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Langley Research Center

Scientific and Technical Information Program Office

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- Domestic and foreign dissertations and theses.

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STAR subject coverage includes all aspects of aeronautics and space research and development, supporting basic and applied research, and applications. Aerospace aspects of Earth resources, energy development, conservation, oceanography, environmental protection, urban transportation, and other topics of high national priority are also covered.

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Table of Contents

Subject Divisions

Document citations are grouped first by the following divisions. Select a division title to view the category-level Table of Contents.

A. Aeronautics
B. Astronautics
C. Chemistry and Materials
D. Engineering
E. Geosciences
F. Life Sciences
G. Mathematical and Computer Sciences
H. Physics
I. Social and Information Sciences
J. Space Sciences
K. General

Indexes

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

Subject Term Index
Personal Author Index

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Subject Categories of the Division A. Aeronautics

Select a category to view the collection of records cited.

01 Aeronautics (General) 1

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

02 Aerodynamics 2

Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans and other elements of turbomachinery. For related information, see also *34 Fluid Mechanics and Heat Transfer.*

03 Air Transportation and Safety 11

Includes passenger and cargo air transport operations; aircraft 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.*

04 Aircraft Communications and Navigation 12

Includes all modes of communication with and between aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information see also *06 Avionics and Aircraft Instrumentation*; *17 Space Communications; Spacecraft Communications, Command and Tracking*, and *32 Communications and Radar.*

05 Aircraft Design, Testing and Performance 14

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*.

06 Avionics and Aircraft Instrumentation 18

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

07 Aircraft Propulsion and Power 19

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; 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*.

08 Aircraft Stability and Control 20

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

09 Research and Support Facilities (Air) 21

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

Subject Categories of the Division B. Astronautics

Select a category to view the collection of records cited.

12 Astronautics (General) 24

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*.

13 Astrodynamics 24

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

15 Launch Vehicles and Launch Operations 24

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.*

16 Space Transportation and Safety 26

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

18 Spacecraft Design, Testing and Performance 30

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.*

19 Spacecraft Instrumentation and Astrionics 31

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 Aircraft Instrumentation and Avionics;* For spaceborne instruments not integral to the vehicle itself see *35 Instrumentation and Photography*; For spaceborne telescopes and other astronomical instruments see *89 Astronomy, Instrumentation and Photography*; For spaceborne telescopes and other astronomical instruments see *89 Astronomy.*

20 Spacecraft Propulsion and Power 32

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*.

Subject Categories of the Division C. Chemistry and Materials

Select a category to view the collection of records cited.

24 Composite Materials 37

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

25 Inorganic, Organic, and Physical Chemistry 40

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

26 Metals and Metallic Materials 42

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

27 Nonmetallic Materials 45

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

28 Propellants and Fuels 47

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*.

29 Space Processing 50

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

Subject Categories of the Division D. Engineering

Select a category to view the collection of records cited.

31 Engineering (General) 51

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

32 Communications and Radar 53

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.*

33 Electronics and Electrical Engineering 61

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.*

34 Fluid Mechanics and Thermodynamics 63

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*

35 Instrumentation and Photography 68

Includes remote sensors; measuring instruments and gauges; 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*.

36 Lasers and Masers 73

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*.

37 Mechanical Engineering 74

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*.

38 Quality Assurance and Reliability 76

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

39 Structural Mechanics 78

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structure. For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

Subject Categories of the Division E. Geosciences

Select a category to view the collection of records cited.

42 Geosciences (General) 80

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

43 Earth Resources and Remote Sensing 83

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

44 Energy Production and Conversion 91

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

45 Environment Pollution 92

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

46 Geophysics 98

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*.

47 Meteorology and Climatology 108

Includes weather observation forecasting and modification.

48 Oceanography 115

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*.

Subject Categories of the Division F. Life Science

Select a category to view the collection of records cited.

51 Life Sciences (General) 117

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*.

52 Aerospace Medicine 122

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 Science*. For the effects of space on animals and plants see *51 Life Sciences*.

53 Behavioral Sciences 122

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 Man/System Technology and Life Support 127

Includes human factors engineering; bionics, man–machine, life support, space suits and protective clothing. For related information see also *16 Space Transportation* and *52 Aerospace Medicine.*

Subject Categories of the Division G. Mathematical and Computer Sciences

Select a category to view the collection of records cited.

59 Mathematical and Computer Sciences (General) 132

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

61 Computer Programming and Software 133

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.

62 Computer Systems 136

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.

63 Cybernetics, Artificial Intelligence and Robotics 141

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

64 Numerical Analysis 142

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

Subject Categories of the Division H. Physics

Select a category to view the collection of records cited.

70 Physics (General) 143

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

71 Acoustics 143

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution.* For aircraft noise see also *02 Aerodynamics* and *07 Aircraft Propulsion Propulsion and Power.*

72 Atomic and Molecular Physics 144

Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see *73 Nuclear Physics*.

73 Nuclear Physics 145

Includes nuclear particles; and reactor theory. For space radiation see *93 Space Radiation*. For atomic and molecular physics see *72 Atomic and Molecular Physics*. For elementary particle physics see *77 Physics of Elementary Particles and Fields*. For nuclear astrophysics see *90 Astrophysics*.

74 Optics 150

Includes light phenomena and the theory of optical devices. For lasers see *36 Lasers and Masers*.

75 Plasma Physics 153

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

76 Solid-State Physics 156

Includes condensed matter physics, crystallography, and superconductivity. For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

77 Physics of Elementary Particles and Fields 160

Includes quantum mechanics; theoretical physics; and statistical mechanics. For related information see also *72 Atomic and Molecular Physics, 73 Nuclear Physics, and 25 Inorganic, Organic and Physical Chemistry.*

Subject Categories of the Division I. Social and Information Sciences

Select a category to view the collection of records cited.

80 Social and Information Sciences (General) 161

Includes general research topics related to sociology; educational programs and curricula.

81 Administration and Management 162

Includes management planning and research.

82 Documentation and Information Science 163

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

83 Economics and Cost Analysis 167

Includes cost effectiveness studies.

84 Law, Political Science and Space Policy 167

Includes aviation law; space law and policy; international law; international cooperation; and patent policy.

Subject Categories of the Division J. Space Sciences

Select a category to view the collection of records cited.

89 Astronomy 168

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

90 Astrophysics 179

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

91 Lunar and Planetary Science and Exploration 185

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*.

92 Solar Physics 233

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

93 Space Radiation 238

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *52 Aerospace Medicine*. For theory see *73 Nuclear Physics.*

Subject Categories of the Division K. General

Select a category to view the collection of records cited.

99 General 241

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.

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Typical Report Citation and Abstract

❶ **19970001126** NASA Langley Research Center, Hampton, VA USA
❷ **Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes**
❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
❹ Mar. 1996; 130p; In English
❺ Contract(s)/Grant(s): RTOP 505-68-70-04
❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10’ to 50’, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65’ swept forebody serrations tended to roll together, while vortices from 40’ swept serrations were more effective in generating additional lift caused by their more independent nature.
❽ Author
❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

A Biweekly Publication of the National Aeronautics and Space Administration

VOLUME 38, JUNE 2, 2000

01
AERONAUTICS (GENERAL)

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

20000039412 NASA Langley Research Center, Hampton, VA USA
Aeronautical Engineering: A Continuing Bibliography with Indexes, Supplement 413
March 2000; 122p; In English
Report No.(s): NASA/SP-2000-7037/SUPPL413; NAS 1.21:7037/SUPPL413; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This supplemental issue of Aeronautical Engineering, A Continuing Bibliography with Indexes (NASA/SP-2000-7037) lists reports, articles, and other documents recently announced in the NASA STI Database. The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles. Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract. Two indexes-subject and author are included after the abstract section.
Derived from text
Bibliographies; Aerodynamics; Aeronautical Engineering; Indexes (Documentation)

20000039430 Old Dominion Univ., Virginia Space Grant Consortium, Hampton, VA USA
National General Aviation Design Competition Guidelines 1999-2000 Academic Year ***Final Report, 1 Oct. 1998 - 30 Sep. 1999***
[1999]; 6p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG1-2212; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The National Aeronautics and Space Administration (NASA), the Federal Aviation Administration (FAA) and the Air Force Research Laboratory are sponsoring a National General Aviation Design Competition for students at U.S. aeronautical and engineering universities for the 1999-2000 academic year. The competition challenges individuals and teams of undergraduates and/or graduate students, working with faculty advisors, to address design challenges for general aviation aircraft. Now in its sixth year, the competition seeks to increase the involvement of the academic community in the revitalization of the U.S. general aviation industry while providing real-world design and development experiences for students. It allows university students to participate in a major national effort to rebuild the U.S. general aviation sector while raising student awareness of the value of general aviation for business and personal use , and its economic relevance. Faculty and student participants have indicated that the open-ended design challenges offered by the competition have provided the basis for quality educational experiences.
Derived from text
Aeronautical Engineering; Competition; General Aviation Aircraft; NASA Programs; Universities; Aircraft Design; Students

20000039693 University Aviation Association, Auburn, AL USA

Collegiate Aviation Review, Volume 17

Carney, Thomas Q., Editor, Purdue Univ., USA; Luedtke, Jacqueline R., Editor, Utah State Univ., USA; Johnson, Jeffrey A., Editor, Nebraska Univ., USA; Barker, Ballard M., Editor, Florida Inst. of Tech., USA; Bowen, Brent D., Editor, Nebraska Univ., USA; Carstenson, Larry G., Editor, Nebraska Univ., USA; Chubb, Gerald P., Editor, Ohio State Univ., USA; Green, Mavis F., Editor, Illinois Univ. at Urbana-Champaign, USA; Harraf, Abe, Editor, Embry-Riddle Aeronautical Univ., USA; NewMeyer, David A., Editor, University of Southern Illinois, USA; October 1999; ISSN 1523-5955; 108p; In English; See also 20000039694 through 20000039699; Copyright; Avail: Issuing Activity

The Collegiate Aviation Review, published annually by the University Aviation Association and distributed to its members, is a compilation of the annual Fall Proceedings of the University Aviation Association Fall Education Conference and includes such topics as: Enhancing Global Competitiveness: Benchmarking Airline Operational Performance in Highly Regulated Environments; Multiple Expert Evaluations of a PC Computer-Based Aviation Flight Training Device; An Examination of the U.S. Collegiate Aviation Workforce in Preparing the Next Generation of Aviation Faculty Members Beyond 2000; Assessing the Environment and Outcomes of Four-Year Aviation Programs: Does Program Quality Make a Difference?; Airport Internships: Effectively Structuring a Department Rotation Internship; An Evaluation of a Major Airline Flight Internship Program: Participant's Perceptions of Curricular Preparation for, and Components of, the Internship.

Author

Airline Operations; Computer Techniques; Flight Training; Training Devices; Evaluation; Documents

20000039696 Nebraska Univ., Omaha, NE USA

An Examination of the US Collegiate Aviation Workforce in Preparing the Next Generation of Aviation Faculty Members Beyond 2000

Johnson, Jeffrey A., Nebraska Univ., USA; Collegiate Aviation Review; October 1999; Volume 17, No. 1, pp. 31-39; In English; See also 20000039693; Copyright; Avail: Issuing Activity

Aviation as an academic field of study has evolved in the span of a century. As the new millennium approaches, collegiate aviation will be called upon to prepare a new generation of highly skilled workers. These workers need to be educated by current and future generations of aviation faculty members. The purpose of this study was to examine the US collegiate aviation workforce to determine if the next generation of faculty members are being adequately prepared. A descriptive study survey questionnaire was used to collect data for this study which was sent to US University Aviation Association (UAA) institutional members in order to ascertain their workforce needs. The study found that a significant amount of hiring for qualified aviation faculty members is already occurring. The survey results also indicated a substantial number of retirements is either taking place or is anticipated to take place by the year 2000. A very significant finding was that almost all of the respondents believe the public at large does not have an adequate understanding of collegiate aviation.

Author

Surveys; Civil Aviation

02
AERODYNAMICS

Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans and other elements of turbomachinery. For related information, see also 34 Fluid Mechanics and Heat Transfer.

20000038344 NASA Marshall Space Flight Center, Huntsville, AL USA

Background Simulation of the MSFC GSPC Balloon Payload

Swartz, D. A., NASA Marshall Space Flight Center, USA; Chen, Y., NASA Marshall Space Flight Center, USA; Ramsey, B. D., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 45th, 30 Jul. - 4 Aug. 2000, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Numerical simulations are used to predict the cosmic-ray induced background in a passively shielded gas scintillation proportional counter to be used as the focal plane instrument of a balloon-borne hard x-ray telescope system. The predicted background in the 20-75 keV operating range of the detector shows a spectral shape characteristic of a power law photoelectrically absorbed by the stainless steel pressure vessel walls. It is found that the dominant background radiation component is simply cosmic diffuse and atmospheric gamma-ray leakage though there is a contribution from nuclear interactions of energetic particles in the walls and nearby payload structures. The correlation between shielding properties and background flux is examined parametrically

using one-dimensional slab models, within material and weight constraints, in order to optimize predicted sensitivity. The addition of a few mm thick Sn passive shielding reduces the primary photon contribution by up to 50% at the spectral peak, E 150 keV, and adds only negligibly to the flux due to photon production within the high-Z shields at lower energies.
Author
Scintillation Counters; X Ray Telescopes; Radiation Shielding; Mathematical Models

20000038422 NASA Langley Research Center, Hampton, VA USA
1998 NASA High-Speed Research Program Aerodynamic Performance Workshop, Volume 1, Configuration Aerodynamics
McMillin, S. Naomi, Editor, NASA Langley Research Center, USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; 954p; In English; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop, 9-13 Feb. 1998, Los Angeles, CA, USA; See also 20000038423 through 20000038441
Contract(s)/Grant(s): RTOP 537-07
Report No.(s): NASA/CP-1999-209692/VOL1/PT2; L-17758B; NAS 1.55:209692/VOL1/PT2; No Copyright; Avail: CASI; A99, Hardcopy; A10, Microfiche

NASA's High-Speed Research Program sponsored the 1998 Aerodynamic Performance Technical Review on February 9-13, in Los Angeles, California. The review was designed to bring together NASA and industry High-Speed Civil Transport (HSCT) Aerodynamic Performance technology development participants in areas of Configuration Aerodynamics (transonic and supersonic cruise drag prediction and minimization), High-Lift, and Flight Controls. The review objectives were to (1) report the progress and status of HSCT aerodynamic performance technology development; (2) disseminate this technology within the appropriate technical communities; and (3) promote synergy among the scientists and engineers working HSCT aerodynamics. In particular, single and multi-point optimized HSCT configurations, HSCT high-lift system performance predictions, and HSCT simulation results were presented along with executive summaries for all the Aerodynamic Performance technology areas. The HSR Aerodynamic Performance Technical Review was held simultaneously with the annual review of the following airframe technology areas: Materials and Structures, Environmental Impact, Flight Deck, and Technology Integration. Thus, a fourth objective of the Review was to promote synergy between the Aerodynamic Performance technology area and the other technology areas of the HSR Program.
Author
High Speed; Civil Aviation; Aerodynamic Configurations; Optimization; Engine Airframe Integration; Aircraft Design; Supersonic Transports; Computational Fluid Dynamics

20000038423 Boeing Co., Long Beach, CA USA
Aerodynamic Gradients Using Three Methods
Kuruvila, Geojoe, Boeing Co., USA; Hager, James O., Boeing Co., USA; Sundaram, P., Boeing Co., USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 2, pp. 931-977; In English; See also 20000038422; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This paper investigates the relative merits of three methods for computing the gradients of aerodynamic forces with respect to shape design variables. The three methods considered in this study are the finite-difference, the sensitivity equation and the adjoint. The development cost, computing cost, accuracy and overall cycle-time for each of these approaches are addressed.
Author
Aerodynamic Forces; Finite Difference Theory; Gradients; Shape Functions; Optimization; Adjoints

20000038427 Northrop Grumman Corp., USA
Nacelle Airframe Integration Aerodynamic Performance HSR Task 32
Peavey, Charlie, Northrop Grumman Corp., USA; Malone, Michael, Northrop Grumman Corp., USA; Westra, Bryan, Northrop Grumman Corp., USA; Dimanlig, Arsenio, Northrop Grumman Corp., USA; Bard, Bill, Northrop Grumman Corp., USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 2, pp. 1143-1185; In English; See also 20000038422; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The 1997 Bleed Exhaust and Inlet Spillage Assessment study was initiated to develop an understanding of how the propulsion/inlet system affects the aerodynamic performance of the High Speed Civil Transport Technology Concept Airplane (TCA). Boeing subcontracted Northrop Grumman Corporation (NGC) to perform this analysis. The objective of the task was to perform a parametric, viscous, CFD analysis to determine the effects of bleed exhaust and inlet spillage on the external aerodynamics of the TCA. The amount of bleed air exhaust is not significant in the transonic regime and was not included in the subsonic cruise (M=0.9) or transonic climbout (M=1.2) conditions where the spill effects dominate. Likewise, the inlet operates on design (i.e. shock-on-lip) at the supersonic cruise-condition (M=2.4) without

spillage, yet has significant bleed exhaust. Thus two separate investigations could be made. by analyzing the nacelles isolated and the TCA configuration with flow-through nacelles (wind tunnel configuration), a detailed drag build-up could be performed. The first section of this presentation details the bleed exhaust study and the following section discusses the effect of inlet spillage. There was no bypass flow for any of the cases in this study.
Author
Aerodynamic Characteristics; Computational Fluid Dynamics; Supersonic Transports; Aerodynamic Interference; Wing Nacelle Configurations; Aerodynamic Drag

20000038428 NASA Ames Research Center, Moffett Field, CA USA
Propulsion Induced Effects (PIE) Test Program
Cappuccio, Gelsomina, NASA Ames Research Center, USA; Won, Mark J., NASA Ames Research Center, USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 2, pp. 1187-1239; In English; See also 20000038422; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

The Propulsion Induced Effects (PIE) test program is being lead by NASA Ames for Configuration Aerodynamics (CA). Representatives from CA, Technology Integration (TI), Inlet, and the Nozzle ITD's are working with Ames in defining and executing this test program. The objective of the CA 4-14 milestone is to assess the propulsion/airframe integration characteristics of the Technology Concept Airplane (TCA) and design variations using computational and experimental methods. The experimental aspect includes static calibrations, transonic and supersonic wind tunnel testing. The test program will generate a comprehensive database that will include all appropriate wind tunnel corrections, with emphasis placed on establishing the propulsion induced effects on the flight performance of the TCA.
Author
Aerodynamic Configurations; Aircraft Design; Engine Airframe Integration; Wind Tunnel Tests; Supersonic Transports

20000038432 Boeing Commercial Airplane Co., Seattle, WA USA
Nonlinear Cruise-pt. Validation (NCV) Model Wind Tunnel Test Summary & Posttest Analysis
Mejia, Kevin M., Boeing Commercial Airplane Co., USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 2, pp. 1505-1543; In English; See also 20000038422; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This paper provides the transcript of one of the presentations made during the 1998 HSR Biannual Airframe Technical review on February 11, 1998. This presentation reviews the events of the UPWT 1687 wind tunnel test where the HSR Configuration Aerodynamics Nonlinear Cruise-point Validation (NCV) model was tested to validate one of three nonlinear optimization processes for drag reduction. Also covered are the results of several posttest analysis exercises conducted to understand the differences between test data and pretest predictions.
Author
Aerodynamic Configurations; Drag Reduction; Wind Tunnel Tests; Supersonic Transports

20000038435 Boeing Co., Long Beach, CA USA
Effect of Aeroelasticity on the Aerodynamic Performance of the TCA
Kuruvila, George, Boeing Co., USA; Hartwich, Peter M., Boeing Co., USA; Baker, Myles L., Boeing Co., USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 2, pp. 1589-1647; In English; See also 20000038422; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

This paper investigates the effect of static aeroelasticity on the aerodynamic performance of the TCA in the wind-tunnel and in flight. The first part of the paper addresses the impact of wind-tunnel model deformation on the measured and predicted aerodynamic performance of the TCA. The measured model deformations are lofted on to the OML and analyzed using CFD. The results are compared with the wind-tunnel data. The second part of the paper investigates the change in shape and performance of the TCA, during supersonic cruise-climb, due to static aeroelastic effects, using nonlinear aerodynamics and structural interactions. The TCA OML is assumed to be the shape at mid-cruise. Using appropriate correction terms, the need to explicitly know the "jig shape" is alleviated.
Author
Aerodynamic Characteristics; Aeroelasticity; Wind Tunnel Models; Wind Tunnel Tests; Supersonic Transports; Aerodynamic Configurations; Elastic Deformation

20000038438 Boeing Commercial Airplane Co., Seattle, WA USA

Overview of Technology Integration Activities Related to Configuration Aerodynamics

Nelson, Chester P., Boeing Commercial Airplane Co., USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 2, pp. 1757-1776; In English; See also 20000038422; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This paper presents a summary of recent and planned activities under the NASA High Speed Research program Technology Integration task (HSR TI) which are of particular interest to the high speed Configuration Aerodynamics (CA) technical element. The role of high speed aerodynamic design and analysis data supporting the Ti sub-tasks is outlined. The contribution of planned trade studies to the definition of an Optimized Aeroelastic Concept configuration (OAC), and the subsequent integration of the Technology Configuration (TC) planned for late 1998 are reviewed. Key trade studies supporting those efforts include those for Alternate Control Configurations (ACC), planform and propulsion system configuration trades, and high aspect ratio wing integration studies. Results of a typical technology integration sub-task using CFD are shown for the case of assessing the potential excrescence drag penalties of several proposed external configuration features.

Author

Aerodynamic Configurations; Systems Integration; Engine Airframe Integration; Technology Assessment; Supersonic Transports

20000038900 Colorado Univ., Colorado Springs, CO USA

Metamodeling Techniques and Applications ***Final Report, Mar. 1996 - Sep. 1998***

Caughlin, Don; Jan. 2000; 82p; In English

Contract(s)/Grant(s): F30602-96-C-0040; AF Proj. 4594

Report No.(s): AD-A374583; AFRL-IF-RS-TR-2000-1; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

This report represents a compendium of previously published response generated during the conduct of this contract. They describe model abstraction techniques in general; reduced order metamodeling as a specific abstraction technique, and other applications of metamodeling.

DTIC

Software Engineering; System Identification; Wind Tunnel Models

20000039423 Rice Univ., Dept. of Mechanical Engineering and Materials Science, Houston, TX USA

Numerical Simulation of Receptivity for a Transition Experiment, *Oct. 1997 - Nov. 1999*

Collis, S. Scott, Rice Univ., USA; Apr. 25, 2000; 6p; In English

Contract(s)/Grant(s): NAG1-1976; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The cost of fuel to overcome turbulence induced viscous drag on a commercial airplane constitutes a significant fraction of the operating cost of an airline. Achieving laminar flow and maintaining it over a large portion of the wing can significantly reduce the viscous drag, and hence the cost. Design of such laminar-flow-control wings and their practical operation requires the ability to accurately and reliably predict the transition from laminar to turbulent flow. The transition process begins with the conversion of environmental and surface disturbances into the instability waves of the flow by a process called receptivity. The goal of the current research project has been to improve the prediction of transition through a better understanding of the physics of receptivity. The initial objective of this work was to investigate the specific stability and receptivity characteristics of a particular experimental investigation of boundary layer receptivity at NASA Langley. Some simulation results using direct solutions of the linearized Navier-Stokes equations which modeled this experiment where presented in the 1999 APS DFD meeting. However, based on these initial investigations, it became clear that to cover the vast receptivity parameter space required for a practical transition prediction tool, more efficient methods would be required. Thus, the focus of this research was shifted from modeling this particular experiment to formulating and developing new techniques that could efficiently yet accurately predict receptivity for a wide range of disturbance conditions.

