agreement for wind tunnel experiments using solid objects on a nonerodible surface. However, the Marticorena and Bergametti (1995) approach displays a scaling dependency when the difference between the roughness length of the surface and the overall roughness length is too great, while the Raupach et al. (1993) model's predictions perform better owing to the incorporation of the roughness geometry and the alterations to the flow they can cause.
Author
Mathematical Models; Parameterization; Sediment Transport; Shear Stress; Vegetation; Wind (Meteorology); Wind Tunnels

43
EARTH RESOURCES AND REMOTE SENSING

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

20070031217 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Comparisons of Remote Sensing Retrievals and in situ Measurements of Aerosol Fine Mode Fraction during ACE-Asia
Gasso, Santiago; O'Neill, Norm; Geophysical Research Letters; March 08, 2006; ISSN 0094-8276; Volume 33, pp. L05807; In English; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1029/2005GL024926

We present sunphotometer-retrieved and in situ fine mode fractions (FMF) measured onboard the same aircraft during the ACE-Asia experiment. Comparisons indicate that the latter can be used to identify whether the aerosol under observation is dominated by a mixture of modes or a single mode. Differences between retrieved and in situ FMF range from 5-20%. When profiles contained multiple layers of aerosols, the retrieved and measured FMF were segregated by layers. The comparison of layered and total FMF from the same profile indicates that columnar values are intermediate to those derived from layers. As a result, a remotely sensed FMF cannot be used to distinguish whether the aerosol under observation is composed of layers each with distinctive modal features or all layers with the same modal features. Thus, the use of FMF in multiple layer environments does not provide unique information on the aerosol under observation.
Author
In Situ Measurement; Remote Sensing; Aerosols

20070031218 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Deep Blue Retrievals of Asian Aerosol Properties During ACE-Asia
Hsu, N. Christina; Tsay, Si-Cee; King, Michael D.; Herman, Jay R.; IEEE Transactions on Geoscience and Remote Sensing; November 2006; Volume 44, Issue 11, pp. 3180; In English; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1109/TGRS.2006.879540

During the ACE-Asia field campaign, unprecedented amounts of aerosol property data in East Asia during springtime were collected from an array of aircraft, shipboard, and surface instruments. However, most of the observations were obtained in areas downwind of the source regions. In this paper, the newly developed satellite aerosol algorithm called 'Deep Blue' was employed to characterize the properties of aerosols over source regions using radiance measurements from the Sea-viewing Wide Field-of-view Sensor (SeaWiFS) and Moderate Resolution Imaging Spectroradiometer (MODIS). Based upon the ngstr m exponent derived from the Deep Blue algorithm, it was demonstrated that this new algorithm is able to distinguish dust plumes from fine-mode pollution particles even in complex aerosol environments such as the one over Beijing. Furthermore, these results were validated by comparing them with observations from AERONET sites in China and Mongolia during spring 2001. These comparisons show that the values of satellite-retrieved aerosol optical thickness from Deep Blue are generally within 20%-30% of those measured by sunphotometers. The analyses also indicate that the roles of mineral dust and anthropogenic particles are comparable in contributing to the overall aerosol distributions during spring in northern China,

while fine-mode particles are dominant over southern China. The spring season in East Asia consists of one of the most complex environments in terms of frequent cloudiness and wide ranges of aerosol loadings and types. This paper will discuss how the factors contributing to this complexity influence the resulting aerosol monthly averages from various satellite sensors and, thus, the synergy among satellite aerosol products.
Author
Aerosols; Asia; Photometers; Satellite Observation; Dust; Plumes; MODIS (Radiometry); Algorithms

20070031226 Science Systems and Applications, Inc., Lanham, MD, USA
Measurements of Nitrogen Dioxide Total Column Amounts using a Brewer Double Spectrophotometer in Direct Sun Mode
Cede, Alexander; Herman, Jay; Richter, Andreas; Krotkov, Nickolay; Burrows, John; Journal of Geophysical Research; March 02, 2006; Volume 111; 1 pp.; In English; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1029/2005JD006585

NO2 column amounts were measured for the past 2 years at Goddard Space Flight Center, Greenbelt, Maryland, using a Brewer spectrometer in direct Sun mode. A new bootstrap method to calibrate the instrument is introduced and described. This technique selects the cleanest days from the database to obtain the solar reference spectrum. The main advantage for direct Sun measurements is that the conversion uncertainty from slant column to vertical column is negligible compared to the standard scattered light observations where it is typically on the order of 100% (2sigma) at polluted sites. The total 2sigma errors of the direct Sun retrieved column amounts decrease with solar zenith angle and are estimated at 0.2 to 0.6 Dobson units (DU, 1 DU approx. equal to 2.7 10(exp 16) molecules cm(exp -2)), which is more accurate than scattered light measurements for high NO2 amounts. Measured NO2 column amounts, ranging from 0 to 3 DU with a mean of 0.7 DU, show a pronounced daily course and a strong variability from day to day. The NO2 concentration typically increases from sunrise to noon. In the afternoon it decreases in summer and stays constant in winter. As expected from the anthropogenic nature of its source, NO2 amounts on weekends are significantly reduced. The measurements were compared to satellite retrievals from Scanning Image Absorption Spectrometer for Atmospheric Chartography (SCIAMACHY). Satellite data give the same average NO2 column and show a seasonal cycle that is similar to the ground data in the afternoon. We show that NO2 must be considered when retrieving aerosol absorption properties, especially for situations with low aerosol optical depth.
Author
Calibrating; Nitrogen Dioxide; Spectrophotometers; Sun; Aerosols; Remote Sensing; Geophysics

20070031632 Science Systems and Applications, Inc., Bay Saint Louis, MS, USA
Coral Reef Early Warning System (CREWS) RPC Experiment
Estep, Leland; Spruce, Joseph P.; Hall, Callie; [2007]; 14 pp.; In English; Mississippi Research Consortium RPC Project Review, 7 Nov. 2007, Starkville, MS, USA; Original contains color illustrations
Contract(s)/Grant(s): NNS04AB54T
Report No.(s): SSTI 2220-0110; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031632

This viewgraph document reviews the background, objectives, methodology, validation, and present status of the Coral Reef Early Warning System (CREWS) Rapid Prototyping Capability (RPC) experiment. The potential NASA contribution to CREWS Decision Support Tool (DST) centers on remotely sensed imagery products.
CASI
Coral Reefs; Remote Sensing; Satellite Observation; Warning Systems; Data Products

20070031635 Science Systems and Applications, Inc., Bay Saint Louis, MS, USA
Use of AIRS, OMI, MLS, and TES Data in Assessing Forest Ecosystem Exposure to Ozone
Spruce, Joseph P.; [2007]; 6 pp.; In English
Contract(s)/Grant(s): NNS04AB54T
Report No.(s): SSTI-2220-0116; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031635

Ground-level ozone at high levels poses health threats to exposed flora and fauna, including negative impacts to human health. While concern is common regarding depletion of ozone in the stratosphere, portions of the urban and rural USA

periodically have high ambient levels of tropospheric ozone on the ground. Ozone pollution can cause a variety of impacts to susceptible vegetation (e.g., Ponderosa and Jeffrey pine species in the southwestern USA), such as stunted growth, alteration of growth form, needle or leaf chlorosis, and impaired ability to withstand drought-induced water stress. In addition, Southern Californian forests with high ozone exposures have been recently subject to multiyear droughts that have led to extensive forest overstory mortality from insect outbreaks and increased incidence of wildfires. Residual forests in these impacted areas may be more vulnerable to high ozone exposures and to other forest threats than ever before. NASA sensors collect a wealth of atmospheric data that have been used recently for mapping and monitoring regional tropospheric ozone levels. AIRS (Atmospheric Infrared Sounder), OMI (Ozone Monitoring Instrument), MLS (Microwave Limb Sounder), and TES (Tropospheric Emission Spectrometer) data could be used to assess forest ecosystem exposure to ozone. Such NASA data hold promise for providing better or at least complementary synoptic information on ground-level ozone levels that Federal agency partners can use to assess forest health trends and to mitigate the threats as needed in compliance with Federal laws and mandates. NASA data products on ozone concentrations may be able to aid applications of DSTs (decision support tools) adopted by the USDA FS (U.S. Department of Agriculture Forest Service) and by the NPS (National Park Service), such as the Ozone Calculator, in which ground ozone estimates are employed to assess ozone impacts to forested vegetation.
Author
Ecosystems; Microwave Sounding; Ozone; MODIS (Radiometry); Earth Sciences; Troposphere; Data Acquisition; Spectrometers

20070031639 Science Systems and Applications, Inc., Bay Saint Louis, MS, USA
Regional Sediment Management Experiment Using the Visible/Infrared Imager/Radiometer Suite and the Landsat Data Continuity Mission Sensor
Estep, Leland; Spruce, Joseph P.; [2007]; 2 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NNS04AB54T
Report No.(s): SSTI-2220-0119; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031639

The central aim of this RPC (Rapid Prototyping Capability) experiment is to demonstrate the use of VIIRS (Visible/Infrared Imager/ Radiometer Suite and LDCM (Landsat Data Continuity Mission) sensors as key input to the RSM (Regional Sediment Management) GIS (geographic information system) DSS (Decision Support System). The project affects the Coastal Management National Application.
Derived from text
Infrared Radiometers; Landsat Satellites; Rapid Prototyping; Sediments; Light (Visible Radiation); Satellite Imagery

45
ENVIRONMENT POLLUTION

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

20070031219 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Smoke and Pollution Aerosol Effect on Cloud Cover
Kaufman, Yoram J.; Koren, Ilan; Science; August 04, 2006; Volume 313, pp. 655; In English; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1126/Science.1126232

Pollution and smoke aerosols can increase or decrease the cloud cover. This duality in the effects of aerosols forms one of the largest uncertainties in climate research. Using solar measurements from Aerosol Robotic Network sites around the globe, we show an increase in cloud cover with an increase in the aerosol column concentration and an inverse dependence on the aerosol absorption of sunlight. The emerging rule appears to be independent of geographical location or aerosol type, thus increasing our confidence in the understanding of these aerosol effects on the clouds and climate. Preliminary estimates suggest an increase of 5% in cloud cover.
Author
Air Pollution; Aerosols; Cloud Cover; Smoke; Climate

46
GEOPHYSICS

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

20070031558 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Analysis of Raman Lidar and Radiosonde Measurements from the AWEX-G Field Campaign and Its Relation to Aqua Validation

Whiteman, D. N.; Russo, F.; Demoz, B.; Miloshevich, L. M.; Veselovskii, I.; Hannon, S.; Wang, Z.; Vomel, H.; Schmidlin, F.; Lesht, B.; Moore, P. J.; Beebe, A. S.; Gambacorta, A.; Barnet, C.; Journal of Geophysical Research; April 12, 2006; ISSN 0148-0227; Volume 111; In English

Report No.(s): D09S09; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1029/2005JD006429

Early work within the Aqua validation activity revealed there to be large differences in water vapor measurement accuracy among the various technologies in use for providing validation data. The validation measurements were made at globally distributed sites making it difficult to isolate the sources of the apparent measurement differences among the various sensors, which included both Raman lidar and radiosonde. Because of this, the AIRS Water Vapor Experiment-Ground (AWEX-G) was held in October-November 2003 with the goal of bringing validation technologies to a common site for intercomparison and resolving the measurement discrepancies. Using the University of Colorado Cryogenic Frostpoint Hygrometer (CFH) as the water vapor reference, the AWEX-G field campaign permitted correction techniques to be validated for Raman lidar, Vaisala RS80-H and RS90/92 that significantly improve the absolute accuracy of water vapor measurements from these systems particularly in the upper troposphere. Mean comparisons of radiosondes and lidar are performed demonstrating agreement between corrected sensors and the CFH to generally within 5% thereby providing data of sufficient accuracy for Aqua validation purposes. Examples of the use of the correction techniques in radiance and retrieval comparisons are provided and discussed.

Author

Radar Measurement; Radiosondes; Water Vapor; Accuracy; Optical Radar

20070031590 Guelph Univ., Ontario, Canada

Aeolian Shear Stress Ratio Measurements within Mesquite-Dominated Landscapes of the Chihuahuan Desert, New Mexico, USA

King, James; Nickling, W. G.; Gilliles, J. A.; Geomorphology; December 15, 2006; Volume 82, Issues 3-4, pp. 229-244; In English

Contract(s)/Grant(s): NAG5-12759; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1016/j.geomorph.2006.05.004

A field study was conducted to ascertain the amount of protection that mesquite-dominated communities provide to the surface from wind erosion. The dynamics of the locally accelerated evolution of a mesquite/coppice dune landscape and the undetermined spatial dependence of potential erosion by wind from a shear stress partition model were investigated. Sediment transport and dust emission processes are governed by the amount of protection that can be provided by roughness elements. Although shear stress partition models exist that can describe this, their accuracy has only been tested against a limited dataset because instrumentation has previously been unable to provide the necessary measurements. This study combines the use of meteorological towers and surface shear stress measurements with Irwin sensors to measure the partition of shear stress in situ. The surface shear stress within preferentially aligned vegetation (within coppice dune development) exhibited highly skewed distributions, while a more homogenous surface stress was recorded at a site with less developed coppice dunes. Above the vegetation, the logarithmic velocity profile deduced roughness length (based on 10-min averages) exhibited a distinct correlation with compass direction for the site with vegetation preferentially aligned, while the site with more homogenously distributed vegetation showed very little variation in the roughness length. This distribution in roughness length within an area, defines a distribution of a resolved shear stress partitioning model based on these measurements, ultimately providing potential closure to a previously uncorrelated model parameter.

Author

Shear Stress; Deserts; Mexico; Topography; Wind Erosion; Wind (Meteorology)

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20070031188 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Atmospheric Teleconnection over Eurasia Induced by Aerosol Radiative Forcing during Boreal Spring

Kim, Maeng-Ki; Lau, William K. M.; Chin, Mian; Kim, Kyu-Myong; Sud, Y. C.; Walker, Greg K.; Journal of Climate; September 2006; Volume 19, Issue 18, pp. 4700-4718; In English; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1175/JCLI3871.1

The direct effects of aerosols on global and regional climate during boreal spring are investigated based on numerical simulations with the NASA Global Modeling and Assimilation Office finite-volume general circulation model (fvGCM) with Microphyics of Clouds with the Relaxed Arakawa Schubert Scheme (McRAS), using aerosol forcing functions derived from the Goddard Ozone Chemistry Aerosol Radiation and Transport model (GOCART). The authors find that anomalous atmospheric heat sources induced by absorbing aerosols (dust and black carbon) excite a planetary-scale teleconnection pattern in sea level pressure, temperature, and geopotential height spanning North Africa through Eurasia to the North Pacific. Surface cooling due to direct effects of aerosols is found in the vicinity and downstream of the aerosol source regions, that is, South Asia, East Asia, and northern and western Africa. Significant atmospheric heating is found in regions with large loading of dust (over northern Africa and the Middle East) and black carbon (over Southeast Asia). Paradoxically, the most pronounced feature in aerosol-induced surface temperature is an east west dipole anomaly with strong cooling over the Caspian Sea and warming over central and northeastern Asia, where aerosol concentrations are low. Analyses of circulation anomalies show that the dipole anomaly is a part of an atmospheric teleconnection pattern driven by atmospheric heating anomalies induced by absorbing aerosols in the source regions, but the influence was conveyed globally through barotropic energy dispersion and sustained by feedback processes associated with the regional circulations. The surface temperature signature associated with the aerosol-induced teleconnection bears striking resemblance to the spatial pattern of observed long-term trend in surface temperature over Eurasia. Additionally, the boreal spring wave train pattern is similar to that reported by Fukutomi et al. associated with the boreal summer precipitation seesaw between eastern and western Siberia. The results of this study raise the possibility that global aerosol forcing during boreal spring may play an important role in spawning atmospheric teleconnections that affect regional and global climates.

Author

Atmospheric General Circulation Models; Teleconnections (Meteorology); Aerosols; Radiation Transport; Atmospheric Heating; Heat Sources; Finite Volume Method; Surface Temperature; Climatology

20070031189 NASA Goddard Space Flight Center, Greenbelt, MD, USA; George Mason Univ., Fairfax, VA, USA

Precipitation and Latent Heating Distributions from Satellite Passive Microwave Radiometry. Part II: Evaluation of Estimates Using Independent Data

Yang, Song; Olson, William S.; Wang, Jian-Jian; Bell, Thomas L.; Smith, Eric A.; Kummerow, Christian D.; Journal of Applied Meteorology and Climatology; May 2006; Volume 45, No. 6, pp. 721-739; In English; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1175/JAM2370.1

Rainfall rate estimates from spaceborne microwave radiometers are generally accepted as reliable by a majority of the atmospheric science community. One of the Tropical Rainfall Measuring Mission (TRMM) facility rain-rate algorithms is based upon passive microwave observations from the TRMM Microwave Imager (TMI). In Part I of this series, improvements of the TMI algorithm that are required to introduce latent heating as an additional algorithm product are described. Here, estimates of surface rain rate, convective proportion, and latent heating are evaluated using independent ground-based estimates and satellite products. Instantaneous, 0.5 deg. -resolution estimates of surface rain rate over ocean from the improved TMI algorithm are well correlated with independent radar estimates (r approx. 0.88 over the Tropics), but bias reduction is the most significant improvement over earlier algorithms. The bias reduction is attributed to the greater breadth of cloud-resolving model simulations that support the improved algorithm and the more consistent and specific convective/stratiform rain separation method utilized. The bias of monthly 2.5 -resolution estimates is similarly reduced, with comparable correlations to radar estimates. Although the amount of independent latent heating data is limited, TMI-estimated latent heating profiles compare favorably with instantaneous estimates based upon dual-Doppler radar observations, and time series of surface rain-rate and heating profiles are generally consistent with those derived from rawinsonde analyses. Still, some biases in profile shape are evident, and these may be resolved with (a) additional contextual information brought to the

estimation problem and/or (b) physically consistent and representative databases supporting the algorithm. A model of the random error in instantaneous 0.5 deg. -resolution rain-rate estimates appears to be consistent with the levels of error determined from TMI comparisons with collocated radar. Error model modifications for nonraining situations will be required, however. Sampling error represents only a portion of the total error in monthly 2.5 -resolution TMI estimates; the remaining error is attributed to random and systematic algorithm errors arising from the physical inconsistency and/or nonrepresentativeness of cloud-resolving-model-simulated profiles that support the algorithm.
Author
Rain; TRMM Satellite; Latent Heat; Algorithms; Earth Sciences; Microwave Radiometers; Precipitation (Meteorology)

20070031190 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Asian Summer Monsoon Anomalies Induced by Aerosol Direct Forcing: The Role of the Tibetan Plateau
Lau, K. M.; Kim, M. K.; Kim, K. M.; Climate Dynamics; February 09, 2006; Volume 26, No. 7-8, pp. 855-864; In English; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1007/s00382-006-0114-z

In this paper we present results of a numerical study using the NASA finite-volume GCM to elucidate a plausible mechanism for aerosol impact on the Asian summer monsoon involving interaction with physical processes over the Tibetan Plateau (TP). During the premonsoon season of March April, dusts from the deserts of western China, Afghanistan/Pakistan, and the Middle East are transported into and stacked up against the northern and southern slopes of the TP. The absorption of solar radiation by dust heats up the elevated surface air over the slopes. On the southern slopes, the atmospheric heating is reinforced by black carbon from local emission. The heated air rises via dry convection, creating a positive temperature anomaly in the mid-to-upper troposphere over the TP relative to the region to the south. In May through early June in a manner akin to an elevated heat pump , the rising hot air forced by the increasing heating in the upper troposphere, draws in warm and moist air over the Indian subcontinent, setting the stage for the onset of the South Asia summer monsoon. Our results suggest that increased dust loading coupled with black carbon emission from local sources in northern India during late spring may lead to an advance of the rainy periods and subsequently an intensification of the Indian summer monsoon. The enhanced rainfall over India is associated with the development of an aerosol-induced large-scale sea level pressure anomaly pattern, which causes the East Asia (Mei-yu) rain belt to shift northwestward, suppressing rainfall over East Asia and the adjacent oceanic regions.
Author
Aerosols; Anomalies; Asia; Monsoons; Plateaus; Summer; Tibet; Numerical Analysis