Derived from text

Computerized Simulation; Mathematical Models; Navier-Stokes Equation; Boundary Layer Transition; Receiving

20000044552 NASA Glenn Research Center, Cleveland, OH USA

Ice Accretions and Icing Effects for Modern Airfoils

Addy, Harold E., Jr., NASA Glenn Research Center, USA; April 2000; 292p; In English

Contract(s)/Grant(s): RTOP 548-21-23

Report No.(s): NASA/TP-2000-210031; NAS 1.60:210031; E-12228; DOT/FAA/AR-99/89; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

Icing tests were conducted to document ice shapes formed on three different two-dimensional airfoils and to study the effects of the accreted ice on aerodynamic performance. The models tested were representative of airfoil designs in current use for each of the commercial transport, business jet, and general aviation categories of aircraft. The models were subjected to a range of icing conditions in an icing wind tunnel. The conditions were selected primarily from the Federal Aviation Administration's Federal Aviation Regulations 25 Appendix C atmospheric icing conditions. A few large droplet icing conditions were included. to verify the aerodynamic performance measurements, molds were made of selected ice shapes formed in the icing tunnel. Castings of the ice were made from the molds and placed on a model in a dry, low-turbulence wind tunnel where precision aerodynamic performance measurements were made. Documentation of all the ice shapes and the aerodynamic performance measurements made during the icing tunnel tests is included in this report. Results from the dry, low-turbulence wind tunnel tests are also presented.
Author
Deposition; Ice; Aircraft Icing; Two Dimensional Bodies; Airfoils; Aerodynamic Characteristics

20000044616 NASA Langley Research Center, Hampton, VA USA
First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop, Part 1
Wood, Richard M., Editor, NASA Langley Research Center, USA; December 1999; 352p; In English; See also 20000044617 through 20000044630
Contract(s)/Grant(s): RTOP 537-07-20
Report No.(s): NASA/CP-1999-209690/PT1; NAS 1:55:209690/PT1; L-17574A/PT1; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche

This publication is a compilation of documents presented at the First NASA/Industry High Speed Research Configuration Aerodynamics Workshop held on February 27-29, 1996 at NASA Langley Research Center. The purpose of the workshop was to bring together the broad spectrum of aerodynamicists, engineers, and scientists working within the Configuration Aerodynamics element of the HSR Program to collectively evaluate the technology status and to define the needs within Computational Fluid Dynamics (CFD) Analysis Methodology, Aerodynamic Shape Design, Propulsion/Airframe Integration (PAI), Aerodynamic Performance, and Stability and Control (S&C) to support the development of an economically viable High Speed Civil Transport (HSCT) aircraft. to meet these objectives, papers were presented by representative from NASA Langley, Ames, and Lewis Research Centers; Boeing, McDonnell Douglas, Northrop-Grumman, Lockheed-Martin, Vigyan, Analytical Services, Dynacs, and RIACS.
Author
Aerodynamic Characteristics; Aerodynamic Configurations; Civil Aviation; Computational Fluid Dynamics; Supersonic Transports; Government/Industry Relations; Control Stability

20000044617 NASA Langley Research Center, Hampton, VA USA
HSR Aerodynamic Performance Status and Challenges
Gilbert, William P., NASA Langley Research Center, USA; Antani, Tony, McDonnell Douglas Corp., USA; Ball, Doug, Boeing Co., USA; Calloway, Robert L., NASA Langley Research Center, USA; Snyder, Phil, NASA Ames Research Center, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 1, pp. 1-14; In English; See also 20000044616; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper describes HSR (High Speed Research) Aerodynamic Performance Status and Challenges. The topics include: 1) Aero impact on HSR; 2) Goals and Targets; 3) Progress and Status; and 4) Remaining Challenges. This paper is presented in viewgraph form.
CASI
Aerodynamic Characteristics; Civil Aviation; Aerodynamic Configurations; High Speed; Technology Utilization

20000044618 NASA Langley Research Center, Hampton, VA USA
Configuration Aerodynamics: Past - Present - Future
Wood, Richard M., NASA Langley Research Center, USA; Agrawal, Shreekant, McDonnell-Douglas Aerospace, USA; Bencze, Daniel P., NASA Ames Research Center, USA; Kulfan, Robert M., Boeing Commercial Airplane Co., USA; Wilson, Douglas L., Boeing Commercial Airplane Co., USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 1, pp. 15-40; In English; See also 20000044616; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The Configuration Aerodynamics (CA) element of the High Speed Research (HSR) program is managed by a joint NASA and Industry team, referred to as the Technology Integration Development (ITD) team. This team is responsible for the development of a broad range of technologies for improved aerodynamic performance and stability and control characteristics at subsonic

to supersonic flight conditions. These objectives are pursued through the aggressive use of advanced experimental test techniques and state of the art computational methods. As the HSR program matures and transitions into the next phase the objectives of the Configuration Aerodynamics ITD are being refined to address the drag reduction needs and stability and control requirements of High Speed Civil Transport (HSCT) aircraft. In addition, the experimental and computational tools are being refined and improved to meet these challenges. The presentation will review the work performed within the Configuration Aerodynamics element in 1994 and 1995 and then discuss the plans for the 1996-1998 time period. The final portion of the presentation will review several observations of the HSR program and the design activity within Configuration Aerodynamics.
Author
Aerodynamic Configurations; Civil Aviation; Supersonic Transports; Supersonic Flight; Technology Utilization

20000044619 NASA Langley Research Center, Hampton, VA USA
Technology Integration Overview
Coen, Peter G., NASA Langley Research Center, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 1, pp. 41-63; In English; See also 20000044616; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper describes an Overview of Technology Integration. The topics include: 1) Technology Concept Airplane Description; 2) LCAP Overview; and 3) ACE (Aeroelastic Concept Engineering) Overview.
CASI
Technology Assessment; General Overviews; High Speed; Civil Aviation; Systems Integration

20000044621 NASA Langley Research Center, Hampton, VA USA
High-Speed Research Project, 4.3, Aerodynamic Performance
Bharadvaj, Bala, McDonnell-Douglas Aerospace, USA; Fischer, Mike, NASA Langley Research Center, USA; Joslin, Ronald D., NASA Langley Research Center, USA; King, Lyn, NASA Ames Research Center, USA; Parikh, Pradip, Boeing Commercial Airplane Co., USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 1, pp. 81-98; In English; See also 20000044616; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The SLFC (Supersonic Laminar Flow Control) mission is to develop and validate technologies and perform the SLFC aerodynamic design for the HSCT with an assessment of the net benefits and risks.
Derived from text
Laminar Boundary Layer; Supersonic Flow; Civil Aviation; Aerodynamic Configurations; Active Control; High Speed

20000044622 NASA Langley Research Center, Hampton, VA USA
HSR High-Lift Technology Overview
Applin, Z. T., NASA Langley Research Center, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 1, pp. 99-111; In English; See also 20000044616; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

High-lift system performance will have a large impact on airplane noise and weight. Successful completion of PCD1 activities provided greater understanding of aerodynamic characteristics and configuration features important to high-lift system performance including: 1) Reynolds number effects (Ref. H); 2) Propulsion/airframe integration effects; and 3) Planform effects, canard/3-surface, alternate high-lift concepts, etc. PCD2 plans are aimed at achieving technology development performance goals and increasing technology readiness level for Technology Concept.
Derived from text
Technology Assessment; Lift; High Speed; Civil Aviation; Aerodynamic Characteristics; Aerodynamic Configurations

20000044623 NASA Ames Research Center, Moffett Field, CA USA
Experimental Results of the 2.7% Reference H Nacelle Airframe Interference High Speed Civil Transport Model
Cappuccio, Gelsomina, NASA Ames Research Center, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 1, pp. 113-138; In English; See also 20000044616; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Experiments were conducted in the NASA Ames 9-Ft by 7-Ft Supersonic and 11-Ft by 11-Ft Transonic Wind Tunnels of a 2.7% Reference H (Ref. H) Nacelle Airframe Interference (NAI) High Speed Civil Transport (HSCT) model. NASA Ames did the experiment with the cooperation and assistance of Boeing and McDonnell Douglas. The Ref. H geometry was designed by Boeing. The model was built and tested by NASA under a license agreement with Boeing. Detailed forces and pressures of individual components of the configuration were obtained to assess nacelle airframe interference through the transonic and supersonic

flight regime. The test apparatus was capable of measuring forces and pressures of the Wing body (WB) and nacelles. Axisymmetric and 2-D inlet nacelles were tested with the WB in both the in-proximity and captive mode. The in-proximity nacelles were mounted to a nacelle support system apparatus and were individually positioned. The right hand nacelles were force instrumented with flow through strain-gauged balances and the left hand nacelles were pressure instrumented. Mass flow ratio was varied to get steady state inlet unstart data. In addition, supersonic spillage data was taken by testing the 2-D inlet nacelles with ramps and the axisymmetric inlet nacelles with an inlet centerbody for the Mach condition of interest. The captive nacelles, both axisymmetric and 2-D, were attached to the WB via diverters. The captive 2-D inlet nacelle was also tested with ramps to get supersonic spillage data. Boeing analyzed the data and showed a drag penalty of four drag counts for the 2-D compared with the axisymmetric inlet nacelle. Two of the four counts were attributable to the external bevel designed into the 2-D inlet contour. Boeing and McDonnell Douglas used these data for evaluating Computational Fluid Dynamic (CFD) codes and for evaluation of nacelle airframe integration problems and solutions.
Author
Aerodynamic Interference; Civil Aviation; Computational Fluid Dynamics; Supersonic Transports; Wing Nacelle Configurations; Airframes; Transonic Wind Tunnels

20000044624 Boeing Aerospace Co., Seattle, WA USA
HSCT Propulsion Airframe Integration Studies
Chaney, Steve, Boeing Aerospace Co., USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 1, pp. 139-181; In English; See also 20000044616; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The Lockheed Martin spillage study was a substantial effort and is worthy of a separate paper. However, since a paper was not submitted a few of the most pertinent results have been pulled out and included in this paper. The reader is urged to obtain a copy of the complete Boeing Configuration Aerodynamics final 1995 contract report for the complete Lockheed documentation of the spillage work. The supersonic cruise studies presented here focus on the bifurcated - axisymmetric inlet drag delta. In the process of analyzing this delta several test/CFD data correlation problems arose that lead to a correction of the measured drag delta from 4.6 counts to 3.1 counts. This study also lead to much better understanding of the OVERFLOW gridding and solution process, and to increased accuracy of the force and moment data. Detailed observations of the CFD results lead to the conclusion that the 3.1 count difference between the two inlet types could be reduced to approximately 2 counts, with an absolute lower bound of 1.2 counts due to friction drag and the bifurcated lip bevel.
Author
Civil Aviation; Computational Fluid Dynamics; Engine Airframe Integration; Supersonic Transports; Wind Tunnel Tests; Supersonic Inlets

20000044625 Boeing Aerospace Co., Seattle, WA USA
HSCT Nacelle Boundary Layer Diverter Study
Ogg, Steven S., Boeing Aerospace Co., USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 1, pp. 183-195; In English; See also 20000044616; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The objectives of this study were to understand how lift and drag are affected by diverter geometry, to develop a potential diverter geometry for the Technology Concept Airplane (TCA) that increased lift at constant angle of attack and lift to drag ratio, and to provide insight into how the wing camber in the vicinity of the diverters and nacelles should be shaped. The Reference H wing-body configuration was used to study the impact of boundary layer diverter planform shape on aerodynamic characteristics. In order to make the results more applicable to the TCA a systematic variation of nacelle and diverter geometry was performed. The nacelles were first scaled to 673 pps to more accurately match the TCA engine airframe matching. The impact of changing from a purely axisymmetric nacelle to one that has an axisymmetric inlet which transitions to a 2D nozzle was then explored. The diverter planform was then varied with consideration for the wing alone pressure distribution and the geometrical relationship of the 2D nozzle to the wing. Boundary layer diverters, such as the wedge-slab variant of the Reference H configuration tend to dominate the pressure field in the region of the nacelles due to the strong compression field from the wedge and the strong expansion field from the diverter shoulder. An examination using the TRANAIR full potential code of candidate diverters highlights potential areas of improvement in diverter geometry and in wing camber design in the region of the nacelles.
Author
Body-Wing Configurations; Boundary Layers; Civil Aviation; Diverters; Nacelles; Supersonic Transports

20000044626 McDonnell-Douglas Aerospace, Long Beach, CA USA

Analysis of Alternate Inlets and Nacelles for HSCT Configuration

Sundaram, P., McDonnell-Douglas Aerospace, USA; Tinetti, Ana, Eagle Aeronautics, Inc., USA; Arslan, Alan, McDonnell-Douglas Aerospace, USA; Agrawal, Shreekant, McDonnell-Douglas Aerospace, USA; Hartwich, Peter, McDonnell-Douglas Aerospace, USA; Jones, Jay, McDonnell-Douglas Aerospace, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 1, pp. 197-221; In English; See also 20000044616; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper presents the computational investigation of the PAI related study to evaluate various installation parameters in an attempt to minimize the cruise drag of the HSCT configuration with nacelles installed. In particular, an assessment is made of the supersonic cruise point aerodynamic performance of axisymmetric and 2-D inlets installed on the MDC M2.4-7A Opt5 wing/body/ nacelle/diverter (W/B/N/D) geometry. Earlier analysis and experimental study on Ref. H configurations have shown that the installed axisymmetric nacelles have better drag characteristics compared to the 2-D nacelles. However, in that study, the optimum wing/body geometry for each nacelle installation was not determined. The present investigation evaluates the aerodynamic performance of the optimized wing/body geometry accounting for the effects of two inlet concepts, namely the axisymmetric and 2-D inlets. The wing/body configuration chosen for the present investigation is the Opt5 geometry. The nacelles are sized to fit the realistic MFTF A12 engine and are installed with either axisymmetric or 2-D bifurcated inlets. Results of the analysis including nacelle position, nacelle cambering, diverter width, and diverter leading-edge sweep modifications of the baseline Opt5 nacelle configuration are presented. CFL3D Euler analysis showed that the 2-D inlet nacelles have nearly 4.5 counts of higher pressure drag compared to the axisymmetric nacelles before optimization. After wing/body optimization with the nacelle effects, the drag difference increased to 5.2 counts. Examination of the results indicates that adverse nacelle/diverter/wing geometry for the 2-D inlet nacelles may account for a significant part of the drag penalty.

Author

Body-Wing Configurations; Civil Aviation; Nacelles; Supersonic Transports; Intake Systems; Aerodynamic Characteristics; Diverters

20000044627 NASA Lewis Research Center, Cleveland, OH USA

High Speed Civil Transport (HSCT) Isolated Nacelle Transonic Boattail Drag Study and Results Using Computational Fluid Dynamics (CFD)

Midea, Anthony C., NASA Lewis Research Center, USA; Austin, Thomas, McDonnell-Douglas Aerospace, USA; Pao, S. Paul, NASA Langley Research Center, USA; DeBonis, James R., NASA Lewis Research Center, USA; Mani, Mori, McDonnell-Douglas Aerospace, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 1, pp. 223-270; In English; See also 20000044616; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Nozzle boattail drag is significant for the High Speed Civil Transport (HSCT) and can be as high as 25% of the overall propulsion system thrust at transonic conditions. Thus, nozzle boattail drag has the potential to create a thrust-drag pinch and can reduce HSCT aircraft aerodynamic efficiencies at transonic operating conditions. In order to accurately predict HSCT performance, it is imperative that nozzle boattail drag be accurately predicted. Previous methods to predict HSCT nozzle boattail drag were suspect in the transonic regime. In addition, previous prediction methods were unable to account for complex nozzle geometry and were not flexible enough for engine cycle trade studies. A computational fluid dynamics (CFD) effort was conducted by NASA and McDonnell Douglas to evaluate the magnitude and characteristics of HSCT nozzle boattail drag at transonic conditions. A team of engineers used various CFD codes and provided consistent, accurate boattail drag coefficient predictions for a family of HSCT nozzle configurations. The CFD results were incorporated into a nozzle drag database that encompassed the entire HSCT flight regime and provided the basis for an accurate and flexible prediction methodology.

Author

Boattails; Civil Aviation; Computational Fluid Dynamics; Aerodynamic Drag; Nacelles; Supersonic Transports; Transonic Flow

20000044628 McDonnell-Douglas Aerospace, Long Beach, CA USA

Transonic Drag Study for the Installed Ref. H Axisymmetric Nozzle Boattail Configurations

Shieh, Chih Fang, McDonnell-Douglas Aerospace, USA; Jones, Jay, McDonnell-Douglas Aerospace, USA; Agrawal, Shreekant, McDonnell-Douglas Aerospace, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, pp. 271-289; In English; See also 20000044616; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The transonic drag study for the installed Ref. H nozzle boattail was carried out by a NASA/Industry team. The primary objective of this study was to use CFD to estimate the installed nozzle boattail transonic drag for the Ref. H configuration. The nozzle boattail configurations included 2-D (Boeing/Northrop Grumman tasks) and axisymmetric (MDA tasks) configurations. The results of the axisymmetric nozzle boattail study, the MDA tasks, are reported here. The CFL3D Navier-Stokes code with the Bald-

win-Barth turbulence model was used for the axisymmetric nozzle boattail drag study. Two configurations were analyzed: the axi/transonic (boattail angle approximately 14 deg.) and the axi/supersonic boattail angle approximately 2 deg.) configurations. In this study, the CFL3D code was first validated for a 2-D nozzle at transonic condition, the AGARD B.4.2 nozzle, where shock-induced flow separation occurs in the boattail region. Then, the code was further validated for the Ref. H wing/body at M (sub infinity) =0.9 and 1.1 for Re (sub c) = 40 million. In addition, the isolated nozzle boattail drag, and the installed wing/body/nacelle/diverter drag were computed. Based on the CFL3D solutions, the installation and interference drag due to the nacelle installation were calculated. During the course of this study, numerical instability was experienced for all of the cases calculated. Although the numerical instability problem for the AGARD B.4.2 nozzle and the Ref. H wing/body was overcome, the problem for some of the installed nozzle boattail configurations still exists. With the limited converged solutions for the installed axi/transonic configuration, favorable interference between the wing and the nacelle installation was obtained.
Author
Boattails; Body-Wing Configurations; Computational Fluid Dynamics; Transonic Flow; Aerodynamic Drag; Axisymmetric Flow

20000044629 Northrop Grumman Corp., Military Aircraft Systems Div., Pico Rivera, CA USA
Installed Transonic 2D Nozzle Nacelle Boattail Drag Study
Malone, Michael B., Northrop Grumman Corp., USA; Peavey, Charles C., Northrop Grumman Corp., USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 1, pp. 291-320; In English; See also 20000044616; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The Transonic Nozzle Boattail Drag Study was initiated in 1995 to develop an understanding of how external nozzle transonic aerodynamics effect airplane performance and how strongly those effects are dependent on nozzle configuration (2D vs. axisymmetric). MDC analyzed the axisymmetric nozzle. Boeing subcontracted Northrop-Grumman to analyze the 2D nozzle. AU participants analyzed the AGARD nozzle as a check-out and validation case. Once the codes were checked out and the gridding resolution necessary for modeling the separated flow in this region determined, the analysis moved to the installed wing/body/nacelle/diverter cases. The boat tail drag validation case was the AGARD B.4 rectangular nozzle. This test case offered both test data and previous CFD analyses for comparison. Results were obtained for test cases B.4.1 (M=0.6) and B.4.2 (M=0.938) and compared very well with the experimental data. Once the validation was complete a CFD grid was constructed for the full Ref. H configuration (wing/body/nacelle/diverter) using a combination of patched and overlapped (Chimera) grids. This was done to ensure that the grid topologies and density would be adequate for the full model. The use of overlapped grids allowed the same grids from the full configuration model to be used for the wing/body alone cases, thus eliminating the risk of grid differences affecting the determination of the installation effects. Once the full configuration model was run and deemed to be suitable the nacelle/diverter grids were removed and the wing/body analysis performed. Reference H wing/body results were completed for M=0.9 (a=0.0, 2.0, 4.0, 6.0 and 8.0), M=1.1 (a=4.0 and 6.0) and M=2.4 (a=0.0, 2.0, 4.4, 6.0 and 8.0). Comparisons of the M=0.9 and M=2.4 cases were made with available wind tunnel data and overall comparisons were good. The axi-inlet/2D nozzle nacelle was analyzed isolated. The isolated nacelle data coupled with the wing/body result enabled the interference effects of the installed nacelles to be determined. Isolated nacelle mm were made at M=0.9 and M=1.1 for both the supersonic and transonic nozzle settings. AU of the isolated nacelle cases were run at alpha=0. Full configuration runs were to be made at Mach numbers of 0.9, 1.1, and 2.4 (the same as the wing/body and isolated nacelles). Both the isolated nacelles and installed nacelles were run with inlet conditions designed to give zero spillage. This was to be done in order to isolate the boattail effects as much as possible. Full configuration runs with the supersonic nozzles were completed for M=0.9 and 1.1 at a=4.0 and 6.0 (4 runs total) and with the transonic nozzles at M=0.9 and 1.1 at a=2.0, 4.0 and 6.0 (6 runs total). Drag breakdowns were completed for the M=0.9 and M= 1.1 showing favorable interference drag for both cases.
Author
Boattails; Nacelles; Transonic Nozzles; Two Dimensional Flow; Body-Wing Configurations; Computational Fluid Dynamics; Wind Tunnel Tests

20000044630 NASA Langley Research Center, Hampton, VA USA
Afterbody External Aerodynamic and Performance Prediction at High Reynolds Numbers
Carlson, John R., NASA Langley Research Center, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 1, pp. 321-333; In English; See also 20000044616; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This CFD experiment concludes that the potential difference between the flow between a flight Reynolds number test and a sub-scale wind tunnel test are substantial for this particular nozzle boattail geometry. The early study was performed using a

linear k-epsilon turbulence model. The present study was performed using the Girimaji formulation of a algebraic Reynolds stress turbulent simulation.
Derived from text
Afterbodies; High Reynolds Number; Performance Prediction; Aerodynamic Characteristics; Computational Fluid Dynamics; Wind Tunnel Tests

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; aircraft 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.

20000039441 Transportoekonomisk Inst., Oslo, Norway
Cost Benefit Analyses in the Norwegian Aviation Sector ***Samfunnsoekonomiske Analyser innen Luftfart. Del 2. Eksempelsamling***
Brathen, S.; Eriksen, K. S.; Hjelle, H. M.; Killi, M.; Jul. 1999; 86p; In Norwegian
Report No.(s): PB2000-103150; TOI-1134/1999; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

The Norwegian Civil Aviation Administration (NCAA) is responsible for building and operation of the Norwegian airport system, and the air traffic management systems. The report presents the development of a cost benefit analysis (CBA) methodology for the NCAA. Methodological problems are addressed, such as the handling of project risk and uncertainty, and projects with mutual interdependency. The report consist of two parts: Part one is the manual for how and when CBA should be carried out; Part two is a collection of four examples of CBA in the aviation sector.
NTIS
Civil Aviation; Cost Effectiveness; Norway; Airports

20000039694 Nebraska Univ., Omaha, NE USA
Enhancing Global Competitiveness: Benchmarking Airline Operational Performance in Highly Regulated Environments
Bowen, Brent D., Nebraska Univ., USA; Headley, Dean, Wichita State Univ., USA; Kane, Karisa D., Nebraska Univ., USA; Lutte, Rebecca K., Nebraska Univ., USA; Collegiate Aviation Review; October 1999; Volume 17, No. 1, pp. 1-14; In English; See also 20000039693; Copyright; Avail: Issuing Activity

Enhancing competitiveness in the global airline industry is at the forefront of attention with airlines, government, and the flying public. The seemingly unchecked growth of major airline alliances is heralded as an enhancement to global competition. However, like many mega-conglomerates, mega-airlines will face complications driven by size regardless of the many recitations of enhanced efficiency. Outlined herein is a conceptual model to serve as a decision tool for policy-makers, managers, and consumers of airline services. This model is developed using public data for the USA (U.S.) major airline industry available from the U.S. Department of Transportation, Federal Aviation Administration, the National Aeronautics and Space Administration, the National Transportation Safety Board, and other public and private sector sources. Looking at historical patterns of Airline Quality Rating results provides the basis for establishment of an industry benchmark for the purpose of enhancing airline operational performance. Applications from this example can be applied to the many competitive environments of the global industry and assist policy-makers faced with rapidly changing regulatory challenges.
Author
Airline Operations; Commercial Aircraft; Competition; Policies; Safety Management

20000040456 Honeywell Technology Center, Minneapolis, MN USA
Description of the AILS Alerting Algorithm
Samanant, Paul, Honeywell Technology Center, USA; Jackson, Mike, Honeywell Technology Center, USA; May 20000; 88p; In English
Contract(s)/Grant(s): RTOP 576-02-11-17
Report No.(s): NASA/CR-2000-210109; L-10690; NAS1.26:210109; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This document provides a complete description of the Airborne Information for Lateral Spacing (AILS) alerting algorithms. The purpose of AILS is to provide separation assurance between aircraft during simultaneous approaches to closely spaced paral-

lel runways. AILS will allow independent approaches to be flown in such situations where dependent approaches were previously required (typically under Instrument Meteorological Conditions (IMC)). This is achieved by providing multiple levels of alerting for pairs of aircraft that are in parallel approach situations. This document#s scope is comprehensive and covers everything from general overviews, definitions, and concepts down to algorithmic elements and equations. The entire algorithm is presented in complete and detailed pseudo-code format. This can be used by software programmers to program AILS into a software language. Additional supporting information is provided in the form of coordinate frame definitions, data requirements, calling requirements as well as all necessary pre-processing and post-processing requirements. This is important and required information for the implementation of AILS into an analysis, a simulation, or a real-time system.
Author
Algorithms; Programming Languages; Software Development Tools; Spacing

20000040869 Federal Aviation Administration, Washington, DC USA
Aeronautical Information Publication, USA of America, Fifteenth Edition, Dated January 28, 1999. Amendment 2, February 24, 2000
Feb. 24, 2000; 196p; In English
Report No.(s): PB2000-103660; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche
Contents include the following: National Regulations and Requirements; tables and Codes; Services; and Chares for Aerodromes/Heliports and Air Navigation Services.
NTIS
Air Navigation; USA; Civil Aviation; Aeronautical Engineering; Airports

20000041717 Federal Aviation Administration, Washington, DC USA
Notices to Airmen, Domestic/International, February 24, 2000
Feb. 24, 2000; 228p
Report No.(s): PB2000-103643; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche
Contents include the following: Airway Notams; Airports, Facilities, and Procedural Notams; General FDC Notams; Part 95 Revisions to Minimum En Route IFR Altitudes and Changeover Points; International Notices to Airmen; and Graphic Notices.
NTIS
Air Navigation; Runways; Airports; Navigation Aids; Instrument Flight Rules

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes all modes of communication with and between aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information see also 06 Avionics and Aircraft Instrumentation; 17 Space Communications; Spacecraft Communications, Command and Tracking, and 32 Communications and Radar.

20000038331 Hokkaido Univ., Div. of Earth and Planetary Sciences, Sapporo, Japan
GPS Measurement at Summit Peaks of the Taisetsu Mountains, Central Hokkaido, Japan
Koyama, Junji, Hokkaido Univ., Japan; Moriya, Takeo, Hokkaido Univ., Japan; Kaneso, Takayuki, Hokkaido Univ., Japan; Takahashi, Hiroaki, Hokkaido Univ., Japan; Geophysical Bulletin of Hokkaido University; March 2000; ISSN 0439-3503, No. 63, pp. 15-21; In Japanese; Copyright; Avail: Issuing Activity
To investigate the precise crustal deformation in the Taisetsu mountains, Central Hokkaido, Japan, we have conducted GPS survey in-1998 and 1999. The coordinates at summit peaks of the mountain chain, horizontal displacements and strain are evaluated in this period. Major results are summarized as (1) horizontal displacements at summit peaks are about 2cm in the direction of north, (2) horizontal strain is estimated to be compressional in the NW-SE direction. Although the precision of the estimates awaits for the future survey, this results are consistent with the direction of the compressional axes of focal mechanism solutions of local earthquakes in the surrounding region and with the deformation vector by the triangulation in central Hokkaido.
Author
Global Positioning System; Japan; Mountains; Crustal Fractures; Seismology

20000038333 Hokkaido Univ., Inst. of Seismology and Volcanology, Sapporo, Japan
Dense GPS Array Around the Craters of the Tokachi Volcano for Determination of Crustal Deformation
Takahashi, Hiroaki, Hokkaido Univ., Japan; Ichiyanagi, Masayoshi, Hokkaido Univ., Japan; Okazaki, Noritoshi, Geological Sur-

vey of Japan, Japan; Geophysical Bulletin of Hokkaido University; March 2000; ISSN 0439-3503, No. 63, pp. 33-42; In Japanese; Copyright; Avail: Issuing Activity

To investigate the-crustal deformation in and around the craters of the Tokachi volcano, Central Hokkaido, we established a new dense GPS array with 15 sites in 1996 and made temporal observations in April 1998, October 1998 and September 1999. by the data analysis using static and rapid-static methods, site coordinates were collocated from the GSI-BIEI fixed site for each campaign. Displacements of the GSI-HKGS site, about 2.5km from the craters, were small within 2mm on horizontal and 18mm on vertical component in this period. Displacements of another sites also did not exceed the precision of the GPS survey. We concluded remarkable crustal deformation did not occur in this region between April 1998 and September 1999.
Author

Craters; Crustal Fractures; Global Positioning System; Volcanoes; Seismology

20000039219 NASA Marshall Space Flight Center, Huntsville, AL USA

Lab Development for INS/GPS Testing of Launch and Space Vehicles

Schrock, Ken, NASA Marshall Space Flight Center, USA; Freestone, Todd, NASA Marshall Space Flight Center, USA; Bell, Leon, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; International Telemetering Conference, 23-26 Oct. 2000, San Diego, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

NASA Marshall Space Flight Center's experience with different GPS simulators and receivers over the last 10 years has shown a need for testing the receivers in more than just a nominal mission. The Spaceliner 100 program is researching blended INS/GPS data tuned specifically for launch vehicles and orbital deployments. The paper will discuss layout of the testing lab, the test equipment, test scenarios that all receivers will be evaluated under, and a discussion of receiver types planned to test. It will conclude with a discussion of some of the current tests and goals of future testing.
Author

Global Positioning System; Launch Vehicles; Inertial Navigation; Spacecraft Launching; Test Equipment

20000039786 NASA Marshall Space Flight Center, Huntsville, AL USA

ProSEDS Telemetry System Utilization of GPS Position Data for Transmitter Cycling

Kennedy, Paul, NASA Marshall Space Flight Center, USA; Sims, Herb, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; International Telemetering Conference, 23-26 Oct. 2000, San Diego, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

NASA Marshall Space Flight Center will launch the Propulsive Small Expendable Deployer System (ProSEDS) space experiment in late 2000. ProSEDS will demonstrate the use of an electrodynamic tether propulsion system and will utilize a conducting wire tether to generate limited spacecraft power. This paper will provide an overview of the ProSEDS mission and will discuss the design, development and test of the spacecraft telemetry system which utilizes a custom designed GPS subsystem to determine spacecraft position relative to ground station location and to control transmitter on/off cycling based on spacecraft state vector and ground station visibility.
Author

Telemetry; Global Positioning System; Data Bases; Transmitters; Spaceborne Experiments

20000044095 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Dinamika Ionosfer, Jakarta, Indonesia

TEC Determination Using Code Data and Phase Data from GPS Satellites ***Penentuan TEC Dengan Menggunakan Data Kode Dan Data Fase Dari Satelit GPS***

Saroso, Sarmoko, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; July - September 1999; Volume 1, No. 3, pp. 18-25; In Malay-Indonesian; See also 20000044092; Copyright; Avail: Issuing Activity

GPS (Global Positioning System) is a highly accurate global navigation service available to use for all-weather precision navigation by land, sea and air to anybody. Recently, GPS is a valuable tool for many purposes, such as for TEC (Total Electron Content) measurements. Since the GPS Satellites broadcast signals in two frequencies, TEC determination is possible by analyzing the different path delays undergone by the signals in both frequencies. This paper will present an algorithm for TEC determination using dual frequencies GPS pseudorange and carrier phase.
Author

Electron Density (Concentration); Atmospheric Composition; Earth Atmosphere; Algorithms

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.

20000038403 NASA Langley Research Center, Hampton, VA USA

Design of Supersonic Transport Flap Systems for Thrust Recovery at Subsonic Speeds

Mann, Michael J., NASA Langley Research Center, USA; Carlson, Harry W., Lockheed Engineering and Sciences Co., USA; Domack, Christopher S., Lockheed Engineering and Sciences Co., USA; December 1999; 52p; In English

Contract(s)/Grant(s): RTOP 537-09-20-02

Report No.(s): NASA/TP-1999-209536; NAS 1.60:209536; L-17279; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A study of the subsonic aerodynamics of hinged flap systems for supersonic cruise commercial aircraft has been conducted using linear attached-flow theory that has been modified to include an estimate of attainable leading edge thrust and an approximate representation of vortex forces. Comparisons of theoretical predictions with experimental results show that the theory gives a reasonably good and generally conservative estimate of the performance of an efficient flap system and provides a good estimate of the leading and trailing-edge deflection angles necessary for optimum performance. A substantial reduction in the area of the inboard region of the leading edge flap has only a minor effect on the performance and the optimum deflection angles. Changes in the size of the outboard leading-edge flap show that performance is greatest when this flap has a chord equal to approximately 30 percent of the wing chord. A study was also made of the performance of various combinations of individual leading and trailing-edge flaps, and the results show that aerodynamic efficiencies as high as 85 percent of full suction are predicted.

Author

Subsonic Speed; Supersonic Transports; Design Analysis; Flapping; Aerodynamic Configurations

20000038424 Boeing Co., Long Beach, CA USA

CFD-Based Flap Optimization of the TCA in Transonic Flight Conditions

Narducci, Robert P., Boeing Co., USA; Unger, Eric R., Boeing Co., USA; Yeh, David T., Boeing Co., USA; Novean, Michael G., Boeing Co., USA; Sundaram, P., Boeing Co., USA; Magee, Todd E., Boeing Co., USA; Kuruvila, Geojoe, Boeing Co., USA; Martin, Grant L., Boeing Co., USA; Arslan, Alan E., Boeing Co., USA; Agrawal, Shreekant, Boeing Co., USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 2, pp. 979-1041; In English; See also 20000038422; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

Until recently, the emphasis of non-linear aerodynamic shape design for HSCT configurations has been on drag minimization at the supersonic cruise condition. The performance of the aircraft at the transonic flight condition, as well as for the acceleration and deceleration through the subsonic and low supersonic flight regimes, can be much improved with flap deflections. The primary objective of this study was to incorporate CFD simulations and a grid perturbation tool to model flap deflections with optimization theory to determine the flap deflections for least drag at a given flight condition. The procedure leveraged lessons learned from an earlier procedure developed under an Independent Research and Development (IRAD) project at Boeing Long Beach for flap optimization of the M2.4-7A HSCT configuration. Optimization runs were performed at a series of Mach numbers using Euler analyses on a coarse grid. Fine grid Navier-Stokes analyses were performed on baseline and finalized flap configurations to measure a drag reduction. The optimization procedure was validated through testing at the NASA Langley 16-foot transonic wind tunnel.

Author

Aerodynamic Configurations; Computational Fluid Dynamics; Navier-Stokes Equation; Optimization; Supersonic Transports; Flaps (Control Surfaces); Aircraft Design

20000038425 NASA Langley Research Center, Hampton, VA USA

Viscous Design of TCA Configuration

Krist, Steven E., NASA Langley Research Center, USA; Bauer, Steven X. S., NASA Langley Research Center, USA; Campbell, Richard L., NASA Langley Research Center, USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 2, pp. 1043-1069; In English; See also 20000038422; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The goal in this effort is to redesign the baseline TCA configuration for improved performance at both supersonic and transonic cruise. Viscous analyses are conducted with OVERFLOW, a Navier-Stokes code for overset grids, using PEGSUS to com-

pute the interpolations between overset grids. Viscous designs are conducted with OVERDISC, a script which couples OVERFLOW with the Constrained Direct Iterative Surface Curvature (CDISC) inverse design method. The successful execution of any computational fluid dynamics (CFD) based aerodynamic design method for complex configurations requires an efficient method for regenerating the computational grids to account for modifications to the configuration shape. The first section of this presentation deals with the automated regridding procedure used to generate overset grids for the fuselage/wing/diverter/nacelle configurations analysed in this effort. The second section outlines the procedures utilized to conduct OVERDISC inverse designs. The third section briefly covers the work conducted by Dick Campbell, in which a dual-point design at Mach 2.4 and 0.9 was attempted using OVERDISC; the initial configuration from which this design effort was started is an early version of the optimized shape for the TCA configuration developed by the Boeing Commercial Airplane Group (BCAG), which eventually evolved into the NCV design. The final section presents results from application of the Natural Flow Wing design philosophy to the TCA configuration.

Author

Aircraft Design; Viscous Flow; Supersonic Transports; Aerodynamic Configurations; Applications Programs (Computers); Computational Fluid Dynamics; Computational Grids

20000038426 Boeing Co., Long Beach, CA USA

Progress Towards a Multipoint Optimization Procedure

Narducci, Robert P., Boeing Co., USA; Agrawal, Shreekant, Boeing Co., USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 2, pp. 1071-1142; In English; See also 20000038422; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

This paper investigates the relative merits of two multipoint design approaches for the HSCT. In the first, a supersonic cruise point design is used as initial conditions for a flap optimization at the transonic cruise condition. In the second approach, the shape of the HSCT is optimized with considerations of aerodynamic performance at the supersonic and transonic cruise conditions weighed according to its impact on the maximum take-off gross weight (MTOGW). Results using the first approach are presented using the Boeing Long Beach (BLB), and NASA Ames Cycle 2 designs. The impact of the initial configuration shape on transonic cruise performance and flap deflection angles is addressed. An intermediate multipoint design using the second approach is also presented and compared with designs from the first approach.

Author

Supersonic Transports; Optimization; Aircraft Design; Flaps (Control Surfaces); Design Analysis; Aerodynamic Configurations

20000038429 Boeing Co., Long Beach, CA USA

Transonic Installed Nacelle Analyses

Chaney, Steve, Boeing Co., USA; Blom, Gordon, Boeing Co., USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 2, pp. 1241-1363; In English; See also 20000038422; No Copyright; Avail: CASI; A06, Hardcopy; A10, Microfiche

The primary objective for propulsion/airframe integration (PAI) work stated in the planning and control document (PCD) is to develop technology required to support the development of the High Speed Civil Transport (HSCT). The technology development includes: 1) Developing computational and empirical based tools for the aerodynamic design & analysis of complex geometry configurations. This development consists primarily of adapting current state-of-the-art computational fluid dynamics (CFD) codes to the HSCT PAI configurations and conditions. This is followed by validation with wind tunnel or flight aerodynamic data. 2) Identifying the key design variables for HSCT PAI installations with the tools described above. Exercising these variables in parametric or direct design optimization studies in order to develop design guidelines for efficient nacelle installations. These overall three year objectives for sub-task 3 lead to the specific objectives for 1997 as described herein.

Author

Computational Fluid Dynamics; Design Analysis; Engine Airframe Integration; Supersonic Transports; Aerodynamic Configurations

20000038430 Boeing Co., Long Beach, CA USA

Nacelle Diverter Design and Nozzle Boattail Drag Studies

Sundaram, P., Boeing Co., USA; Shieh, Chih F., Boeing Co., USA; Arslan, Alan E., Boeing Co., USA; Wallace, Hoyt, Boeing Co., USA; Agrawal, Shreekant, Boeing Co., USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 2, pp. 1365-1455; In English; See also 20000038422; Original contains color illustrations; No Copyright; Avail: CASI; A05, Hardcopy; A10, Microfiche

The paper presents the results of the various PAI related effort performed during FY97 at Boeing Long Beach (BLB). One of the important studies performed was the TCA nacelle diverter parametric shape modifications carried out to improve the TCA baseline nacelle installation drag. CFL3D Navier-Stokes solutions for wing/body/nacelle/diverter configurations incorporating simple shape modifications to the TCA baseline nacelles and diverters have been obtained at the supersonic cruise Mach number of M(sub infinity) = 2.4 for Re(sub c) = 212 million. These shape modifications, called N/D cycle 1, kinked the inboard and outboard nacelles to align the local flow at the nacelle inlet face and pitched the inboard nacelle to reduce the diverter volume by lowering the diverter leading-edge height requirement of 0.14% boundary layer run. The N/D cycle 1 design reduced the TCA baseline drag by nearly 1.2 count at the Right Reynolds number and 1.4 counts at the wind-tunnel Reynolds number (Re(sub c) = 6.36 million). The paper also describes the successful completion of the CFL3D Navier-Stokes solutions for the Reference H installed transonic nozzle boattail configurations for axisymmetric and 2-D powered nozzles at both the transonic and reference settings. These installed nozzle computations were obtained on parallel platforms using the CFL3Dhp code with a fast turn-around time. Using these solutions, the jet effects on the aftbody for the axisymmetric nozzles at transonic Mach numbers of M(sub infinity) = 0.9 and 1.1 were calculated. Finally, the paper also presents the isolated nozzle study that investigated the effect of turbulence models on the nozzle boattail pressures. This study provided an insight into CFL3D Navier-Stokes solutions for powered nozzle simulations.
Author
Aerodynamic Configurations; Navier-Stokes Equation; Engine Airframe Integration; Supersonic Transports; Computerized Simulation; Computational Fluid Dynamics

20000038431 NASA Ames Research Center, Moffett Field, CA USA
Model 2b Test Results
Goodsell, Aga M., NASA Ames Research Center, USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 2, pp. 1461-1503; In English; See also 20000038422; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This activity is part of the Wind Tunnel Database and Wind Tunnel Data Corrections Programs. The main purpose of this test was to evaluate the aerodynamic performance of the TCA Baseline configuration around the supersonic cruise point.
Author
Aerodynamic Characteristics; Wind Tunnel Tests; Supersonic Transports

20000038433 NASA Langley Research Center, Hampton, VA USA
Aftbody Closure Model Design: Lessons Learned
Capone, Francis J., NASA Langley Research Center, USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 2, pp. 1545-1568; In English; See also 20000038422; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

An Aftbody Closure Test Program is necessary in order to provide aftbody drag increments that can be added to the drag polars produced by testing the performance models (models 2a and 2b). These models had a truncated fuselage, thus, drag was measured for an incomplete configuration. In addition, trim characteristics cannot be determined with a model with a truncated fuselage. The stability and control tests were conducted with a model (model 20) having a flared aftbody. This type aftbody was needed in order to provide additional clearance between the base of the model and the sting. This was necessary because the high loads imposed on the model for stability and control tests result in large model deflections. For this case, the aftbody model will be used to validate stability and control performance.
Author
Aircraft Models; Aerodynamic Configurations; Wind Tunnel Models; Wind Tunnel Tests; Supersonic Transports; Afterbodies; Aircraft Design

20000038434 NASA Langley Research Center, Hampton, VA USA
HSR Model Deformation Measurements from Subsonic to Supersonic Speeds
Burner, A. W., NASA Langley Research Center, USA; Erickson, G. E., NASA Langley Research Center, USA; Goodman, W. L., NASA Langley Research Center, USA; Fleming, G. A., NASA Langley Research Center, USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 2, pp. 1569-1588; In English; See also 20000038422; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This paper describes the video model deformation technique (VMD) used at five NASA facilities and the projection moire interferometry (PMI) technique used at two NASA facilities. Comparisons between the two techniques for model deformation measurements are provided. Facilities at NASA-Ames and NASA-Langley where deformation measurements have been made

are presented. Examples of HSR model deformation measurements from the Langley Unitary Wind Tunnel, Langley 16-foot Transonic Wind Tunnel, and the Ames 12-foot Pressure Tunnel are presented. A study to improve and develop new targeting schemes at the National Transonic Facility is also described. The consideration of milled targets for future HSR models is recommended when deformation measurements are expected to be required. Finally, future development work for VMD and PMI is addressed. Author

Moire Interferometry; Elastic Deformation; Wind Tunnel Tests; Photogrammetry; Wind Tunnel Models

20000038437 Boeing Co., Long Beach, CA USA

Initial Predictions of Canard Integration

Magee, Todd E., Boeing Co., USA; Hager, James O., Boeing Co., USA; Yeh, David T., Boeing Co., USA; Haynes, Tim, DYNACS Engineering Co., Inc., USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 2, pp. 1671-1755; In English; See also 20000038422; No Copyright; Avail: CASI; A05, Hardcopy; A10, Microfiche

This paper presents the initial CFD predictions obtained by Boeing Long Beach (BLB) and Dynacs Engineering Company for the integration of a canard on the TCA (Technology Concept Aircraft) wing/body configuration. Each company analyzed different canard configurations. Boeing analyzed the PTC (Preliminary Technology Concept) canard planform, while Dynacs focused on the ACC (Alternate Controls Concept) canard planform. Euler and Navier-Stokes solutions are presented in this paper. The results from both analyses were used to define a wind-tunnel test program, that is outlined in the paper. The results indicate that the PTC planform has a small impact on the wing/body/canard performance. The ACC planform has greater impact on the wing/body/canard performance, because of its close proximity to the wing and its larger planform size.
Author

Aircraft Configurations; Body-Wing Configurations; Canard Configurations; Computational Fluid Dynamics; Navier-Stokes Equation; Planforms; Wind Tunnel Tests; Euler Equations of Motion

20000038439 Boeing Commercial Airplane Co., Seattle, WA USA

Cross-Discipline Evaluation of Optimized Designs and Features

Vegter, Chris A., Boeing Commercial Airplane Co., USA; Stanislaw, Greg S., Boeing Commercial Airplane Co., USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 2, pp. 1777-1796; In English; See also 20000038422; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The NCV (optimized TCA geometry) contains many features which are different from the TCA. Some of the more obvious differences are the body cross sectional shape changes, the wing shear (or gulling), and the span-wise curvature variations (bumps). One of the drawbacks of the optimization, is that it proceeds in the direction of lowest drag, whether the shape change results in a large or small drag improvement. Some of the features have impact on other disciplines. It was unknown which of the features were contributing significantly to the drag reduction. The purpose of this study was to better understand the drag benefits of the various features, and how those features affect the other disciplines.
Author

Drag Reduction; Supersonic Transports; Optimization; Aerodynamic Configurations; Aerodynamic Drag

20000038441 NASA Ames Research Center, Moffett Field, CA USA

CFD Data Generation Process for Nonlinear Loads

Arslan, Alan, Boeing Co., USA; Magee, Todd, Boeing Co., USA; Unger, Eric, Boeing Co., USA; Hartwich, Peter, Boeing Co., USA; Agrawal, Shreekant, Boeing Co., USA; Giesing, Joseph, Boeing Co., USA; Bharadvaj, Bala, Boeing Co., USA; Chaderjian, Neal, NASA Ames Research Center, USA; Murman, Scott, NASA Ames Research Center, USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 2, pp. 1817-1871; See also 20000038422; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

This paper discusses the development of a process to generate a CFD database for the non-linear loads process capability for critical loads evaluation at Boeing Long Beach. The CFD simulations were performed for wing/body configurations at high angles of attack and Reynolds numbers with transonic and elastic deflection effects. Convergence criteria had to be tailored for loads applications rather than the usual drag performance. The time-accurate approach was subsequently adopted in order to improve convergence and model possible unsteadiness in the flowfield. In addition, uncertainty issues relating to the turbulence model and grid resolution in areas of high vortical flows were addressed and investigated for one of the cases.
Author

Body-Wing Configurations; Computational Fluid Dynamics; Critical Loading; Data Bases; Computerized Simulation; Supersonic Transports

20000042895 Range Commanders Council, White Sands Missile Range, NM USA

Range Safety Criteria for Unmanned Air Vehicles

Dec. 1999; 21p; In English

Report No.(s): AD-A375224; RCC-323-99; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This document provides a common approach for the Range Commander to make decisions regarding Unmanned Air Vehicle flight operations. The use of this tool depends on the needs of the Range Commander. The five criteria are described in this document along with the conditions necessary to meet the criteria.

DTIC

Range Safety; Pilotless Aircraft; Flight Operations

20000043604 Northrop Corp., Aircraft Div., Hawthorne, CA USA

Maximum Normalized Rate as a Flying Qualities Parameter

Onstott, E. D., Northrop Corp., USA; Warner, J. S., Northrop Corp., USA; Hodgkinson, J., Northrop Corp., USA;]1984]; 28p; In English; 20th; Manual Control Conference, 12-14 Jun. 1984, Moffett Field, VA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Discrete attitude commands have become a standard task for flying qualities evaluation and control system testing. Much pilot opinion data is now available for ground-based and in-flight simulations, but adequate performance measures and prediction methods have not been established. The Step Target Tracking Prediction method, introduced in 1978, correlated time-on-target and rms tracking data with NT-33 in-flight longitudinal simulations, but did not employ parameters easily measured in manned flight and simulation. Recent application of the Step Target Tracking Prediction method to lateral flying qualities analysis has led to a new measure of performance. This quantity, called Maximum Normalized Rate (MNR), reflects the greatest attitude rate a pilot can employ during a discrete maneuver without excessive overshoot and oscillation. MNR correlates NT-33 lateral pilot opinion ratings well, and is easily measured during night test or simulation. Furthermore, the Step Target MNR method can be used to analyze large amplitude problems concerning rate limiting and nonlinear aerodynamics.

Author

Flight Characteristics; In-Flight Simulation; Prediction Analysis Techniques; Quality; Performance Prediction

06
AVIONICS AND AIRCRAFT INSTRUMENTATION

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.

20000041753 NASA Dryden Flight Research Center, Edwards, CA USA

Development of a Flush Airdata Sensing System on a Sharp-Nosed Vehicle for Flight at Mach 3 to 8

Davis, Mark C., NASA Dryden Flight Research Center, USA; Pahle, Joseph W., NASA Dryden Flight Research Center, USA; White, John Terry, NASA Dryden Flight Research Center, USA; Marshall, Laurie A., NASA Dryden Flight Research Center, USA; Mashburn, Michael J., Micro Craft, Inc., USA; Franks, Rick, Sverdrup Technology, Inc., USA; May 2000; 25p; In English; 38th; 38th Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 522-51-54

Report No.(s): NASA/TM-2000-209017; NAS 1.15:209017; H-2396; AIAA Paper 2000-0504; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA Dryden Flight Research Center has developed a flush airdata sensing (FADS) system on a sharp-nosed, wedge-shaped vehicle. This paper details the design and calibration of a real-time angle-of-attack estimation scheme developed to meet the onboard airdata measurement requirements for a research vehicle equipped with a supersonic-combustion ramjet engine. The FADS system has been designed to perform in flights at speeds between Mach 3 and Mach 8 and at angles of attack between -6 deg. and 12 deg. The description of the FADS architecture includes port layout, pneumatic design, and hardware integration. Predictive models of static and dynamic performance are compared with wind-tunnel results across the Mach and angle-of-attack range. Results indicate that static angle-of-attack accuracy and pneumatic lag can be adequately characterized and incorporated into a real-time algorithm.
Author
Mach Number; Research Vehicles; Supersonic Combustion Ramjet Engines; Wind Tunnel Tests; Air Data Systems; Design Analysis; Detection

20000044327 NASA Marshall Space Flight Center, Huntsville, AL USA
Using Modern Design Tools for Digital Avionics Development
Hyde, David W., NASA Marshall Space Flight Center, USA; Lakin, David R., II, NASA Marshall Space Flight Center, USA; Asquith, Thomas E., NASA Marshall Space Flight Center, USA; [2000]; 2p; In English; 19th; 19th Digital Avionics System Conference, 7-12 Oct. 2000, Philadelphia, PA, USA
Contract(s)/Grant(s): RTOP 477-72-W3; No Copyright; Avail: Issuing Activity; Abstract Only

Using Modem Design Tools for Digital Avionics Development Shrinking development time and increased complexity of new avionics forces the designer to use modem tools and methods during hardware development. Engineers at the Marshall Space Flight Center have successfully upgraded their design flow and used it to develop a Mongoose V based radiation tolerant processor board for the International Space Station's Water Recovery System. The design flow, based on hardware description languages, simulation, synthesis, hardware models, and full functional software model libraries, allowed designers to fully simulate the processor board from reset, through initialization before any boards were built. The fidelity of a digital simulation is limited to the accuracy of the models used and how realistically the designer drives the circuit's inputs during simulation. by using the actual silicon during simulation, device modeling errors are reduced. Numerous design flaws were discovered early in the design phase when they could be easily fixed. The use of hardware models and actual MIPS software loaded into full functional memory models also provided checkout of the software development environment. This paper will describe the design flow used to develop the processor board and give examples of errors that were found using the tools. An overview of the processor board firmware will also be covered.
Author
Circuits; Computer Programming; Computer Programs; Digital Simulation; Hardware Description Languages; Simulation; Water Reclamation

07
AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; 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.

20000038440 Boeing Commercial Airplane Co., Seattle, WA USA
TRANAIR Applications for Technology Integration Propulsion Trades
Dees, Paul W., Boeing Commercial Airplane Co., USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 2, pp. 1797-1816; In English; See also 20000038422; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

Propulsion trade studies often require rapid, inexpensive drag increments between several candidate geometries. Typically a linear potential analysis tool such as A389 is used to get a quick and reasonable drag impact. Some configuration analyses require a tool with the ability to quickly evaluate complex 3D geometry changes. The TRANAIR 3D full potential CFD code offers the capability to evaluate more complex geometry with less cost than the OVERFLOW Navier-Stokes CFD code. It is well validated with experimental test data. TRANAIR was recently applied as a preliminary design tool to support the TI Task 20 nozzle aspect ratio trade study. This paper compares A389, TRANAIR, and OVERFLOW nacelle pressure drag for the TCA configuration with

2D bifurcated and axi-symmetric nacelles. Several 2D nacelle nozzle aspect ratio analyses will be discussed including the high speed drag results.
Author
Computational Fluid Dynamics; Pressure Drag; Supersonic Transports; Drag Measurement; Wing Nacelle Configurations

08
AIRCRAFT STABILITY AND CONTROL

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

20000038436 Boeing Co., Long Beach, CA USA
Initial TCA Stability and Control Assessment
Blake, David A., Boeing Co., USA; Glessner, Paul T., Boeing Co., USA; Kubiatko, Paul, Boeing Co., USA; Nishida, Brian A., Boeing Commercial Airplane Co., USA; Wilson, Douglas L., Boeing Commercial Airplane Co., USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 2, pp. 1649-1670; In English; See also 20000038422; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This presentation documents work performed by the Stability and Control groups at the Boeing Company in both Seattle and Long Beach. This work along with the delivery of the corresponding report completed Configuration Aerodynamics Milestone 4-13. There were two main objectives for this milestone. The first was to assess the high speed Stability and Control (S&C) characteristics of the TCA. The second was to make inputs to help guide future updates of the High Speed Civil Transport. The approach proposed included the evaluation of flying qualities of the TCA for specific Flying Qualities Requirements. An experimental and computational database would be generated and incorporated into a computer simulation to evaluate the S&C characteristics. Due to proposed configuration changes to the baseline, the Flight Controls ITD team abandoned plans for a full-flight envelope nonlinear simulation. Therefore, both rigid and elastic airplane comparisons between the TCA and Reference H were used in order to perform the assessment. With regards to pitch stability, two items were of concern. The first involved significant pitch-up at higher angles-of-attack for the TCA while no pitch-up was observed for the Reference H. The second item was the dramatic impact on the Time-to-Double (T(sub 2)) values for the TCA. Compared to a (T(sub 2)) of 6 seconds for the Reference H, the TCA had a (T(sub 2))of between 1 and 2 seconds at cruise angle-of-attack and less at higher angles-of-attack. The TCA appears to have about 80% of the lateral control authority of the Reference H. With new proposed changes to the time-to-bank requirements, the TCA should have acceptable control authority for this critical maneuver. Similar to the Reference H, the TCA will also not be able to meet the emergency decent requirements using only spoiler slot deflectors for the speedbrake function.
Author
Flight Control; Supersonic Transports; Aircraft Stability; Flight Characteristics; Aerodynamic Configurations