20070031191 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Dryline on 22 May 2002 during IHOP_2002: Convective-Scale Measurements at the Profiling Site
Demoz, Belay; Flamant, Cyrille; Weckwerth, Tammy; Whiteman, David; Evans, Keith; Fabry, Frederic; DiGirolamo, Paolo; Miller, David; Geerts, Bart; Brown, William; Schwemmer, Geary; Gentry, Bruce; Feltz, Wayne; Wang, Zhien; Monthly Weather Review; [2006]; Volume 134, Issue 1, pp. 294-310; In English
Report No.(s): MWR3054; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1175/MWR3054.1

A detailed analysis of the structure of a double dryline observed over the Oklahoma panhandle during the first International H2O Project (IHOP_2002) convective initiation (CI) mission on 22 May 2002 is presented. A unique and unprecedented set of high temporal and spatial resolution measurements of water vapor mixing ratio, wind, and boundary layer structure parameters were acquired using the National Aeronautics and Space Administration (NASA) scanning Raman lidar (SRL), the Goddard Lidar Observatory for Winds (GLOW), and the Holographic Airborne Rotating Lidar Instrument Experiment (HARLIE), respectively. These measurements are combined with the vertical velocity measurements derived from the National Center for Atmospheric Research (NCAR) Multiple Antenna Profiler Radar (MAPR) and radar structure function from the high-resolution University of Massachusetts frequency-modulated continuous-wave (FMCW) radar to reveal the evolution and structure of the late afternoon double-dryline boundary layer. The eastern dryline advanced and then retreated over the Homestead profiling site in the Oklahoma panhandle, providing conditions ripe for a detailed observation of the small-scale variability within the boundary layer and the dryline. In situ aircraft data, dropsonde and radiosonde data, along with NCAR S-band dual-polarization Doppler radar (S-Pol) measurements, are also used to provide the larger-scale picture of the double-dryline environment. Moisture and temperature jumps of about 3 g kg(sup -1) and 1 -2 K, respectively, were observed across the eastern radar fine line (dryline), more than the moisture jumps (1-2 g kg(sup -1)) observed across the western radar fine line (secondary dryline). Most updraft plumes observed were located on the moist side of the eastern dryline with vertical velocities exceeding 3 m s(sup -1) and variable horizontal widths of 2-5 km, although some were as wide as 7-8

km. These updrafts were up to 1.5 g kg(sup -1) moister than the surrounding environment. Although models suggested deep convection over the Oklahoma panhandle and several cloud lines were observed near the dryline, the dryline itself did not initiate any storms over the intensive observation region (IOR). Possible reasons for this lack of convection are discussed. Strong capping inversion and moisture detrainment between the lifting condensation level and the level of free convection related to an overriding drier air, together with the relatively small near-surface moisture values (less than 10 g kg(sup -1)), were detrimental to CI in this case.
Author
Water Vapor; Weather; International Cooperation; Airborne Radar; Wind Measurement

20070031192 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Bayesian Estimation of Precipitation from Satellite Passive Microwave Observations Using Combined Radar-Radiometer Retrievals
Grecu, Mircea; Olson, William S.; Journal of Applied Meteorology and Climatology; Mar. 2006; Volume 45, Issue 3, pp. 416-433; In English; Copyright; Avail.: Other Sources

Precipitation estimation from satellite passive microwave radiometer observations is a problem that does not have a unique solution that is insensitive to errors in the input data. Traditionally, to make this problem well posed, a priori information derived from physical models or independent, high-quality observations is incorporated into the solution. In the present study, a database of precipitation profiles and associated brightness temperatures is constructed to serve as a priori information in a passive microwave radiometer algorithm. The precipitation profiles are derived from a Tropical Rainfall Measuring Mission (TRMM) combined radar radiometer algorithm, and the brightness temperatures are TRMM Microwave Imager (TMI) observed. Because the observed brightness temperatures are consistent with those derived from a radiative transfer model embedded in the combined algorithm, the precipitation brightness temperature database is considered to be physically consistent. The database examined here is derived from the analysis of a month-long record of TRMM data that yields more than a million profiles of precipitation and associated brightness temperatures. These profiles are clustered into a tractable number of classes based on the local sea surface temperature, a radiometer-based estimate of the echo-top height (the height beyond which the reflectivity drops below 17 dBZ), and brightness temperature principal components. For each class, the mean precipitation profile, brightness temperature principal components, and probability of occurrence are determined. The precipitation brightness temperature database supports a radiometer-only algorithm that incorporates a Bayesian estimation methodology. In the Bayesian framework, precipitation estimates are weighted averages of the mean precipitation values corresponding to the classes in the database, with the weights being determined according to the similarity between the observed brightness temperature principal components and the brightness temperature principal components of the classes. Because the classes are stratified by the sea surface temperature and the echo-top-height estimator, the number of classes that are considered for retrieval is significantly smaller than the total number of classes, making the algorithm computationally efficient. The radiometer-only algorithm is applied to TMI observations, and precipitation estimates are compared with combined TRMM precipitation radar (PR) TMI reference estimates. The TMI-only algorithm, supported by the empirically derived database, produces estimates that are more consistent with the reference values than the precipitation estimates from the version-6 TRMM facility TMI algorithm. Cloud-resolving model simulations are used to assign a latent heating profile to each precipitation profile in the empirically derived database, making it possible to estimate latent heating using the radiometer-only algorithm. Although the evaluation of latent heating estimates in this study is preliminary, because realistic conditional probability distribution functions are attached to latent heating structures in the algorithm s database, a generally positive impact on latent heating estimation from passive microwave observations is expected.
Author
Precipitation (Meteorology); Estimating; Satellite Observation; Microwave Radiometers; Meteorological Radar; TRMM Satellite; Brightness Temperature

20070031212 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Numerical Study of Hurricane Erin (2001), Part 1, Model Verification and Storm Evolution
Wu, Liguang; Braun, Scott A.; Halverson, J.; Heymsfield, G.; Journal of Atmospheric Sciences; January 2006; Volume 63, Issue 1, pp. 65; In English; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1175/JAS3597.1

The fifth-generation Pennsylvania State University National Center for Atmospheric Research (PSU NCAR) Mesoscale Model (MM5) is used to simulate Hurricane Erin (2001) at high resolution (4-km spacing) from its early development as a tropical depression on 7 September 2001, through a period of rapid intensification into a strong hurricane (8 9 September), and finally into a stage during which it maintains its intensity on 10 September. These three stages of formation, intensification,

and maintenance in the simulation are in good agreement with the observed evolution of Erin. The simulation shows that during the formation and early portions of the intensification stages, intensification is favored because the environmental wind shear is weak and the system moves over a warm tongue of water. As Erin intensifies, the wind shear gradually increases with the approach of an upper-level trough and strengthening of a low-level high pressure system. By 10 September, the wind shear peaks and begins to decrease, the storm moves over slightly cooler waters, and the intensification ends. Important structural changes occur at this time as the outer precipitation shifts from the northeastern and eastern sides to the western side of the eye. A secondary wind maximum and an outer eyewall begin to develop as precipitation begins to surround the entire eye. The simulation is used to investigate the role of vertical wind shear in the changes of the precipitation structure that took place between 9 and 10 September by examining the effects of changes in storm-relative flow and changes in the shear-induced tilt. Qualitative agreement is found between the divergence pattern and advection of vorticity by the relative flow with convergence (divergence) generally associated with asymmetric inflow (outflow) in the eyewall region. The shift in the outer precipitation is consistent with a shift in the low-level relative inflow from the northeastern to the northwestern side of the storm. The changes in the relative flow are associated with changes in the environmental winds as the hurricane moves relative to the upper trough and the low-level high pressure system. Examination of the shear-induced tilt of the vortex shows that the change in the tilt direction is greater than that of the shear direction as the tilt shifts from a northerly orientation to northwesterly. Consistent with theory for adiabatic vortices, the maximum low-level convergence and upper-level divergence (and the maximum upward motion) occurs in the direction of tilt. Consequently, both mechanisms may play roles in the changes in the precipitation pattern.

Author

Hurricanes; Mesoscale Phenomena; Wind Effects; Wind Shear; Atmospheric Models; Simulation; Storms

20070031216 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Mechanisms for Diurnal Variability of Global Tropical Rainfall Observed from TRMM

Yang, Song; Smith, Eric a.; Journal of Climate; October 2006; Volume 19, Issue 20, pp. 5190; In English

Report No.(s): JCLI3883; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1175/JCLI3883.1

The behavior and various controls of diurnal variability in tropical-subtropical rainfall are investigated using Tropical Rainfall Measuring Mission (TRMM) precipitation measurements retrieved from the three level-2 TRMM standard profile algorithms for the 1998 annual cycle. Results show that diurnal variability characteristics of precipitation are consistent for all three algorithms, providing assurance that TRMM retrievals are producing consistent estimates of rainfall variability. As anticipated, most ocean areas exhibit more rainfall at night, while over most land areas, rainfall peaks during daytime; however, important exceptions are noted. The dominant feature of the oceanic diurnal cycle is a rainfall maximum in late-evening-early-morning (LE-EM) hours, while over land the dominant maximum occurs in the mid- to late afternoon (MLA). In conjunction with these maxima are pronounced seasonal variations of the diurnal amplitudes. Amplitude analysis shows that the diurnal pattern and its seasonal evolution are closely related to the rainfall accumulation pattern and its seasonal evolution. In addition, the horizontal distribution of diurnal variability indicates that for oceanic rainfall, there is a secondary MLA maximum coexisting with the LE-EM maximum at latitudes dominated by large-scale convergence and deep convection. Analogously, there is a preponderancy for an LE EM maximum over land coexisting with the stronger MLA maximum, although it is not evident that this secondary continental feature is closely associated with the large-scale circulation. Neither of the secondary maxima exhibit phase behavior that can be considered semidiurnal in nature. Diurnal rainfall variability over the ocean associated with large-scale convection is clearly an integral component of the general circulation. Phase analysis reveals differences in regional and seasonal features of the diurnal cycle, indicating that underlying forcing mechanisms differ from place to place. This is underscored by the appearance of secondary ocean maxima in the presence of large-scale convection, along with other important features. Among these, there are clear-cut differences between the diurnal variability of seasonal rainfall over the mid-Pacific and Indian Ocean Basins. The mid-Pacific exhibits double maxima in spring and winter but only LE-EM maxima in summer and autumn, while the Indian Ocean exhibits double maxima in spring and summer and only an LE-EM maximum in autumn and winter. There are also evident daytime maxima within the major large-scale marine stratocumulus regions off the west coasts of continents. The study concludes with a discussion concerning how the observational evidence either supports or repudiates possible forcing mechanisms that have been suggested to explain diurnal rainfall variability.

Author

TRMM Satellite; Tropical Regions; Rain; Precipitation Measurement; Diurnal Variations; Annual Variations; Estimates

20070031220 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Impact of Three-Dimensional Radiative Effects on Satellite Retrievals of Cloud Droplet Sizes

Marshak, Alexander; Platnick, Steven; Varnai, Tamas; Wen, Guoyong; Cahalan, Robert F.; Journal of Geophysical Research; May 13, 2006; ISSN 0148-0227; Volume 111, pp. D09207; In English; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1029/2005JD006686

There are several dozen papers that study the effects of cloud horizontal inhomogeneity on the retrievals of cloud optical thickness, but only a few of them deal with cloud droplet sizes. This paper is one of the first comprehensive attempts to fill this gap: It takes a close theoretical look at the radiative effects of cloud 3-D structure in retrievals of droplet effective radii. Under some general assumptions, it was found that ignoring subpixel (unresolved) variability produces a negative bias in the retrieved effective radius, while ignoring cloud inhomogeneity at scales larger than a pixel scale (resolved variability), on the contrary, leads to overestimation of the domain average droplet size. The theoretical results are illustrated with examples from Large Eddy Simulations (LES) of cumulus (Cu) and stratocumulus (Sc) cloud fields. The analysis of cloud drop size distributions retrieved from both LES fields confirms that ignoring shadowing in 1-D retrievals results in substantial overestimation of effective radii which is more pronounced for broken Cu than for Sc clouds. Collocated measurements of broken Cu clouds by Moderate Resolution Imaging Spectrometer (MODIS) and Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) are used to check simulations and theory with observations. The analysis of ASTER and MODIS data and associated derived products recommends against blindly using retrieved effective radii for broken cloud fields, especially if one wants to relate aerosol amounts to cloud droplet sizes.

Author

Cloud Physics; Drop Size; Size Distribution; Aerosols; Radiometers; Large Eddy Simulation; MODIS (Radiometry); Cloud Cover; Stratocumulus Clouds; Drops (Liquids)

20070031221 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Aerosol Direct Radiative Effect at the Top of the Atmosphere Over Cloud Free Ocean Derived from Four Years of MODIS Data

Remer, L. A.; Kaufman, Y. J.; Atmospheric Chemistry and Physics; 30 Jan. 2006; Volume 6, Issue 1, pp. 237; In English; Copyright; Avail.: Other Sources

A four year record of MODIS spaceborne data provides a new measurement tool to assess the aerosol direct radiative effect at the top of the atmosphere. MODIS derives the aerosol optical thickness and microphysical properties from the scattered sunlight at 0.55-2.1 microns. The monthly MODIS data used here are accumulated measurements across a wide range of view and scattering angles and represent the aerosol s spectrally resolved angular properties. We use these data consistently to compute with estimated accuracy of +/-0.6W/sq m the reflected sunlight by the aerosol over global oceans in cloud free conditions. The MODIS high spatial resolution (0.5 km) allows observation of the aerosol impact between clouds that can be missed by other sensors with larger footprints. We found that over the clear-sky global ocean the aerosol reflected 5.3+/-0.6W/sq m with an average radiative efficiency of 49+/-2W/sq m per unit optical thickness. The seasonal and regional distribution of the aerosol radiative effects are discussed. The analysis adds a new measurement perspective to a climate change problem dominated so far by models.

Author

MODIS (Radiometry); Aerosols; Atmospheric Effects; Optical Thickness; Climate Change; Air Water Interactions

20070031222 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Performance of Two Cloud-Radiation Parameterization Schemes in the Finite Volume General Circulation Model for Anomalously Wet May and June 2003 Over the Continental USA and Amazonia

Sud, Y. C.; Mocko, David M.; Lin, S. J.; Journal of Geophysical Research; March 16, 2006; ISSN 0148-0227; Voluem 111, pp. D06201; In English; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1029/2005JD006246

An objective assessment of the impact of a new cloud scheme, called Microphysics of Clouds with Relaxed Arakawa-Schubert Scheme (McRAS) (together with its radiation modules), on the finite volume general circulation model (fvGCM) was made with a set of ensemble forecasts that invoke performance evaluation over both weather and climate timescales. The performance of McRAS (and its radiation modules) was compared with that of the National Center for Atmospheric Research Community Climate Model (NCAR CCM3) cloud scheme (with its NCAR physics radiation). We specifically chose the boreal summer months of May and June 2003, which were characterized by an anomalously wet eastern

half of the continental USA as well as northern regions of Amazonia. The evaluation employed an ensemble of 70 daily 10-day forecasts covering the 61 days of the study period. Each forecast was started from the analyzed initial state of the atmosphere and spun-up soil moisture from the first-day forecasts with the model. Monthly statistics of these forecasts with up to 10-day lead time provided a robust estimate of the behavior of the simulated monthly rainfall anomalies. Patterns of simulated versus observed rainfall, 500-hPa heights, and top-of-the-atmosphere net radiation were recast into regional anomaly correlations. The correlations were compared among the simulations with each of the schemes. The results show that fvGCM with McRAS and its radiation package performed discernibly better than the original fvGCM with CCM3 cloud physics plus its radiation package. The McRAS cloud scheme also showed a reasonably positive response to the observed sea surface temperature on mean monthly rainfall fields at different time leads. This analysis represents a method for helpful systematic evaluation prior to selection of a new scheme in a global model.
Author
Climate Models; Atmospheric General Circulation Models; Cumulus Clouds; Cloud Physics

20070031223 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Influence of Aerosols on the Shortwave Cloud Radiative Forcing from North Pacific Oceanic Clouds: Results from the Cloud Indirect Forcing Experiment (CIFEX)
Wilcox, Eric M.; Roberts, Greg; Ramanathan, V.; Geophysical Research Letters; November 03, 2007; Volume 33, pp. L21804; In English; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1029/2006GL027150

Aerosols over the Northeastern Pacific Ocean enhance the cloud drop number concentration and reduce the drop size for marine stratocumulus and cumulus clouds. These microphysical effects result in brighter clouds, as evidenced by a combination of aircraft and satellite observations. In-situ measurements from the Cloud Indirect Forcing Experiment (CIFEX) indicate that the mean cloud drop number concentration in low clouds over the polluted marine boundary layer is greater by 53 cm(sup -3) compared to clean clouds, and the mean cloud drop effective radius is smaller by 4 micrometers. We link these in-situ measurements of cloud modification by aerosols, for the first time, with collocated satellite broadband radiative flux observations from the Clouds and the Earth s Radiant Energy System to show that these microphysical effects of aerosols enhance the top-of-atmosphere cooling by -.9.9 plus or minus 4.3 W m(sup -2) for overcast conditions.
Author
Aerosols; Cloud Cover; Marine Meteorology; Ocean Surface; Pacific Ocean; Stratocumulus Clouds; Short Wave Radiation

20070031224 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Test of Sensitivity to Convective Transport in a Global Atmospheric CO2 Simulation
Bian, H.; Kawa, S. R.; Chin, M.; Pawson, S.; Zhu, Z.; Rasch, P.; Wu, S.; Tellus: Series B Chemical and Physical Meteorology; November 2006; Volume 58, Issue 5, pp. 463; In English; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1111/j.1600-0889.2006.00212.x

Two approximations to convective transport have been implemented in an offline chemistry transport model (CTM) to explore the impact on calculated atmospheric CO2 distributions. GlobalCO2 in the year 2000 is simulated using theCTM driven by assimilated meteorological fields from the NASA s Goddard Earth Observation System Data Assimilation System, Version 4 (GEOS-4). The model simulates atmospheric CO2 by adopting the same CO2 emission inventory and dynamical modules as described in Kawa et al. (convective transport scheme denoted as Conv1). Conv1 approximates the convective transport by using the bulk convective mass fluxes to redistribute trace gases. The alternate approximation, Conv2, partitions fluxes into updraft and downdraft, as well as into entrainment and detrainment, and has potential to yield a more realistic simulation of vertical redistribution through deep convection. Replacing Conv1 by Conv2 results in an overestimate of CO2 over biospheric sink regions. The largest discrepancies result in a CO2 difference of about 7.8 ppm in the July NH boreal forest, which is about 30% of the CO2 seasonality for that area. These differences are compared to those produced by emission scenario variations constrained by the framework of Intergovernmental Panel on Climate Change (IPCC) to account for possible land use change and residual terrestrial CO2 sink. It is shown that the overestimated CO2 driven by Conv2 can be offset by introducing these supplemental emissions.
Author
Sensitivity; Carbon Dioxide Concentration; Convection; Simulation; Transport Theory; Remote Sensing

20070031225 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Algorithm for NO2 Vertical Column Retrieval from the Ozone Monitoring Instrument

Bucsela, Eric J.; Celarier, Edward A.; Wenig, Mark O.; Gleason, James F.; Veefkind, J. Pepijn; Boersma, K. Folkert; Brinksma, Ellen J.; IEEE Transactions on Geoscience and Remote Sensing; May 2006; ISSN 0196-2892; Volume 44, Issue 5, pp. 1245; In English; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1109/TGRS.2005.863715

We describe the operational algorithm for the retrieval of stratospheric, tropospheric, and total column densities of nitrogen dioxide NO2 from earthshine radiances measured by the Ozone Monitoring Instrument (OMI), aboard the EOS-Aura satellite. The algorithm uses the DOAS method for the retrieval of slant column NO densities. Air mass factors (AMFs) calculated from a stratospheric NO2 profile are used to make initial estimates of the vertical column density. Using data collected over a 24-h period, a smooth estimate of the global stratospheric field is constructed. Where the initial vertical column densities exceed the estimated stratospheric field, we infer the presence of tropospheric NO2, and recalculate the vertical column density (VCD) using an AMF calculated from an assumed tropospheric NO2 profile. The parameters that control the operational algorithm were selected with the aid of a set of data assembled from stratospheric and tropospheric chemical transport models. We apply the optimized algorithm to OMI data and present global maps of NO2 VCDs for the first time.