20000038742 NASA Langley Research Center, Hampton, VA USA
Active Control Technology at NASA Langley Research Center
Antcliff, Richard R., NASA Langley Research Center, USA; McGowan, Anna–Marie R., NASA Langley Research Center, USA; [2000]; 16p; In English; Active Control Technology for Enchanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles, 8-11 May 2000, Braunschweig, Germany; Sponsored by North Atlantic Treaty Organization, Unknown; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA Langley has a long history of attacking important technical opportunities from a broad base of supporting disciplines. The research and development at Langley in this subject area range from the test tube to the test flight. The information covered here will range from the development of innovative new materials, sensors and actuators, to the incorporation of smart sensors and actuators in practical devices, to the optimization of the location of these devices, to, finally, a wide variety of applications of these devices utilizing Langley's facilities and expertise. Advanced materials are being developed for sensors and actuators, as well as polymers for integrating smart devices into composite structures. Contributions reside in three key areas: computational materials; advanced piezoelectric materials; and integrated composite structures. The computational materials effort is focused on developing predictive tools for the efficient design of new materials with the appropriate combination of properties for next generation smart airframe systems. Research in the area of advanced piezoelectrics includes optimizing the efficiency, force output, use temperature, and energy transfer between the structure and device for both ceramic and polymeric materials. For structural health monitoring, advanced non-destructive techniques including fiber optics are being developed for detection of delaminations, cracks and environmental deterioration in aircraft structures. The computational materials effort is focused on developing predictive tools for the efficient design of new materials with the appropriate combination of properties for next generation smart air-

frame system. Innovative fabrication techniques processing structural composites with sensor and actuator integration are being developed.
Derived from text
Active Control; Technology Assessment; Aircraft Structures; Composite Structures; Fabrication; Fiber Optics; Piezoelectricity

20000041704 Calspan Advanced Technology Center, Buffalo, NY USA
Effects of Control System Dynamics on Fighter Approach and Landing Longitudinal Flying Qualities, Volume 1 ***Interim Report, Jun. 1977 - Mar. 1978***
Smith, Rogers E., Calspan Advanced Technology Center, USA; March 1978; 234p; In English
Contract(s)/Grant(s): F33615-73-C-3051; AF Proj. 2403
Report No.(s): AK-5280-F-12-Vol-1; AFFDL-TR-78-122-Vol-1; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The effects of significant control system dynamics on fighter approach and landing longitudinal flying qualities were investigated in flight using the USAF/Calspan variable stability NT-33 aircraft. Two pilots evaluated 49 different combinations of control system and short period dynamics while performing representative approach and landing tasks. The landing task for the majority of the evaluations included an actual touchdown. Pilot rating and comment data, supported by task performance records, indicate that the landing task, in particular the last 50 ft of the task, is clearly critical task for aircraft with significant control system lags. For these aircraft, a sharp degradation in flying qualities takes place during this critical phase of the landing task; for example, severe pilot induced oscillations occurred during the landing task but were not in evidence during the approach task. The results provide a data base for the development of suitable flying qualities requirements which are applicable to aircraft with significant control system dynamics; the results show that the present landing approach requirements in MIL-F-8785B(ASG) are not adequate; in particular, they are not applicable to aircraft with complex flight control systems.
Author
Approach; Flight Control; Aircraft Landing; Longitudinal Control; Fighter Aircraft; Aerodynamics

09
RESEARCH AND SUPPORT FACILITIES (AIR)

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

20000038519 Institute for Human Factors TNO, Soesterberg, Netherlands
A Critical Review of Validation Methods for Man-In-The-Loop Simulators ***Interim Report Een Kritisch Overzicht van Validatiemethoden voor Man-in-the Loop Simulatoren***
Korteling, J. E., Institute for Human Factors TNO, Netherlands; Sluimer, R. R., Institute for Human Factors TNO, Netherlands; Mar. 16, 1999; 40p; In English
Contract(s)/Grant(s): A98/KL/301; TNO Proj. 730.3
Report No.(s): TD-99-0026; TM-99-A023; Copyright; Avail: Issuing Activity

This review examines the methodological concepts, paradigms and pitfalls related to validation- and fidelity studies of man-in-the-loop simulators. A distinction is made between validation methods for training simulators and for research simulators. Validation methods for training simulator are applied in experiments which assess effects of simulator variables (e.g. resolution of the display, cue augmentation, moving base characteristics) on the effectiveness of a simulator as a training device. Validation methods for research simulators are applied in experiments which assess the effects of simulator variables an the effectiveness of a simulator as a research tool. The review is particularly focussed on the various artefacts that may affect the outcome of such validation experiments. The artefacts are separately described for each single validation method. It will be demonstrated that validation of simulators is a very complicated matter and prone to various methodological flaws and confounding factors. After the discussion of the common methods including their advantages and disadvantages the following recommendations for future research are given: 1 . Terminology in the field of simulator research is ambiguous. It is advised to standardize terms, which will lead to more comprehensible communication among researchers. 2. Validity is not a single, independent attribute, The term validity in simulator research only makes sense if related to functional aspects of simulators, such as the purpose of the simulator (training, research) and the tasks and training methods involved. This will reduce the amount of overgeneralizations that are now encountered too frequently. 3. Always take face validity into consideration. If people do not believe in the simulator they are not very likely to use it properly. 4. Apply more than one method in a simulator validity study. Combination of e.g. objective with subjective methods reduces the risk of erroneous conclusions and combines the benefits of both kinds of methods. 5. Aim more

research at creating task-specific formulas, which relate physical simulator variables to psycho-physical and human performance variables. This will reduce the need to measure human task performance in simulator validation studies. 6. Always allocate substantial effort to find a practical method that still compares simulator performance with on-the-job performance by subjects. A relatively simple and practical method is proposed to assess the effectiveness of a driving simulator training.
Author
Procedures; Education; Human Performance; Simulators; Training Simulators

20000039438 Federal Aviation Administration, William J. Hughes Technical Center, Atlantic City, NJ USA
Year 2000 Test Report for the Airport Movement Area Safety System (AMASS)
Livings, Jeffrey; Feb. 2000; 22p; In English
Report No.(s): AD-A374584; DOT/FAA/CT-TN99/3; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This test report documents the tests performed on the Airport Movement Area Safety System (AMASS) to ensure that the system is Year 2000 compliant. The AMASS is an enhancement to the Airport Surface Detection Equipment (ASDE-3) AMASS receives digitized radar data, synchronization data, and a time/date stamp from the ASDE. AMASS does not process the ASDE data/time information but only logs the event. AMASS does not transmit time or date information to the ASDE or any other system. AMASS also receives digitized beacon radar data through its Terminal Automation Interface Unit (TAIU) . The TAIU receives data from the Airport Surveillance Radar (ASR-9) . There is no date information transferred to or from the AMASS TAIU interface. The AMASS system has met all of the Year 2000 compliance criteria. Additional checks have been added to the AMASS acceptance data package (ADP) which will insure that the built-in operating system (BIOS) of each production AMASS will be compliant. The Surveillance Branch, ACT-310, recommends certifying the AMASS as Year 2000 compliant.
DTIC
Airport Surface Detection Equipment; Safety; Search Radar

20000039705 Technische Hochschule, Institut fuer Raumfahrtsysteme, Stuttgart, Germany
Diagnostic Tools for Plasma Wind Tunnels and Reentry Vehicles at the IRS
Auweter–Kurtz, Monika, Technische Hochschule, Germany; Feigl, Markus, Technische Hochschule, Germany; Winter, Michael, Technische Hochschule, Germany; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 2B-1 - 2B-78; In English; See also 20000039703; Copyright Waived; Avail: CASI; A05, Hardcopy

Various plasma wind tunnels have been built for developing reusable space transportation systems and space probes entering the atmospheres of celestial bodies. All together they cover almost the whole reentry trajectory of a space craft. They generate continuous plasma flows of high specific enthalpy and velocity with thermal or magnetoplasmadynamic generators. Plasma wind tunnels are used for: (1) development and qualification of radiation and ablative cooling materials and thermal protection systems, (2) validation of numerical codes for reentry prediction, and (3) development and qualification of reentry measurement devices. The accuracy of the simulation of reentry conditions strongly depends on the ability to determine the flow conditions. These three lectures give an overview of the diagnostic methods which are qualified and in use at the IRS. Both intrusive probe measurement techniques (part A) including mass spectrometry and non-intrusive, optical techniques (part B) such as emission spectroscopy and laser induced fluorescence (LIF) are used to investigate high enthalpy plasma flows. Several measurement techniques are being developed for flight application (see part C). The minimum set of parameters which have to be duplicated during the tests for material qualification are the specific enthalpy of the gas, the stagnation pressure and the surface temperature in the case of a radiation cooling material, or the heat flux for an ablative material. This is a minimum set of parameters which has to be adjusted during the test. A whole series of probes and non-intrusive techniques were developed to determine these parameters. The average specific enthalpy of the flow in the exit plane of the plasma generator nozzle can be derived for all kinds of plasma wind tunnels by an energy balance. Therefore, the electric power consumed by the plasma source, the mass flow rate and the heat losses within the plasma generator are measured. The average specific enthalpy at the end of the plasma generator is then derived as the difference of the electrical power and the total heat loss related to the mass flow rate.
Author
Emission Spectra; Laser Induced Fluorescence; Magnetohydrodynamic Flow; Mathematical Models; Nonintrusive Measurement; Thermal Protection; Wind Tunnels; Simulation

20000039708 Rouen Univ., Centre National de la Recherche Scientifique, France

Overview of Measurement Techniques at CORIA

Robin, L., Rouen Univ., France; Boubert, P., Rouen Univ., France; Bourdon, A., Rouen Univ., France; Bultel, A., Rouen Univ., France; vanOotegem, B., Rouen Univ., France; Vervisch, P., Rouen Univ., France; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 4A-1 - 4A-14; In English; See also 20000039703; Copyright Waived; Avail: CASI; A03, Hardcopy

At CORIA, three wind tunnels have been built up to simulate reentry conditions of different planetary atmospheres. They have been implemented by numerous optical and probe measurement techniques to carry out flow parameters to improve understanding of the aerodynamic behavior and chemical processes.

Author

Wind Tunnels; Fabrication; Aerodynamic Characteristics; Flow Characteristics; Optical Measurement

20000039718 Technische Hochschule, Institut fuer Raumfahrtsysteme, Stuttgart, Germany

Overview of IRS Plasma Wind Tunnel Facilities

Auweter–Kurtz, Monika, Technische Hochschule, Germany; Wegmann, Thomas, Technische Hochschule, Germany; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 2A-1 - 2A-20; In English; See also 20000039703; Copyright Waived; Avail: CASI; A03, Hardcopy

Upon entering the atmosphere of celestial bodies, spacecrafts encounter gases at velocities of more than ten km/s, thereby being subjected to great heat loads. The Artist's concept of X-38 reentering Earth's atmosphere are shown. The X-38 is a technology demonstrator for the proposed Crew Return Vehicle (CRV), which will be designed for an emergency return from the International Space Station.

Derived from text

Celestial Bodies; Proving; X-38 Crew Return Vehicle; Temperature Effects; Reentry Vehicles

20000042294 NASA Johnson Space Center, Houston, TX USA

Bioregenerative Planetary Life Support Systems Test Complex (BIO-Plex): NASA's Next Human-Rated Testing Facility

Tri, Terry O., NASA Johnson Space Center, USA; Nov. 28, 1999; 1p; In English, 28-30 Nov. 1999, Malmo, Sweden; Sponsored by Lund Technical Univ., Sweden

Contract(s)/Grant(s): RTOP 131-50-10-24; No Copyright; Avail: Issuing Activity; Abstract Only

As a key component in its ground test bed capability, NASA's Advanced Life Support Program has been developing a large-scale advanced life support test facility capable of supporting long-duration evaluations of integrated bioregenerative life support systems with human test crews. This facility-targeted for evaluation of hypogravity compatible life support systems to be developed for use on planetary surfaces such as Mars or the Moon-is called the Bioregenerative Planetary Life Support Systems Test Complex (BIO-Plex) and is currently under development at the Johnson Space Center. This test bed is comprised of a set of interconnected chambers with a sealed internal environment which are outfitted with systems capable of supporting test crews of four individuals for periods exceeding one year. The advanced technology systems to be tested will consist of both biological and physicochemical components and will perform all required crew life support functions. This presentation provides a description of the proposed test "missions" to be supported by the BIO-Plex and the planned development strategy for the facility.

Author

Planetary Surfaces; Closed Ecological Systems; NASA Programs; Test Facilities

20000044620 NASA Langley Research Center, Hampton, VA USA

Wind Tunnel Test Technique and Instrumentation Development at LaRC

Putnam, Lawrence E., NASA Langley Research Center, USA; First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop; December 1999, Part 1, pp. 65-79; In English; See also 20000044616; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

LaRC has an aggressive test technique development program underway. This program has been developed using 3rd Generation R&D management techniques and is a closely coordinated program between suppliers and wind tunnel operators- wind tunnel customers' informal input relative to their needs has been an essential ingredient in developing the research portfolio. An attempt has been made to balance this portfolio to meet near term and long term test technique needs. Major efforts are underway to develop techniques for determining model wing twist and location of boundary layer transition in the NTF (National Transonic Facility). The foundation of all new instrumentation developments, procurements, and upgrades will be based on uncertainty analysis.

Derived from text

Research and Development; Wind Tunnel Tests; Measuring Instruments; Management Methods

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.

20000044002 Air Force Space Battlelab, Schriever AFB, CO USA
Space Object Identification in Living Color (SILC), *22 Jan. 1999 - 29 Feb. 2000*
Trimble, James D., Air Force Space Battlelab, USA; Mar. 23, 2000; 12p; In English
Report No.(s): AD-A375479; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

SILC is a low cost method of multi-color photometry that is utilized to enhance the Space Object Identification (SOI) capability. Currently, USSPACECOM has two radar systems to conduct deep space object identification, which are located in one area of the globe; this limits USSPACECOM global coverage. USSPACECOM also has three Electro-optic ground based deep space surveillance systems that are strategically located around the world. However, they provide only the gross stability of a satellite. This measurement is of limited value to USSPACECOM. The demonstration of SILC shows that GEODSS could use multi color photometry to identify satellites down to their bus class; this is a tremendous leap for SOI capabilities.
DTIC
Photometry; Space Missions

13
ASTRODYNAMICS

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

20000038360 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Satellite Attitude Determination With Use of the On Board Imaging Camera: A Computer Simulation *O Uso da Camera Imageadora a Bordo de Satelites Para Determinacao de Atitude: Simulacao Computacional*
VicentedeBrum, Antonio Gil, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 126p; In Portuguese
Report No.(s): INPE-7265-TDI/707; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The growing need for a better quality in satellite images, in terms of image resolution, is also translated as requirements of a still better accuracy in the satellite control and attitude determination. Due to this, the search for solutions that could supply these needs is still far from its end. This work main concern is the possibility and viability of using the own satellite images as a mean of obtaining and refining the satellite attitude, thus making it possible to integrate the imaging camera to the satellite navigation system. The results of this work, once obtained, would mean the achievement of a new redundancy in the navigation system (with implications in future designs). Most important in implementing results is the fact that this can be easily achieved via software with no extra hardware requirement, once imaging camera and computer are already on board.
Author
Satellite Navigation Systems; Satellite Control; Attitude Control; Attitude (Inclination); Cameras; Computerized Simulation

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.

20000038421 NASA Goddard Space Flight Center, Greenbelt, MD USA
Proceedings for the 1st Annual NRO-OSL/GSFC-ATS Rideshare Conference
Cutlip, William, Editor, NASA Goddard Space Flight Center, USA; October 1999; In English; 1st, 15-16 Apr. 1999, Dulles, VA, USA; Sponsored by National Reconnaissance Office, USA; CD-ROM contains full text document
Report No.(s): NASA/CP-1999-209482; NAS 1.55:209482; Rept-99A01867; No Copyright; Avail: CASI; C01, CD-ROM

This document contains the proceeding of the first Annual NRO-OSL/GSFC-ATS Rideshare Conference. The viewgraphs from the 27 presentations are included. The presentations were about the various programs to give access to space for scientific experiments. Several programs are designed to give access to space for free or nominal cost for educational objectives. Other pro-

grams are designed to give access for commercial purposes. Included in many of the presentations are the individual program's requirements.
CASI
Conferences; Spaceborne Experiments; NASA Programs

20000038886 Alabama Univ., Systems Management and Production Lab., Huntsville, AL USA
Microelectronic Status Analysis and Secondary Part Procureability Assessment of the Multiple Launch Rocket System (MLRS) ***Final Report, 28 Feb. - 31 Dec. 1996***
Maddux, Gary A.; Jul. 1999; 8p; In English
Contract(s)/Grant(s): DAAH01-92-D-R006
Report No.(s): AD-A374504; 5-34393; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

AMCOM Industrial Operations Division (IOD) required engineering support in performing microelectronic technology and availability assessments for several hundred items and in assessing the impact of nonavailability on the MLRS weapon system. IOD also required engineering support in performing producibility analyses of the MLRS weapon system. In order to facilitate the assessment of this system, the Systems Management and Production Laboratory at The University of Alabama in Huntsville Research Institute was tasked to conduct an in-depth analysis as to the life cycle health of the MLRS weapon system's component parts.
DTIC
Microelectronics; Technology Assessment; Systems Management

20000039349 NASA Marshall Space Flight Center, Huntsville, AL USA
NASA's Advanced Propulsion Technology Activities for Third Generation Fully Reusable Launch Vehicle Applications
Hueter, Uwe, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 51st; 51st International Astronautical Congress, 2-6 Oct. 2000, Rio de Janeiro, Brazil; No Copyright; Avail: Issuing Activity; Abstract Only

NASA's Office of Aeronautics and Space Transportation Technology (OASTT) established the following three major goals, referred to as "The Three Pillars for Success": Global Civil Aviation, Revolutionary Technology Leaps, and Access to Space. The Advanced Space Transportation Program Office (ASTP) at the NASA's Marshall Space Flight Center in Huntsville, Ala. focuses on future space transportation technologies under the "Access to Space" pillar. The Propulsion Projects within ASTP under the investment area of Spaceliner100, focus on the earth-to-orbit (ETO) third generation reusable launch vehicle technologies. The goals of Spaceliner 100 is to reduce cost by a factor of 100 and improve safety by a factor of 10,000 over current conditions. The ETO Propulsion Projects in ASTP, are actively developing combination/combined-cycle propulsion technologies that utilized air-breathing propulsion during a major portion of the trajectory. System integration, components, materials and advanced rocket technologies are also being pursued. Over the last several years, one of the main thrusts has been to develop rocket-based combined cycle (RBCC) technologies. The focus has been on conducting ground tests of several engine designs to establish the RBCC flow-paths performance. Flowpath testing of three different RBCC engine designs is progressing. Additionally, vehicle system studies are being conducted to assess potential operational space access vehicles utilizing combined-cycle propulsion systems. The design, manufacturing, and ground testing of a scale flight-type engine are planned. The first flight demonstration of an airbreathing combined cycle propulsion system is envisioned around 2005. The paper will describe the advanced propulsion technologies that are being being developed under the ETO activities in the ASTP program. Progress, findings, and future activities for the propulsion technologies will be discussed.
Author
Propulsion System Configurations; Propulsion System Performance; Reusable Launch Vehicles; Space Transportation; Spacecraft Propulsion; Air Breathing Engines; Rocket-Based Combined-Cycle Engines

16
SPACE TRANSPORTATION AND SAFETY

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

20000038348 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-35/ASTRO-1: Day-1 Down-links
Dec. 02, 1990; In English; Videotape: 1 hr. 9 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000043340; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

Live footage shows views of the ASTRO-1 observatory telescopes, moving into position. These views are shown from the right rear camera in the payload area. The telescopes are the Hopkins Ultraviolet Telescope (HUT), Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE), Ultraviolet Imaging Telescope (UIT), and the Broad Band X-Ray Telescope (BBXRT).
CASI
Astro Missions (STS); Spaceborne Astronomy; Spaceborne Telescopes; Downlinking

20000038404 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-37: Downlinks M. E. T.
Apr. 06, 1991; In English; Videotape: 34 min. 34 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000013424; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

Live footage shows the crewmembers of STS-37, Commander Steven R. Nagel, Pilot Kenneth D. Cameron, and Mission Specialists Jerry L. Ross, Jay Apt, and Linda M. Godwin, participating in a question and answer segment with students at the Launch Control Center (LCC). The crew is also seen working in the zero-gravity environment and taking photographs of the space environment. Also seen are some beautiful shots of the Atlantis orbiter with the Earth as its background.
CASI
Downlinking; Communication Satellites; Ground Stations; Space Transportation System; Space Transportation System Flights; Atlantis (Orbiter)

20000038701 NASA Johnson Space Center, Houston, TX USA
STS-31: Post Flight Press Conference (Tape 2 of 2)
May 09, 1990; In English; Videotape: 16 min. 4 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000039775; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

Live footage shows panelists answering questions from various NASA Centers. The panelists takes turn fielding questions from NASA Headquarters, Goddard Space Flight Center, and Kennedy Space Center.
CASI
Conferences; Postflight Analysis

20000038714 NASA Marshall Space Flight Center, Huntsville, AL USA
NASA's Integrated Space Transportation Plan
Cook, Stephen A., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 51st; 51st International Astronautical Congress, 2-6 Oct. 2000, Rio de Janeiro, Brazil; No Copyright; Avail: Issuing Activity; Abstract Only

Improvements in the safety, reliability and affordability of current and future space transportation systems must be achieved if NASA is to perform its mission and if the U.S. space industry is to reach its full commercial potential. In response to Presidential Policy in 1994, NASA, working with our industrial partners, initiated several efforts including the X-33, X-34, X-37 and Advanced Space Transportation programs with the goal of demonstrating the technologies that could enable these goals. We have learned that emerging technologies will enable the needed advancements but that more development along multiple, competing paths is needed. We have learned that developing requirements diligently and in partnership with industry will allow us to better converge with commercial capabilities. We have learned that commercial markets are not growing as fast as projected earlier, but there are still possibilities in the near-term to pursue alternate paths that can make access to space more robust. The goal of transitioning NASA's space transportation needs to commercial launch vehicles remains the key aim of our efforts and will require additional investment to reduce business and technical risks to acceptable levels.
Author
Space Transportation System; NASA Space Programs; Space Commercialization; Industries; Launch Vehicles

20000039290 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-34: Atlantis Stacking Activities in the VAB
Aug. 22, 1989; In English; Videotape: 9 min. 45 sec. in color, with sound
Report No.(s): NONP-NASA-VT-2000039786; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

The primary mission for STS-34 was the launch of the Galileo Probe to Jupiter. This videotape shows the shuttle Atlantis in the Vertical Assembly Building (VAB) being hoisted from the horizontal position to the vertical position. It also shows the shuttle being moved into position for mating with the solid rocket boosters.

NASA

Space Shuttle Boosters; Space Transportation System; Atlantis (Orbiter)

20000039309 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-37: TCDT Pad B Atlantis GRO (3 of 3)
Mar. 20, 1991; In English; Videotape: 40 min. 48 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000013418; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

Live footage shows some beautiful panoramic views of STS-37 on the pad. Scenes include the narration of simulated auto sequence start, engine start, engine firing and cut-off. Also shown is the crew emergency egress procedure. This is tape 3 of 3. Tape 1 has a report # of NONP-NASA-VT-2000013416, and tape 2 has a report # of NONP-NASA-VT-2000013417.

CASI

Crew Procedures (Preflight); Astronaut Training; Training Simulators; Flight Simulation; Prelaunch Tests; Preflight Operations; Test Firing; Prefiring Tests; Preflight Analysis; Systems Analysis

20000039310 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-37: TCDT Pad B Atlantis GRO (2 of 3)
Mar. 20, 1991; In English; Videotape: 55 min. 49 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000013417; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

Live footage shows the remaining two crewmembers of STS-37, Mission Specialists Jerry L. Ross, and Jay Apt, entering the White Room, putting on their life preservation vest, and then entering the launch vehicle. Video playbacks, of the crew during the earlier stage of the Terminal Countdown and Demonstration Test, and the processing of the primary payload (Gamma Ray Observatory) are shown. Scenes showing the arrival of Ross at Kennedy Space Center in the T-38 aircraft, the crew on the launch complex during familiarization activities, and training with the M113 vehicle are presented. Also shown are some beautiful panoramic views of the shuttle on the pad. This is tape 2 of 3. Tape 1 has a report # of NONP-NASA-VT-2000013416, and tape 3 has a report # of NONP-NASA-VT-2000013418.

CASI

Crew Procedures (Preflight); Astronaut Training; Training Simulators; Flight Simulation; Flight Tests; Prelaunch Tests; Preflight Operations; Test Firing

20000039311 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-37: TCDT Pad B Atlantis GRO (1 of 3)
Mar. 20, 1991; In English; Videotape: 1 hr. 1 min. 32 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000013416; No Copyright; Avail: CASI; B04, Videotape-Beta; V04, Videotape-VHS

Live footage shows the crewmembers of STS-37, Commander Steven R. Nagel, Pilot Kenneth D. Cameron, and Mission Specialists Jerry L. Ross, Jay Apt, and Linda M. Godwin, participating in Terminal Countdown Demonstration Test. The crew is seen in the breakfast room, in the Operations and Checkout Building suiting up and walking out to the Astronaut-Van. Scenes include the drive out to the launch pad, the boarding of the crew on the elevator, crew entrance in the White Room, and the ingress of the crew into the launch vehicle. Linda and Jerry are seen standing on the Gantry (bridge) looking out as they wait to enter the White Room to finish suiting up to enter the vehicle. Also shown are some beautiful panoramic views of the shuttle on the pad. This is tape 1 of 3. Tape 2 has a report # of NONP-NASA-VT-2000013417, and tape 3 has a report # of NONP-NASA-VT-2000013418.

CASI

Crew Procedures (Preflight); Astronaut Training; Training Simulators; Flight Simulation; Flight Tests; Prelaunch Tests; Preflight Operations; Test Firing

20000039385 NASA Johnson Space Center, Houston, TX USA

X-38 Experimental Controls Laws

Munday, Steve, NASA Johnson Space Center, USA; Estes, Jay, NASA Johnson Space Center, USA; Bordano, Aldo J., NASA Johnson Space Center, USA; [2000]; 1p; In English; 85th; Aerospace Control and Guidance Systems Meeting, 15-17 mAR. 2000, Lake Tahoe NV, USA; Sponsored by Society of Automotive Engineers, Inc., Unknown

Contract(s)/Grant(s): RTOP 487-20-XC-RV; No Copyright; Avail: Issuing Activity; Abstract Only

X-38 Experimental Control Laws X-38 is a NASA JSC/DFRC experimental flight test program developing a series of prototypes for an International Space Station (ISS) Crew Return Vehicle, often called an ISS ”lifeboat.” X- 38 Vehicle 132 Free Flight 3, currently scheduled for the end of this month, will be the first flight test of a modem FCS architecture called Multi-Application Control-Honeywell (MACH), originally developed by the Honeywell Technology Center. MACH wraps classical P&I outer attitude loops around a modem dynamic inversion attitude rate loop. The dynamic inversion process requires that the flight computer have an onboard aircraft model of expected vehicle dynamics based upon the aerodynamic database. Dynamic inversion is computationally intensive, so some timing modifications were made to implement MACH on the slower flight computers of the subsonic test vehicles. In addition to linear stability margin analyses and high fidelity 6-DOF simulation, hardware-in-the-loop testing is used to verify the implementation of MACH and its robustness to aerodynamic and environmental uncertainties and disturbances.

Author

Aircraft Models; Control Theory; Flight Control; Flight Tests; Free Flight; Simulation; X-38 Crew Return Vehicle

20000039757 NASA Kennedy Space Center, Cocoa Beach, FL USA

Mars Surveyor ’98 Animation From JPL

Jun. 16, 1997; In English; Videotape: 19 min. 40 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000010563; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

This video presents live animation of the Mars Surveyor Program. NASA is looking for faster, better, cheaper missions to Mars since the Mars Observer malfunctioned on August 22, 1993. Daniel Goldin, NASA Administrator says that NASA will perform flyby missions, orbiters, landers, and sample returns to look for evidence of life on Mars. The first mission to Mars, the Mars Global Surveyor, was launched on November 7, 1996, to provide geological, topographical, and atmospheric maps from its polar orbit about Mars. The second, the Mars Pathfinder, launched on December 4, 1996, photographs terrain, monitors weather and deploys a robotic rover that analyzes samples of Mars’ rocks and soils. The third, the Mars Surveyor ’98, includes two separate, launched spacecraft, the orbiter and the lander. The Orbiter was launched December 98 from Cape Canaveral. Its 9-month journey to Mars will circle the planet every two hours and once stability was achieved, will configure itself for mapping. On January 3, 1999, the lander was on an 11-month journey to Mars, scheduled to arrive on Mars on December 3, 1999 to record the geological composition of the landing site from its SSI (Surface Stereo Imager).

CASI

Flyby Missions; Mars (Planet); Mars Global Surveyor; Mars Missions; Surveyor Project; Mars Surface

20000040070 NASA Marshall Space Flight Center, Huntsville, AL USA

Advanced Engineering Environments for Space Transportation System Development

Thomas, L. Dale, NASA Marshall Space Flight Center, USA; Smith, Charles A., NASA Marshall Space Flight Center, USA; Beveridge, James, QTEC, Inc., USA; [2000]; 1p; In English; IAF Congress, Oct. 2000, Rio de Janeiro, Brazil; Sponsored by International Astronautical Federation, Unknown; No Copyright; Avail: Issuing Activity; Abstract Only

There are significant challenges facing today’s launch vehicle industry. Global competition, more complex products, geographically-distributed design teams, demands for lower cost, higher reliability and safer vehicles, and the need to incorporate the latest technologies quicker, all face the developer of a space transportation system. Within NASA, multiple technology development and demonstration projects are underway toward the objectives of safe, reliable, and affordable access to space. New information technologies offer promising opportunities to develop advanced engineering environments to meet these challenges. Significant advances in the state-of-the-art of aerospace engineering practice are envisioned in the areas of engineering design and analytical tools, cost and risk tools, collaborative engineering, and high-fidelity simulations early in the development cycle. At the Marshall Space Flight Center, work has begun on development of an advanced engineering environment specifically to support the design, modeling, and analysis of space transportation systems. This paper will give an overview of the challenges of developing space transportation systems in today’s environment and subsequently discuss the advanced engineering environment and its anticipated benefits.

Author

Aerospace Engineering; Launch Vehicles; Space Transportation System

20000040788 Boeing Co., Space and Communications Group, Huntsville, AL USA

How X-37 Technology Demonstration Supports Reusable Launch Vehicles

Manley, David J., Boeing Co., USA; Cervisi, Richard T., Boeing Co., USA; Staszak, Paul R., Boeing Co., USA; [2000]; 26p; In English; Space Technology and Applications, 1 Jan. - 3 Feb. 2000, Albuquerque, NM, USA; Original contains color illustrations
Contract(s)/Grant(s): NCC8-190; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This presentation discusses, in viewgraph form, how X-37 Technology Demonstration Supports Reusable Launch Vehicles. The topics include: 1) X-37 Program Objectives; 2) X-37 Description; 3) X-37 Vehicle Characteristics; 4) X-37 Expands the Testbed Envelope to Orbital Capability; 5) Overview of X-37 Flight Test Program; 6) Thirty-Nine Technologies and Experiments are Being Demonstrated on the X-37; 7) X-37 Airframe/Structures Technologies; 8) X-37 Mechanical, Propulsion, and Thermal System Technologies and Experiments; 9) X-37 GN&C Technologies; 10) X-37 Avionics, Power, and Software Technologies and Experiments; and 11) X-37 Technologies and Experiments Support Reusable Launch Vehicle Needs.

CASI

Reusable Launch Vehicles; Technology Utilization; X-37 Vehicle; Flight Tests; Aircraft Structures

20000040798 NASA Kennedy Space Center, Cocoa Beach, FL USA

STS-31: Mission Highlights Resource Tape, Part 2

June 1990; In English; Videotape: 25 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000039768; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

The primary objective of STS-31 was the deployment of the Hubble Space Telescope (HST). The flight was commanded by Loren J. Shriver. The pilot was Charles F. Bolden, Jr., and the mission specialists were Steven A. Hawley, Bruce McCandless II, and Kathryn D. Sullivan. This videotape shows an inflight press conference that occurred after the deployment of the HST. The press gathered at the Goddard Space Flight Center and the Kennedy Space Center, asked questions mainly about the deployment of the HST.

CASI

Hubble Space Telescope; Space Shuttle Payloads

20000042295 NASA Johnson Space Center, Houston, TX USA

STS-101: Crew Interview - Jim Halsell

Mar. 24, 2000; In English; Videotape: 36 min. 9 sec. playing time, in color, with sound
Report No.(s): JSC-1809A; NONP-NASA-VT-2000039861; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

The objective of STS-101 will be the servicing of the International Space Station, to ensure that it will be ready to receive a crew later in 2000. The crew, commanded by James D. Halsell, will include Pilot Scott J. Horowitz, Mission Specialists Mary Ellen Weber, Jeffrey N. Williams, James S. Voss, Susan J. Helms and Yuri V. Usachev. This videotape provides live coverage of an interview with the mission commander Jim Halsell. He describes the influences on his life that led him to become a NASA astronaut, and the importance of the mission. He discusses the new glass cockpit design. He describes the flight plan and the docking maneuver. An important feature of this mission is the replacement of electric components, voltage and current regulators on the space station. Commander Halsell also describes the role of each crew member during the re-supply and refitting of the Space Station and reviews the priorities.

CASI

International Space Station; Space Transportation System; Spacecraft Docking; Orbital Rendezvous; Spacecraft Maintenance; Replacing; Space Station Power Supplies

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.

20000039380 NASA Johnson Space Center, Houston, TX USA

A Cost Effective System Design Approach for Critical Space Systems

Abbott, Larry Wayne, NASA Johnson Space Center, USA; Cox, Gary, NASA Johnson Space Center, USA; Nguyen, Hai, NASA Johnson Space Center, USA; [2000]; 2p; In English; 19th; 19th Digital Avionics System Conference, 6-13 Oct. 2000, Philadelphia, PA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 953-74-00; No Copyright; Avail: Issuing Activity; Abstract Only

NASA-JSC required an avionics platform capable of serving a wide range of applications in a cost-effective manner. In part, making the avionics platform cost effective means adhering to open standards and supporting the integration of COTS products with custom products. Inherently, operation in space requires low power, mass, and volume while retaining high performance, reconfigurability, scalability, and upgradability. The Universal Mini-Controller project is based on a modified PC/104-Plus architecture while maintaining full compatibility with standard COTS PC/104 products. The architecture consists of a library of building block modules, which can be mixed and matched to meet a specific application. A set of NASA developed core building blocks, processor card, analog input/output card, and a Mil-Std-1553 card, have been constructed to meet critical functions and unique interfaces. The design for the processor card is based on the PowerPC architecture. This architecture provides an excellent balance between power consumption and performance, and has an upgrade path to the forthcoming radiation hardened PowerPC processor. The processor card, which makes extensive use of surface mount technology, has a 166 MHz PowerPC 603e processor, 32 Mbytes of error detected and corrected RAM, 8 Mbytes of Flash, and I Mbytes of EPROM, on a single PC/104-Plus card. Similar densities have been achieved with the quad channel Mil-Std-1553 card and the analog input/output cards. The power management built into the processor and its peripheral chip allows the power and performance of the system to be adjusted to meet the requirements of the application, allowing another dimension to the flexibility of the Universal Mini-Controller. Unique mechanical packaging allows the Universal Mini-Controller to accommodate standard COTS and custom oversized PC/104-Plus cards. This mechanical packaging also provides thermal management via conductive cooling of COTS boards, which are typically designed for convection cooling methods.

Author

Cost Effectiveness; Systems Engineering; Design Analysis; Compatibility; Controllers; Temperature Control

20000039434 NASA Marshall Space Flight Center, Huntsville, AL USA

Analysis and Assessment of Peak Lightning Current Probabilities at the NASA Kennedy Space Center

Johnson, D. L., NASA Marshall Space Flight Center, USA; Vaughan, W. W., Alabama Univ., USA; May 1999; 42p; In English

Report No.(s): NASA/TM-2000-210131; NAS 1.15:210131; M-977; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This technical memorandum presents a summary by the Electromagnetics and Aerospace Environments Branch at the Marshall Space Flight Center of lightning characteristics and lightning criteria for the protection of aerospace vehicles. Probability estimates are included for certain lightning strikes (peak currents of 200, 100, and 50 kA) applicable to the National Aeronautics and Space Administration Space Shuttle at the Kennedy Space Center, Florida, during rollout, on-pad, and boost/launch phases. Results of an extensive literature search to compile information on this subject are presented in order to answer key questions posed by the Space Shuttle Program Office at the Johnson Space Center concerning peak lightning current probabilities if a vehicle is hit by a lightning cloud-to-ground stroke. Vehicle-triggered lightning probability estimates for the aforementioned peak currents are still being worked. Section 4.5, however, does provide some insight on estimating these same peaks.

Author

Lightning; Electricity; Probability Theory

20000040159 Naval Postgraduate School, Monterey, CA USA
Attitude Determination of a Three-Axis Stabilized Spacecraft Using Star Sensors
Vogt, Jay D.; Dec. 1999; 86p; In English
Report No.(s): AD-A374426; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The purpose of this thesis is to investigate the application of a six-state discrete Kalman filter for estimates of angular rates based solely on star sensor data. The satellite is in a Molnyia orbit where orbital angular velocity and orbital angular acceleration are predetermined and stored in the on-board computer; such that they will be available each time a star observation is made. A two-axis star sensor will provide two angles to the estimator whereupon the third ”unsensed” angle will be predicted; the rates about all three axes are then estimated. The results show that the rate estimates are accurate to within 10(exp -7) r/s, which is equivalent to the data produced by gyroscopes.
DTIC
Satellite Attitude Control; Airborne/Spaceborne Computers; Gyroscopes; Orbital Velocity; Kalman Filters

20000044100 Lembaga Penerbangan dan Antariksa Nasional, Jakarta, Indonesia
The Effects of Operating the International Space Station on Future National Space Activities ***Pengaruh pengoperasian stasiun antariksa internasional terhadap kegiatan keantariksaan negara-negara di masa datang***
Sitindjak, Alfred, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; April 1999; Volume 1, No. 2, pp. 15-32; In Malay-Indonesian; See also 20000044098; Copyright; Avail: Issuing Activity

The International Space Station is the largest and most complex scientific and technological project ever attempted on an international cooperative basis. There are 16 nations contributing to the final product which is scheduled for completion in the year 2004. The contributing nations are the USA, Canada, Japan, 11 nations of the European Space Agency and Brazil. When completed, the space station will measure 108.6 m across and 79.9 m in length. The solar panels will power seven modem experimental laboratories and modules on board. The size is four times as large as the Russian Mir station and the solar panels will deliver 60 times the power capability of the Mir. The Space station will orbit approximately 400 km above the Earth’s surface at 51.6 degrees of inclination. The life span of the station is estimated at up to 20 years. In this paper, the strong impacts of the establishment and operation of the International Space Station on nations’ space programmes in the first two decades of the twenty-first century as well as the Indonesian strategy in utilization of the station are comprehensively explored.
Author
International Space Station; Space Programs; Technology Utilization; European Space Agency; USA

19
SPACECRAFT INSTRUMENTATION AND ASTRIONICS

Includes the design, manufacture, or use of devices for the purpose of measuring, detecting, controlling, computing, recording, or processing data related to the operation of space vehicles or platforms. For related information, see also 06 Aircraft Instrumentation and Avionics; For spaceborne instruments not integral to the vehicle itself see 35 Instrumentation and Photography; For spaceborne telescopes and other astronomical instruments see 89 Astronomy, Instrumentation and Photography; For spaceborne telescopes and other astronomical instruments see 89 Astronomy.

20000039217 NASA Marshall Space Flight Center, Huntsville, AL USA
Charge Detector for the Imaging Calorimeter for ACCESS (ICA)
Lee, Jeongin, National Academy of Sciences - National Research Council, USA; Adams, J. H., Jr., Naval Research Lab., USA; [2000]; 1p; In English, 29 Apr. - 3 May 2000, Long Beach, CA, USA; Sponsored by American Physical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

NASA’s Advanced Cosmic Ray Experiment for the Space Station (ACCESS) Mission is planned to consist of a transition radiation detector (TRD) and a thin ionization calorimeter. In order to measure the charge of the primary cosmic ray, it is necessary for the calorimeter to have its own charge detector. Silicon detectors are chosen for the charge detector because of their excellent resolution, small size and nearly square shape. Monte Carlo simulations are performed to find the probability of misidentifying protons as alpha particles due to backscattered radiation from the calorimeter. Simulations were also used to investigate identifying primary cosmic rays that fragmented in the TRD before reaching the calorimeter. For this study algorithms have been developed for determining a direction of the core shower in the calorimeter. These algorithms are used to find the approximate location

of the primary particle in the silicon detectors. Results show the probability to misidentify the charge depends upon the energy and direction of the primary particles.
Author
Calorimeters; Imaging Techniques; Cosmic Rays; Space Stations; Ionization; Silicon Radiation Detectors

20000039384 NASA Johnson Space Center, Houston, TX USA
Validation of Galactic Cosmic Radiation and Geomagnetic Transmissions
Badhwar, Gautam D., NASA Johnson Space Center, USA; Troung, A., NASA Johnson Space Center, USA; ONeill, P., NASA Johnson Space Center, USA; Bman, B., European Organization for Nuclear Research, Switzerland; [2000]; 1p; In English; 33rd, 16-23 Jul. 2000, Warsaw, Poland; Sponsored by Committee on Space Research, Unknown; No Copyright; Avail: Issuing Activity; Abstract Only

The Alpha Magnet Spectrometer (AMS) was flown on Shuttle flight STS-91 in June 1998 near solar minimum. This unique spectrometer has provided very high resolution, calibrated data on the galactic hydrogen and helium rigidity spectra form approx. 100 MeV/n to approx. 200 GeV/n as a function of magnetic latitude. This paper describes a comparison of the AMS data with the Badhwar-O'Neill GCR model and the geomagnetic transmission calculated using the quiescent DGRF 1990 cutoffs. The results have strong bearing on radiation modeling for the International Space Station.
Author
Cosmic Rays; Galactic Cosmic Rays; Geomagnetism; Solar Activity Effects; High Resolution

20
SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information, see also 07 Aircraft Propulsion and Power; 28 Propellants and Fuels; 15 Launch Vehicles and Launch Operations; and 44 Energy Production and Conversion.

20000038369 Alabama Univ., Propulsion Research Center, Huntsville, AL USA
Space Solar Power Exploratory Research and Technology (SERT) Technical Interchange Meeting 2 (SERT TIM 2) ***Final Report***
Howell, Joe, Alabama Univ., USA; Sanders, Clark W., Alabama Univ., USA; Mar. 17, 2000; 37p; In English
Contract(s)/Grant(s): NASA Order H-32056-D; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The University of Alabama in Huntsville's (UAH) Propulsion Research Center hosted the Space Solar Power Exploratory Research & Technology (SERT) Technical Interchange Meeting TIM) 2 in Huntsville, Alabama December 7-10. 1999 with 126 people in attendance. The SERT program includes both competitively procured activities. which are being implemented through a portfolio of focused R&D investments--with the maximum leveraging of existing resources inside and outside NASA. and guided by these system studies. Axel Roth. Director of the Flight Projects Directorate NASA MSFC, welcomed the SERT TIM 2 participants and challenged them to develop the necessary technologies and demonstrations that will lead to Space Solar Power (SSP) International implementation. Joe Howell, NASA MSFC, reiterated the SERT TIM 2 objectives: 1) Refining and modeling systems approaches for the utilization of SSP concepts and technologies, ranging, from the near-term e.g. for space science, exploration and commercial space applications to the far-term (e. g. SSP for terrestrial markets), including systems concepts, technology, infrastructure (i.g., transportation), and economics. 2) Conducting technology research, development and demonstration activities to produce "proof- of-concept" validation of critical SSP elements for both the nearer and farther-term applications. 3) Initiating partnerships Nationality and Internationally that could be expanded, as appropriate, to pursue later SSP technology and applications (e.g., space science. colonization, etc.). Day one began with the NASA Centers presenting their SERT activities summary since SERT TIM 1 and wound up with a presentation by Masahiro Mori, NASDA titled "NASDA In-house Study for SSP". Demonstration for the Near-Term. Day two began with the SERT Systems Studies and Analysis reports resulting from NRA 8-23 followed by presentations of SERT Technology Demonstrations reports resulting from NRA 8-23. Day two closed with John Mankins presentation on "Technology Roadmapping" and the delivery of the charge to the Work Breakout Sessions. Day three began with the eleven Work Breakout Session which was the major function of this TIM 2 and day three ended with reports by the Chairs of the eleven Work Breakdown Sessions. Day four began with the six Integrated Product Team OPT) meetings and ended with closing plenary panel sessions.
Author
Conferences; Market Research; Propulsion; Space Exploration; Technology Utilization

20000039356 NASA Marshall Space Flight Center, Huntsville, AL USA

Temperature Dependent Modal Test/Analysis Correlation of X-34 Fastrac Composite Rocket Nozzle

Brown, Andrew M., American Inst. of Aeronautics and Astronautics, USA; [2000]; 1p; In English; SDM Conference, 3-8 Apr. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A unique high temperature modal test and model correlation/update program has been performed on the composite nozzle of the FASTRAC engine for the NASA X34 Reusable Launch Vehicle. The program was required to provide an accurate high temperature model of nozzle for incorporation into the engine system structural dynamics model for loads calculation; this model is significantly different from the ambient case due to the large decrease in composite material properties due to heating. The modal test was enabled by piggybacking onto a hot-fire test of the nozzle at NASA/Marshall and tracking the natural frequencies as they decreased. A series of high fidelity modal tests and finite element model correlation of the nozzle in a free-free configuration was initially performed. This model was then attached to a modal-test verified model of the engine hot-fire test stand and the' ambient system mode shapes identified. A reduced set of accelerometers was then attached to the nozzle, the engine fired full-duration, and the frequency peaks corresponding to the ambient nozzle modes individually isolated and tracked. to update the finite element model of the nozzle to these frequency curves, a multiplicative factor was. applied to the rate of decline of the composite material property versus temperature table. This new property table was used to create high-temperature nozzle models corresponding to 10 second engine operation increments and tied into the engine system model for loads determination.

Author

Temperature Dependence; Dynamic Response; Dynamic Structural Analysis; Mathematical Models; X-34 Reusable Launch Vehicle; Nozzle Efficiency; Nozzleless Rocket Engines; Rocket Nozzles; Composite Materials

20000039678 Johns Hopkins Univ., Chemical Propulsion Information Agency, Columbia, MD USA

49th JANNAF Propulsion Meeting, Volume 1, *Jul. 1998 - Dec. 1999*

Eggleston, Debra S., Editor, Johns Hopkins Univ., USA; December 1999; 230p; In English; 49th; Propulsion, 14-16 Dec. 1999, Tucson, AZ, USA; Sponsored by NASA, USA; See also 20000039679 through 20000039692

Contract(s)/Grant(s): SPO700-97-D-4004

Report No.(s): CPIA-Publ-696-Vol-1; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

This volume, the first of three volumes, is a collection of 15 unclassified/unlimited-distribution papers which were presented at the 49,h Joint Army-Navy-NASA-Air Force (JANNAF) Propulsion Meeting, held 14-16 December 1999 at the Sheraton El Conquistador Resort in Tucson, Arizona. Specific subjects discussed include solid propellants; solid propellant ingredients, hazards, and demilitarization/disposal; composite materials used in propulsion applications; and sensors.

Author

Military Technology; Defense Industry; Weapon Systems; Tests; Conferences

20000039687 Astro Technology, Inc., Houston, TX USA

Russian Solid Rocket Motor Demilitarization Safety Issues

Brower, D. V., Astro Technology, Inc., USA; Losee, L. A., Astro Technology, Inc., USA; 49th JANNAF Propulsion Meeting; December 1999; Volume 1, pp. 131-145; In English; See also 20000039678; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Demilitarization of aged Russian motors offer some unique safety challenges. Although the motor designs and propellant formulations are similar to USA (U.S.) systems, some formulation ingredients may cause increased sensitivity and reactivity that can be enhanced by aging and environmental conditions. Some propellant and motor characteristics may be out of our range of experience requiring additional preparation and training. Motor case design and propellant formulations must be considered susceptible to dielectric breakdown electrostatic discharge (ESD) ignition during handling unless it can be demonstrated otherwise. Motor handling and grounding protocol developed as a result of European and U.S. incident investigations should be applied in all operations to mitigate potential incidents. An aggressive safety program including a formal system safety hazards analysis effort must be in place throughout the concept, design, and operations phases of the program. Incidents can result in injury or death, shutdown programs, result in considerable financial loss, generate mistrust, and jeopardize future demilitarization programs of benefit to both foreign and U.S. interests.

Author

Hazards; Propellants; Safety; Safety Factors; Solid Propellant Rocket Engines; Military Technology

20000039689 Boeing Co., Seal Beach, CA USA

Non-Toxic Reaction Control System for the Reusable First Stage Vehicle

Keith, E. L., Boeing Co., USA; Rothschild, W. J., Boeing Co., USA; 49th JANNAF Propulsion Meeting; December 1999; Volume 1, pp. 155-161; In English; See also 20000039678

Contract(s)/Grant(s): NAS8-97272; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

This paper presents the Boeing Reusable Space Systems vision of a Reaction Control System (RCS) for the Reusable First Stage (RFS) being considered as a replacement for the Solid Rocket Booster for the Space Shuttle. The requirement is to achieve reliable vehicle control during the upper atmospheric portion of the RFS trajectory while enabling more efficient ground operations, unhindered by constraints caused by operating with highly toxic RCS propellants. Boeing's objective for this effort is to develop a safer, more efficient and environmentally friendly RCS design approach that is suitable for the RFS concept of operations, including a low cost, efficient turnaround cycle. The Boeing RCS concept utilizes ethanol and liquid oxygen in place of the highly toxic, suspected carcinogen, ozone-depleting mono-methyl-hydrazine and highly toxic nitrogen tetroxide. The Space Shuttle Upgrade program, under the leadership of the NASA Johnson Space Flight Center, is currently developing liquid oxygen and ethanol (ethyl alcohol) technology for use as non-toxic orbital maneuvering system (OMS) and RCS. The development of this liquid oxygen and ethanol technology for the Space Shuttle offers a significant leverage to select much of the same technology for the RFS program. There are significant design and development issues involved with bringing this liquid oxygen and ethanol technology to a state of maturity suitable for an operational RCS. The risks associated with a new LOX and Ethanol RCS are mitigated by maintaining kerosene and hydrogen peroxide RCS technology as an alternative. These issues, presented within this paper, include managing the oxygen supply and achieving reliable ignition in the short pulse mode of engine operation. Performance, reliability and operations requirements are presented along with a specific RCS design concept to satisfying these requirements. The work reported in this paper was performed under NASA Marshall Space Flight Center Contract Number NAS8-97272 to define Reusable First Stage design concepts for the Space Shuttle.
Author

Toxicity; Reusable Launch Vehicles; Reusable Rocket Engines; Rocket Propellants; Ethyl Alcohol; Liquid Oxygen; Control Systems Design

20000039690 Sverdrup Technology, Inc., Arnold AFS, TN USA

Transient Testing of a LOX/LH2 Upper Stage Propulsion System

McAmis, R. W., Sverdrup Technology, Inc., USA; Bates, L. B., Sverdrup Technology, Inc., USA; Williams, B. M., Sverdrup Technology, Inc., USA; 49th JANNAF Propulsion Meeting; December 1999; Volume 1, pp. 163-173; In English; See also 20000039678; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

An RL 10 high area ratio upper stage propulsion system was tested at the USAF Arnold Engineering Development Center's J-4 facility as part of the qualification for flight on the upper stage of the Boeing Delta III. During a single test period, simulated altitude pressure was varied over a range of 110,000 to 55,000 ft in real time to assess the thrust of the upper stage engine as a function of engine nozzle exit static pressure. The successful test demonstrates the ability of a large rocket test facility to obtain several discrete altitude simulation pressures during one "test period." to simulate altitude pressure, test cell J-4 uses multiple stages of vacuum pumping. The transient performance of these stages are reviewed and theoretical predictions are compared to actual facility performance. In addition, facility subsystem performance is reviewed including steam ejector-diffuser performance.
Author

Rocket Test Facilities; Rocket Engines; Engine Tests; Propulsion System Performance; Propellant Tests; Hydrogen Oxygen Engines; Altitude Simulation

20000039692 General Dynamics Ordnance Systems, Burlington, VT USA

MK66 Rocket Motor Applications for Advanced Precision Kill Weapon System Concepts

Slocum, D. C., General Dynamics Ordnance Systems, USA; 49th JANNAF Propulsion Meeting; December 1999; Volume 1, pp. 183-193; In English; See also 20000039678; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The U.S. Army has identified a requirement for an Advanced Precision Kill Weapon System, which consists of a laser-based guidance and control system mated to current 2.75 inch rocket components, including the MK66 motor. The requirement to utilize the MK66 rocket motor has raised concerns that the APKWS might not have sufficient energy to engage targets at the specified maximum effective range of 6,000 meters. In addition, the seeker field-of-view limits might be exceeded if a highly lofted trajectory is required to achieve the maximum range. This paper presents analysis that addresses these concerns. The paper begins with

a review of the applicable APKWS performance requirements. APKWS propulsion and mass properties models are then presented together with an APKWS aerodynamic model that is derived from wind tunnel data. A guidance and control system design is proposed which utilizes a proportional navigation guidance law and an acceleration command autopilot. The complete APKWS model is incorporated into a 6-DOF simulation, and simulation results are presented for both the minimum and maximum range cases. The simulation results show that the MK66 rocket motor provides sufficient energy to engage targets at 6,000 meters, and that reasonable seeker field-of-view limits are not exceeded.
Author
Control Systems Design; Homing Devices; Simulation; Weapon Systems; Wind Tunnel Tests; Guidance (Motion)