Author

Algorithms; Nitrogen Dioxide; Ozone; Troposphere; Atmospheric Models; Ozone Depletion

20070031227 Science Systems and Applications, Inc., Lanham, MD, USA

Spectral Measurements of PMCs from SBUV/2 Instruments

DeLand, Matthew T.; Shettle, Eric P.; Thomas, Gary E.; Olivero, John J.; Journal of Atmospheric and Solar-Terrestrial Physics; January 2006; Volume 68, Issue 1, pp. 65-77; In English; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1016/j.jastp.2005.08.006

The SBUV/2 (Solar Backscattered Ultraviolet, model 2) instrument is designed to monitor ozone stratospheric profile and total column ozone using measurements of the Earth's backscattered ultraviolet albedo. We have previously demonstrated that the normal radiance measurements from SBUV/2 instruments, which sample 12 discrete wavelengths between 252 and 340 nm during each scan, can be used to identify polar mesospheric clouds (PMCs). Some SBUV/2 instruments also periodically view the earth in continuous scan mode, covering the wavelength range 160-400 nm with 0.15 nm sampling. Analysis of these data show PMC occurrence rates similar to the normal discrete scan results, although the observation technique reduces the number of daily measurements by a factor of six. PMC observed by SBUV/2 instruments show a monotonic variation in the residual spectral albedo over the wavelength range 250 300 nm, with maximum enhancements of 10 15% at 250 nm. This result is consistent with microphysical model predictions from Jensen [1989. A numerical model of polar mesospheric cloud formation and evolution, Ph. D. Thesis, University of Colorado]. We find no evidence for a systematic localized increase in PMC residual albedo for wavelengths near 260 nm, in contrast to the recently reported results from the MSX UVISI instrument [Carbary J.F., et al., 2004. Evidence for bimodal particle distribution from the spectra of polar mesospheric clouds. Geophysics Research. Letters 31, L13108]. This result is observed for three different SBUV/2 instruments in both Northern and Southern Hemisphere data over a 13-year span. Our Mie scattering calculations show that the location and magnitude of the 260 nm hump feature is dependent upon the specific scattering angles appropriate to the MSX measurements. Although it explains the MSX spectrum, the bimodal size distribution proposed by Carbary et al. (2004), cannot explain the lack of scattering angle dependence of the SBUV/2 spectral shapes. The spectral signature of the SBUV/2 continuous scan PMC data is thus inconsistent with the bimodal particle size distribution suggested by Carbary et al. (2004).

Author

Solar Backscatter UV Spectrometer; Remote Sensing; Mesosphere; Polar Meteorology; Geophysics; Clouds (Meteorology)

20070031228 NASA Goddard Space Flight Center, Greenbelt, MD, USA

First Results from the OMI Rotational Raman Scattering Cloud Pressure Algorithm

Joiner, Joanna; Vasilkov, Alexander P.; IEEE Transactions on Geoscience and Remote Sensing; May 2006; Volume 44, No. 5, pp. 1272-1282; In English; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1109/TGRS.2005.861385

We have developed an algorithm to retrieve scattering cloud pressures and other cloud properties with the Aura Ozone Monitoring Instrument (OMI). The scattering cloud pressure is retrieved using the effects of rotational Raman scattering (RRS). It is defined as the pressure of a Lambertian surface that would produce the observed amount of RRS consistent with the derived reflectivity of that surface. The independent pixel approximation is used in conjunction with the Lambertian-

equivalent reflectivity model to provide an effective radiative cloud fraction and scattering pressure in the presence of broken or thin cloud. The derived cloud pressures will enable accurate retrievals of trace gas mixing ratios, including ozone, in the troposphere within and above clouds. We describe details of the algorithm that will be used for the first release of these products. We compare our scattering cloud pressures with cloud-top pressures and other cloud properties from the Aqua Moderate-Resolution Imaging Spectroradiometer (MODIS) instrument. OMI and MODIS are part of the so-called A-train satellites flying in formation within 30 min of each other. Differences between OMI and MODIS are expected because the MODIS observations in the thermal infrared are more sensitive to the cloud top whereas the backscattered photons in the ultraviolet can penetrate deeper into clouds. Radiative transfer calculations are consistent with the observed differences. The OMI cloud pressures are shown to be correlated with the cirrus reflectance. This relationship indicates that OMI can probe through thin or moderately thick cirrus to lower lying water clouds.
Author
Algorithms; Cloud Physics; Ozone; Raman Spectra; Aura Spacecraft; Earth Observing System (EOS)

20070031230 NASA Goddard Space Flight Center, Greenbelt, MD, USA
An Ozone Increase in the Antarctic Summer Stratosphere: A Dynamical Response to the Ozone Hole
Stolarski, R. S.; Douglass, A. R.; Gupta, M.; Newman, P. A.; Pawson, S.; Schoeberl, M. R.; Nielsen, J. E.; Geophysical Reseach Letters; November 07, 2007; Volume 33; 1 pp.; In English; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1029/2006GL026820

Profiles of ozone concentration retrieved from the SBUV series of satellites show an increase between 1979 and 1997 in the summertime Antarctic middle stratosphere (approx. 25-10 hPa). Data over the South Pole from ozone sondes confirm the increase. A similar ozone increase is produced in a chemistry climate model that allows feedback between constituent changes and the stratospheric circulation through radiative heating. A simulation that excludes the radiative coupling between predicted ozone and the circulation does not capture this ozone increase. We show that the ozone increase in our model simulations is caused by a dynamical feedback in response to the changes in the stratospheric wind fields forced by the radiative perturbation associated with the Antarctic ozone hole.
Author
Antarctic Regions; Dynamic Response; Ozone Depletion; Stratosphere; Summer; Solar Backscatter UV Spectrometer

20070031231 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Tropospheric Ozone Determined from Aura OMI and MLS: Evaluation of Measurements and Comparison with the Global Modeling Initiative's Chemical Transport Model
Ziemke, J. R.; Chandra, S.; Duncan, B. N.; Froidevaux, L.; Bhartia, P. K.; Levelt, P. F.; Waters, J. W.; Journal of Geophysical Research; October 05, 2006; Volume 111; 1 pp.; In English; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1029/2006JD007089

Ozone measurements from the OMI and MLS instruments on board the Aura satellite are used for deriving global distributions of tropospheric column ozone (TCO). TCO is determined using the tropospheric ozone residual method which involves subtracting measurements of MLS stratospheric column ozone (SCO) from OMI total column ozone after adjusting for intercalibration differences of the two instruments using the convective-cloud differential method. The derived TCO field, which covers one complete year of mostly continuous daily measurements from late August 2004 through August 2005, is used for studying the regional and global pollution on a timescale of a few days to months. The seasonal and zonal characteristics of the observed TCO fields are also compared with TCO fields derived from the Global Modeling Initiative's Chemical Transport Model. The model and observations show interesting similarities with respect to zonal and seasonal variations. However, there are notable differences, particularly over the vast region of the Saharan desert.
Author
Ozone; Microwave Sounding; Troposphere; Aura Spacecraft; Stratosphere

20070031554 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Structure of Highly Sheared Tropical Storm Chantal during CAMEX-4
Heymsfield, G. M.; Halverson, J.; Ritchie, E.; Simpson, Joanne; Molinari, J.; Tian, L.; Journal of The Atmospheric Sciences; [2006]; Volume 63, Issue 1, pp. 268-287; In English; Copyright; Avail.: Other Sources

Tropical Storm Chantal during August 2001 was a storm that failed to intensify over the few days prior to making landfall on the Yucatan Peninsula. An observational study of Tropical Storm Chantal is presented using a diverse dataset including remote and in situ measurements from the NASA ER-2 and DC-8 and the NOAA WP-3D N42RF aircraft and satellite. The

authors discuss the storm structure from the larger-scale environment down to the convective scale. Large vertical shear (850-200-hPa shear magnitude range 8-15 m/s) plays a very important role in preventing Chantal from intensifying. The storm had a poorly defined vortex that only extended up to 5-6-km altitude, and an adjacent intense convective region that comprised a mesoscale convective system (MCS). The entire low-level circulation center was in the rain-free western side of the storm, about 80 km to the west-southwest of the MCS. The MCS appears to have been primarily the result of intense convergence between large-scale, low-level easterly flow with embedded downdrafts, and the cyclonic vortex flow. The individual cells in the MCS such as cell 2 during the period of the observations were extremely intense, with reflectivity core diameters of 10 km and peak updrafts exceeding 20 m/s. Associated with this MCS were two broad subsidence (warm) regions, both of which had portions over the vortex. The first layer near 700 hPa was directly above the vortex and covered most of it. The second layer near 500 hPa was along the forward and right flanks of cell 2 and undercut the anvil divergence region above. There was not much resemblance of these subsidence layers to typical upper-level warm cores in hurricanes that are necessary to support strong surface winds and a low central pressure. The observations are compared to previous studies of weakly sheared storms and modeling studies of shear effects and intensification. The configuration of the convective updrafts, low-level circulation, and lack of vertical coherence between the upper- and lower-level warming regions likely inhibited intensification of Chantal. This configuration is consistent with modeled vortices in sheared environments, which suggest the strongest convection and rain in the downshear left quadrant of the storm, and subsidence in the upshear right quadrant. The vertical shear profile is, however, different from what was assumed in previous modeling in that the winds are strongest in the lowest levels and the deep tropospheric vertical shear is on the order of 10-12 m/s.
Author
Tropical Storms; In Situ Measurement; Remote Sensing; Hurricanes; Cores; Mesoscale Phenomena; Ground Wind

20070031556 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Precipitation and Latent Heating Distributions from Satellite Passive Microwave Radiometry, Part 1, Improved Method and Uncertainties
Olson, William S.; Kummerow, Christian D.; Yang, Song; Petty, Grant W.; Tao, Wei-Kuo; Bell, Thomas L.; Braun, Scott A.; Wang, Yansen; Lang, Stephen E.; Johnson, Daniel E.; Chiu, Christine; Journal of Applied Meteorology and Climatology; May 2006; Volume 45, pp. 702-720; In English
Report No.(s): JAM2369; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1175/JAM2369.1

A revised Bayesian algorithm for estimating surface rain rate, convective rain proportion, and latent heating profiles from satellite-borne passive microwave radiometer observations over ocean backgrounds is described. The algorithm searches a large database of cloud-radiative model simulations to find cloud profiles that are radiatively consistent with a given set of microwave radiance measurements. The properties of these radiatively consistent profiles are then composited to obtain best estimates of the observed properties. The revised algorithm is supported by an expanded and more physically consistent database of cloud-radiative model simulations. The algorithm also features a better quantification of the convective and nonconvective contributions to total rainfall, a new geographic database, and an improved representation of background radiances in rain-free regions. Bias and random error estimates are derived from applications of the algorithm to synthetic radiance data, based upon a subset of cloud-resolving model simulations, and from the Bayesian formulation itself. Synthetic rain-rate and latent heating estimates exhibit a trend of high (low) bias for low (high) retrieved values. The Bayesian estimates of random error are propagated to represent errors at coarser time and space resolutions, based upon applications of the algorithm to TRMM Microwave Imager (TMI) data. Errors in TMI instantaneous rain-rate estimates at 0.5 -resolution range from approximately 50% at 1 mm/h to 20% at 14 mm/h. Errors in collocated spaceborne radar rain-rate estimates are roughly 50%-80% of the TMI errors at this resolution. The estimated algorithm random error in TMI rain rates at monthly, 2.5deg resolution is relatively small (less than 6% at 5 mm day.1) in comparison with the random error resulting from infrequent satellite temporal sampling (8%-35% at the same rain rate). Percentage errors resulting from sampling decrease with increasing rain rate, and sampling errors in latent heating rates follow the same trend. Averaging over 3 months reduces sampling errors in rain rates to 6%-15% at 5 mm day.1, with proportionate reductions in latent heating sampling errors.
Author
Bayes Theorem; Algorithms; Meteorological Radar; Estimating; Rain; Microwave Radiometers; Atmospheric Models; Clouds (Meteorology); Error Analysis

20070031557 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Retrieval of Latent Heating from TRMM Measurements

Tao, W.-K.; Smith, E. A.; Adler, R. F.; Hou, A. Y.; Meneghini, R.; Simpson, J.; Haddad, Z. S.; Iguchi, T.; Satoh, S.; Kakar, R.; Krishnamurti, T. N.; Kummerow, C. D.; Lang, S.; Nakamura, K.; Nakazawa, T.; Okamoto, K.; Shige, S.; Olson, W. S.; Takayabu, Y.; Tripoli, G. J.; Yang, S.; Bulletin of the American Meteorological Society; November 2006; Volume 87, Issue 11, pp. 1555-1572; In English; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1175/BAMS-87-11-1555

Precipitation, in driving the global hydrological cycle, strongly influences the behavior of the Earth's weather and climate systems and is central to their variability. Two-thirds of the global rainfall occurs over the Tropics, which leads to its profound effect on the general circulation of the atmosphere. This is because its energetic equivalent, latent heating (LH), is the tropical convective heat engine's primary fuel source as originally emphasized by Riehl and Malkus (1958). At low latitudes, LH stemming from extended bands of rainfall modulates large-scale zonal and meridional circulations and their consequent mass overturnings (e.g., Hartmann et al. 1984; Hack and Schubert 1990). Also, LH is the principal energy source in the creation, growth, vertical structure, and propagation of long-lived tropical waves (e.g., Puri 1987; Lau and Chan 1988). Moreover, the distinct vertical distribution properties of convective and stratiform LH profiles help influence climatic outcomes via their tight control on large-scale circulations (Lau and Peng 1987; Nakazawa 1988; Sui and Lau 1988; Emanuel et al. 1994; Yanai et al. 2000; Sumi and Nakazawa 2002; Schumacher et al. 2004). The purpose of this paper is to describe how LH profiles are being derived from satellite precipitation rate retrievals, focusing on those being made with Tropical Rainfall Measuring Mission (TRMM) satellite measurements.

Derived from text

TRMM Satellite; Latent Heat; Precipitation (Meteorology); Weather

20070031576 NASA Langley Research Center, Hampton, VA, USA

Requirements and Technology Advances for Global Wind Measurement with a Coherent Lidar: A Shrinking Gap

Kavaya, Michael J.; Kavaya, Michael J.; Yu, Jirong; Koch, Grady J.; Amzajerdian, Farzin; Singh, Upendra N.; Emmitt, G. David; August 26, 2007; 15 pp.; In English; SPIE Lidar Remote Sensing for Environmental Monitoring VIII, 26-30 Aug. 2007, San Diego, CA, USA; Original contains color illustrations

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

Report No.(s): SPIE 6681-6; Copyright; Avail.: CASI: A03, Hardcopy

Early concepts to globally measure vertical profiles of vector horizontal wind from space planned on an orbit height of 525 km, a single pulsed coherent Doppler lidar system to cover the full troposphere, and a continuously rotating telescope/scanner that mandated a vertical line of sight wind profile from each laser shot. Under these conditions system studies found that laser pulse energies of approximately 20 J at 10 Hz pulse repetition rate with a rotating telescope diameter of approximately 1.5 m was required. Further requirements to use solid state laser technology and an eyesafe wavelength led to the relatively new 2-micron solid state laser. With demonstrated pulse energies near 20 mJ at 5 Hz, and no demonstration of a rotating telescope maintaining diffraction limited performance in space, the technology gap between requirements and demonstration was formidable. Fortunately the involved scientists and engineers set out to reduce the gap, and through a combination of clever ideas and technology advances over the last 15 years, they have succeeded. This paper will detail the gap reducing factors and will present the current status.

Author

Doppler Radar; Laser Applications; Optical Radar; Wind Measurement; Wind Profiles; Satellite Observation

20070031577 NASA Langley Research Center, Hampton, VA, USA

Parameter Trade Studies For Coherent Lidar Wind Measurements of Wind from Space

Kavaya, Michael J.; Frehlich, Rod G.; August 26, 2007; 22 pp.; In English; SPIE Lidar Remote Sensing for Environmental Monitoring VIII, 26-30 Aug. 2007, San Diego, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 478643.02.02.02.09; Copyright; Avail.: CASI: A03, Hardcopy

The design of an orbiting wind profiling lidar requires selection of dozens of lidar, measurement scenario, and mission geometry parameters; in addition to prediction of atmospheric parameters. Typical mission designs do not include a thorough trade optimization of all of these parameters. We report here the integration of a recently published parameterization of coherent lidar wind velocity measurement performance with an orbiting coherent wind lidar computer simulation; and the use

of these combined tools to perform some preliminary parameter trades. We use the 2006 NASA Global Wind Observing Sounder mission design as the starting point for the trades.
Author
Meteorological Parameters; Optical Radar; Radar Measurement; Wind (Meteorology); Wind Measurement; Earth Observations (From Space)

20070031724 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Introduction to MODIS Cloud Products, Chapter 5
Baum, Bryan A.; Platnick, Steven; Earth Science Satellite Remote Sensing; 2006; Volume 1, pp. 74; In English; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1007/978-3-540-37293-6_5

The Earth's radiative energy balance and hydrological cycle are fundamentally coupled with the distribution and properties of clouds. Therefore, the ability to remotely infer cloud properties and their variation in space and time is crucial for establishing climatologies as a reference for validation of present-day climate models and in assessing future climate change. Remote cloud observations also provide data sets useful for testing and improving cloud model physics, and for assimilation into numerical weather prediction models. The MODerate Resolution Imaging Spectroradiometer (MODIS) imagers on the Terra and Aqua Earth Observing System (EOS) platforms provide the capability for globally retrieving these properties using passive solar reflectance and infrared techniques. In addition to providing measurements similar to those offered on a suite of historical operational weather platforms such as the Advanced Very High Resolution Radiometer (AVHRR), the High-resolution Infrared Radiation Sounder (HIRS), and the Geostationary Operational Environmental Satellite (GOES), MODIS provides additional spectral and/or spatial resolution in key atmospheric bands, along with on-board calibration, to expand the capability for global cloud property retrievals. The core MODIS operational cloud products include cloud top pressure, thermodynamic phase, optical thickness, particle size, and water path, and are derived globally at spatial resolutions of either 1- or 5-km (referred to as Level-2 or pixel-level products). In addition, the MODIS atmosphere team (collectively providing cloud, aerosol, and clear sky products) produces a combined gridded product (referred to as Level-3) aggregated to a 1 equal-angle grid, available for daily, eight-day, and monthly time periods. The wealth of information available from these products provides critical information for climate studies as well as the continuation and improved understanding of existing satellite-based cloud climatologies derived from heritage instruments. This chapter provides an overview of the MODIS Level-2 and -3 operational cloud products.
Author
Climate Models; Clouds (Meteorology); MODIS (Radiometry); Remote Sensing

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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*.