20000040113 NASA Goddard Space Flight Center, Greenbelt, MD USA
GPS Sounding Rocket Development at NASA with Simultaneous Multi-Payload Tracking Application
Bull, Barton, NASA Goddard Space Flight Center, USA; Martel, Hugh, Waypoint Consulting, Inc., Canada; [2000]; 2p; In English; International Workshop on Aerospace Applications of the Global Positioning System, Breckenridge, CO, USA; No Copyright; Avail: Issuing Activity; Abstract Only

An inverse differential GPS system has been developed for Sounding Rocket use which includes the flight unit and a ground station capable of extracting GPS data from sounding rocket telemetry, performing a real time differential solution and graphically displaying the rocket's path relative to a predicted trajectory plot. Accuracy has been proven to within less than 10 meters. Postprocessing has increased the precision to within 10 - 20 centimeters. The system has been successfully flown several times and delivered to the Sounding Program Office for routine field use. In addition to providing position, velocity and time GPS data has been used on sounding rockets for vehicle performance analysis, effecting a one hundred fold improvement in data time tagging, and steering an optical tracking device to intercept payloads launched from over the horizon. Precise velocity separation information and timing has been provided to multiple payload systems. Future plans include its use for Range Safety and enabling of interferometric techniques. The technology and software developed also has potential application to small satellite navigation and formation flying.
Author
Global Positioning System; Fabrication; Sounding Rockets; Reliability Analysis; Optical Tracking; Data Acquisition

20000044093 Lembaga Penerbangan dan Antariksa Nasional, Structural Dynamics Lab., Jakarta, Indonesia
Active Vibration Control of Rocket RX-250-LPN Payload Structures
Goenardi, Lilies M., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Setiadi, Mujtahid, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Ginting, Salam, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; July - September 1999; Volume 1, No. 3, pp. 1-11; In English; See also 20000044092; Copyright; Avail: Issuing Activity

As it has been reported that there was a possibility of LAPAN rocket payload function failure due to excessive vibrations during lift-off. It is the purpose of this paper to investigate the feasibility of controlling actively vibrations of rocket RX-250-LPN payload structure during the launch and throughout its flight. This paper also serves as a preliminary process before conducting an active vibration control experiment in the Structural Dynamics Laboratory. In the analysis the payload and its structures were modeled as a single-degree-of-freedom lumped mass system. The structural system is excited at the base by the rocket-payload base interface acceleration in modal coordinates. The sensor measures response acceleration of the system, then it is fed back to the controller. In order to evaluate the effectiveness, three types of controllers, based on Active Vibration Absorber (AVA), state estimator by using Pole Placement (PP) method, and Linear Quadratic Gaussian (LQG) regulator, were designed for active vibration control process. Performance of each controller is presented to show the possibility of using the active control method to reduce vibrations of rocket payload structures. A new controller, a combination of AVA and LQG controller is introduced to improve the performance of AVA controller when the AVA controller mass used is very light.
Author
Active Control; Dynamic Structural Analysis; Liftoff (Launching); Mathematical Models; Structural Vibration

20000044343 Boeing Co., Rocketdyne, Canoga Park, CA USA
Advanced Transportation System Studies. Technical Area 3: Alternate Propulsion Subsystem Concepts ***Final Report, 6 Apr. 1992 - 30 Apr. 2000***
Levack, Daniel J. H., Boeing Co., USA; April 2000; 26p; In English
Contract(s)/Grant(s): NAS8-39210
Report No.(s): DCN-1-1-PP-02147; RD00-164-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Alternate Propulsion Subsystem Concepts contract had seven tasks defined for this report. The tasks were: F-1A Restart Study, J-2S Restart Study, Propulsion Database Development, SSME Upper Stage Use, CERs for Liquid Propellant Rocket

Engines, Advanced Low Cost Engines, and Tripropellant Comparison Study. The detailed study results, with the data to support the conclusions from various analyses, are being reported as a series of five separate Final Task Reports. Consequently, this volume only reports the required programmatic information concerning Computer Aided Design Documentation, and New Technology Reports. A detailed Executive Summary, covering all the tasks, is also available as Volume I of this report.
Author
Propulsion System Configurations; Propulsion; Computer Aided Design; Computer Graphics; Data Processing; Technologies

20000044344 NASA Marshall Space Flight Center, Huntsville, AL USA
Laser Transmission Measurements of Soot Extinction Coefficients in the Exhaust Plume of the X-34 60K-lb Thrust Fastrac Rocket Engine
Dobson, C. C., NASA Marshall Space Flight Center, USA; Eskridge, R. H., NASA Marshall Space Flight Center, USA; Lee, M. H., NASA Marshall Space Flight Center, USA; March 2000; 38p; In English
Report No.(s): NASA/TP-2000-210075; NAS 1.60:210075; M-972; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A four-channel laser transmissometer has been used to probe the soot content of the exhaust plume of the X-34 60k-lb thrust Fastrac rocket engine at NASA's Marshall Space Flight Center. The transmission measurements were made at an axial location approximately equal 1.65 nozzle diameters from the exit plane and are interpreted in terms of homogeneous radial zones to yield extinction coefficients from 0.5-8.4 per meter. The corresponding soot mass density, spatially averaged over the plume cross section, is, for Rayleigh particles, approximately equal 0.7 microgram/cc, and alternative particle distributions are briefly considered. Absolute plume radiance at the laser wavelength (515 nm) is estimated from the data at approximately equal 2,200 K equivalent blackbody temperature, and temporal correlations in emission from several spatial locations are noted.
Author
Laser Applications; Transmissometers; Plumes; Soot

20000044345 Boeing Co., Rocketdyne, Canoga Park, CA USA
Advanced Transportation System Studies. Technical Area 3: Alternate Propulsion Subsystems Concepts, Volume 3, Program Cost Estimates ***Final Report, 6 Apr. 1992 - 30 Apr. 2000***
Levack, Daniel J. H., Boeing Co., USA; April 2000; 38p; In English
Contract(s)/Grant(s): NAS8-39210
Report No.(s): DCN-1-1-PP-02147; RD00-164-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this contract was to provide definition of alternate propulsion systems for both earth-to-orbit (ETO) and in-space vehicles (upper stages and space transfer vehicles). For such propulsion systems, technical data to describe performance, weight, dimensions, etc. was provided along with programmatic information such as cost, schedule, needed facilities, etc. Advanced technology and advanced development needs were determined and provided. This volume separately presents the various program cost estimates that were generated under three tasks: the F- IA Restart Task, the J-2S Restart Task, and the SSME Upper Stage Use Task. The conclusions, technical results , and the program cost estimates are described in more detail in Volume I - Executive Summary and in individual Final Task Reports.
Author
Cost Estimates; Costs; Propulsion System Configurations; Launch Vehicle Configurations; Spacecraft Configurations; Rocket Engines

20000044647 Boeing Co., Rocketdyne, Canoga Park, CA USA
Advanced Transportation System Studies. Technical Area 3: Alternate Propulsion Subsystem Concepts, Volume 1, Executive Summary ***Final Report, 6 Apr. 1992 - 30 Apr. 2000***
Levack, Daniel J. H., Boeing Co., USA; April 2000; 170p; In English
Contract(s)/Grant(s): NAS8-39210
Report No.(s): DCN-1-1-PP-02147; RD00-164-1; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The Alternate Propulsion Subsystem Concepts contract had seven tasks defined that are reported under this contract deliverable. The tasks were: FAA Restart Study, J-2S Restart Study, Propulsion Database Development. SSME Upper Stage Use. CERs for Liquid Propellant Rocket Engines. Advanced Low Cost Engines, and Tripropellant Comparison Study. The two restart studies, F-1A and J-2S, generated program plans for restarting production of each engine. Special emphasis was placed on determining changes to individual parts due to obsolete materials, changes in OSHA and environmental concerns, new processes available, and any configuration changes to the engines. The Propulsion Database Development task developed a database structure and format which is easy to use and modify while also being comprehensive in the level of detail available. The database structure

included extensive engine information and allows for parametric data generation for conceptual engine concepts. The SSME Upper Stage Use task examined the changes needed or desirable to use the SSME as an upper stage engine both in a second stage and in a translunar injection stage. The CERs for Liquid Engines task developed qualitative parametric cost estimating relationships at the engine and major subassembly level for estimating development and production costs of chemical propulsion liquid rocket engines. The Advanced Low Cost Engines task examined propulsion systems for SSTO applications including engine concept definition, mission analysis. trade studies. operating point selection, turbomachinery alternatives, life cycle cost, weight definition. and point design conceptual drawings and component design. The task concentrated on bipropellant engines, but also examined tripropellant engines. The Tripropellant Comparison Study task provided an unambiguous comparison among various tripropellant implementation approaches and cycle choices, and then compared them to similarly designed bipropellant engines in the SSTO mission This volume overviews each of the tasks giving its objectives, main results. and conclusions. More detailed Final Task Reports are available on each individual task.
Author
Engine Design; Liquid Rocket Propellants; Propulsion; Propulsion System Configurations; Propulsion System Performance; Space Shuttle Main Engine

24
COMPOSITE MATERIALS

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

20000038771 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Evaluation of the Ballistic Resistance of Composite Materials Under FSP Impact: Experimental Results ***Final Report***
Deutekom, M. J., Prins Maurits Lab. TNO, Netherlands; March 1999; 42p; In English; Original contains color illustrations
Contract(s)/Grant(s): A96/KL/453; TNO Proj. 231096210
Report No.(s): TD-98-0347; PML-1998-A106; Copyright; Avail: Issuing Activity

Personal protection equipment of the soldier consists more and more of polymeric composite materials. to understand the ballistic resistance of these materials, a reliable analysis tool is necessary. However, there is still a need for reliable experimental data to calibrate and validate the simulation predictions. The University of British Columbia (UBC) in Vancouver is developing simulation models for ballistic impact on composite materials under assignment from the Defence Research Establishment Valcartier (DREV). A joint project with DREV was started to study the impact behaviour of fibre reinforced plastics (FRP). to validate the models, TNO Prins Maurits Laboratory (TNO-PML) performed instrumented ballistic impact experiments on two types of FRPs impacted by FSPs (Fragment Simulating Projectiles). A cineradiographic high-speed camera (IMAX) was used to measure the displacement of the backface and FSP during impact. A Velocity Interference System for Any Reflector (VISAR) was also used to measure the velocity changes at the backface of the target. The experiments with the aramide FRP panels were successful and gave very reliable data to verify computer simulation models. A trend for the penetration process could not be observed.
Author
Terminal Ballistics; Impact Velocity; Polymer Matrix Composites; Reinforced Plastics; Aramid Fiber Composites

20000038894 Maryland Univ., College Park, MD USA
Damage Tolerance of Composite Sandwich Structures ***Final Report***
Moody, R. C.; Vizzini, Anthony J.; Jan. 2000; 24p; In English
Report No.(s): AD-A374568; DOT/FAA/AR-99/91; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The use of sandwich structures with composite facesheets in commercial aviation is increasing. Such structures provide redundant load paths and high specific bending stiffness. Because of their structural efficiency, light-weight designs result in thin facesheets that are susceptible to impact damage. This study concentrated on the modeling aspects of damage tolerance of thin-gage composite sandwich structures. As such, it is a companion work to the FAA report "Review of Damage Tolerance for Composite Sandwich Airframe Structures," DOT/FAA/AR-99/49, August 1999, which contains a literature review and describes current technical challenges. Current analytical attempts to assess the damage tolerance of composite sandwich structures first characterize the damage state. Based on the type and extent of damage, models are constructed to determine the stress and strain distributions. A failure criterion is then implemented with the calculated stress and strain state. Often components of the damage are neglected to simplify the model of the sandwich structure. Two models to be developed are proposed. The first is a model to determine the extent of load transfer around a damaged area. Localized stiffness reductions will result in a shift in the neutral axis as well as load transfer in the damaged facesheet and to the undamaged facesheet. The amount of load transfer coupled with detailed models of facesheet stability and strength will provide a methodology to determine damage tolerance. The second model

is of the specific damage resulting from low-speed impacts. This model will provide a methodology to predict the growth of such damage.
DTIC
Impact Damage; Tolerances (Mechanics); Sandwich Structures; Composite Structures

20000039346 NASA Marshall Space Flight Center, Huntsville, AL USA
Concept for Determining the Life of Ceramic Matrix Composites Using Nondestructive Characterization Techniques
Effinger, Michael, NASA Marshall Space Flight Center, USA; Ellingson, Bill, Argonne National Lab., USA; Spohnholtz, Todd, Argonne National Lab., USA; Koenig, John, Southern Research Inst., USA; [2000]; 1p; In English; 4th; 4th Aerospace Materials, Processes and Environmental Technology Conference, 18-21 Sep. 2000, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Damping measurements have been taken on ceramic matrix composite (CMC) turbopump blisks in the as fabricated, post proof testing, and post turbopump testing conditions. These results indicate that damping is able to quantify fatigue of the CMC blisk. This gives hope for the potential of determining the actual and residual life of CMC materials using a combination of nondestructive techniques. If successful, then this new paradigm for life prediction of CMCs could revolutionize the approach for designing and servicing CMC components, thereby significantly reducing costs for design, development, health monitoring, and maintenance of CMC components and systems. The Nondestructive Characterization (NDC) life prediction approach would complement life prediction using micromechanics and continuum finite element models. This paper reports on the initial concept of NDC life prediction and how changes in damping and ultrasonic elastic modulus data have established the concept as a possibility.
Author
Ceramic Matrix Composites; Life (Durability); Nondestructive Tests; Nonintrusive Measurement; Damping Tests

20000039381 NASA Johnson Space Center, Houston, TX USA
Synthesis of Single Wall Carbon Nanotubes by Plasma Arc: Role of Plasma Parameters
Farhart, Samir, Paris Univ., France; Scott, Carl D., NASA Johnson Space Center, USA; [2000]; 2p; In English; 10th; 10th Canadian on Hydrogen Conference, 28-31 May 2000, Quebec, France
Contract(s)/Grant(s): RTOP 274-01-97-05; No Copyright; Avail: Issuing Activity; Abstract Only

Single wall carbon nanotubes (SWNT) are porous objects on the molecular scale and have a low density, which gives them potential applications as adsorbent for molecular hydrogen. Their H2 absorption capacity published in the literature varies from 4 to 10% by mass according to the purity of the materials and storage conditions. Optimization of production methods of SWNTs should permit improving these new materials for storage of hydrogen. In this article, we show the potential of using SWNTs in hydrogen storage. In particular, we pose problems associated with synthesis, purification, and opening up of the nanotubes. We present an electric arc process currently used at laboratory scale to produce single wall carbon nanotubes. We discuss, in particular, operating conditions that permit growth of nanotubes and some plasma parameters that assure control of the material. Analysis of the process is carried out with the aid of local measurements of temperature and scanning and transmission electron microscopy of the materials.
Author
Adsorbents; Carbon; Plasmas (Physics); Purification; Temperature Measurement; Walls; Product Development

20000039679 Naval Air Warfare Center, Weapons Div., China Lake, CA USA
Composite Missile Technology Fleet Introduction: Composite Case Captive Carry Qualification (C (exp 4)Q) Program
Paulsen, Nolan, Naval Air Warfare Center, USA; Hudson, Peter, Naval Air Warfare Center, USA; Gehris, Allen, Naval Air Systems Command, USA; 49th JANNAF Propulsion Meeting; December 1999; Volume 2, pp. 1-10; In English; See also 20000039678; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The Composite Case Captive Carry Qualification (C4Q) under the sponsorship of the Insensitive Munitions Technology Transition Program (IMTTP) is an effort to qualify for the first time a composite tactical rocket motor case for flight on the wing of an F/A-18. Up until this time, there has never been a full flight clearance granted for a tactical weapon with a filament-wound composite material as its primary structure. This paper documents the modifications to the flight certification processes and describes the design features of the composite rocket motor case, including new lug and wing attachment concepts. In addition, it discusses the schedules, tasks, and testing for this effort.
Author
Composite Materials; Missiles; Rocket Engine Cases; Safety; Explosions

20000039717 Academy of Sciences (USSR), Inst. for Problems in Mechanics, Moscow, USSR

Methodology, Technical Approach and Measurement Techniques for Testing of TPM Thermal Protection Materials in IPM Plasmatrons

Gordeev, A. N., Academy of Sciences (USSR), USSR; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 1B-1 - 1B-13; In English; See also 20000039703; Copyright Waived; Avail: CASI; A03, Hardcopy

An induction plasmatron application for testing of thermal protection materials is discussed in presented paper on the basis of 35-years experience of Plasma Laboratory of IPM RAS. Methodology of testing of thermal protection materials in plasmatrons was based on simulation of hypersonic reentry heating near stagnation point using subsonic plasma jets, possibility to regulate pressure and flow enthalpy smoothly and independently of one another and the using of plasmatronS advantages such as purity of plasma flow, its high stability and reproducibility as well as wide ranges of realized pressure and heat flux. Purity of plasma flow allows to fulfill long-term aging tests (up to 100 15-minute testing cycles for one sample) at excellent stability and reproducibility flow parameters. Conventional techniques of measurements and analysis such as pyrometry, SEM etc. are discussed together with developed approach to study of thermochemical stability of materials using complex application of optical spectral analysis, tests in different gases and methods of post test analysis.

Author

Procedures; Heat Flux; Long Term Effects; Purity; Reentry Effects; Spectrum Analysis; Temperature Measurement; Thermal Protection; Thermochemistry

20000040109 NASA Marshall Space Flight Center, Huntsville, AL USA

Technological Readiness of Ceramic Matrix Composites: A Review

Neergaard, Lynn, Illinois Inst. of Tech., USA; Effinger, Michael, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 4th; 4th Conference on Aerospace Materials, Processes and Environmental Technology, 18-21 Sep. 2000, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

This review intends to provide a snapshot of the state of industry of ceramic matrix composites (CMC). It is therefore organized in terms of design needs, composite properties, system capabilities, and technological availability. This publication will cover CMCs in use and development, with technological readiness levels (TRL) from laboratory testing of coupons to flight proven hardware.

Author

Ceramic Matrix Composites; Mechanical Properties; Transport Properties; Technology Assessment; Strategic Materials

20000044318 NASA Marshall Space Flight Center, Huntsville, AL USA

Polar Plate Theory for Orthogonal Anisotropy

Bailey, Michelle D., NASA Marshall Space Flight Center, USA; Bower, Mark V., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 51st; 51st International Astronautical Congress, 2-6 Oct. 2000, Rio de Janeiro, Brazil; No Copyright; Avail: Issuing Activity; Abstract Only

Laminated fiber-reinforced (or filamentary) composites are used today for their high strength-to-weight and stiffness-to-weight ratios. However, because of the anisotropic behavior of composites, determining the response on a macroscopic scale is challenging. This is particularly evident in the evaluation of the governing differential equations of a circular disk with the fibers of the lamina oriented with rectilinear orthogonality. This includes any situation involving a composite plate of circular geometry in which out-of-plane displacements due to load are desired, such as fastener pull through loading of a composite plate. Current analysis techniques use numerical methods with rectilinear coordinate systems to solve problems with circular geometry. These analyses over predict plate stiffness by 20% and underpredict failure by 70%. Consequently, there is a need to transform classical composite plate theory to a polar coordinate system. In order to better analyze structures with circular geometries the classical composite plate equations are transformed into the plate equations for a rectilinearly anisotropic composite in polar coordinates. A composite plate is typically a laminate of fibers in rectilinear directions. Subsequent to the lay-tip the necessary geometry is cut out of a rectangular plate. In a similar manner, the derivation of the plate equation starts with the fundamental definitions of strain, displacement and curvature and incorporates the material property angular dependence into the equilibrium equations for a differential polar element. In the transformed state, the stiffness coefficients are no longer constant, adding to the complexity of the governing differential equations. This paper discusses the new derivation and evaluation of the plate equations for a circular composite disk with orthogonal rectilinear anisotropy. The resultant new three partial differential equations, which describe the circular anisotropic plate, can be used to evaluate out-of-plane displacements for given load conditions in design of composite Structures. Without the formation of these unique plate equations, design of such structures is not a precise engineering accomplishment due to the lack of precise design tools. Such structures are over designed to compensate and costly tests need to be performed after production to validate safety. Though impossible to present the mathematical solution within the limits of this paper,

the application of the newly derived plate equation in its orthotropic form for a balanced symmetric laminate compared favorably with test results and surpassed the results of standard numerical methods. Within the limitations of the problem foundation the predictive model provides a mechanism for establishing out-of-plane deflection levels for a circular composite plate. Future work in this area should include incorporating the circular composite plate equations in Finite Element Models. The new anisotropic polar plate equations call be utilized as a design tool so that the design more accurately meets the requirements, thus taking full advantage of the weight savings of composites. These accomplishments have not previously been presented to the engineering community nor ever proposed to the IAF. Should the proposed paper be accepted for presentation, attendance is assured.
Author
Anisotropic Plates; Anisotropy; Circular Plates; Differential Equations; Equilibrium Equations; Fiber Composites; Finite Element Method; Laminates; Orthogonality

25
INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

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

20000038346 NASA Marshall Space Flight Center, Huntsville, AL USA
Solidification Processing of Immiscible Liquids in the Presence of Applied Ultrasonic Energy
Kim, Shinwood, Hoseo Univ.; Grugel, R. N., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; TMS Conference, 13 Mar. 2000, Nashville, TN, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Uniform microstructural development during solidification of immiscible liquids on Earth is hampered by inherent density differences between the phases. Microgravity processing minimizes settling but segregation still occurs due to gravity independent wetting and coalescence phenomena. Experiments with the transparent organic, metal analogue, succinonitrile-glycerol system were conducted in conjunction with applied ultrasonic energy. The processing parameters associated with this technique have been evaluated in view of optimizing dispersion uniformity. Experimental results to evaluate microstructural phase distributions, based on other liquid-liquid immiscibility systems, will also be presented.
Author
Liquids; Settling; Solidification; Space Processing; Ultrasonics; Microgravity; Solubility

20000038691 NASA Johnson Space Center, Houston, TX USA
JSC Toxicology Web Site
Garcia, Hector D., NASA Johnson Space Center, USA; Coleman, M., NASA Johnson Space Center, USA; James, J., NASA Johnson Space Center, USA; Lam, C., Wyle, USA; [1999]; 1p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Data on chemical and biological materials to be flown in the pressurized volumes of habitable spacecraft, including the International Space Station (ISS), are needed by JSC toxicologists to assess the toxicity and assign hazard levels. This document defines submission schedules and establishes requirements for the types and format of these data. JSC 27472 Rev A is a major revision of JSC 25607, "Requirements for Submission of Test Sample-Materials Data for Shuttle Payload Safety Evaluations", dated October 1994, which was subsequently re-issued (September 1996) with a new document number, JSC 27472, but with the same title and date and no revisions. The revisions in the present document have been necessitated by the recent introduction of a two-step process (described in this document) for verification of data for flight materials and by the anticipated needs of the ISS. The requirements -for data submission apply to items which contain liquids, gases, gels, greases, powders/ particulates, radioisotopes, or biological materials and are located in the habitable pressurized volume of ISS or U.S. operated spacecraft. These include, but are not limited to, science payloads, government furnished equipment (GFE), risk mitigation experiments (RmEs), development test objectives (DTOs), detailed supplementary objectives (DSOs), life science experiments, and medical studies.
Author
Toxicology; Data Acquisition; Hazards; Life Sciences; Risk; Schedules; Toxicity

20000038692 White Sands Test Facility, Las Cruces, NM USA
Ignition and Thermal Hazards of Selected Aerospace Fluids
Benz, Frank J., White Sands Test Facility, USA; Bishop, Craig V., Lockheed Engineering and Management Services Co., Inc., USA; [2000]; 1p; In English
Contract(s)/Grant(s): NAS9-99100; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This handbook is designed to provide a summary of the ignition and thermal hazards associated with common aerospace fluids. It is not intended to be a final treatise, since research into these properties of fluids used in spacecraft and aircraft will continue to be necessary. However, the information provided should enable scientists and engineers to assess the hazards associated with the use of many flammable and explosive fluids. It is hoped that the handbook will contribute to the standardization of test methods, concepts, terminology, and data formats that are presently unnecessarily diverse and occasionally conflicting, and will also stimulate research in areas which have received little attention. Readers are cautioned that, although every reasonable effort has been made to present accurate information, the authors and publisher make no warranty nor do they assume legal responsibility for its correctness. Readers are urged to assess each situation carefully and to choose data that appear most appropriate. The materials considered in this book are flammable fluids. Fluids which have a strong oxidizing nature (e.g., dinitrogen tetroxide and liquid oxygen) are not considered. In many cases testing was performed at the NASA JSC White Sands Test Facility (WSTF) to provide data that was not available in the literature. The handbook is divided into three main sections, plus appendices and a bibliography. The first section provides general information on the uses of fluids included in the handbook and on the evaluation of ignition, then-nal, and explosion hazards associated with flammable and explosive materials. The second section provides specific information on each of the fluids considered; a standard format is used to facilitate comparison of different fluids. The third section of the handbook describes selected test procedures for hazard evaluation. The appendices include a glossary of terms, ignition limits and reaction hazard rat ratings of miscellaneous fluids, fluid specifications, and unit conversion tables. The International System of Units (S.I.) is used throughout; wherever feasible, English units are included in parenthesis.
Author
Handbooks; Ignition Limits; Hazards; Explosions; Flammability; Free Convection

20000038738 National Inst. for Fusion Science, Nagoya, Japan
A Simple Theoretical Approach to Determine Relative Ion Yield (RIY) in Glow Discharge Mass Spectrometry (GDMS)
Born, Sabine, Deutsche Gold- und Silber-Scheideanstalt-Huels A.G., Germany; Matsunami, Noriaki, Nagoya Univ., Japan; Tawara, Hiroyuki, National Inst. for Fusion Science, Japan; January 2000; ISSN 0915-6364; 20p; In English
Report No.(s): NIFS-DATA-56; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Direct current glow discharge mass spectrometry (dc-GDMS) has been applied to detect impurities in metals. The aim of this study is to understand quantitatively the processes taking place in GDMS and establish a model to calculate the relative ion yield (RIY), which is inversely proportional to the relative sensitivity factor (RSF), in order to achieve better agreement between the calculated and the experimental RIYs. A comparison is made between the calculated RIY of the present model and the experimental RIY, and also with other models.
Author
Direct Current; Glow Discharges; Mass Spectroscopy; Electron Impact; Ionization; Penning Effect; Sputtering

20000039372 Boeing Co., Canoga Park, CA USA
Quantitative Hydrocarbon Surface Analysis
Douglas, Vonnie M., Boeing Co., USA; [2000]; 1p; In English; Aerospace Materials, Processes and Environmental Tech Conference, Sep. 2000, Huntsville, AL, USA
Contract(s)/Grant(s): NAS8-40000; No Copyright; Avail: Issuing Activity; Abstract Only