20070031561 Scripps Institution of Oceanography, La Jolla, CA, USA
Eddies Enhance Biological Production in the Weddell-Scotia Confluence of the Southern Ocean
Kahru, M.; Mitchell, B. G.; Gille, S. T.; Hewes, C. D.; Holm,-Hansen, O.; Geophysical Research Letters; July 19, 2007; ISSN 0094-8276; Volume 34, pp. 2007; In English; Original contains color illustrations
Contract(s)/Grant(s): NNG05GR23G; NSF ANT-04-44134; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1029/2007GL030430

Satellite data show that oceanic eddies generated in the Southern Antarctic Circumpolar Current Front (SACCF) are associated with increased phytoplankton biomass. Cyclonic eddies with high chlorophyll a concentration (Chl-a) retain phytoplankton within the eddy cores and increase the light available for photosynthesis in the upper mixed layer by limiting vertical mixing and lifting of the isopycnal surfaces. Anticyclonic eddies have low Chl-a in the core but increased Chl-a in the periphery. Cross-frontal mixing mediated by eddies transports nutrients (e.g., Fe and Si) to the north and contributes to the increased Chl-a in the frontal zone. Interannual variations in the cyclonic eddy activity are positively correlated with variations in Chl-a during the spring bloom in regions of the Antarctic Circumpolar Current around South Georgia.
Author
Antarctic Ocean; Antarctic Regions; Chlorophylls; Vortices; Ocean Currents

20070031637 Science Systems and Applications, Inc., Bay Saint Louis, MS, USA

Simulated NASA Satellite Data Products for the NOAA Integrated Coral Reef Observation Network/Coral Reef Early Warning System

Estep, Leland; Spruce, Joseph P.; [2007]; 2 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NNS04AB54T

Report No.(s): SSTI-2220-0118; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070031637

This RPC (Rapid Prototyping Capability) experiment will demonstrate the use of VIIRS (Visible/Infrared Imager/ Radiometer Suite) and LDCM (Landsat Data Continuity Mission) sensor data as significant input to the NOAA (National Oceanic and Atmospheric Administration) ICON/ CREWS (Integrated Coral Reef Observation System/Coral Reef Early Warning System). The project affects the Coastal Management Program Element of the Applied Sciences Program.

Derived from text

Coral Reefs; Data Products; NOAA Satellites; Early Warning Systems; Rapid Prototyping; Oceanography

51
LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance of animals and plants in space and related environmental conditions. For specific topics in life sciences see *categories 52 through 55*.

20070031730 NASA Marshall Space Flight Center, Huntsville, AL, USA

Environmental Public Health Surveillance for Exposure to Respiratory Health Hazards: A Joint NASA/CDC Project to Use Remote Sensing Data for Estimating Airborne Particulate Matter Over the Atlanta, Georgia Metropolitan Area

Quattrochi, Dale A.; Al-Hamdan, Mohammad; Estes, Maurice; Crosson, William; April 17, 2007; 2 pp.; In English; Association of American Geographers (AAG) Annual Meeting, 17-21 Apr. 2007, San Francisco, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

As part of the National Environmental Public Health Tracking Network (EPHTN) the National Center for Environmental Health (NCEH) at the Centers for Disease Control and Prevention (CDC) is leading a project called Health and Environment Linked for Information Exchange (HELiX-Atlanta). The goal of developing the National Environmental Public Health Tracking Network is to improve the health of communities. Currently, few systems exist at the state or national level to concurrently track many of the exposures and health effects that might be associated with environmental hazards. An additional challenge is estimating exposure to environmental hazards such as particulate matter whose aerodynamic diameter is less than or equal to 2.5 micrometers (PM2.5). HELIX-Atlanta's goal is to examine the feasibility of building an integrated electronic health and environmental data network in five counties of Metropolitan Atlanta, GA. NASA Marshall Space Flight Center (NASA/MSFC) is collaborating with CDC to combine NASA earth science satellite observations related to air quality and environmental monitoring data to model surface estimates of PM2.5 concentrations that can be linked with clinic visits for asthma. While use of the Air Quality System (AQS) PM2.5 data alone could meet HELIX-Atlanta specifications, there are only five AQS sites in the Atlanta area, thus the spatial coverage is not ideal. We are using NASA Moderate Resolution Imaging Spectroradiometer (MODIS) satellite Aerosol Optical Depth (AOD) data for estimating daily ground level PM2.5 at 10 km resolution over the metropolitan Atlanta area supplementing the AQS ground observations and filling their spatial and temporal gaps.

Author

Public Health; Surveillance; Respiration; Environmental Monitoring; Exposure; Hazards; Remote Sensing; Air Pollution; Particulates

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*.

20070031167 NASA Johnson Space Center, Houston, TX, USA

The Apollo Medical Operations Project: Recommendations to Improve Crew Health and Performance for Future Exploration Missions and Lunar Surface Operations

Scheuring, Richard A.; Jones, Jeffrey A.; Jones, Jeffrey A.; Novak, Joseph D.; Polk, James D.; Gillis, David B.; Schmid, Josef; Duncan, James M.; Davis, Jeffrey R.; [2007]; 63 pp.; In English; Original contains color illustrations; Copyright; Avail.: CASI: A04, Hardcopy

Medical requirements for the future Crew Exploration Vehicle (CEV), Lunar Surface Access Module (LSAM), advanced Extravehicular Activity (EVA) suits and Lunar habitat are currently being developed. Crews returning to the lunar surface will construct the lunar habitat and conduct scientific research. Inherent in aggressive surface activities is the potential risk of injury to crewmembers. Physiological responses and the operational environment for short forays during the Apollo lunar missions were studied and documented. Little is known about the operational environment in which crews will live and work and the hardware will be used for long-duration lunar surface operations. Additional information is needed regarding productivity and the events that affect crew function such as a compressed timeline. The Space Medicine Division at the NASA Johnson Space Center (JSC) requested a study in December 2005 to identify Apollo mission issues relevant to medical operations that had impact to crew health and/or performance. The operationally oriented goals of this project were to develop or modify medical requirements for new exploration vehicles and habitats, create a centralized database for future access, and share relevant Apollo information with the multiple entities at NASA and abroad participating in the exploration effort.

Author

Aerospace Medicine; Health; Lunar Surface; Spacecrews; Apollo Spacecraft; Space Exploration

20070031168 Brigham and Women's Hospital, Boston, MA, USA; NASA Johnson Space Center, Houston, TX, USA

The NASA-Sponsored Study of Cataract in Astronauts (NASCA). Relationship of Exposure to Radiation in Space and the Risk of Cataract Incidence and Progression. Report 1: Recruitment and Methodology

Chylack, Leo T.; Peterson, Leif E.; Feiveson, Alan H.; Wear, Mary; Manuel, F. Keith; [2007]; 23 pp.; In English; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

The NASA Study of Cataract in Astronauts (NASCA) is a five-year, multi-centered, investigation of lens opacification in populations of U.S. astronauts, military pilots, and ground-based (nonaviator) comparison participants. For astronauts, the explanatory variable of most interest is radiation exposure during space flight, however to properly evaluate its effect, the secondary effects of age, nutrition, general health, solar ocular exposure, and other confounding variables encountered in non-space flight must also be considered. NASCA contains an initial baseline, cross-sectional objective assessment of the severity of cortical (C), nuclear (N), and posterior subcapsular (PSC) lens opacification, and annual follow-on assessments of severity and progression of these opacities in the population of astronauts and in participants sampled from populations of military pilots and ground-based exposure controls. From these data, NASCA will estimate the degree to which space radiation affects lens opacification for astronauts and how the overall risks of each cataract type for astronauts compared with those of the other exposure control groups after adjusting for differences in age and other explanatory variables.

Derived from text

Astronauts; Cataracts; Extraterrestrial Radiation; Radiation Dosage; Aerospace Medicine; Eye (Anatomy)

20070031202 Wyle Labs., Inc., Houston, TX, USA; NASA Johnson Space Center, Houston, TX, USA

Adapting Project Management Practices to Research-Based Projects

Bahr, P.; Baker, T.; Corbin, B.; Keith, L.; Loerch, L.; Mullenax, C.; Myers, R.; Rhodes, B.; Skytland, N.; [2007]; 1 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

From dealing with the inherent uncertainties in outcomes of scientific research to the lack of applicability of current NASA Procedural Requirements guidance documentation, research-based projects present challenges that require unique application of classical project management techniques. If additionally challenged by the creation of a new program transitioning from basic to applied research in a technical environment often unfamiliar with the cost and schedule constraints addressed by project management practices, such projects can find themselves struggling throughout their life cycles. Finally, supplying deliverables to a prime vehicle customer, also in the formative stage, adds further complexity to the development

and management of research-based projects. The Biomedical Research and Countermeasures Projects Branch at NASA Johnson Space Center encompasses several diverse applied research-based or research-enabling projects within the newly-formed Human Research Program. This presentation will provide a brief overview of the organizational structure and environment in which these projects operate and how the projects coordinate to address and manage technical requirements. We will identify several of the challenges (cost, technical, schedule, and personnel) encountered by projects across the Branch, present case reports of actions taken and techniques implemented to deal with these challenges, and then close the session with an open forum discussion of remaining challenges and potential mitigations.
Author
Project Management; Biomedical Data; Research Projects; Life Sciences

20070031573 NASA Johnson Space Center, Houston, TX, USA
Operational and Research Musculoskeletal Summit: Summit Recommendations
Scheuring, Richard A.; Walton, Marlei; Davis-Street, Janis; Smaka, Todd J.; Griffin, DeVon; January 17, 2006; 23 pp.; In English; Operational and Research Musculoskeletal Summit: Summit Recommendations, 23-25 Aug. 2005, Houston, TX, USA; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031573

The Medical Informatics and Health Care Systems group in the Office of Space Medicine at NASA Johnson Space Center (JSC) has been tasked by NASA with improving overall medical care on the International Space Station (ISS) and providing insights for medical care for future exploration missions. To accomplish this task, a three day Operational and Research Musculoskeletal Summit was held on August 23-25th, 2005 at Space Center Houston. The purpose of the summit was to review NASA#s a) current strategy for preflight health maintenance and injury screening, b) current treatment methods in-flight, and c) risk mitigation strategy for musculoskeletal injuries or syndromes that could occur or impact the mission. Additionally, summit participants provided a list of research topics NASA should consider to mitigate risks to astronaut health. Prior to the summit, participants participated in a web-based pre-summit forum to review the NASA Space Medical Conditions List (SMCL) of musculoskeletal conditions that may occur on ISS as well as the resources currently available to treat them. Data from the participants were compiled and integrated with the summit proceedings. Summit participants included experts from the extramural physician and researcher communities, and representatives from NASA Headquarters, the astronaut corps, JSC Medical Operations and Human Adaptations and Countermeasures Offices, Glenn Research Center Human Research Office, and the Astronaut Strength, Conditioning, and Reconditioning (ASCR) group. The recommendations in this document are based on a summary of summit discussions and the best possible evidence-based recommendations for musculoskeletal care for astronauts while on the ISS, and include recommendations for exploration class missions.
Derived from text
Aerospace Medicine; Health; Bioastronautics; Musculoskeletal System; Bone Demineralization; Physiological Effects; Gravitational Physiology

20070031611 Universities Space Research Association, Houston, TX, USA
Bone Research at NASA: Career Pathway to the Space Program
Sibonga, Jean D.; September 16, 2007; 29 pp.; In English; ASBMR, 16 Sep. 2007, Honolulu, HI, USA; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

This viewgraph document is comprised of two presentations about Bone Research at NASA. The first document has slides that show the percent of bone loss from specific bones as demonstrated from research of the Mir cosmonauts, and the required preflight and postflight BMD measurements for long duration flights. The second presentation entitled 'Recovery of Spaceflight-induced Bone Loss: Bone Mineral Density after Long-duration Missions as Fitted with an Exponential Function' reviews the recovery of Bone Mineral Density (BMD) after long duration missions. Between 1990 and 2004, 56 missions were flown with 45 crewmembers for an average of 181 days +/- 47 days. For each of these flights the change in BMD was calculated after the flight. The BMD changes were plotted against the number of days for bone recovery after the landing. The plots for the bones that were measured are shown.
CASI
Bone Demineralization; Bone Mineral Content; Long Duration Space Flight; Bones; Osteogenesis

20070031714 NASA Ames Research Center, Moffett Field, CA, USA; San Jose State Univ., Moffett Field, CA, USA
The Effects of Blood Glucose Levels on Cognitive Performance: A Review of the Literature
Feldman, Jolene; Barshi, Immanuel; June 2007; 142 pp.; In English
Contract(s)/Grant(s): 21-1614-3718; 457280.02.07.01.04; 21-1614-3718
Report No.(s): NASA/TM-2007-214555; A-070002; No Copyright; Avail.: CASI: A07, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031714

The purpose of this review paper is to discuss the research literature on the effects of blood glucose levels on executive and non-executive functions in humans. The review begins with a brief description of blood glucose, how it has been studied, previous syntheses of prior studies, and basic results regarding the role of blood glucose on cognitive functioning. The following sections describe work that investigated the effect of blood glucose on both non-executive and executive functions (e.g., sensory processing, psychomotor functioning, attention, vigilance, memory, language and communication, judgement and decision-making, and complex task performance). Within each section, summaries of the findings and challenges to the literature are included. Measurement conversions of blood glucose levels, blood glucose values, and associated symptoms are depicted. References to the types of tests used to investigate blood glucose and cognitive performance are provided. For more detailed descriptions of references within (and in addition to) this paper, an annotated bibliography is also provided. Several moderator variables including individual differences and contextual variables related to the effects of blood glucose levels on performance (e.g., age, gender, time of day, familiarity with the task and symptom awareness, expectancy effects, dose dependent effects, time dependent effects, task specific effects, rising and falling blood glucose levels, and speed and/or accuracy trade-offs) are addressed later in the paper. Some suggestions for future experimental methodologies are also made. Author

Blood; Glucose; Mental Performance; Pilot Performance

55
EXOBIOLOGY

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see *52 Aerospace Medicine*; on animals and plants see *51 Life Sciences*. For psychological and behavioral effects of aerospace environments see *53 Behavioral Sciences*.

20070031174 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Development of Focused Metabolite Profiling Capability for Dissecting Cellular and Molecular Processes of Living Organisms in Space Environments
Wheeler, Raymond; Center Director's Discretionary Fund 2005 Annual Report; 2007, pp. 39-46; In English; See also 20070031172; Original contains color illustrations; Copyright; Avail.: CASI: A02, Hardcopy

The purposes of this project are to establish a high-throughput and robust metabolite profiling (MP) platform and prove the concept of integrating MP and transcript (gene expression) profiling approaches for better understanding the 'law' of biological regulation. Regulatory control in biological systems is exerted at all levels within the central dogma of biology: DNA(approaches)messenger RNA (mRNA)(approaches)Enzymeinactive(approaches)Enzymeactive(approaches)Metabolites. Metabolites are the end products of all cellular regulatory processes and reflect the ultimate outcome of potential changes suggested by genomics and proteomics caused by an environmental stimulus or genetic modification. Following on the heels of genomics, transcriptomics, and proteomics, metabolomics has become an inevitable part of complete systems biology because none of the lower '-omics' alone provides direct information about how changes in mRNA or protein are coupled to changes in biological function. Analogous to the precedent '-omics,' metabolomics is the systematic study of collections of small molecules (i.e., metabolites) in a biological system (a cell, organ, or organism). In contrast to the traditional biochemistry approach in which target metabolites and enzymes are studied, metabolomics takes a holistic view of the entire suite of metabolites (the metabolome) in an organism to capture the coordinated regulation of biological systems. Th us, metabolomics, coupled with other '-omics' such as transcriptomics and proteomics, holds great promises for deciphering the functions of genes, predicting novel metabolic pathways, and providing insights to the regulation of a biological event, as well as in directing metabolic engineering of plants for human benefit. However, the challenge is much greater than that met in genomics because of the greater number of metabolites and greater structural diversity, and thus properties. Developmental

work is needed in such areas as (1) methodologies for unbiased extraction of metabolites and subsequent quantification, (2) algorithms for systematic identification of metabolites, (3) expertise and competency in handling a large amount information (data set), and (4) integration of metabolomics with other '-omics' and data mining (implication of the information).
Derived from text
Metabolites; Biochemistry; Gene Expression; Aerospace Environments; Cells (Biology); Metabolism; Ribonucleic Acids; Genetics; Organisms

61
COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20070031170 North Dakota State Univ., Fargo, ND, USA
Testing for Software Safety
Chen, Ken; Lee, Yann-Hang; Wong, W. Eric; Xu, Dianxiang; September 24, 2007; 56 pp.; In English; Software Assurance Symposium (SAS), 24-27 Sep. 2007, Morgantown, WV, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A04, Hardcopy

This research focuses on testing whether or not the hazardous conditions identified by design-level fault tree analysis will occur in the target implementation. Part 1: Integrate fault tree models into functional specifications so as to identify testable interactions between intended behaviors and hazardous conditions. Part 2: Develop a test generator that produces not only functional tests but also safety tests for a target implementation in a cost-effective way. Part 3: Develop a testing environment for executing generated functional and safety tests and evaluating test results against expected behaviors or hazardous conditions. It includes a test harness as well as an environment simulation of external events and conditions.
Derived from text
Fault Trees; Safety; Software Engineering; Performance Tests; Systems Integration

20070031181 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Model for Software Quality Diagnosis and Prognosis
Beaver, Justin; Center Director's Discretionary Fund 2005 Annual Report; 2007, pp. 83-88; In English; See also 20070031172; Original contains color illustrations; Copyright; Avail.: CASI: A02, Hardcopy

The purpose of this project is to develop a model that can produce a reliable diagnosis of the quality of a software product and an accurate prognosis of the quality of software that is under development. The model can be used to identify potential technical risks within a software development effort and will enable a project team to mitigate those risks earlier in the software life cycle, when they are least expensive to correct. The aim of any software project is to deliver the most useful and reliable product within the budget and schedule allotted, but the very nature of software development puts the project at risk of missing these parameters. Through statistical and machine learning methods, software quality models illuminate facets of the product and process that might otherwise escape notice and thereby increase the chances of project success. Modeling software quality is inherently difficult given the complexities of any software development effort. The software life cycle covers a wide range of factors that can influence the quality of the delivered system. To accurately portray the quality of a software product, the model must represent all of those factors. Prior software quality models do not address all the influencing factors, are not universally applicable, and have data quality problems during validation. Much of the body of software quality research focuses on establishing empirical relationships to forecast software quality and ignores any logical or causal relationships that may exist. However, recent progress in software quality modeling, using complex adaptive systems such as Bayesian Belief Networks, has shown promise in accurately representing cause-effect relationships in software product development and providing models that are adaptable to a given development team and environment.
Derived from text
Software Engineering; Computer Programs; Product Development; Prognosis; Diagnosis; Complex Systems; Statistical Analysis

20070031705 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Distributed Computing Framework for Synthetic Radar Application
Gurrola, Eric M.; Rosen, Paul A.; Aivazis, Michael; April 24, 2006; In English; IEEE Radar Conference, 24-27 Apr. 2006, Verona, NY, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40180

We are developing an extensible software framework, in response to Air Force and NASA needs for distributed computing

facilities for a variety of radar applications. The objective of this work is to develop a Python based software framework, that is the framework elements of the middleware that allows developers to control processing flow on a grid in a distributed computing environment. Framework architectures to date allow developers to connect processing functions together as interchangeable objects, thereby allowing a data flow graph to be devised for a specific problem to be solved. The Pyre framework, developed at the California Institute of Technology (Caltech), and now being used as the basis for next-generation radar processing at JPL, is a Python-based software framework. We have extended the Pyre framework to include new facilities to deploy processing components as services, including components that monitor and assess the state of the distributed network for eventual real-time control of grid resources.
Author
Distributed Parameter Systems; Network Control; Synthetic Aperture Radar; Active Control; Grid Computing (Computer Networks)

62
COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.

20070031574 United Space Alliance, Houston, TX, USA
Shuttle Architecture and Identical Inputs
Cox, Christopher Scott; September 17, 2007; 18 pp.; In English; SAE 2007 AeroTech Congress and Exhibition, 17-20 Sep. 2007, Los Angeles, CA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAS9-20000; Copyright; Avail.: CASI: A03, Hardcopy