The elimination of ozone depleting substances, such as carbon tetrachloride, has resulted in the use of new analytical techniques for cleanliness verification and contamination sampling. The last remaining application at Rocketdyne which required a replacement technique was the quantitative analysis of hydrocarbons by infrared spectrometry. This application, which previously utilized carbon tetrachloride, was successfully modified using the SOC-400, a compact portable FTIR manufactured by Surface Optics Corporation. This instrument can quantitatively measure and identify hydrocarbons from solvent flush of hardware as well as directly analyze the surface of metallic components without the use of ozone depleting chemicals. Several sampling accessories are utilized to perform analysis for various applications.
Author
Contamination; Hydrocarbons; Infrared Spectroscopy; Quantitative Analysis; Sampling; Decontamination

20000040857 Virginia Transportation Research Council, Charlottesville, VA USA
Cathodic Protection of Concrete Bridge Decks Using Titanium-Mesh Anodes ***Final Report, Oct. 1992 - Oct. 1998***
Clemena, G. G.; Jackson, D. R.; Feb. 2000; 34p; In English
Report No.(s): PB2000-103397; VTRC-00-R14; Copyright; Avail: National Technical Information Service (NTIS)

Anodes are a critical component of cathodic protection systems. A continuous research effort in Virginia is being aimed at searching for the most suitable anode for use in cathodic protection of the various types of concrete bridge components that are

exposed to intrusion by chloride ions. As part of this effort, three different catalyzed titanium mesh anodes were tested, side by side, in a cathodic protection system that was designed and constructed (in conjunction with the rehabilitation of several concrete deck spans) to prevent further reinforcement corrosion-related damage to these structures. The purpose of this study was to determine whether this type of new anode is suitable for application in bridge decks, and if any of the three mesh anodes tested in this study excels over the other.
NTIS
Cathodic Coatings; Catalysis; Bridges (Structures)

20000041719 National Inst. of Standards and Technology, (BFRL), Gaithersburg, MD USA
Building and Fire Research Laboratory Activities, Accomplishments, and Recognitions, 1999
Snell, J. E.; Feb. 2000; 60p; In English; Original contains color illustrations
Report No.(s): PB2000-101946; NIST/SP-838-16; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The National Institute of Standards and Technology Building and Fire Research Laboratory (NIST/BFRL), one of NIST's measurements and standards laboratories, provides the measurement technologies, performance prediction methods, and technical advances needed to enhance the competitiveness of U.S. industry and public safety, and assure the life cycle quality and economy of constructed facilities. This report summarizes selected technical accomplishments and staff recognitions and describes activities conducted by the laboratory during FY 1998. Also, the report presents BFRL's organizations and customer interactions.
NTIS
Buildings; Fires; Research Management; Safety Management; Prediction Analysis Techniques; Performance Prediction

20000042894 Alabama Univ., Dept. of Chemistry, Birmingham, AL USA
Lithium Borides: High Energy Materials ***Final Report, 1 Sep. 1996 - 31 Aug. 1999***
Lammertsma, Koop, Alabama Univ., USA; Hamilton, Tracy P., Alabama Univ., USA; Feb. 28, 2000; 127p; In English
Contract(s)/Grant(s): F49620-91-1-0450
Report No.(s): AD-A375216; AFRL-SR-BL-TR-00-0073; No Copyright; Avail: CASI; A02, Microfiche; A07, Hardcopy

A theoretical research investigation of materials that are potential additives for solid hydrogen rocket fuels is investigated. The ab initio calculations show that mixed clusters of boron and lithium prefer to have an electronegative boron atom at the middle, surrounded by positively charged lithium. The bonding is ionic, and not very directional. There is extensive bridging by the lithium atoms to form nonclassical structures. Upon replacement of boron by aluminum, the clusters are more metallic and quite different. The aluminum stays at the edge of the cluster, more segregated. A great deal of energy will be lost if mixed boron-lithium clusters are formed (relative to the energy of pure lithium clusters), up to around 6 or 7 lithium. After that, the boron atom is saturated and further lithium addition has the same aggregation energy as pure lithium clusters.
DTIC
Lithium; Energy Technology; High Energy Fuels; Boron; Solid Rocket Propellants

26
METALS AND METALLIC MATERIALS

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

20000038375 Forschungszentrum Geesthacht G.m.b.H., Germany
Investigation on fracture toughness of laser beam welded steels
Riekehr, S.; Cam, G.; Santos, J. F.; Kocak, M.; Klein, R. M.; Dec. 31, 1999; 11p; In English; 7th; Laser treatment of materials (ECLAT-7)
Report No.(s): DE99-772685; GKSS-99/E/11; No Copyright; Avail: Department of Energy Information Bridge

Laser beam welding is currently used in the welding of a variety of structural materials including hot and cold rolled steels, high strength low alloy and stainless steels, aluminium and titanium alloys, refractory and high temperature alloys and dissimilar materials. This high power density welding process has unique advantages of cost effectiveness, low distortion, high welding speed, easy automation, deep penetration, narrow bead width, and narrow HAZ compared to the conventional fusion welding processes. However, there is a need to understand the deformation and fracture properties of laser beam weld joints in order to use this cost effective process for fabrication of structural components fully. In the present study, an austenitic stainless steel, X5CrNi18 10 (1.4301) and a ferritic structural steel, RSt37-2 (1.0038), with a thickness of 4 mm were welded by 5 kW CO2 laser process. Microhardness measurements were conducted to determine the hardness profiles of the joints. Flat microtensile specimens were extracted from the base metal, fusion zone, and heat affected zone of ferritic joint to determine the mechanical property

variation across the joint and the strength mismatch ratio between the base metal and the fusion zone. Moreover, fracture mechanics specimens were extracted from the joints and tested at room temperature to determine fracture toughness, Crack Tip Opening Displacement (CTOD), of the laser beam welded specimens. The effect of the weld region strenght mis-matching on the fracture toughness of the joints have been evaluated. Crack initiation, crack growth and crack deviation processes have also been examined. These results were used to explain the influence of mechanical heterogeneity of the weld region on fracture behaviour. This work is a part of the ongoing Brite-Euram project Assessment of Quality of Power Beam Weld Joints (ASPOW).
NTIS
Fracture Strength; Laser Beams; Laser Welding; Structural Design; Fracture Mechanics

20000039345 NASA Marshall Space Flight Center, Huntsville, AL USA
New Alloys for Electroformed Replicated X-Ray Optics
Engelhaupt, D., Alabama Univ., USA; Ramsey, B. D., NASA Marshall Space Flight Center, USA; ODell, S. L., NASA Marshall Space Flight Center, USA; Jones, W. D., NASA Marshall Space Flight Center, USA; Russell, J. K., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 45th, 30 Jul. - 4 Aug. 2000, San Diego, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The process of electroforming x-ray mirror shells off a superpolished mandrel has been widely used. The recently launched XMM mission is a good example of this, containing 174 such mirror shells of diameters ranging from 0.3-0.7 m and thicknesses of 0.47-1.07 mm. to continue to utilize this technique for the next generation of x-ray observatories, where ever-larger collecting areas will be required within the constraints of tight weight budgets, demands that new alloys be developed that can withstand the large stresses imposed on very thin shells by the replication and handling processes. Towards this end, we began a development program in late 1997 to produce a high-strength alloy suitable for electroforming very thin high-resolution x-ray optics. The requirements for this task are quite severe; not only must the electroformed deposit be very strong, it must also have extremely low residual stresses to prevent serious figure distortions in large thin-walled shells. Further, the electroforming must be performed at near room temperature, as large temperature changes will modify the figure of the mandrel, in an environment that is not corrosive for the mandrel. The figure of merit for the strength of the electroformed deposit is its Precision Elastic Limit (PEL). This is a measure of permanent strain, at the few parts per million level, under applied stress. Pure nickel is very ductile and will permanently deform, at the parts-per-million level under loads of a few x 10(exp 7) Pa. These stresses are easily exceeded when thin-walled shells (150 micron thick) are replicated. Our goal was to develop an alloy an order of magnitude stronger than this. We will present the results of our development program, showing the evolution of our plating baths through to our present 'glassy' nickel alloy that satisfies the goals above. For each we will show the electroforming characteristics of the bath and the PEL measurements for the resulting alloys. We estimate the ultimate limit on shell thickness and mass for x-ray mirrors produced in these baths.
Author
Electroforming; High Strength Alloys; X Ray Optics

20000039355 Universities Space Research Association, Alliance for Microgravity Materials Science and Applications, Huntsville, AL USA
Modeling of a Non-Dilute Alloy Solidification Under Terrestrial and Microgravity Conditions
Bune, Andris V., Universities Space Research Association, USA; Gillies, Donald C., NASA Marshall Space Flight Center, USA; Lehoczky, Sandor L., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; ICTAM 2000, 28 Aug. 2000, Chicago, IL, USA
Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only

A general finite element model of non-dilute alloy solidification was used to simulate growth of HgCdTe from the melt. 2-D and 3-D models with and without Oberbeck-Boussinesq (O-B) approximation were used. Verification of the 3-D model was based on experimental data. The location and the shape of the interface were determined using melting temperatures obtained from the HgCdTe liquidus curve. Double-diffusive convection in the melt is caused by radial temperature gradients and by rejection at the solid-melt interface of the heavier HgTe-rich solute. Because of these complicating factors, dimensional rather than non-dimensional modeling was performed. Models based on complete set of Navier-Stokes equations for compressible media are superior to the O-B approximation in microgravity, because they provide more accurate estimation of convection.
Author
Finite Element Method; Solidification; Alloys; Crystal Growth; Mercury Cadmium Tellurides; Two Dimensional Models; Three Dimensional Models; Boussinesq Approximation

20000039357 NASA Marshall Space Flight Center, Huntsville, AL USA

Solidification Studies from the Electrostatic Levitation System at the Marshall Space Flight Center

Rogers, Jan R., NASA Marshall Space Flight Center, USA; Hyers, Robert W., NASA Marshall Space Flight Center, USA; Robinson, Michael B., NASA Marshall Space Flight Center, USA; Savage, Larry, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English, 13 Mar. 2000, Nashville, TN, USA; Sponsored by Metallurgical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Electrostatic levitation (ESL) provides a means to study molten materials in a high-purity environment, free from contact with a container. Many phenomena important to materials science can be studied in the ESL. Solidification of metals, alloys and undercooled materials represent an important topic for research in the ESL. Recent studies of metals and alloys during solidification in the ESL are reported. Measurements include time, temperature and transformation of metallic glass-forming alloys, solidification velocities, and microstructure,

Author

Levitation; Metallic Glasses; Solidification; Electrostatics

20000040431 NASA Langley Research Center, Hampton, VA USA

Advances in Fatigue and Fracture Mechanics Analyses for Metallic Aircraft Structures

Newman, J. C., Jr., NASA Langley Research Center, USA; April 2000; 45p; In English; 17th; Aeronautical Fatigue, 12-16 Jul. 1999, Seattle, WA, USA; Original contains color illustrations

Contract(s)/Grant(s): RTOP 706-11-11-01

Report No.(s): NASA/TM-2000-210084; L-17955; NAS 1.15:210084; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper reviews some of the advances that have been made in stress analyses of cracked aircraft components, in the understanding of the fatigue and fatigue-crack growth process, and in the prediction of residual strength of complex aircraft structures with widespread fatigue damage. Finite-element analyses of cracked metallic structures are now used to determine accurate stress-intensity factors for cracks at structural details. Observations of small-crack behavior at open and rivet-loaded holes and the development of small-crack theory has lead to the prediction of stress-life behavior for components with stress concentrations under aircraft spectrum loading. Fatigue-crack growth under simulated aircraft spectra can now be predicted with the crack-closure concept. Residual strength of cracked panels with severe out-of-plane deformations (buckling) in the presence of stiffeners and multiple-site damage can be predicted with advanced elastic-plastic finite-element analyses and the critical crack-tip-opening angle (CTOA) fracture criterion. These advances are helping to assure continued safety of aircraft structures.

Author

Aircraft Structures; Cracks; Finite Element Method; Fracture Mechanics; Stress Analysis; Metals; Crack Propagation; Metal Fatigue

20000042031 Oak Ridge National Lab., TN USA

ALCAR: A Model for Horizontal R&D Consortia

Barthold, G. B., Oak Ridge National Lab., USA; Das, S. K., Oak Ridge National Lab., USA; Hayden, H. W., Oak Ridge National Lab., USA; Mar. 01, 1999; 7p; In English; TMS Symposium on Automotive Alloys III, 1-4 Mar. 1999, San Diego, CA, USA

Report No.(s): DE00-009116; ORNL/CP-103222; No Copyright; Avail: Department of Energy Information Bridge

The ALCAR Consortium was created to develop a low cost, non-heat treatable automotive body sheet alloy. This paper will discuss the management aspects of organizing and running a horizontal consortium for competing companies to cooperate in conducting pre-competitive research and development involving the US Department of Energy, National Laboratories, Universities and industrial consultants.

NTIS

Aluminum Alloys; Metal Sheets; Research and Development; Automobiles

20000043990 Ocean City Research Corp., NJ USA

Durability Analysis of Aluminized Type 2 Corrugated Metal Pipe ***Final Report, Oct. 1994 - Dec. 1996***

Ault, J. P.; Ellor, J. A.; Mar. 2000; 118p; In English; Original contains color illustrations

Report No.(s): PB2000-103824; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The focus of field studies conducted during this investigation centered on the performance of alumized Type 2 culverts. of the 32 culverts inspected during this investigation, 21 culverts were part of a previous Federal Highway Administration (FHWA) study. These culverts were located in Alabama and Oregon. Eight culverts at five sites in Maine were added with the expansion of these field studies. In situ field measurements of pH and resistivity were taken at each culvert. The abrasive situation at each

culvert was characterized, including slope, flow velocity, and abrasive material. Each culvert was photo-documented and many were videotaped for future reference. Coupon samples were taken at each location for pit-depth analysis. Soil samples were removed for laboratory resistivity measurements.
NTIS
Durability; Pipes (Tubes); Aluminum

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.

20000038636 NASA Marshall Space Flight Center, Huntsville, AL USA
Gravitational Influences on the Growth of Polydiacetylene Films by Ultraviolet Solution Polymerization
Frazier, Donald O., American Chemical Society, USA; [2000]; 1p; In English, 25-31 Mar. 2000, San Francisco, CA, USA; Sponsored by American Chemical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Technically, the field of integrated optics using organic/polymer materials as a new means of information processing, has emerged as of vital importance to optical computers, optical switching, optical communications, the defense industry, etc. The goal is to replace conventional electronic integrated circuits and wires by equivalent miniaturized optical integrated circuits and fibers, offering larger bandwidths, more compactness and reliability, immunity to electromagnetic interference and less cost. From the Code E perspective, this research area represents an opportunity to marry ”front-line” education in science and technology with national scientific and technological interests while maximizing human resources utilization. This can be achieved by the development of untapped resources for scientific research - such as minorities, women, and universities traditionally uninvolved in scientific research.
Author
Organic Materials; Polymerization; Polymeric Films; Gravitation; Integrated Optics; Ultraviolet Radiation

20000039348 NASA Marshall Space Flight Center, Huntsville, AL USA
Optical Analysis of Transparent Polymeric Material Exposed to Simulated Space Environment
Edwards, David L., NASA Marshall Space Flight Center, USA; Finckenor, Miria M., NASA Marshall Space Flight Center, USA; Dec. 17, 1999; 1p; In English; 7th; Photonics for Space Environments Conference, 31 Jul. - 4 Aug. 2000, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA
Contract(s)/Grant(s): RTOP 242-83-00; No Copyright; Avail: Issuing Activity; Abstract Only

Transparent polymeric materials are being designed and utilized as solar concentrating lenses for spacecraft power and propulsion systems. These polymeric lenses concentrate solar energy onto energy conversion devices such as solar cells and thermal energy systems. The conversion efficiency is directly related to the transmissivity of the polymeric lens. The Environmental Effects Group of the Marshall Space Flight Center’s Materials, Processes, and Manufacturing Department exposed a variety of materials to a simulated space environment and evaluated them for an, change in optical transmission. These materials include Lexan(TM), polyethylene terephthalate (PET). several formulations of Tefzel(TM). and Teflon(TM), and silicone DC 93-500. Samples were exposed to a minimum of 1000 Equivalent Sun Hours (ESH) of near-UV radiation (250 - 400 nm wavelength). Data will be presented on materials exposed to charged particle radiation equivalent to a five-year dose in geosynchronous orbit. These exposures were performed in MSFC’s Combined Environmental Effects Test Chamber, a unique facility with the capability to expose materials simultaneously or sequentially to protons, low-energy electrons, high-energy electrons, near UV radiation and vacuum UV radiation.Prolonged exposure to the space environment will decrease the polymer film’s transmission and thus reduce the conversion efficiency. A method was developed to normalize the transmission loss and thus rank the materials according to their tolerance to space environmental exposure. Spectral results and the material ranking according to transmission loss are presented.
Author
Aerospace Environments; Environment Effects; Polymers; Transparence; Lexan (Trademark); Polyethylene Terephthalate; Teflon (Trademark); Silicones; Accelerated Life Tests

20000039442 National Inst. of Standards and Technology, Materials Science and Engineering Lab., Gaithersburg, MD USA
Guide to the Nomenclature of Particle Dispersion Technology for Ceramic Systems
Hackley, V. A.; Feb. 2000; 32p; In English
Report No.(s): PB2000-100138; NIST/SP-945; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

It is generally agreed that measurements and standards play an integral role in the manufacture of ceramic materials. They enhance reliability by providing a basis for quantifying and comparing material properties during each phase of the manufacturing process. Equally important is the establishment of a uniform and widely accepted nomenclature to permit the efficient exchange of scientific and technical information. This document contains a practical guide to the nomenclature of dispersion systems. It was compiled as a resource for those working in particule dispersion-based application, particularly in the ceramic sciences.
NTIS
Ceramics; Dispersions; Particulates; Nomenclatures

20000039470 NASA Marshall Space Flight Center, Huntsville, AL USA
Gold Coating of Fiber Tips in Near-Field Scanning Optical Microscopy
Vikram, Chandra S., Alabama Univ., USA; Witherow, William K., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

We report what is believed to be the first experimental demonstration of gold coating by a chemical baking process on tapered fiber tips used in near-field scanning optical microscopy. Many tips can be simultaneously coated.
Author
Gold Coatings; Near Fields; Optical Scanners; Microscopy; Fibers

20000039472 NASA Marshall Space Flight Center, Huntsville, AL USA
Study of Doped ZnO Films Synthesized by Combining Vapor Gases and Pulsed Laser Deposition
Zhu, Shen, Universities Space Research Association, USA; Su, Ching–Hua, NASA Marshall Space Flight Center, USA; Lehoczky, Sandor L., NASA Marshall Space Flight Center, USA; George, M. A., Alabama Univ., USA; [2000]; 1p; In English; 7th; 7th IUMRS-ICEM: Electronic Materials in Symposium D: Photon-induced Material Processing, 30 May - 2 Jun. 2000, Strasbourg, France; No Copyright; Avail: Issuing Activity; Abstract Only

The properties and structure of the ZnO material are similar to those of the GaN. Since an excitonic binding energy of ZnO is about 60 meV, it has strong potential for excitonic lasing at the room temperature. This makes synthesizing ZnO films for applications attractive. However, there are several hurdles in fabricating electro-optical devices from ZnO. One of those is in growing doped p-type ZnO films. Although techniques have been developed for the doping of both p-type and n-type ZnO, this remains an area that can be improved. In this presentation, we will report the experimental results of using both thermal vapor and pulsed laser deposition to grow doped ZnO films. The films are deposited on (0001) sapphire, (001) Si and quartz substrates by ablating a ZnO target. The group III and V elements are introduced into the growth chamber using inner gases. Films are characterized by x-ray diffraction, scanning probe microscopy, energy dispersive spectroscopy, Auger electron spectroscopy, and electrical measurements. The full width at half maximum of theta rocking curves for epitaxial films is less than 0.5 deg. In textured films, it rises to several degrees. Film surface morphology reveals an island growth pattern, but the size and density of these islands vary with the composition of the reactive gases. The electrical resistivity also changes with the doped elements. The relationship between the doping elements, gas composition, and film properties will be discussed.
Author
Doped Crystals; Zinc Oxides; Synthesis (Chemistry); Pulsed Laser Deposition; Vapor Deposition; Metal Films

20000040397 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Propulsi Maju, Jakarta, Indonesia
Estimates of Polybutadiene Diffusion Values in Various Solvents Using the Free Volume Theory *Perkiraan Nilai Difusifitas Polibutadien Pada Berbagai Pelarut Menggunakan Teori Volume Bebas*
Wibowo, Heri Budi, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; April - June 1999; Volume 1, No. 2, pp. 17-22; In Malay-Indonesian; See also 20000040393; Copyright; Avail: Issuing Activity

The phenomenon of diffusion is essential to butadiene polymerization processing such as curing and separation process. Free volume parameters for various solvents are estimated using viscosity-temperature data. Using this parameters in conjunction with the Vrentas-Duda theory, diffusion coefficients then predicted for polymer (polybutadiene) in various solvents systems over wide ranges of concentration and temperature. Diffusion coefficient is computed using numerical methods. The correlation of diffusion coefficient with temperature and concentration is discussed in this paper.
Author
Diffusion; Polybutadiene; Polymerization; Solvents; Estimating; Volumetric Analysis

20000042030 Oak Ridge National Lab., TN USA

Performance Study of Scepter(TM); Metal Bond Diamond Grinding Wheel

Denison, S. K.; Licht, R. W.; McSpadden, S. B.; Parten, R. J.; Picone, J. W.; Jun. 17, 1999; 13p; In English

Report No.(s): DE00-009290; ORNL/CP-103952; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Advanced ceramics are attractive for many applications in the transportation, energy, military, and industrial markets because they possess properties of high-temperature durability, corrosion resistance, strength, hardness, stiffness, and wear resistance. Unfortunately, these same properties make advanced ceramics more difficult to machine than traditional materials. The reliability and manufacturing costs of advanced ceramic components are significant concerns that must be overcome. Nevertheless, the use of advanced ceramic materials is expected to increase dramatically in new transportation systems in response to more stringent energy conservation and pollution reduction requirements. This study discusses the goals, commercialization plans, phased development, scale-up, testing, and external verification of performance of the innovative grinding wheel that evolved from the project. NTIS

Grinding Machines; Ceramics; Diamonds; Wheels

20000042893 Harvard Univ., Dept. of Chemistry and Chemical Biology, Cambridge, MA USA

Nanotribology Investigations of Solid and Liquid Lubricants Using Scanned Probe Microscopies ***Final Report, 1 Nov. 1996 - 31 Oct. 1999***

Lieber, Charles M., Harvard Univ., USA; Jan. 28, 2000; 24p; In English

Contract(s)/Grant(s): F49620-97-1-0005

Report No.(s): AD-A375214; AFRL-SR-BL-TR-00-0074; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

To understand and control friction and wear in both macroscopic and microscopic technologies requires a detailed understanding of material properties, chemical reactivity and intermolecular interactions on the nanometer length scale. The role of nanoscale defects on friction has been elucidated through scanning tunneling microscopy and atomic force microscopy studies of molybdenum disulfide. These investigations have shown that friction increases systematically with increasing defect density, and have demonstrated a novel load-independent friction regime due to sliding on constant area nanocrystals. The mechanical properties of finite size materials, which are important to micro and nanomechanical systems, have also been probed through studies of the bending of different thickness molybdenum oxide nanocrystals. Significantly, this work has shown that there is a substantial and systematic decrease in the modulus with decreasing thickness. This large drop in stiffness shows that materials will exhibit greater flexibility as their dimensions are reduced. Lastly, a new generation of molecular resolution tools has been developed. Carbon nanotubes were attached to conventional force microscopy tips and shown to provide large improvements in image resolution. Methods to localize molecules at the nanotube ends were also developed, and these modified probes were used to measure intermolecular forces and image with chemical sensitivity.

DTIC

Nanocrystals; Scanning Tunneling Microscopy; Solid Lubricants; Tribology; Atomic Force Microscopy

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.