This viewgraph document reviews the computer architecture requirements for computers aboard the Space Shuttle. Reliability is the overriding criterion for computers and software.
CASI
Architecture (Computers); Component Reliability; Software Reliability; Computer Systems Performance; Computer Design; Computer Program Integrity; Computer Components

20070031613 Lockheed Martin Corp., Houston, TX, USA
Integrated Approach to User Account Management
Kesselman, Glenn; Smith, William; October 17, 2007; 29 pp.; In English; Mission Critical Enterprise Systems Symposium 2006, 17 October 2007, Orlando, FL, USA; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

IT environments consist of both Windows and other platforms. Providing user account management for this model has become increasingly difficult. If Microsoft#s Active Directory could be enhanced to extend a Windows identity for authentication services for Unix, Linux, Java and Macintosh systems, then an integrated approach to user account management could be realized.
Author
Computer Security; Access Control; Computer Networks; Protocol (Computers)

63
CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also *54 Man/System Technology and Life Support*.

20070031132 NASA Johnson Space Center, Houston, TX, USA
Learning Grasp Strategies Composed of Contact Relative Motions
Platt, Robert, Jr.; [2007]; 8 pp.; In English; IEEE International Conference on Humanoid Robotics, 30 Nov. - 1 Dec. 2007, Pittsburgh, PA, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031132

Of central importance to grasp synthesis algorithms are the assumptions made about the object to be grasped and the sensory information that is available. Many approaches avoid the issue of sensing entirely by assuming that complete

information is available. In contrast, this paper proposes an approach to grasp synthesis expressed in terms of units of control that simultaneously change the contact configuration and sense information about the object and the relative manipulator-object pose. These units of control, known as contact relative motions (CRMs), allow the grasp synthesis problem to be recast as an optimal control problem where the goal is to find a strategy for executing CRMs that leads to a grasp in the shortest number of steps. An experiment is described that uses Robonaut, the NASA-JSC space humanoid, to show that CRMs are a viable means of synthesizing grasps. However, because of the limited amount of information that a single CRM can sense, the optimal control problem may be partially observable. This paper proposes expressing the problem as a k-order Markov Decision Process (MDP) and solving it using Reinforcement Learning. This approach is tested in a simulation of a two-contact manipulator that learns to grasp an object. Grasp strategies learned in simulation are tested on the physical Robonaut platform and found to lead to grasp configurations consistently.
Author
Manipulators; Holding; Robotics; Algorithms; Motion

64
NUMERICAL ANALYSIS

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

20070031123 NASA Langley Research Center, Hampton, VA, USA
Revisiting and Extending Interface Penalties for Multi-Domain Summation-by-Parts Operators
Carpenter, Mark H.; Nordstrom, Jan; Gottlieb, David; August 2007; 57 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): F49620-96-1-0150; NSF DMS-95-00814; WBS 23-599489
Report No.(s): NASA/TM-2007-214892; L-19377; Copyright; Avail.: CASI: A04, Hardcopy

General interface coupling conditions are presented for multi-domain collocation methods, which satisfy the summation-by-parts (SBP) spatial discretization convention. The combined interior/interface operators are proven to be L2 stable, pointwise stable, and conservative, while maintaining the underlying accuracy of the interior SBP operator. The new interface conditions resemble (and were motivated by) those used in the discontinuous Galerkin finite element community, and maintain many of the same properties. Extensive validation studies are presented using two classes of high-order SBP operators: 1) central finite difference, and 2) Legendre spectral collocation.
Author
Finite Difference Theory; Simulation; Discretization (Mathematics); Operators (Mathematics); Spatial Dependencies

20070031643 Old Dominion Univ., Norfolk, VA, USA
On the Relationality of the Composition Product: A Survey
DuffautEspinosa, Luis A.; Gray, W. Steven; Gonzalez, Oscar R.; March 04, 2007; 6 pp.; In English; Thirty-ninth Southeastern Symposium on System Theory, 2007 (SSST'07), 4-6 Mar. 2007, Macon, GA, USA
Contract(s)/Grant(s): NNL04AA03A; NCC-1-03026
Report No.(s): TA1.1; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1109/SSST.2007.352356

When two bilinear state space systems are interconnected in a cascade fashion, the resulting input-output map may not have a bilinear realization. So in 1972, Brockett asked under what conditions is bilinearity preserved under composition. In 1979, Ferfera produced the least restrictive sufficient condition which is presently known using formal power series representations of the input-output maps. The primary intent of this paper is to supply a self-contained proof of Ferfera's sufficient condition for preserving rationality under composition, or equivalently, preserving bilinearity under composition. The proof provided here, which in the large follows the original, is somewhat less complicated as it employs different tools from the theory of rational transductions.
Author
Linear Systems; State Estimation; Rational Functions; Surveys

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*.

20070031122 Connecticut Univ., Storrs, CT, USA; NASA Langley Research Center, Hampton, VA, USA
Can the Hypothesis 'Photon Interferes only with Itself' be Reconciled with Superposition of Light from Multiple Beams or Sources?
Roychoudhuri, Chandrasekhar; Prasad, Narasimha S.; Peng, Qing; August 26, 2007; 10 pp.; In English; SPIE Optics and Photonics 2007, 26-30 August 2007, San Diego, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A02, Hardcopy

Any superposition effect as measured (SEM) by us is the summation of simultaneous stimulations experienced by a detector due to the presence of multiple copies of a detectee each carrying different values of the same parameter. We discus the cases with light beams carrying same frequency for both diffraction and multiple beam Fabry-Perot interferometer and also a case where the two superposed light beams carry different frequencies. Our key argument is that if light really consists of indivisible elementary particle, photon, then it cannot by itself create superposition effect since the state vector of an elementary particle cannot carry more than one values of any parameter at the same time. Fortunately, semiclassical model explains all light induced interactions using quantized atoms and classical EM wave packet. Classical physics, with its deeper commitment to Reality Ontology, was better prepared to nurture the emergence of Quantum Mechanics and still can provide guidance to explore nature deeper if we pay careful attention to successful classical formulations like Huygens-Fresnel diffraction integral.
Author
Light Beams; Photons; Quantum Mechanics; Superposition (Mathematics); Mathematical Models; Light Sources

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20070031162 NASA Marshall Space Flight Center, Huntsville, AL, USA
Self-consistent Model of Magnetospheric Ring Current and Propagating Electromagnetic Ion Cyclotron Waves. 2. Wave Induced Ring Current Precipitation and Thermal Electron Heating
Khazanov, G. V.; Gamayunov, K. V.; Gallagher, D. L.; Kozyra, J. U.; Liemohn, M. W.; Journal of Geophysical Research; Apr. 20, 2007; Volume 112; 48 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): UPN 370-16-10; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://dx.doi.org/10.1029/2006JA012033

This paper continues presentation and discussion of the results from our new global self-consistent theoretical model of interacting ring current ions and propagating electromagnetic ion cyclotron waves [Khazanov et al., 2006]. To study the effects of electromagnetic ion cyclotron wave propagation and refraction on the wave induced ring current precipitation and heating of the thermal plasmaspheric electrons, we simulate the May 1998 storm. The main findings after a simulation can be summarized as follows. Firstly, the wave induced ring current precipitation exhibits quite a lot of fine structure, and is highly organized by location of the plasmapause gradient. The strongest fluxes of about 4 x 10(exp 6) (cm(raised dot) s(raised dot) sr(raised dot) (sup -1)) are observed during the maill and early recovery phases of the storm. The very interesting and probably more important finding is that in a number of cases the most intense precipitating fluxes are not connected to the most intense waves in simple manner. The characteristics of the wave power spectral density distribution over the wave normal angle are extremely crucial for the effectiveness of the ring current ion scattering. Secondly, comparison of the global proton precipitating patterns with the results from RAM [Kozyra et al., 1997a] reveals that although we observe a qualitative agreement between the localizations of the wave induced precipitations in the models, there is no quantitative agreement between the magnitudes of the fluxes. The quantitative differences are mainly due to a qualitative difference between the characteristics of the wave power spectral density distributions over the wave normal angle in RAM and in our model. Thirdly, the heat fluxes to plasmaspheric electrons caused by Landau resonate energy absorption from electromagnetic ion cyclotron waves are observed in the postnoon-premidnight MLT sector, and can reach the magnitude of 10(exp 11) eV/(cm(sup 2)(raised dot)s). The Coulomb energy degradation of the RC H(+) and O(+) ions maximizes at about 10(exp 11) (eV/(cm(sup 2) (raised

dot) s), and typically leads to electron energy deposition rates of about 2(raised dot) 10(exp 10) (eV/(cm(sup 2)(raised dot)s) which are observed during two periods; 32-48 hours, and 76-86 hours after 1 May, 0000 UT. The theoretically derived spatial structure of the thermal electron heating caused by interaction of the ring current with the plasmasphere is strongly supported by concurrent and conjugate plasma measurements from the plasmasphere, ring current, and topside ionosphere [Gurgiolo et al., 2005]. Finally, the wave induced intense electron heating has a structure of the spot-like patches along the most enhanced density gradients in the plasmasphere boundary layer and can be a possible driver to the observed but still not explained small-scale structures of enhanced emissions in the stable auroral red arcs.
Author
Electron Energy; Ion Cyclotron Radiation; Mathematical Models; Ring Currents; Simulation; Self Consistent Fields; Electromagnetic Radiation

20070031721 NASA Marshall Space Flight Center, Huntsville, AL, USA
Electrodynamic Tether Operations beyond the Ionosphere in the Low-Density Magnetosphere
Stone, Nobie H.; May 14, 2007; 10 pp.; In English; 54th JANNAF Propulsion Meeting/5th Modeling and Simulation/3rd Liquid Propulsion/2nd Spacecraft Propulsion Joint Subcommittee, 14-17 May 2007, Denver, CO, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NNM04AA11C; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031721

In the classical concept for the operation of electrodynamic tethers in space, a voltage is generated across the tether, either by the tether's orbital motion through the earth's planetary magnetic field or by a power supply; electrons are then collected from the ionospheric plasma at the positive pole; actively emitted back into space at the negative pole; and the circuit is closed by currents driven through the ambient conducting ionosphere. This concept has been proven to work in space by the Tethered Satellite System TSS-1 and TSS-1R Space Shuttle missions; and the Plasma Motor-Generator (PMG) tether flight experiment. However, it limits electrodynamic tether operations to the F-region of the ionosphere where the plasma density is sufficient to conduct the required currents--in other words, between altitudes of approximately 200 to 1000 km in sunlight. In the earth's shadow, the ionospheric density drops precipitously and tether operations, using the above approach, are not effective--even within this altitude range. There are numerous missions that require in-space propulsion in the Earth's shadow and/or outside of the above altitude range. This paper will, therefore, present the fundamentals of a concept that would allow electrodynamic tethers to operate almost anywhere within the magnetosphere, the region of space containing the earth's planetary magnetic field. In other words, because operations would be virtually independent of any ambient plasma, the range of electrodynamic operations would be extended into the earth's shadow and out to synchronous orbit--forty times the present operational range. The key to this concept is the active generation of plasma at each pole of the tether so that current generation ,does not depend on the conductivity of the ambient ionosphere. Arguments will be presented, based on ,existing flight data, which shed light on the behavior of charge emissions in space and show the plausibility of the concept.
Author
Tethering; Electrodynamics; Low Density Flow; Tethered Satellites; Planetary Magnetic Fields; Earth Magnetosphere

88
SPACE SCIENCES (GENERAL)

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through 93*.

20070031171 NASA Johnson Space Center, Houston, TX, USA
Overview for Attached Payload Accommodations and Environments
Schaffer, Craig; Cook, Gene; Nabizadeh, Rodney; Phillion, James; September 2007; 34 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

External payload accommodations are provided at attach sites on the U.S provided ELC, U.S. Truss, the Japanese Experiment Module Exposed Facility (JEM EF) and the Columbus EPF (External Payload Facilities). The Integrated Truss Segment (ITS) provides the backbone structure for the ISS. It attaches the solar and thermal control arrays to the rest of the complex, and houses cable distribution trays Extravehicular Activity (EVA) support equipment such as handholds and lighting; and providing for Extravehicular Robotic (EVR) accommodations using the Mobile Servicing System (MSS). It also provides logistics and maintenance, and payload attachment sites. The attachment sites accommodate logistics and maintenance and payloads carriers, zenith and nadir. The JEM-EF, a back porch-like attachment to the JEM Pressurized Module, accommodates

up to eight payloads, which can be serviced by the crew via the JEM PM's airlock and dedicated robotic arm. The Columbus-EPF is another porch-like platform that can accommodate two zenith and two nadir looking payloads.
Derived from text
Payloads; Trusses; International Space Station; Japanese Space Program; Spacecraft Modules; Space Shuttles; General Overviews

20070031172 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Center Director's Discretionary Fund 2005 Annual Report
Nurge, Mark; Griffin, Timothy; Arens, Ellen; Calle, Carlos; Quinn, Jacqueline; Wheeler, Raymond; Metzger, Phillip T.; Calle, Luz Marina; Beaver, Justin M.; Williams, Martha; Smith, Trent; Robertso, Luke; Clayton, LaNetra; Sager, John; Li, Wenyan; Monje, Oscar; 2007; 136 pp.; In English; See also 20070031173 - 20070031183; Original contains color illustrations
Report No.(s): NASA/TP-2007-214731; Copyright; Avail.: CASI: A07, Hardcopy

The FY 2005 CDDF projects were selected from the following spaceport and range technology and science areas: fluid system technologies; spaceport structures and materials; command, control, and monitoring technologies; and biological sciences (including support for environmental stewardship). The FY 2005 CDDF research projects involved development of the following: a) Capacitance-based moisture sensors to optimize plant growth in reduced gravity; b) Commodity-free calibration methods; c) Application of atmospheric plasma glow discharge to alter the surface properties of polymers for improved electrostatic dissipation characteristics; d) A wipe-on, wipe-off chemical process to remove lead oxides found in paint; e) A robust metabolite profiling platform for better understanding the 'law' of biological regulation; f) An explanation of the excavation processes that occur when a jet of gas impinges on a bed of sand; g) 'Smart coatings' to detect and control corrosion at an early stage to prevent further corrosion h) A model that can produce a reliable diagnosis of the quality of a software product; i) The formulation of advanced materials to meet system safety needs to minimize electrostatic charges, flammability, and radiation exposure; j) A lab-based instrument that uses the electro-optic Pockels effect to make static electric fields visible; k) A passive volatile organic compound (VOC) cartridge to filter, identify, and quantify VOCs flowing into or emanating from plant flight experiments.
Derived from text
Command and Control; Vegetation Growth; Electro-Optics; Electrostatic Charge; Chemical Reactions; Systems Engineering

20070031177 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Capacitance-Based Moisture Sensing
Nurge, Mark; Center Director's Discretionary Fund 2005 Annual Report; 2007, pp. 1-8; In English; See also 20070031172; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A02, Hardcopy

The purpose of this project is to develop capacitance-based moisture sensors (CBMSs) to provide the information needed to minimize moisture stress to plants. Improved sensors are needed for studying and understanding the mechanisms of water transfer and diffusion in reduced-gravity root zone environments and other terrestrial-based bulk-media applications. A capacitance- based bulk-moisture sensor is to be developed and tested to determine if it can address limitations of point sensors. In addition, a three-dimensional (3-D) electrical-capacitance tomography system will be developed for possible use in imaging moisture distribution in soils in reduced-gravity applications.
Derived from text
Capacitance; Detection; Moisture; Soil Moisture; Tomography; Microgravity

20070031179 NASA Kennedy Space Center, Cocoa Beach, FL, USA
VOC Filter Cartridge for Biological Experiments in Space
Sager, John; Monje, Oscar; Center Director's Discretionary Fund 2005 Annual Report; 2007, pp. 109-126; In English; See also 20070031172; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

Biological experiments in space are potential sources of volatile organic compounds (VOCs), which can add to the Trace Contaminant Control System of the International Space Station (ISS). Currently, only sporadic sampling of Space Transportation System (STS)/ISS cabin air is available; and gas sampling schemes occupy large volumes and are susceptible to leaks during stowage. The ability to filter, identify, and quantify VOCs flowing into or emanating from plant flight experiments will augment the science capabilities for research payloads and provide data for developing supplemental food

production systems that use plants. The project objective is to develop a VOC filter cartridge that is passive (multiple passes over absorbent), is able to reversibly bind the VOCs after long-term storage, permits identification and quantification of VOCs, and meets flight safety guidelines.
Derived from text
Volatile Organic Compounds; Cartridges; Spaceborne Experiments; Trace Contaminants; Absorbers (Materials)

20070031182 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Commodity-Free Calibration
Griffin, Timothy; Center Director's Discretionary Fund 2005 Annual Report; 2007, pp. 9-22; In English; See also 20070031172; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

In general, commodity-free calibration uses the reaction rates of compounds inherent in the analysis system to determine the concentration of the compound being monitored. This will help in developing a technique that truly can replace or enhance existing methods. This work will help to determine the strengths and weaknesses in the proposed techniques. Preliminary experiments have been performed to better grasp what is necessary to make advances in the new calibration technique. All sensors, transducers, and instruments must be calibrated to provide optimum performance. In general, an instrument (sensor, transducer, etc.) is calibrated offline. Most commonly, instruments are removed from service and calibrated in another location. Alternatively, the calibration might be performed in the same location, but the instrument is still usually taken offline. Although this is usually an insignificant process, there are many applications where this method is extremely difficult, if not impossible. For example, how will instruments be calibrated on the Moon or Mars? A resupply ship most likely will not arrive every three months as is the case with the International Space Station (ISS).
Derived from text
Calibrating; Reaction Kinetics; Optimization

20070031207 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Jet Propulsion Laboratory Environmental Verification Processes and Test Effectiveness
Hoffman, Alan R.; Green, Nelson W.; March 20, 2006; 16 pp.; In English; 2nd International Workshop on Verification and Testing of Space Systems, 20-22 Mar. 2006, Torino, Italy; Original contains black and white illustrations; Copyright;
Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40141

Viewgraphs on the JPL processes for enviornmental verification and testing of aerospace systems is presented. The topics include: 1) Processes: a) JPL Design Principles b) JPL Flight Project Practices; 2) Environmental Verification; and 3) Test Effectiveness Assessment: Inflight Anomaly Trends.
CASI
Aerospace Systems; Environmental Tests; Program Verification (Computers); Aerospace Engineering; Space Missions

20070031735 American Inst. of Aeronautics and Astronautics, Reston, VA, USA; American Inst. of Aeronautics and Astronautics, Reston, VA, USA
Space: The Fragile Frontier
Williamson, Mark; [2006]; 3 pp.; In English; Copyright; Avail.: Other Sources

Protection of the space environment - for the study of and use by successive generations of explorers and developers - is an important concept that has yet to enter the collective consciousness of the space community. This book illustrates the relevance of the space environment to science, commerce and the individual, and explains why we should consider protecting some of its unique properties and most significant territories. Space: The Fragile Frontier is the first book to draw together the recognized issues of Earth orbital debris and planetary protection, set them in the context of space law and ethical policies, and encourage a balance between desirable expansion into space and protection of the space environment. It calls for a sustainable approach to space exploration and development. Space: The Fragile Frontieris aimed at scientists, engineers and policy-makers with an interest in space exploration and development, and students who intend to develop a career in a space-related subject. You may not agree with everything you read. but it will change the way you think about space and everything we do there.
Derived from text
Aerospace Environments; Space Exploration; Aerospace Sciences; Planetary Protection

20070031739 American Inst. of Aeronautics and Astronautics, Reston, VA, USA

Microshutters Offer High-Tech Squint into Space

Flinn, Edward D.; Aerospace America; May 2007; Volume 45, No. 5, pp. 26-27; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

NASA engineers and scientists have created something that will give better information about faraway galaxies. Called a microshutter, the invention is only a few hairs wide and will be used in a future space telescope. Microshutters are tiny doorways that bring very distant stars and galaxies into better focus. The new technology will ride into space aboard the James Webb Space Telescope, scheduled to be launched in a decade to take over for the Hubble Space Telescope. The devices will enable scientists to block unwanted light from objects that are closer to the camera in space, allowing the light from faraway objects to shine through. To get an idea of how these tiny hairlike shutters work, think about how you try to make something look clearer-you squint. This causes your eyelashes to block out light closer to you. The microshutters work in a similar fashion. These microshutters, unique to the Webb telescope, will allow the telescope to focus on the faint light of stars and galaxies that were formed early in the history of the universe. Moving at 186,000 mi./sec, the light from these faint stars and galaxies is still traveling through space from the time when the universe began. New technology always gets tested and retested to make sure it is ready to go on a spacecraft. In December 2006, the microshutters passed important tests that showed they can handle the stresses of being launched and placed in deep space. The microshutters were designed, built, and tested at NASA Goddard in Greenbelt, Md. They will work with the Near Infrared Spectrograph, a camera to be built by ESA for the Webb telescope. The spectrograph will break up the light from the galaxies into different colors, allowing scientists to determine the kinds of stars and gases that make up the galaxies and to measure their distances and motions.

Derived from text

Shutters; Deep Space; James Webb Space Telescope; Technology Utilization

89
ASTRONOMY

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

20070031580 Smithsonian Astrophysical Observatory, Cambridge, MA, USA

Cepheus OB2: Disk Evolution and Accretion at 3-10 Myr

Sicilia-Aguilar, A., et al.; The Astronomical Journal; July 2005; Volume 130, Issue 1, pp. 188-209; In English

Contract(s)/Grant(s): NAG5-13210; Copyright; Avail.: Other Sources

We presented the results of MMT observations of young stars for our study of protoplanetary disks at ages 1-10 Myr in Tr 37 and NGC 7160. Using low-resolution optical spectra from the Hectospec multifiber spectrograph, we have tripled the number of known low-mass cluster members, identifying 130 new members in Tr 37 and 30 in NGC 7160. We used indicators of youth to identify and classify the low-mass cluster members. With the extended samples, we estimated the disk fraction in the clusters, finding that 40% of the low-mass stars in Tr 37 are actively accreting, whereas only 1 of the 55 low-mass stars in NGC 7160 shows indications of accretion. Optical photometry and theoretical isochrones are used to refine the ages of the clusters, confirming the estimates of 4 Myr for Tr 37 and 10 Myr for NGC 7160.

Author

Accretion Disks; Stellar Evolution

20070031581 Smithsonian Astrophysical Observatory, Cambridge, MA, USA

Disk Evolution in Cep OB2: Results from the Spitzer Space Telescope

Sicilia-Aguilar Aurora; Hartmann, Lee W.; Calvet Nuria; Megeath, S. T.; Muzerolle, James; Allen, Lori; D'Alessio, Paola; Merin, Bruno; Stauffer, John; Lada, Charles; Young, Erick; The Astrophysical Journal; 2006; Volume 638, pp. 897-919; In English

Contract(s)/Grant(s): NAG5-13210; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1086/498085

We presented the results of an infrared imaging survey of Tr 37 and NGC 7160 using the IRAC and MIPS instruments on board the Spitzer Space Telescope. Our observations cover the wavelength range from 3.6 to 24 microns, allowing us to detect disk emission over a typical range of radii 0.1 to 20 AU from the central star. In Tr 37, with an age of about 4 Myr, about 48% of the low-mass stars exhibit detectable disk emission in the IRAC bands. Roughly 10% of the stars with disks may be 'transition' objects, with essentially photospheric fluxes at wavelengths i 4.5 microns but with excesses at longer

wavelengths, indicating an optically thin inner disk. The median optically thick disk emission in Tr 37 is lower than the corresponding median for stars in the younger Taurus region; the decrease in infrared excess is larger at 6-8 microns than at 24 microns, suggesting that grain growth and/or dust settling has proceeded faster at smaller disk radii, as expected on general theoretical grounds. Only about 4% of the low-mass stars in the 10 Myr old cluster NGC 7160 show detectable infrared disk emission. We also find evidence for 24 micron excesses around a few intermediate-mass stars, which may represent so-called 'debris disk' systems. Our observations provided new constraints on disk evolution through an important age range.
Author
Space Infrared Telescope Facility; Accretion Disks; Infrared Imagery

20070031582 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
The Accretion Disk of the Lithium-Depleted Young Binary St 34
Hartmann, Lee; Calvet, Nuria; Watson, Dan M.; D'Alessio, P.; Furlan, E.; Sargent, B.; Forrest, W. J.; Uchida, K. I.; Green, J. D.; Sloan, G. C.; Chen, C. H.; Najita, J.; Kemper, F.; Herter, T. L.; Morris, P.; Barry, D. J.; Hall, P.; The Astrophysical Journal; July 12, 2005; Volume 628, Issue 2, pp. L147 - L150; In English
Contract(s)/Grant(s): NAG5-13210; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1086/432756

We presented the infrared spectrum of the young binary system St 34 obtained with the Infrared Spectrograph (IRS) on the Spitzer Space Telescope. The IRS spectrum clearly shows excess dust emission, consistent with the suggestion of White & Hillenbrand that St 34 is accreting from a circumbinary disk. The disk emission of St 34 is low in comparison with the levels observed in typical T Tauri stars; silicate features at 10 and 20 microns are much weaker than typically seen in T Tauri stars; and excess emission is nearly absent at the shortest wavelengths observed. These features of the infrared spectrum suggest substantial grain growth (to eliminate silicate features) and possible settling of dust to the disk midplane (to reduce the continuum excess emission levels), along with a relatively evacuated inner disk, as expected due to gravitational perturbations by the binary system. Although the position of St 34 in the H-R diagram suggests an age of 8f Myr, assuming that it lies at the distance of the Taurus-Auriga molecular clouds, White & Hillenbrand could not detect any Li I absorption, which would indicate a Li depletion age of roughly 25 Myr or more. We suggest that St 34 is closer than the Taurus clouds by about 30-40 pc and has an age roughly consistent with Li depletion models. Such an advanced age would make St 34 the oldest known low-mass pre-main-sequence object with a dusty accretion disk. The persistence of optically thick dust emission well outside the binary orbit may indicate a failure to make giant planets that could effectively remove dust particles.
Author
Accretion Disks; Lithium; Binary Stars; Pre-Main Sequence Stars

20070031584 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Disks in Transition in the Taurus Population: Spitzer IRS Spectra of GM Aurigae and DM Tauri
Calvet, N.; D'Alessio, P.; Watson, D. M.; Franco-Hernandez, R.; Furlan, E.; Green, J.; Sutter, P. M.; Forrest, W. J.; Hartmann, L.; Uchida, K. I.; Keller, L. D.; Sargent, B.; Najita, J.; Herter, T. L.; Barry, D. J.; Hall, P.; The Astrophysical Journal; 30 Aug. 2005; Volume 630, Issue 2, pp. L185 - L188; In English
Contract(s)/Grant(s): NAG5-13210; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1086/491652

We presented Spitzer Infrared Spectrograph (IRS) observations of two objects of the Taurus population that show unambiguous signs of clea,ring in their inner disks. In one of the objects, DM Tau, the outer disk is truncated at 3 AU; this object is akin to another recently reported in Taurus, CoKu Tau/4, in that the inner disk region is free of small dust. Unlike CoKu Tau/4, however, this star is still accreting, so optically thin gas should still remain in the inner disk region. The other object, GM Aur, also accreting, has about 0.02 lunar masses of small dust in the inner disk region within about 5 AU, consistent with previous reports. However, the IRS spectrum clearly shows that the optically thick outer disk has an inner truncation at a much larger radius than previously suggested, of order 24 AU. These observations provide strong evidence for the presence of gaps in protoplanetary disks.
Author
Taurus Constellation; Space Infrared Telescope Facility; Infrared Astronomy; Protoplanetary Disks; Spectrographs

20070031585 Universidad Nacional Autonoma de Mexico, Morelia, Mexico

Effects of Dust Growth and Settling in T Tauri Disks

D'Alessio, Paola; Calvet, Nuria; Hartmann, Lee; Franco-Hernandez, Ramiro; Servin, Hermelinda; The Astrophysical Journal; Feb. 2006; Volume 638, Issue 1, pp. 314-335; In English

Contract(s)/Grant(s): NAG5-13210; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1086/498861

We presented self-consistent disk models of T Tauri stars that include a parameterized treatment of dust settling and grain growth, building on techniques developed in a series of papers by D'Alessio et al. The models incorporate depleted distributions of dust in upper disk layers along with larger sized particles near the disk midplane, which are expected theoretically and, as we suggested earlier, are necessary to account for millimeter-wave emission, SEDs, scattered light images, and silicate emission features simultaneously. By comparing the models with recent mid- and near-IR observations, we find that the dust-to-gas mass ratio of small grains at the upper layers should be less than 10% of the standard value. The grains that have disappeared from the upper layers increase the dust-to-gas mass ratio of the disk interior; if those grains grow to maximum sizes of the order of millimeters during the settling process, then both the millimeter-wave fluxes and spectral slopes can be consistently explained. Depletion and growth of grains can also enhance the ionization of upper layers, increasing the possibility of the magnetorotational instability for driving disk accretion.

Author

T Tauri Stars; Cosmic Dust; Stellar Models; Near Infrared Radiation

20070031586 Michigan Univ., Ann Arbor, MI, USA

Why Do T Tauri Disks Accrete?

Hartmann, Lee; D'Alessio, Paola; Calvet, Nuria; Muzerolle, James; The Astrophysical Journal; September 2006; Volume 648, Issue 1, pp. 484-490; In English

Contract(s)/Grant(s): NAG5-13210; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1086/505788

Observations of T Tauri stars and young brown dwarfs suggest that the accretion rates of their disks scales roughly with the square of the central stellar mass. No dependence of accretion rate on stellar mass is predicted by the simplest version of the Gammie layered disk model, in which nonthermal ionization of upper disk layers allows accretion to occur via the magnetorotational instability. We show that a minor modification of Gaminie's model to include heating by irradiation from the central star yields a modest dependence of accretion on the mass of the central star. A purely viscous disk model could provide a strong dependence of accretion rate on stellar mass if the initial disk radius (before much viscous evolution has occurred) has a strong dependence on stellar mass. However, it is far from clear that at least the most massive pre-main-sequence disks can be totally magnetically activated by X-rays or cosmic rays. We suggest that a combination of effects are responsible for the observed dependence, with the lowest mass stars having the lowest mass disks, which can be thoroughly magnetically active, while the higher mass stars have higher mass disks that have layered accret,ion and relatively inactive or 'dead' central zones at some radii. In such dead zones, we suggest that gravitational instabilities may play a role in allowing accretion to proceed. In this connection, we emphasize the uncertainty in disk masses derived from dust emission and argue that T Tauri disk masses have been systematically underestimated by conventional analyses. Furtlier study of accretion rates, especially in the lowest mass stars, would help to clarify the mechanisms of accretion in T Tauri stars.

Author

T Tauri Stars; Accretion Disks; Stellar Mass; Brown Dwarf Stars

20070031723 American Inst. of Aeronautics and Astronautics, Reston, VA, USA

Webb: Anatomy of a Cost Overrun

Iannotta, Ben; Aerospace America; May 2007; ISSN 0740-722X; Volume 45, No. 5, pp. 38-42; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

In March 2005, Northrop Grumman sent a letter to NASA Goddard asking for $270 million on top of the $824 million the company had been promised to build the James Webb Space Telescope, the last of NASA's planned Great Observatories in space. According to NASA officials, the letter explained that the cost of developing and assembling Webb would be higher than the company anticipated when it outbid Lockheed Martin for the contract in 2002. When the telescope is launched, sometime in the next decade, astronomers are counting on its 6.6-m-wide mirror and four infrared-sensitive instruments to match the scientific significance of the Hubble Space Telescope. Webb is supposed to provide the first detailed pictures of the

epoch after the Big Bang, when particles began coalescing and emitting light as galaxies. Time and the expansion of the universe have stretched that first light into soft, infrared waves, and the challenge of detecting those with precision will make this a technologically formidable mission. The Northrop Grumman request triggered alarm bells at Goddard, where the project is managed, and at NASA Headquarters, where budget officials were already struggling to make room in their spending plans for the new Vision for Space Exploration, the Bush administration's plan to return astronauts to the Moon and eventually send them to Mars. After months of searching for ways to trim Webb's costs, NASA Administrator Mike Griffin signed off on a plan to delay Webb's launch to 2013-a 22-month slip-and raise the estimated mission cost by 29% to $4.5 billion, a figure that includes development of the spacecraft and 10 years of operations.
Derived from text
Cost Estimates; Hubble Space Telescope; James Webb Space Telescope; Space Missions; NASA Space Programs

20070031733 NASA Marshall Space Flight Center, Huntsville, AL, USA
Monitoring the Low-Energy Gamma-Ray Sky Using Earth Occultation with GLAST GBM
Case, G.; Wilson-Hodge, C.; Cherry, M.; Kippen, M.; Ling, J.; Radocinski, R.; Wheaton, W.; [2007]; 2 pp.; In English; First GLAST Symposium Stanford University, 5-8 Feb. 2007, Palo Alto, CA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Long term all-sky monitoring of the 20 keV - 2 MeV gamma-ray sky using the Earth occultation technique was demonstrated by the BATSE instrument on the Compton Gamma Ray Observatory. The principles and techniques used for the development of an end-to-end earth occultation data analysis system for BATSE can be extended to the GLAST Gamma-ray Burst Monitor (GBM), resulting in multiband light curves and time-resolved spectra in the energy range 8 keV to above 1 MeV for known gamma-ray sources and transient outbursts, as well as the discovery of new sources of gamma-ray emission. In this paper we describe the application of the technique to the GBM. We also present the expected sensitivity for the GBM.
Author
Gamma Ray Bursts; Occultation; Monitors; Hubble Space Telescope

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LUNAR AND PLANETARY SCIENCE AND EXPLORATION

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

20070031131 NASA Johnson Space Center, Houston, TX, USA
Coatings on Atacama Desert Basalt: A Possible Analog for Coatings on Gusev Plains Basalt
Sutter, B.; Golden, D. C.; Amundson, R.; Chong-Diaz, G.; Ming, D. W.; [2007]; 1 pp.; In English; Geological Society America, 29-31 Oct. 2007, Denver, CO, USA; Copyright; Avail.: Other Sources; Abstract Only

Surface coatings on Gusev Plains basalt have been observed and may contain hematite and nanophase Fe-oxides along with enrichments in P, S, Cl, and K relative to the underlying rock. The Gusev coatings may be derived from the dissolution of adhering soil and/or parent rock along with the addition of S and Cl from outside sources. Transient water for dissolution could be sourced from melting snow during periods of high obliquity, acid fog, and/or ground water (Haskin et al., 2005). Coatings on basalt in the hyper-arid (less than 2mm y(sup -1)) Atacama Desert may assist in understanding the chemistry, mineralogy and formation mechanisms of the Gusev basalt coatings. The Atacama Desert climate is proposed to be analogous to a paleo-Mars climate that was characterized by limited aqueous activity when the Gusev coatings could have formed. The objectives of this work are to (i) determine the chemical nature and extent of surface coatings on Atacama Desert basalt, and (ii) assess coating formation mechanisms in the Atacama Desert. Preliminary backscattered electron imaging of Atacama basalt thin-sections indicated that the coatings are as thick as 20 m. The boundary between the coating and the basalt labradorite, ilmenite, and augite grains was abrupt indicating that the basalt minerals underwent no chemical dissolution. The Atacama coatings have been added to the basalt instead of being derived from basalt chemical weathering. Semi-quantitative energy dispersive spectroscopy shows the coatings to be chemically homogeneous. The coating is depleted in Ca (0.9 wt% CaO) and enriched in K (1.3 wt.% K2O) and Si (69.1 wt.% SiO2) relative to the augite and labradorite grains. A dust source enriched in Si (e.g., poorly crystalline silica) and K and depleted in Ca appears to have been added to the basalt surface. Unlike the Gusev coatings, no P, S, and Cl enrichment was observed. However, Fe (3.2 wt.% FeO) was present in the Atacama

coatings suggesting the present of Fe-oxides. While the chemistry of Atacama coating does not mirror the Gusev coating, the coating formation mechanism may be similar. The Atacama coatings of surface basalt are derived completely from exogenous sources. If surface Mars rocks have experienced limited wetting conditions as in the Atacama, then Mars coatings may be derived only from dissolution of material adhering to rock.
Author
Basalt; Coatings; Deserts; Plains; Analogs; Mineralogy

20070031133 NASA Johnson Space Center, Houston, TX, USA
Exposed Ice in the Northern Mid-Latitudes of Mars
Allen, Carlton C.; [2007]; 2 pp.; In English; American Geophysical Union Fall Meeting, 10-14 Dec. 2007, San Francisco, CA, USA; No Copyright; Avail.: CASI: A01, Electronic Document
ONLINE: http://hdl.handle.net/2060/20070031133

Ice-Rich Layer: Polygonal features with dimensions of approximately 100 meters, bounded by cracks, are commonly observed on the martian northern plains. These features are generally attributed to thermal cracking of ice-rich sediments, in direct analogy to polygons in terrestrial polar regions. We mapped polygons in the northern mid-latitudes (30 to 65 N) using MOC and HiRISE images. Polygons are scattered across the northern plains, with a particular concentration in western Utopia Planitia. This region largely overlaps the Late Amazonian Astapus Colles unit, characterized by polygonal terrain and nested pits consistent with periglacial and thermokarst origins. Bright and Dark Polygonal Cracks: An examination of all MOC images (1997 through 2003) covering the study area demonstrated that, at latitudes of 55 to 65 N, most of the imaged polygons show bright bounding cracks. We interpret these bright cracks as exposed ice. Between 40 and 55 N, most of the imaged polygons show dark bounding cracks. These are interpreted as polygons from which the exposed ice has been removed by sublimation. The long-term stability limit for exposed ice, even in deep cracks, apparently lies near 55 N. Bright and Dark Spots: Many HiRISE and MOC frames showing polygons in the northern plains also show small numbers of bright and dark spots, particularly in western Utopia Planitia. Many of the spots are closely associated with collapse features suggestive of thermokarst. The spots range from tens to approximately 100 meters in diameter. The bright spots are interpreted as exposed ice, due to their prevalence on terrain mapped as ice rich. The dark spots are interpreted as former bright spots, which have darkened as the exposed ice is lost by sublimation. The bright spots may be the martian equivalents of pingos, ice-cored mounds found in periglacial regions on Earth. Terrestrial pingos from which the ice core has melted often collapse to form depressions similar to the martian dark spots. Future Observations: The SHARAD radar should be able to confirm the presence and measure the depth of the interpreted ice-rich layer that forms the Astapus Colles unit. If this layer is confirmed it will strengthen the interpretation of bright polygon cracks and bright spots as exposed ice. HiRISE images of the northern plains are showing unprecedented details of the polygonal cracks. Future HiRISE images that include bright spots, compared to MOC images taken years earlier, will illustrate the temporal stability of the spots. The CRISM spectrometer, with multiple spectral bands and a spatial resolution around 20 meters, should allow mineralogical identification of the material exposed in the polygonal bounding cracks and in the bright spots.
Author
Planetary Geology; Midlatitude Atmosphere; Mars Atmosphere; Ice; Northern Hemisphere

20070031134 NASA Johnson Space Center, Houston, TX, USA
High-Precision Nd Isotopes in Picrites from Hawaii and Iceland - No Evidence for an Early-Formed Enriched Reservoir
Brandon, A. D.; Norman, M. D.; Debaille, V.; [2007]; 1 pp.; In English; American Geophysical Union Meeting, 10-14 Dec. 2007, San Francisco, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

New high-precision Nd isotope measurements have shown that the present-day Nd-142/Nd-144 for average chondrites is approximately 20 ppm lower than that for the terrestrial standard and all recent mantle-derived samples measured to date. One explanation for these differences is that an enriched missing reservoir with lower Nd-142/Nd-144 resides in the mantle to balance the bulk Earth to chondritic. Data from Archean Greenland rocks show anomalies in Nd-142/Nd-144 of up to 40 ppm higher than the proposed average for chondrites. This difference between the Archean Greenland rocks and present-day mantle-derived samples has been interpreted to result from remixing of an early-formed enriched reservoir into the convecting mantle during the Archean. If so, the implication from this is that remixing of the enriched reservoir largely shut down some time in the past such that it must at present reside in a region in the mantle that infrequently participates dynamically and leading to volcanism at the surface. Several studies have suggested that the missing reservoir may be present just above the coremantle boundary (CMB). Depending on the size of this reservoir it could potentially make up all of D or exist as distinct domains within it. If such a reservoir does exist, then mantle-derived samples from plume systems that are thought to come

from the CMB may be the best opportunity to identify this component using high-precision Nd isotope measurements. To test this, picrites from Hawaii with coupled enrichments in Os-186-Os-187 that has been proposed to be a signature of core-mantle interaction were measured on the JSC Triton for high-precision Nd-142/Nd-144. For comparison, picrites from Hawaii and Iceland that do not show coupled enrichments in Os-186-Os-187 were measured. We have established an external precision for Nd-142/Nd-144 of 3.6 ppm (2 sigma) during the analytical campaign. The Iceland (n=5) and Hawaiian data (n=9) have Nd-142 ranging from -0.01 plus or minus 0.03 to +0.03 plus or minus 0.03 (2 sigma) and there is no resolvable difference between samples with Os isotope enrichments versus those without. The average epsilon Nd-142 of +0.011 plus or minus 0.034 (2 sigma) for all of the samples (n=14) is not resolvable from the Ames and La Jolla standards with epsilon Nd-142 of +0.000 plus or minus 0.036 (n=16, 2 sigma). These data confirm recent measurements on lavas for the absence of an ancient enriched Nd-142 isotopic signature in plume systems likely derived from D and indicates that such a reservoir, if existing, must now reside in areas of the deep mantle that plumes do not sample.
Author
Iceland; Neodymium Isotopes; Hawaii; Reservoirs; Precision

20070031173 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Physics of Rocket Exhaust Cratering
Metzger, Philip; Center Director's Discretionary Fund 2005 Annual Report; 2007, pp. 47-64; In English; See also 20070031172; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

This project sought to unravel and explain the excavation processes that occur when a jet of gas impinges on a bed of sand. This is important for rockets launching or landing on the dusty, sandy surfaces of the Moon and Mars. During the Apollo and Viking programs, there was considerable research into the blast effects of launching and landing on planetary regoliths. That work ensured the success of those missions but also demonstrated that cratering (or soil erosion) would be a significant challenge for other mission scenarios. For example, high-velocity spray of eroded soil will pose a challenge when we attempt to land multiple spacecraft within short distances of one another on the Moon (Figure 1). The first spacecraft to land may be scoured and contaminated by the spray from the second. We have the relevant experience of the Apollo 12 Lunar Module (LM) landing 155 meters away from the deactivated Surveyor 3 spacecraft (Figure 2). Portions of Surveyor were returned to Earth by the Apollo astronauts for analysis. It was found that the surfaces had been sandblasted and pitted and that every opening and joint was injected with grit from the high-speed spray.
Derived from text
Gas Jets; Cratering; Soil Erosion; Rocket Exhaust; Sands; Dust

20070031206 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Unusual Radar Backscatter along the Northern Rim of Imbrium Basin
Thompson, Thomas W.; Campbell, Bruce A.; Ghent, Rebecca R.; Hawke, B. Ray; Leverington, David W.; March 13, 2006; 23 pp.; In English; Lunar and Planetary Science Conference, 13-17 Mar. 2007, Houston, TX, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40137

A viewgraph presentation of the unusual radar backscatter properties along the Northern Rim of Imbrium Basin is shown. The contents include: 1) Visual and Infrared Observations of Moon; 2) Radar Observations of Moon; 3) Lunar Orbiter Photographs Geologic Setting; 4) 70-cm Radar Data; 5) .70-cm Radar Dark Halo Craters; 6) 3.8-cm Radar Data; 7) 7.5-m Radar Data; 8) 70cm, 3.8 cm and 7.5-m Radar Data; 9) Optical and Infrared Data; 10) Plato Rilles; 11) Isopachs of Crater Ejecta; 12) Plato-like Craters; 13) Observation Summary; 14) Interpretation Matrix; 15) Dark Halo Diameters vs. Crater Size; and 16) Radar Geologic Column.
Derived from text
Backscattering; Lunar Maria; Lunar Topography; Structural Basins; Radar Scattering

20070031234 NASA, Washington, DC, USA
Mars Wars: The Rise and Fall of the Space Exploration Initiative
Hogan, Thor; August 2007; 198 pp.; In English; Original contains black and white illustrations
Report No.(s): NASA/SP-2007-4410; No Copyright; Avail.: CASI: EA6, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031234

The rise of Space Exploration Initiative (SEI) and its eventual demise represents one of the landmark episodes in the history of the American space program ranking with the creation of NASA, the decision to go to the Moon, the post-Apollo

planning process, and the space station decision. The story of this failed initiative is one shaped by key protagonists and critical battles. It is a tale of organizational, cultural, and personal confrontation. Organizational skirmishes involved the Space Council versus NASA, the White House versus congressional appropriators, and the Johnson Space Center versus the rest of the space agency all seeking control of the national space policy process. Cultural struggles pitted the increasingly conservative engineering ethos of NASA against the faster, better, cheaper philosophy of a Space Council looking for innovative solutions to technical problems. Personality clashes matched Vice President Dan Quayle and Space Council Executive Secretary Mark Albrecht against NASA Administrator Dick Truly and Johnson Space Center Director Aaron Cohen. In the final analysis, the demise of SEI was a classic example of a defective decision-making process one that lacked adequate high-level policy guidance, failed to address critical fiscal constraints, developed inadequate programmatic alternatives, and garnered no congressional support. Some space policy experts have argued that SEI was doomed to fail, due primarily to the immense budgetary pressures facing the nation during the early 1990's. This book will argue, however, that the failure of the initiative was not predetermined; instead, it was the result of a deeply flawed policy process that failed to develop (or even consider) policy options that may have been politically acceptable given the existing political environment.
Derived from text
NASA Space Programs; Mars Exploration; Histories; Mars Surface; Space Law; Mars (Planet)

20070031551 NASA Glenn Research Center, Cleveland, OH, USA
Architecting the Communication and Navigation Networks for NASA's Space Exploration Systems
Bhassin, Kul B.; Putt, Chuck; Hayden, Jeffrey; Tseng, Shirley; Biswas, Abi; Kennedy, Brian; Jennings, Esther H.; Miller, Ron A.; Hudiburg, John; Miller, Dave; Jeffries, Alan; Sartwell, Tom; [2007]; 6 pp.; In English; International Conference on System of Systems Engineering, 16-18 Apr. 2007, San Antonio, TX, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 141141.02.03.03; Copyright; Avail.: CASI: A02, Hardcopy

NASA is planning a series of short and long duration human and robotic missions to explore the Moon and then Mars. A key objective of the missions is to grow, through a series of launches, a system of systems communication, navigation, and timing infrastructure at minimum cost while providing a network-centric infrastructure that maximizes the exploration capabilities and science return. There is a strong need to use architecting processes in the mission pre-formulation stage to describe the systems, interfaces, and interoperability needed to implement multiple space communication systems that are deployed over time, yet support interoperability with each deployment phase and with 20 years of legacy systems. In this paper we present a process for defining the architecture of the communications, navigation, and networks needed to support future space explorers with the best adaptable and evolable network-centric space exploration infrastructure. The process steps presented are: 1) Architecture decomposition, 2) Defining mission systems and their interfaces, 3) Developing the communication, navigation, networking architecture, and 4) Integrating systems, operational and technical views and viewpoints. We demonstrate the process through the architecture development of the communication network for upcoming NASA space exploration missions.
Author
Communication Networks; Space Exploration; Aerospace Systems; Crew Exploration Vehicle; Space Communication; Systems Engineering; NASA Space Programs; Space Navigation; International Space Station

20070031575 Oceaneering Space Systems, Houston, TX, USA
Possible Mafic Patches at Mons Malapert and Scott Crater Highlight the Value of Site Selection studies
Cooper, B. L.; October 2007; 2 pp.; In English; Lunar Exploration Analysis Group, 1-5 Oct. 2007, Houston, TX, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Possible areas of mafic material on the rim and floor of Scott crater (82.1 S, 48.5 E) and on the northeast flank of Mons Malapert (85.5 S, 0 E) are suggested by analysis of shadow-masked Clementine false-colorration images. Mafic materials can produce more oxygen than can highlands materials, and mafic materials close to the south pole may be important for propellant production for a future lunar mission. If the dark patches are confirmed as mafic materials, this finding would suggest that other mafic patches may also exist, perhaps even closer to the poles. These preliminary findings illustrate the need for additional site selection studies in the lunar polar regions, to improve our capability to 'live off the land'
Derived from text
Polar Regions; Site Selection; Lunar Bases; Lunar Maria; Lunar Soil; Moon; Lunar Composition; Lunar Landing Sites; Selenography; In Situ Resource Utilization; Lunar Resources

20070031583 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
IRAC Observations of Taurus Pre-Main-Sequence Stars
Hartmann, L., et al.; Astrophysical Journal; [2005]; Volume 629, pp. 881-896; In English
Contract(s)/Grant(s): NAG5-13210; Copyright; Avail.: Other Sources

We presented infrared photometry obtained with the IRAC camera on the Spitzer Space Telescope of a sample of 82 pre-main-sequence stars and brown dwarfs in the Taurus starforming region. We find a clear separation in some IRAC color-color diagrams between objects with and without disks. A few 'transition' objects are noted, which correspond to systems in which the inner disk has been evacuated of small dust. Separating pure disk systems from objects with remnant protostellar envelopes is more difficult at IRAC wavelengths, especially for objects with infall at low rates and large angular momenta. Our results generally confirm the IRAC color classification scheme used in previous papers by Allen et al. and Megeath et al. to distinguish between protostars, T Tauri stars with disks, and young stars without (inner) disks. The observed IRAC colors are in good agreement with recent improved disk models, and in general accord with models for protostellar envelopes derived from analyzing a larger wavelength region. We also comment on a few Taurus objects of special interest. Our results should be useful for interpreting IRAC results in other, less well studied star-forming regions.
Author
Pre-Main Sequence Stars; Infrared Photometry; Brown Dwarf Stars

20070031609 Washington Univ., Saint Louis, MO, USA; NASA Johnson Space Center, Houston, TX, USA
Stardust in STARDUST - the C, N, and O Isotopic Compositions of Wild 2 Cometary Matter in Al Foil Impacts
Stadermann, Frank J.; Hoppe, Peter; Floss, Christine; Heck, Philipp R.; Hoerz, Friedrich; Huth, Joachim; Kearsley, Anton T.; Leitner, Jan; Marhas, Kuljeet K.; McKeegan, Kevin D.; Sstephan, Thomas; [2007]; 44 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNG05GJ26G; STE 576/17-1; Copyright; Avail.: CASI: A03, Hardcopy

In January 2006, the Stardust mission successfully returned dust samples from the tail of comet 81P/Wild 2 in two principal collection media, low density silica aerogel and Al foil. While hypervelocity impacts at the Stardust encounter velocity of 6.1 kilometers per second into Al foils are generally highly disruptive for natural, silicate-dominated impactors, previous studies have shown that many craters retain sufficient residue to allow a determination of the elemental and isotopic compositions of the original projectile. We have used two NanoSIMS ion microprobes to perform C, N, and O isotope imaging measurements on four large (59-295 micrometer diameter) and on 47 small (0.32-1.9 micrometer diameter) Al foil impact craters as part of the Stardust Preliminary Examination. Most analyzed residues in and around these craters are isotopically normal (solar) in their C, N, and O isotopic compositions. However, the debris in one large crater shows an average N-15 enrichment of approx. 450%o, which is similar to the bulk composition of some isotopically primitive interplanetary dust particles and to components of some primitive meteorites. A 250 nm grain in another large crater has an O-17 enrichment with approx. 2.65 times the solar O-17/O-16 ratio. Such an O isotopic composition is typical for circumstellar oxide or silicate grains from red giant or asymptotic giant branch stars. The discovery of this circumstellar grain clearly establishes that there is authentic stardust in the cometary samples returned by the Stardust mission. However, the low apparent abundance of circumstellar grains in Wild 2 samples and the preponderance of isotopically normal material indicates that the cometary matter is a diverse assemblage of presolar and solar system materials.
Author
Nitrogen 15; Oxygen 17; Stardust Mission; Wild 2 Comet; Carbon Isotopes; Interplanetary Dust; Isotope Ratios

20070031629 NASA Johnson Space Center, Houston, TX, USA
Plume Impingement to the Lunar Surface: A Challenging Problem for DSMC
Lumpkin, Forrest; Marichalar, Jermiah; Piplica, Anthony; Oct. 2, 2007; 20 pp.; In English; Direct Simulation Monte Carlo: Theory, Methods and Applications, 30 Sep. - 3 Oct. 2007, Santa Fe, NM, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): 581570.02.02.02.02; Copyright; Avail.: CASI: A03, Hardcopy

The President's Vision for Space Exploration calls for the return of human exploration of the Moon. The plans are ambitious and call for the creation of a lunar outpost. Lunar Landers will therefore be required to land near predeployed hardware, and the dust storm created by the Lunar Lander's plume impingement to the lunar surface presents a hazard. Knowledge of the number density, size distribution, and velocity of the grains in the dust cloud entrained into the flow is needing to develop mitigation strategies. An initial step to acquire such knowledge is simulating the associated plume impingement flow field. The following paper presents results from a loosely coupled continuum flow solver/Direct Simulation Monte Carlo (DSMC) technique for simulating the plume impingement of the Apollo Lunar module on the lunar surface.

These cases were chosen for initial study to allow for comparison with available Apollo video. The relatively high engine thrust and the desire to simulate interesting cases near touchdown result in flow that is nearly entirely continuum. The DSMC region of the flow field was simulated using NASA's DSMC Analysis Code (DAC) and must begin upstream of the impingement shock for the loosely coupled technique to succeed. It was therefore impossible to achieve mean free path resolution with a reasonable number of molecules (say 100 million) as is shown. In order to mitigate accuracy and performance issues when using such large cells, advanced techniques such as collision limiting and nearest neighbor collisions were employed. The final paper will assess the benefits and shortcomings of such techniques. In addition, the effects of plume orientation, plume altitude, and lunar topography, such as craters, on the flow field, the surface pressure distribution, and the surface shear stress distribution are presented.
Author
Dust Storms; Lunar Module; Monte Carlo Method; Plumes; Impingement; Lunar Surface; Computational Fluid Dynamics

20070031642 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
The Mars Express - NASA Project at JPL
Thompson, Thomas W.; Horttor, Richard L.; Acton, C. H., Jr.; Zamani, P.; Johnson, W. T. K.; Plaut, J. J.; Holmes, D. P.; No, S.; Asmar, S. W.; Goltz, G.; March 13, 2006; 32 pp.; In English; Lunar and Planetary Science Conference, 13-17 Mar. 2006, Houston, TX; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40139

This viewgraph presentation gives a general overview of the Mars Express NASA Project at JPL. The contents include: 1) Mars Express/NASA Project Overview; 2) Experiment-Investigator Matrix; 3) Mars Express Support of NASA's Mars Exploration Objectives; 4) U.S./NASA Support of Mars Express; 5) Mars Express Schedule (2003-2007); 6) Mars Express Data Rates; 7) MARSIS Overview Results; 8) MARSIS with Antennas Deployed; 9) MARSIS Science Objectives; 10) Mars Advanced Radar for Subsurface and Ionospheric Sounding (MARSIS) Experiment Overview; 11) Mars Express Orbit Evolution; 12) MARSIS Science - Subsurface Sounding; 13) MARSIS-North Polar Ice Cap; 14) MARSIS Data-Buried Basin; 15) MARSIS over a Crater Basin; 16) MARSIS-Buried Basin; 17) Ionogram - Orbit 2032 (example from Science paper); 18) Ionogram-Orbit 2018 (example from Science paper); and 19) Recent MARSIS Results ESA Press Releases.
Derived from text
Mars Express; European Space Agency; General Overviews; NASA Space Programs

20070031694 Vertigo, Inc., Santa Cruz, CA, USA
Inflatable Aerocapture Decelerators for Mars Orbiters
Brown, Glen J.; Lingard, J. Stephen; Darley, Matthew G.; Underwood, John C.; May 21, 2007; 13 pp.; In English; AIAA Aerodynamic Decelerator Systems Conference, 21-24 May 2007, Williamsburg, VA, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NNMOSAA14C; NNM05AA14C; Copyright; Avail.: CASI: A03, Hardcopy

A multi-disciplinary research program was recently completed, sponsored by NASA Marshall Space Flight Center, on the subject of aerocapture of spacecraft weighing up to 5 metric tons at Mars. Heavier spacecraft will require deployable drag area beyond the dimensional limits of current and planned launch fairings. This research focuses on the approach of lightweight inflatable decelerators constructed with thin films, using fiber reinforcement and having a temperature limitation of 500 C. Trajectory analysis defines trajectories for a range of low ballistic coefficients for which convective heat flux is compatible with the material set. Fluid-Structure Interaction (FSI) tools are expanded to include the rarified flow regime. Several non-symmetrical configurations are evaluated for their capability to develop lift as part of the necessary trajectory control strategy. Manufacturing technology is developed for 3-D stretch forming of polyimide films and for tailored fiber reinforcement of thin films. Finally, the mass of the decelerator is estimated and compared to the mass of a traditional rigid aeroshell.
Author
Aerocapture; Inflatable Structures; Brakes (For Arresting Motion); Technology Utilization; Mars Climate Orbiter

20070031706 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Technology Assessment in Support of the Presidential Vision for Space Exploration
Weisbin, Charles R.; Lincoln, William; Mrozinski, Joe; Hua, Hook; Merida, Sofia; Shelton, Kacie; Adumitroaie, Virgil; Derleth, Jason; Silberg, Robert; July 24, 2006; 7 pp.; In English; World Automation Congress, Budapest, Hungary, July 24, 2006, 24 Jul. 2006, Budapest, Hungary; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40176

This paper discusses the process and results of technology assessment in support of the USA Vision for Space Exploration

of the Moon, Mars and Beyond. The paper begins by reviewing the Presidential Vision: a major endeavor in building systems of systems. It discusses why we wish to return to the Moon, and the exploration architecture for getting there safely, sustaining a presence, and safely returning. Next, a methodology for optimal technology investment is proposed with discussion of inputs including a capability hierarchy, mission importance weightings, available resource profiles as a function of time, likelihoods of development success, and an objective function. A temporal optimization formulation is offered, and the investment recommendations presented along with sensitivity analyses. Key questions addressed are sensitivity of budget allocations to cost uncertainties, reduction in available budget levels, and shifting funding within constraints imposed by mission timeline. Author

Space Exploration; Technology Assessment; Sensitivity Analysis; Presidential Reports; Time Dependence

20070031727 NASA Marshall Space Flight Center, Huntsville, AL, USA

Human Space Exploration: The Moon, Mars, and Beyond

Sexton, Jeffrey D.; April 06, 2007; 19 pp.; In English; Purdue Pugwash: Social Responsibility in Science and Technology, 6 Apr. 2007, West Lafayette, IN, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy ONLINE: http://hdl.handle.net/2060/20070031727

America is returning to the Moon in preparation for the first human footprint on Mars, guided by the U.S. Vision for Space Exploration. This presentation will discuss NASA's mission, the reasons for returning to the Moon and going to Mars, and how NASA will accomplish that mission in ways that promote leadership in space and economic expansion on the new frontier. The primary goals of the Vision for Space Exploration are to finish the International Space Station, retire the Space Shuttle, and build the new spacecraft needed, to return people to the Moon and go to Mars. The Vision commits NASA and the nation to an agenda of exploration that also includes robotic exploration and technology development, while building on lessons learned over 50 years of hard-won experience. Why the Moon? Many questions about the Moon's potential resources and how its history is linked to that of Earth were spurred by the brief Apollo explorations of the 1960s and 1970s. This new venture will carry more explorers to more diverse landing sites with more capable tools and equipment for extended expeditions. The Moon also will serve as a training ground before embarking on the longer, more difficult trip to Mars. NASA plans to build a lunar outpost at one of the lunar poles, learn to live off the land, and reduce dePendence on Earth for longer missions. America needs to extend its ability to survive in hostile environments close to our home planet before astronauts will reach Mars, a planet very much like Earth. NASA has worked with scientists to define lunar exploration goals and is addressing the opportunities for a range of scientific study on Mars. In order to reach the Moon and Mars within a lifetime and within budget, NASA is building on common hardware, shared knowledge, and unique experience derived from the Apollo Saturn, Space Shuttle and contemporary commercial launch vehicle programs. The journeys to the Moon and Mars will require a variety of vehicles, including the Ares I Crew Launch Vehicle, which transports the Orion Crew Exploration Vehicle, and the Ares V Cargo Launch Vehicle, which transports the Lunar Surface Access Module. The architecture for the lunar missions will use one launch to ferry the crew into orbit, where it will rendezvous with the Lunar Module in the Earth Departure Stage, which will then propel the combination into lunar orbit. The imperative to explore space with the combination of astronauts and robots will be the impetus for inventions such as solar power and water and waste recycling. This next chapter in NASA's history promises to write the next chapter in American history, as well. It will require this nation to provide the talent to develop tools, machines, materials, processes, technologies, and capabilities that can benefit nearly all aspects of life on Earth. Roles and responsibilities are shared between a nationwide Government and industry team. The Exploration Launch Projects Office at the Marshall Space Flight Center manages the design, development, testing, and evaluation of both vehicles and serves as lead systems integrator. A little over a year after it was chartered, the Exploration Launch Projects team is testing engine components, refining vehicle designs, performing wind tunnel tests, and building hardware for the first flight test of Ares I-l, scheduled for spring 2009. The U.S. Vision for Space Exploration lays out a roadmap for a long-term venture of discovery. This endeavor will inspire and attract the best and brightest students to power this nation successfully to the Moon, Mars, and beyond. If one equates the value proposition for space with simple dollars and cents, the potential of the new space economy is tremendous, from orbital space delivery services for the International Space Station to mining and solar energy collection on the Moon and asteroids. The Vision for Space Exploration is fundamentally about bringing the resources of the solar system within the economic sphere of humaind. Given the immense size of our solar system, the amount of available material and energy within it present an enormous economic opportunity.
Author

Space Exploration; Manned Space Flight; Moon; Manned Mars Missions; International Space Station; Wind Tunnel Tests; Launch Vehicle Configurations

20070031732 NASA Marshall Space Flight Center, Huntsville, AL, USA
Heliospheric Physics and NASA's Vision for Space Exploration
Minow, Joseph I.; [2007]; 55 pp.; In English; Physics Department Colliquium University of Utah, 17 Apr. 2007, Logan, UT, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A04, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070031732

The Vision for Space Exploration outlines NASA's development of a new generation of human-rated launch vehicles to replace the Space Shuttle and an architecture for exploring the Moon and Mars. The system--developed by the Constellation Program--includes a near term (approx. 2014) capability to provide crew and cargo service to the International Space Station after the Shuttle is retired in 2010 and a human return to the Moon no later than 2020. Constellation vehicles and systems will necessarily be required to operate efficiently, safely, and reliably in the space plasma and radiation environments of low Earth orbit, the Earth's magnetosphere, interplanetary space, and on the lunar surface. This presentation will provide an overview of the characteristics of space radiation and plasma environments relevant to lunar programs including the trans-lunar injection and trans-Earth injection trajectories through the Earth's radiation belts, solar wind surface dose and plasma wake charging environments in near lunar space, energetic solar particle events, and galactic cosmic rays and discusses the design and operational environments being developed for lunar program requirements to assure that systems operate successfully in the space environment.
Author
Heliosphere; Space Exploration; NASA Space Programs; International Space Station; Lunar Exploration; Constellation Program

20070031736 American Inst. of Aeronautics and Astronautics, Reston, VA, USA
Mimicking Meteor Impacts
Flinn, Edward D.; Aerospace America; May 2007; Volume 45, No. 5, pp. 28-29; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

NASA scientist Bill Cooke has been shooting marbles to learn how to help keep astronauts safe when the U.S. returns to the Moon in the next decade. Cooke is firing 0.25-in.-diam clear shooters made of pyrex glass at soil rather than at other marbles. And he has to use a new one on each round because every 7-km/sec shot destroys his shooter. 'We are simulating meteoroid impacts with the lunar surface,' he explains. Cooke and others in the Space Environments Group at NASA Marshall have recorded the real thing many times. Their telescopes routinely detect explosions on the Moon when meteoroids slam into the lunar surface. A typical flash, says Cooke, involves 'a meteoroid the size of a softball hitting the Moon at 27 km/sec and exploding with as much energy as 70 kg of TNT.'
Derived from text
Hypervelocity Impact; Lunar Surface; Meteorite Collisions; Simulation

92
SOLAR PHYSICS

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

20070031204 NASA Ames Research Center, Moffett Field, CA, USA; CRA International, Boston, MA, USA; Carnegie Institution of Washington, Stanford, CA, USA
Workshop Report on Managing Solar Radiation
Lane, Lee, Compiler; Caldeira, Ken, Compiler; Chatfield, Robert, Compiler; Langhoff, Stephanie, Compiler; April 2007; 40 pp.; In English; Original contains color and black and white illustrations
Report No.(s): NASA/CP-2007-214558; A-070010; Copyright; Avail.: CASI: A03, Hardcopy

The basic concept of managing Earth's radiation budget is to reduce the amount of incoming solar radiation absorbed by the Earth so as to counterbalance the heating of the Earth that would otherwise result from the accumulation of greenhouse gases. The workshop did not seek to decide whether or under what circumstances solar radiation management should be deployed or which strategies or technologies might be best, if it were deployed. Rather, the workshop focused on defining what kinds of information might be most valuable in allowing policy makers more knowledgeably to address the various options for solar radiation management.
Author
Earth Radiation Budget; Solar Radiation; Climatology; Earth Sciences

20070031229 NASA Goddard Space Flight Center, Greenbelt, MD, USA

QBO as Potential Amplifier of Solar Cycle Influence

Mayr, Hans G.; Mangel, John G.; Wolff, Charles L.; Porter, Hayden S.; Geophysical Research Letters; March 10, 2006; Volume 33; 1 pp.; In English; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1029/2005GL025650

The solar cycle (SC) effect in the lower atmosphere has been linked observationally to the quasi-biennial oscillation (QBO) of the zonal circulation. Salby and Callaghan (2000) in particular analyzed the QBO covering more than 40 years and found that it contains a large SC signature at 20 km. We discuss a 3D study in which we simulate the QBO under the influence of the SC. For a SC period of 10 years, the relative amplitude of radiative forcing is taken to vary with height: 0.2% (surface), 2% (50 km), 20% (100 km and above). This model produces in the lower stratosphere a relatively large modulation of the QBO, which appears to come from the SC and qualitatively agrees with the observations. The modulation of the QBO, with constant phase relative to the SC, is shown to persist at least for 50 years, and it is induced by a SC modulated annual oscillation that is hemispherically symmetric and confined to low latitudes.

Author

Quasi-Biennial Oscillation; Solar Cycles; Geophysics; Zonal Flow (Meteorology)

20070031697 NASA Marshall Space Flight Center, Huntsville, AL, USA

The Coronal-Dimming Footprint of a Streamer-Puff Coronal Mass Ejection: Confirmation of the Magnetic-Arch-Blowout Scenario

Moore, Ronald L.; Sterling, Alphonse C.; The Astrophysical Journal; May 27, 2007; Volume 661, pp. 543; In English; American Astronomical Society 210th Meeting, 27-31 May 2007, Honolulu, HI, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070031697

A streamer puff is a recently identified variety of coronal mass ejection (CME) of narrow to moderate width. It (1) travels our along a streamer, transiently inflating the streamer but leaving it largely intact, and (2) occurs in step with a compact ejective flare in an outer flank of the base of the streamer. These aspects suggest the following magnetic-arch-blowout scenario for the production of these CMEs: the magnetic explosion that produces the flare also produces a plasmoid that explodes up the leg of an outer loop of the arcade base of the streamer, blows out the top of this loop, and becomes the core of the CME. In this paper, we present a streamer-puff CME that produced a coronal-dimming footprint. The coronal dimming, its magnetic setting, and the timing and magnetic setting of a strong compact ejective flare within the dimming footprint nicely confirm the magnetic-arch-blowout scenario. From these observations, together with several published cases of a trans-equatorial CME produced in tandem with an ejective flare or filament eruption that was far offset from directly under the CME, we propose the following. Streamer-puff CMEs are a subclass (one variety) of a broader class of 'over-and-out' CMEs that are often much larger than streamer puffs but are similar to them in that they are produced by the blowout of a large quasi-potential magnetic arch by a magnetic explosion that erupts from one foot of the large arch, where it is marked by a filament eruption and/or an ejective flare.

Author

Blowouts; Coronal Mass Ejection; Dimming; Plasmas (Physics); Magnetic Signatures

20070031698 NASA Marshall Space Flight Center, Huntsville, AL, USA

Wireless Power Transmission Options for Space Solar Power

Henley, Mark; Potter, Seth; Howell, Joseph; Mankins, John; May 25, 2007; 15 pp.; In English; 26th International Space Development Conference, 25-28 May 2007, Dallas, TX, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

Space Solar Power (SSP), combined with Wireless Power Transmission (WPT), offers the far-term potential to solve major energy problems on Earth. In this presentation, two basic WPT options, using radio waves an d light waves, are considered for both long-term and near-term SSP applications. In the long-term, we aspire to beam energy to Earth from geostationary Earth orbit (GEO), or even further distances in space. Accordingly, radio- and light- wave WPT options are compared through a wide range of criteria, each showing certain strengths. In the near-term, we plan to beam power over more moderate distances, but still stretch the limits of today's technology. For the near-term, a 100 kWe-class 'Power Plug' Satellite

and a 10 kWe-class Lunar Polar Solar Power outpost are considered as the first steps in using these WPT options for SSP. By using SSP and WPT technology in nearterm space science and exploration missions, we gain experience needed for sound decisions in designing and developing larger systems to send power from Space to Earth.
Author
Wireless Communication; Electric Power Transmission; Aerospace Systems; Remote Sensing; Solar Generators

20070031719 NASA Marshall Space Flight Center, Huntsville, AL, USA
Combined Hinode, STEREO, and TRACE Observations of a Solar Filament Eruption: Evidence for Destabilization by Flux-Cancelation Tether Cutting
Sterling, Alphonse C.; Moore, R. L.; May 27, 2007; 1 pp.; In English; American Astronomical Society 210th Meeting, 27-31 May 2007, Honolulu, HI, USA; No Copyright; Avail.: Other Sources; Abstract Only

We present observations from Hinode, STEREO, and TRACE of a solar filament eruption and flare that occurred on 2007 March 2. Data from the two new satellites, combined with the TRACE observations, give us fresh insights into the eruption onset process. HINODE/XRT shows soft X-ray (SXR) activity beginning approximately 30 minutes prior to ignition of bright flare loops. STEREO andTRACE images show that the filament underwent relatively slow motions coinciding with the pre-eruption SXR brightenings, and it underwent rapid eruptive motions beginning near the time of flare onset. Concurrent HINODE/SOT magnetograms showed substantial flux cancelation under the filament at the site of the pre-eruption SXR activity. From these observations we infer that progressive tether-cutting reconnection driven by photospheric convection caused the slow rise of the filament and led to its eruption. NASA supported this work through a NASA Heliosphysics GI grant.
Author
Tethering; Transition Region and Coronal Explorer; Destabilization; Stereo (Observatory); Filaments

20070031722 NASA Marshall Space Flight Center, Huntsville, AL, USA
Recent Developments in Smart Adaptive Structures for Solar Sailcraft
Whorton, M. S.; Kim, Y. K.; Oakley, J.; Adetona, O.; Keel, L. H.; May 14, 2007; 13 pp.; In English; 54th JANNAF Propulsion Meeting, 5th Modeling and Simulation Subcommittee Meeting, 14-17 May 2007, Denver, CO, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

The 'Smart Adaptive Structures for Solar Sailcraft' development activity at MSFC has investigated issues associated with understanding how to model and scale the subsystem and multi-body system dynamics of a gossamer solar sailcraft with the objective of designing sailcraft attitude control systems. This research and development activity addressed three key tasks that leveraged existing facilities and core competencies of MSFC to investigate dynamics and control issues of solar sails. Key aspects of this effort included modeling and testing of a 30 m deployable boom; modeling of the multi-body system dynamics of a gossamer sailcraft; investigation of control-structures interaction for gossamer sailcraft; and development and experimental demonstration of adaptive control technologies to mitigate control-structures interaction.
Author
Solar Sails; Solar Propulsion; Smart Structures; Mathematical Models; Control Systems Design

20070031742 NASA Marshall Space Flight Center, Huntsville, AL, USA
Curious Behavior of Sunspot Umbrae in the First Half of the 20th Century
Hathaway, D. H.; Wilson, R. M.; Campbell, A.; May 27, 2007; 1 pp.; In English; American Astronomical Society 210th Meeting, 27-31 May 2007, Honolulu, HI, USA; Copyright; Avail.: Other Sources; Abstract Only

We examined the behavior of the areas of sunspot umbrae and penumbrae as reported daily by the Royal Observatory, Greenwich (RGO) from May 1874 to December 1976. We calculated the ratio of the umbral area to the penumbral area (corrected for foreshortening as observed on the solar disc) for each sunspot group and for each day. We found: 1) that this ratio is about 0.2 on average, 2) that larger sunspot groups have slightly smaller ratios, 3) that there is a weak dependence on the phase of the solar cycle, 4) that there is no dependence on the latitude of the sunspot groups, and curiously 5) that for the smaller sunspot groups this ratio increased dramatically from about 1910 to 1930 and then returned to 'normal' from 1930 to 1950. We examined other sunspot records to determine whether this behavior was an artifact of the RGO data and find evidence to indicate that the behavior was real. For the smaller sunspots (constituting the vast majority in both number and total area), the proportional size of the sunspot umbrae slowly increased by more than 50% and then returned to 'normal' over this 40-year period.
Author
Penumbras; Sunspots; Observatories; Solar Physics

20070031743 NASA Marshall Space Flight Center, Huntsville, AL, USA

The Solar Cycle

Hathaway, D. H.; May 27, 2007; 1 pp.; In English; American Astronomical Society 210th Meeting, 27-31 May 2007, Honolulu, HI, USA; No Copyright; Avail.: Other Sources; Abstract Only

Sunspots provided the first evidence for the 11-year cycle of solar activity and continue to provide key indicators of the level and nature of solar activity. Solar flares, prominence eruptions, and coronal mass ejections increase in frequency as the number of sunspots increases during the rising phase of the solar cycle. The total irradiance of the Sun and its irradiance in ultraviolet light and x-rays also increase as the sunspot number increases. On the other hand, the flux of galactic cosmic rays reaching Earth decreases as the sunspot number increases. These changes in the heliospheric environment produce significant effects on our environment. Our technological assets, in space, in the air, and on the ground, can be adversely affected by solar activity. Satellite drag, single-event upsets in electronic components, radio communication outages, power outages, and terrestrial climate can all be influenced by solar activity. In this lecture I will describe many of the significant characteristics of the solar cycle, their roots in solar magnetism, the mechanisms of the Sun's magnetic dynamo, and predictions for the amplitude and timing of next solar cycle.

Author

Solar Cycles; Heliosphere; Solar Prominences; Galactic Cosmic Rays

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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*.

20070031130 NASA Johnson Space Center, Houston, TX, USA

Biomarker for Space Radiation Risk: Painting Analysis of Chromosome Aberrations Induced by Energetic Heavy Ions in Human Cells

Hada, Megumi; George, Kerry; Cucinotta, Francis A.; Wu, Honglu; [2007]; 1 pp.; In English; 50th Annual Meeting of Japan Radiation Research Society, 14-17 Nov. 2007, Chiba, Japan; Copyright; Avail.: Other Sources; Abstract Only

Energetic heavy ions pose a great health risk to astronauts in extended ISS and future Lunar and Mars missions. High-LET heavy ions are particularly effective in causing various biological effects, including cell inactivation, genetic mutations, cataracts and cancer induction. Most of these biological endpoints are closely related to chromosomal damage, which can be utilized as a biomarker for radiation insults. Over the years, we have studied chromosomal damage in human fibroblast, epithelia and lymphocyte cells exposed in vitro to energetic charged particles generated at several accelerator facilities in the world. We have also studied chromosome aberrations in astronaut s peripheral blood lymphocytes before and after space flight. Various fluorescence in situ hybridization painting techniques have been used to identify from only the telomere region of the chromosome to every chromosome in a human cell. We will summarize the results of the investigations, and discuss the unique radiation signatures and biomarkers for space radiation exposure.

Author

Biomarkers; Chromosome Aberrations; Extraterrestrial Radiation; Heavy Ions; Risk; Cells (Biology)

20070031704 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Radiation Effects on Optoelectronic Devices in Space Missions

Johnston, Allan H.; March 20, 2006; In English; Government Microcircuit Applications and Critical Technology Conference, 20-23 Mar. 2006, San Diego, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources ONLINE: http://hdl.handle.net/2014/40181

Radiation degradation of optoelectronic devices is discussed, including effects on optical emitters, detectors and optocouplers. The importance of displacement damage is emphasized, including the limitations of non-ionizing energy loss (NIEL) in normalizing damage. Failures of optoelectronics in fielded space systems are discussed, along with testing and qualification methods.

Author

Optoelectronic Devices; Radiation Effects; Electro-Optics; Optical Measuring Instruments; Energy Dissipation

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GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

20070031215 NASA Dryden Flight Research Center, Edwards, CA, USA

Six Decades of Flight Research: Dryden Flight Research Center, 1946 - 2006 [DVD]

May 2007; 5 pp.; In English

Report No.(s): NASA/TM-2007-214617; No Copyright; Avail.: CASI: C01, DVD

This DVD contains an introduction by Center Director Kevin Peterson, two videos on the history of NASA Dryden Flight Research Center and a bibliography of NASA Dryden Flight Research Center publications from 1946 through 2006. The NASA Dryden 60th Anniversary Summary Documentary video is narrated by Michael Dorn and give a brief history of Dryden. The Six Decades of Flight Research at NASA Dryden lasts approximately 75 minutes and is broken up in six decades: 1. The Early X-Plane Era; 2. The X-15 Era; 3. The Lifting Body Era; 4. The Space Shuttle Era; 5. The High Alpha and Thrust Vectoring Era; and 6. The technology Demonstration Era. The bibliography provides citations for NASA Technical Reports and Conference Papers, Tech Briefs, Contractor Reports, UCLA Flight Systems Research Center publications and Dryden videos. Finally, a link is provided to the NASA Dryden Gallery that features video clips and photos of the many unique aircraft flown at NASA Dryden and its predecessor organizations.

Author

Video Tapes; Histories; NASA Space Programs; Flight Tests; Aircraft Design; Research Vehicles

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