20000039681 Naval Air Warfare Center, Research Dept., China Lake, CA USA

Thermal Decomposition Characteristics of Ammonium Perchlorate (AP) and an AP Based Propellant

Atwood, A. I., Naval Air Warfare Center, USA; Kraeutle, K. J., Naval Air Warfare Center, USA; Curran, P. O., Naval Air Warfare Center, USA; Parr, T. P., Naval Air Warfare Center, USA; Hanson–Parr, D. M., Naval Air Warfare Center, USA; Behrens, R., Sandia National Labs., USA; Minier, L., Sandia National Labs., USA; Ratzel, A., Sandia National Labs., USA; 49th JANNAF Propulsion Meeting; December 1999; Volume 1, pp. 21-50; In English; See also 20000039678

Contract(s)/Grant(s): DE-AC04-94AL-85000; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

This paper summarizes three major efforts that have recently been conducted to further the insight regarding the thermal decomposition characteristics of Ammonium Perchlorate (AP) and an AP-based composite propellant at temperatures less than 270C. The studies utilized various techniques to evaluate the thermal decomposition of neat AP as a function of time, particle size, temperature and crystal structure. For all samples, the nature of the physical processes is probed by the use of SEM and optical

microscopy. The nature of the chemical processes is elucidated by analysis of the time-dependent behavior of the weight-loss curves, the product identities and the time-dependent behavior of the gas evolution rates of the products. The thermal decomposition characteristics of an AP-based propellant are evaluated as a function of time and temperature and compared to that of the analogous neat-AP decomposition experiments. Insight into the complex and coupled decomposition processes is obtained and is relevant to developing a capability to predict the response of these materials in a slow-cookoff environment.
Author
Ammonium Perchlorates; Composite Propellants; Firing (Igniting); Thermal Decomposition; Propellant Decomposition

20000039682 Sandia National Labs., Albuquerque, NM USA
Characterization of Thermally Degraded Energetic Materials: Experiments and Constitutive Modeling
Renlund, A. M., Sandia National Labs., USA; Schmitt, R. G., Sandia National Labs., USA; Wellman, G. W., Sandia National Labs., USA; Miller, J. C., Sandia National Labs., USA; 49th JANNAF Propulsion Meeting; December 1999; Volume 1, pp. 51-63; In English; See also 20000039678
Contract(s)/Grant(s): DE-AC04-94AL-85000; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The violence of reaction from a thermal explosion or ”cookoff” can vary from a quiescent pressure burst to a very violent explosion or possible detonation. The response is highly dependent upon the state of the energetic material at ignition. This material state can be characterized by the temperature, stress, amount of decomposition, meso- and micro-porosity, and crack density. A constitutive model is needed to predict the evolution of the energetic material state during the thermal history. This model must be capable of capturing the effects of thermal expansion, mechanical loading, phase transformation, and chemical decomposition. A constitutive model has been developed for confined HMX. This model includes the effects of elasticity, volumetric and deviatoric creep, thermal expansion, chemical decomposition, and phase change. The volumetric creep aspect of the model represents the evolution of porosity with thermal and mechanical loading. The deviatoric creep model, as the name implies, captures permanent changes in the deformed shape of the energetic material due to the deviatoric stress. The model has been developed from experimental data taken in the hot cell configuration. In these experiments, the energetic material is heavily confined and sealed in a thick-walled, cylindrical cell with pistons along the axis. Data can be taken in either displacement- or load-controlled configurations. Experimental data from the load-controlled system were used to estimate model parameters. The model is shown to reproduce the trends in both the load-controlled and displacement-controlled hot cell configurations. Additional experiments are planned to obtain model parameters from independent tests and to perform model validation in other configurations.
Author
Creep Properties; Elastic Properties; HMX; Mathematical Models; Phase Transformations; Propellant Decomposition; Finite Element Method

20000039683 Naval Air Warfare Center, Weapons Div., China Lake, CA USA
Hazards Associated With Solid Propellants
Boggs, T. L., Naval Air Warfare Center, USA; Atwood, A. I., Naval Air Warfare Center, USA; Lindfors, A. J., Naval Air Warfare Center, USA; Mulder, E. J., Johns Hopkins Univ., USA; Pritchard, R. W., Naval Air Warfare Center, USA; 49th JANNAF Propulsion Meeting; December 1999; Volume 1, pp. 65-105; In English; See also 20000039678; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Hazards associated with solid propellants are presented. Mechanical shock to detonation, including the effects of critical diameter and shock amplitude, and the resulting classification of propellants as hazard class 1. 1 (mass detonating) and 1.3 (mass fire hazard) are discussed. The 1. 1 propellants are usually more susceptible to operational hazards such as fragment or bullet impact, while the 1.3 propellants are susceptible to manufacturing and handling hazards. The hazards of 1.3 propellants are discussed, showing that a 1.3 hazard classification does not necessarily imply ”safe” propellants. Historical incident data are presented.
Author
Hazards; Solid Propellants; Explosions; Hazardous Materials; Ignition; Propellant Combustion

20000039684 Rohm and Haas Co., Redstone Arsenal Research Div., Huntsville, AL USA
Mechanisms and Methods of Suppression of Oscillatory Burning by Metallic Additives
Waesche, R. H. Woodward, Rohm and Haas Co., USA; 49th JANNAF Propulsion Meeting; December 1999; Volume 1, pp. 107-117; In English; See also 20000039678; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Following the discovery of suppression of unstable burning in solid-propellant rocket, motors by the inclusion of aluminum powder in the compositions. studies showed a variation of effects of different grades of aluminum. Later investigations with a variety of additives evaluated the relative importance of thermal conductivity, attenuation by solid particles, and heat addition as suppression mechanisms. Cinemicrographic studies of burning in window bombs led to predictions which were experimentally verified by results of vented-vesssel firings.
Author
Combustion; Propellant Additives; Aluminum

20000039685 Air Force Research Lab., Wright-Patterson AFB, OH USA
Toxicity of Rocket Fuels: Comparison of Hydrogen Peroxide with Current Propellants
Mattie, David R., Air Force Research Lab., USA; 49th JANNAF Propulsion Meeting; December 1999; Volume 1, pp. 119-122; In English; See also 20000039678; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The toxicity of hydrogen peroxide and current exposure limits will be presented in this paper. Toxicity data and exposure limits will also be presented for unleaded gasoline, kerosene and hydrazine. The toxicity of hydrogen peroxide will be compared to gasoline, which is universally known and used by everyone as a fuel. The toxicity of hydrogen peroxide will also be compared to kerosene, one of the first propellants, and to hydrazine, which is very toxic and a candidate for replacement by a less toxic compound.
Author
Propellants; Toxicity; Hydrogen Peroxide; Dosage; Toxic Hazards; Chemical Properties

20000040762 Energy Information Administration, Washington, DC USA
Assumptions to the Annual Energy Outlook (1999) (AE099), With Projections to 2020
Dec. 1998; 118p; In English
Report No.(s): PB2000-103533; No Copyright; Avail: National Technical Information Service (NTIS)

This paper presents the major assumptions of the National Energy Modeling System (NEMS) used to generate the projections in the Annual Energy Outlook 1999 (AEO99) (DE99000974), including general features of the model structure, assumptions concerning energy markets, and the key input data and parameters that are most significant in formulating the model results.
NTIS
Market Research; Energy Consumption

20000040867 Department of Energy, Office of Integrated Analysis and Forecasting, Washington, DC USA
Model Documentation: Renewable Fuels Module of the National Energy Modeling System
Jan. 2000; 152p; In English; Portions of this document are not fully legible
Report No.(s): PB2000-103952; DOE/EIA-M069(2000); No Copyright; Avail: National Technical Information Service (NTIS)

This report documents the objectives, analytical approach, and design of the National Energy Modeling System (NEMS) Renewable Fuels Module (RFM) as it relates to the production of the Annual Energy Outlook 2000(AEO2000) forecasts. The report catalogues and describes modeling assumptions, computational methodologies, data inputs, and parameter estimation techniques. A number of offline analyses used in lieu of RFM modeling components are also described. This documentation report serves three purposes. First, it is a reference document for model analysts, model users, and the public interested in the construction and application of the RFM. Second, it meets the legal requirement of the Energy Information Administration (EIA) to provide adequate documentation in support of its models (Public Law 93-275, Federal Energy Administration Act of 1974, Section 57(b)(1)). Finally, such documentation facilitates continuity in EIA model development by providing information sufficient to perform model enhancements and data updates as part of EIA's ongoing mission to provide analytical and forecasting information systems.
NTIS
Information Systems; Fuels; Renewable Energy

29
SPACE PROCESSING

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

20000039700 Alabama Univ., Huntsville, AL USA
Consortium for Materials Development in Space ***Annual Report, 1 Nov. 1998 - 31 Oct. 1999***
Sep. 10, 1999; 93p; In English; See also 20000039701 through 20000039702
Contract(s)/Grant(s): NCC8-132; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

During FY99 the Consortium for Materials Development in Space (CMDS) was reorganized around the following guidelines: industry driven, product focus, an industry led advisory council, focus on University of Alabama in Huntsville (UAH) core competencies, linkage to regional investment firms to assist commercialization and to take advantage of space flights. The organizational structure of the CMDS changed considerably during the year. The decision was made to reduce the organization to a Director and an Administrative Assistant. The various research projects, including the employees, were transferred to the appropriate UAH research center or college. In addition, an advisory council was established to provide direction and guidance to the CMDS to ensure a strong commercial focus. The council will (i) review CMDS commercial development plans and provide feedback, (ii) perform an annual evaluation of the Center's progress and present the results of this review to the UAH Vice President for Research, (iii) serve as an avenue of communication between the CMDS and its commercial partners, and (iv) serve as an ambassador and advocate for the CMDS.
Derived from text
Organizations; Space Flight; Materials

20000039702 Alabama Univ., Huntsville, AL USA
BioDyn Project ***Final Report***
Consortium for Materials Development in Space; Sep. 10, 1999; 21p; In English; See also 20000039700; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

With the primary objectives designed to foster use of the microgravity environment for commercial production of bio-materials from cells, and to develop services and processes for obtaining these materials through space processing, the BioDyn program was initiated with the flight of the first payload on STS-80 in 1996. The program, managed by the University of Alabama in Huntsville (UAH) Consortium for Materials Development in Space (CMDS), was sponsored by NASA's Office of Space Access and Technology, Space Processing Division. Though this payload was flown on only two missions, STS-80 and STS-95, it significantly advanced the potential for commercialization of space in the areas of tissue engineering and products from cells cultured in microgravity. BioDyn evolved from the activities of the UAH CMDS Materials Dispersion and Biodynamics Program (1992-1996) of which the Commercial MDA ITA Experiments (CMIX) constituted the primary payload. From experience and data derived from the UAH experiments flown on CMIX under joint agreements between UAH and NASA and UAH and Instrumentation Technology Associates, Inc. (ITA) of Exton, PA, the commercial biomedical target products for the UAH BioDyn program were identified. Early Shuttle flights of CMIX (STS-52 and STS-56) achieved significant information on cell growth, response and metabolism in microgravity (See appended list of publications). Information from STS-67 and STS-69, flown in 1995, was essential for selection of the commercial biomedical products flown on BioDyn. The experiments flown on STS-80 and STS-95 by BioDyn's industry affiliates and associated university investigators, advanced commercial potential for a number of products. These included multi-layered, aligned heart cells (not achieved by Earth-based culture) with potential for implantation therapy, cellular aging proteins, natural product insecticides from bacteria, anti-cancer compounds produced by plant cells, and superior micro-capsules for encapsulating pancreatic cells for use in treating diabetes. Additionally, significant information gained on cellular response to drugs and drug metabolism advanced the potential for pharmaceutical development in microgravity. This report describes the commercial products and experiments flown on the 100% successful STS-95 BioDyn Payload.
Derived from text
Biodynamics; Microgravity; Space Transportation System Flights; Space Processing

20000043161 Universities Space Research Association, Huntsville, AL USA

Particle Engulfment and Pushing Micro-Gravity Experiments and Mathematical Modeling

Stefanescu, Doru M., Alabama Univ., USA; Catalina, A. V., NASA Marshall Space Flight Center, USA; Juretzko, F., Alabama Univ., USA; Mukherjee, S., Alabama Univ., USA; Sen, S., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 1st; First International Symposium on Microgravity Research and Application, 11-15 Sep. 2000, Sorrento, Italy

Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only

The phenomenon of interaction of particles with solid-liquid interfaces that results in particle engulfment or pushing (PEP) has been Studied since mid 1960's. While the original interest stemmed from geology applications (frost heaving in soil), it was recognized early that understanding particle behavior at solidifying interfaces mi ht yield 9 practical benefits in other fields. In metallurgical applications the issue is the location of particles with respect to grain boundaries at the end of solidification. Considerable amount of experimental and theoretical research was lately focused on applications to metal matrix composites produced by casting; or spray forming techniques. Another application of PEP is in the growing of Y1Ba2CU3O7-delta(123) superconductor crystals from an undercooled liquid. The oxide melt contains Y2Ba1CU1O5 (211) precipitates, which act as flux pinning sites. The paper presents results of PEP micro-gravity research performed by the authors on two shuttle missions using metallic and polymeric materials. In addition. a discussion on the theoretical aspects of the physics of PEP is offered. Analytical and numerical models for planar solidification interfaces developed by the authors are used to explain the experimental results. Shortcomings of steady-state models are emphasized. A numerical model that includes the effect of the solutal field and of natural convection is introduced. A discussion of phenomena associated with dendritic solidification based on experimental observations is also offered. A mechanism of engulfment is proposed.

Author

Mathematical Models; Microgravity; Precipitation (Chemistry); Particle Interactions; Metal Matrix Composites; Pushing

31
ENGINEERING (GENERAL)

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

20000039703 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France

Measurement Techniques for High Enthalpy and Plasma Flows ***Techniques de Mesure Pour les Ecoulements de Plasma et les Ecoulements a Haute Enthalpie***

Measurement Techniques for High Enthalpy and Plasma Flows; April 2000; 401p; In English, 25-29 Oct. 1999, Rhode-Saint-Genese, Belgium; See also 20000039704 through 20000039719; CD-ROM contains full text document in pdf format

Report No.(s): RTO-EN-8; AC/323(AVT)TP/23; ISBN 92-837-1030-4; Copyright Waived; Avail: CASI; A18, Hardcopy; A04, Microfiche; C01, CD-ROM

The RTO AVT/VKI Special Course on "Measurement Techniques for High Enthalpy and Plasma Flows" gathered specialists in this area from Europe, USA and Russia who combined their efforts to produce this comprehensive set of notes. The following topics were covered: (1) review of various high enthalpy and plasma flow facilities, (2) intrusive and non intrusive measurement techniques for the characterization of the flows generated in these facilities, and (3) utilization of the plasma facilities for the evaluation of material catalytic properties. The material assembled in this report was prepared under the combined sponsorship of the RTO AVT panel, the Consultant and Exchange Program of RTO and the von Karman Institute (VKI) for Fluid Dynamics.

Author

Procedures; Enthalpy; Plasmas (Physics); Magnetohydrodynamic Flow

20000040117 NASA Goddard Space Flight Center, Greenbelt, MD USA

Development of Individually Addressable Micro-Mirror-Arrays for Space Applications

Dutta, Sanghamitra B., International Society for Optical Engineering, USA; Ewin, Audrey J., International Society for Optical Engineering, USA; Jhabvala, Murzy, International Society for Optical Engineering, USA; Kotecki, Carl A., International Society for Optical Engineering, USA; Kuhn, Jonathan L., International Society for Optical Engineering, USA; Mott, D. Brent, International Society for Optical Engineering, USA; [2000]; 1p; In English; Micromachining and Microfabrication. MF05: MOEMS and Miniaturized Systems, 18-21 Sep. 2000, Santa Clara, CA, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We have been developing a 32 x 32 prototype array of individually addressable Micro-Mirrors capable of operating at cryogenic temperature for Earth and Space Science applications. Micro-Mirror-Array technology has the potential to revolutionize

imaging and spectroscopy systems for NASA's missions of the 21st century. They can be used as programmable slits for the Next Generation Space Telescope, as smart sensors for a steerable spectrometer, as neutral density filters for bright scene attenuation etc. The, entire fabrication process is carried out in the Detector Development Laboratory at NASA, GSFC. The fabrication process is low temperature compatible and involves integration of conventional CMOS technology and surface micro-machining used in MEMS. Aluminum is used as the mirror material and is built on a silicon substrate containing the CMOS address circuit. The mirrors are 100 microns x l00 microns in area and deflect by +/- 10 deg induced by electrostatic actuation between two parallel plate capacitors. A pair of thin aluminum torsion straps allow the mirrors to tilt. Finite-element-analysis and closed form solutions using electrostatic and mechanical torque for mirror operation were developed and the results were compared with laboratory performance. The results agree well both at room temperature and at cryogenic temperature. The development demonstrates the first cryogenic operation of two-dimensional Micro-Mirrors with bi-state operation. Larger arrays will be developed meeting requirements for different science applications. Theoretical analysis, fabrication process, laboratory test results and different science applications will be described in detail.
Author
Technology Utilization; Fabrication; Arrays; Mirrors; Parallel Plates; Imaging Techniques

20000040477 Technische Hochschule, Staatliche Materialpruefungsanstalt, Stuttgart, Germany
MPA-seminar: safety and reliability of plant technology with special emphasis on integrity and life management, Volume 2
Dec. 31, 1999; 579p; In German; In English; 24th, USA
Report No.(s): DE99-760759; INIS-DE-0033; No Copyright; Avail: Department of Energy Information Bridge
The second volume is dedicated to the safety and reliability of plant technology with special emphasis on the integrity and life management. Topics discussed include: 1. Integrity of vessels, pipes and components; 2. Fracture mechanics; 3. Measures for the extension of service life; and 4. Online Monitoring.
NTIS
Service Life; Reactor Technology; Reliability Analysis; Industrial Plants; Industrial Safety

20000042028 Oak Ridge National Lab., TN USA
Smart Onboard Inspection of High Pressure Gas Fuel Cylinders
Beshears, D. L.; Starbuck, J. M.; Sep. 27, 1999; 13p; In English; 1st; Automotive Conference, 27-29 Sep. 1999, Detroit, MI, USA
Report No.(s): DE00-009361; ORNL/CP-104041; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The use of natural gas as an alternative fuel in automotive applications is not widespread primarily because of the high cost and durability of the composite storage tanks. Tanks manufactured using carbon fiber are desirable in weight critical passenger vehicles because of the low density of carbon fiber. The high strength of carbon fiber also translates to a weight reduction because thinner wall designs are possible to withstand the internal pressure loads. However, carbon fiber composites are prone to impact damage that over the life of the storage tank may lead to an unsafe condition for the vehicle operator. A technique that potentially may be a reliable indication of developing hazardous conditions in composite fuel tanks is imbedded fiber optics. The applicability of this technique to onboard inspection is discussed and results from preliminary lab testing indicate that fiber optic sensors can reliably detect impact damage.
NTIS
Fiber Composites; Natural Gas; Compressed Gas; Nondestructive Tests; Fiber Optics; Carbon Fibers; Fuel Tanks; Inspection

20000044540 Virginia Polytechnic Inst. and State Univ., Center for Intelligent Materials Systems and Structures, Blacksburg, VA USA
Structural and Machine Design Using Piezoceramic Materials: A Guide for Structural Design Engineers ***Final Report***
Inman, Daniel J., Virginia Polytechnic Inst. and State Univ., USA; Cudney, Harley H., Virginia Polytechnic Inst. and State Univ., USA; Apr. 30, 2000; 127p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG1-1998; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
Using piezoceramic materials is one way the design engineer can create structures which have an ability to both sense and respond to their environment. Piezoceramic materials can be used to create structural sensors and structural actuators. Because piezoceramic materials have transduction as a material property, their sensing or actuation functions are a result of what happens to the material. This is different than discrete devices we might attach to the structure. For example, attaching an accelerometer to a structure will yield an electrical signal proportional to the acceleration at the attachment point on the structure. Using a electromagnetic shaker as an actuator will create an applied force at the attachment point. Active material elements in a structural design are not easily modeled as providing transduction at a point, but rather they change the physics of the structure in the areas where

they are used. Hence, a designer must not think of adding discrete devices to a structure to obtain an effect, but rather must design a structural system which accounts for the physical principles of all the elements in the structure. The purpose of this manual is to provide practicing engineers the information necessary to incorporate piezoelectric materials in structural design and machine design. First, we will review the solid-state physics of piezoelectric materials. Then we will discuss the physical characteristics of the electrical-active material-structural system. We will present the elements of this system which must be considered as part of the design task for a structural engineer. We will cover simple modeling techniques and review the features and capabilities of commercial design tools that are available. We will then cover practical how-to elements of working with piezoceramic materials. We will review sources of piezoceramic materials and built-up devices, and their characteristics. Finally, we will provide two design examples using piezoceramic materials, first as discrete actuators for vibration isolation, and second as structurally-distributed sensor/actuators for active acoustic control.
Author
Actuators; Piezoelectric Ceramics; Structural Design; Vibration Isolators; Smart Materials; Piezoresistive Transducers

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.

20000038640 Nippon Telegraph and Telephone East Corp., Technology Dept., Tokyo, Japan
Standardization Activities and GSC: Report on the 5th Global Standards Collaboration Meeting
Nakashima, Kenji, Nippon Telegraph and Telephone East Corp., Japan; NTT Review; Mar. 2000; ISSN 0915-2334; Volume 12, No. 2, pp. 118-120; In English; Copyright; Avail: Issuing Activity

Jointly with the 8th Radio Standardization (RAST) meeting, the 5th Global Standards Collaboration (GSC) meeting was held in Williamsburg, Virginia (USA). This article presents a summary of these conferences by focusing on recent topics relating to GSC.
Author
Standardization; International Cooperation; Broadcasting

20000038641 Nippon Telegraph and Telephone Public Corp., Access Network Service Systems Labs., Tokyo, Japan
Reducing the Cost of Terminals for the Optical PDS System
Kawasaki, Masahisa, Nippon Telegraph and Telephone Public Corp., Japan; Kitamura, Mamoru, Nippon Telegraph and Telephone Public Corp., Japan; Tatsuta, Tsutomu, Nippon Telegraph and Telephone Public Corp., Japan; Ikeda, Satoshi, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 2000; ISSN 0915-2334; Volume 12, No. 2, pp. 78-84; In English; Copyright; Avail: Issuing Activity

We have reduced the cost of terminals used for the optical Passive Double Star (PDS) system developed to promote the opticalization of access networks. By redesigning the structure of the Narrow-band Subscriber Line Terminal (N-SLT), we reduced its cost by about 40%. We also reduced the cost of the Narrow-band Optical Network Unit (N-ONU) by about 50%. Moreover, by changing the transmission technology used for the video service, we were able to reduce the cost of terminals for the video distribution PDS system by 50%. We introduced this cheaper system in December 1998.
Author
Cost Reduction; Data Processing Terminals; Optical Communication

20000038733 Nippon Telegraph and Telephone Public Corp., Service Integration Labs., Tokyo, Japan
Global Collaborative Experiments on GEMnet
Mizukawa, Makoto, Nippon Telegraph and Telephone Public Corp., Japan; Kawarasaki, Masatoshi, Nippon Telegraph and Telephone Public Corp., Japan; Yamauchi, Noriyoshi, Nippon Telegraph and Telephone Public Corp., Japan; Yamashita, Hiroyuki, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 2000; ISSN 0915-2334; Volume 12, No. 2, pp. 24-28; In English; Copyright; Avail: Issuing Activity

Recent years have seen a vigorous development of global activities, with enterprise activities and academic education leading the way, and there have been many trials of multicultural communication and collaboration. Here, we describe the progress of

collaborative research and collaborative experiments with leading domestic and overseas partners on our globalized communication environment.
Author
Communication; Networks; Research; Experimentation

20000038736 Nippon Telegraph and Telephone Public Corp., Service Integration Labs., Tokyo, Japan
NTT's Global R and D Strategy and Testbed after Reorganization
Okada, Kazuhiko, Nippon Telegraph and Telephone Public Corp., Japan; Yamamoto, Hideo, Nippon Telegraph and Telephone Public Corp., Japan; Yamashita, Hiroyuki, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 2000; ISSN 0915-2334; Volume 12, No. 2, pp. 8-13; In English; Copyright; Avail: Issuing Activity

The cycle from verification of technologies to deployment of information sharing services such as electronic commerce is shrinking, and it is essential that services are viable on the global market when they are rolled out. NTT Laboratories engaged in developing and deploying new information sharing services are pursuing a global strategy that is tailored to the particular circumstances of different regions. Although the Global Enhanced Multifunctional Network (GEMnet) has mainly been used to verify and demonstrate new technologies, it will now also be used as a testbed for businesses linked to the NTT Group in order to make the migration from technology verification to full-scale service deployment more efficient.
Author
Information Systems; Migration

20000038776 Physics and Electronics Lab. TNO, The Hague, Netherlands
Out-of-Area Communication for the Purpose of the Tactical Helicopter Group *Final Report Out-of-Area Communicatie ten Behoeve van de Tactische Helikopter Groep*
vanDam, C., Physics and Electronics Lab. TNO, Netherlands; Gratama, T. N., Physics and Electronics Lab. TNO, Netherlands; January 1999; 128p; In Dutch
Contract(s)/Grant(s): A97/KLu/813; TNO Proj. 27478
Report No.(s): TD-98-0220; FEL-99-A022; Copyright; Avail: Issuing Activity

The operational requirements of the Royal Netherlands Air Force with respect to the communication system for use by units of the Tactical Helicopter Group in Out-of-Area situations are described in this report. Based on these requirements, a communication concept is proposed for THG-units in Out-of-Area situations. In this concept it is specified which type of communication systems can be used for the various types of required connections. In this context, the topic of pursuit was the fact that the concept is applicable in a wide range, so that for F16-units can also use parts of the concept. In addition, security techniques and management issues of the concept are discussed.
Author
Telecommunication; User Requirements; Operational Problems

20000038780 Nippon Telegraph and Telephone East Corp., Corporate Strategy Planning Dept., Tokyo, Japan
Aiming to Further Expand the Utilization of Radio Waves
Takahashi, Chiaki, Nippon Telegraph and Telephone East Corp., Japan; Ohira, Hidetoshi, Nippon Telegraph and Telephone East Corp., Japan; Ishizuka, Shigeki, Nippon Telegraph and Telephone East Corp., Japan; NTT Review; Mar. 2000; ISSN 0915-2334; Volume 12, No. 2, pp. 114-117; In English; Copyright; Avail: Issuing Activity

The Association of Radio Industries and Businesses (ARIB) conducts investigations, research & development and consultation of utilization of radio waves from the view of developing radio industries, and promotes realization and popularization of new radio systems in the field of telecommunications and broadcasting. In this article, we introduce ARIB activities to promote the utilization of radio waves.
Author
Broadcasting; Radio Waves; Technology Utilization

20000038784 Nippon Telegraph and Telephone Public Corp., Access Network Service Systems Labs., Tokyo, Japan
Trends in Optical Access Networks and Related Technology
Watanabe, Ryuichi, Nippon Telegraph and Telephone Public Corp., Japan; Hirooka, Akira, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 2000; ISSN 0915-2334; Volume 12, No. 2, pp. 65-72; In English; Copyright; Avail: Issuing Activity

Today, demand is increasing for networks and associated technology to offer lower price and more flexible communication services, such as Internet services that are provided at a variety of speeds. While work has been progressing on the development

of a trunk network that uses WDM technology, it has remained difficult to reduce access network costs despite the recognized importance of fiber-optics. Since the 1995 launch of its R&D project designed to achieve substantial construction cost reductions, NTT has made considerable progress towards this goal, and is on the verge of success. This article reviews recent conditions in the information transmission market, and describes system technologies that can provide access to various new services (especially in the optical access network), as well as NTT's efforts, which have helped to reduce the cost of optical systems to that of metallic systems.
Author
Data Transmission; Fiber Optics; Internets; Trends

20000038785 Nippon Telegraph and Telephone Public Corp., Communication Science Labs., Tokyo, Japan
Helper Agent: A Chat Assistant for Cross-Cultural Conversations
Isbister, Katherine, Nippon Telegraph and Telephone Public Corp., Japan; Nakanishi, Hideyuki, Kyoto Univ., Japan; NTT Review; Mar. 2000; ISSN 0915-2334; Volume 12, No. 2, pp. 55-59; In English; Copyright; Avail: Issuing Activity

This article introduces a collaborative project between NTT's Open Lab, Kyoto University Department of Social Informatics and Stanford University Communication Department. We created an agent prototype that was designed to support human-human communication in virtual environments. The prototype mimics a party host, trying to find a safe common topic for guests whose conversation has lagged. We performed an experimental evaluation of the prototype's ability to assist in cross-cultural conversations, using the Global Enhanced Multifunctional Network (GEMnet) broadband line between Stanford University, Kyoto University and NTT's Open Lab. In this overview, we will discuss the design of the prototype, as well as the evaluation.
Author
Employee Relations; Prototypes; Experimentation

20000038788 Nippon Telegraph and Telephone Public Corp., Multimedia Super Corridor, Tokyo, Japan
Experiments Over GEMnet in NTT MSC R and D Center
Yamazaki, Takefumi, Nippon Telegraph and Telephone Public Corp., Japan; Hyuga, Fumiaki, Nippon Telegraph and Telephone Public Corp., Japan; Miyaho, Noriharu, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 2000; ISSN 0915-2334; Volume 12, No. 2, pp. 29-32; In English; Copyright; Avail: Issuing Activity

We have conducted the following R&D activities through the use of GEMnet at the NTT MSC R&D Center: (1) Introduction of the latest R&D products. (2) Co-operative research with other research institutions. and (3) Experiments and trials of new network services to meet commercial needs. In this paper we describe the overview of experiments conducted over GEMnet and the future plans of the NTT MSC R&D Center.
Author
Research and Development; Internets

20000038901 Georgia Tech Research Inst., Atlanta, GA USA
Surface Current Determination from Localized Measurements ***Final Report, 1 Jan. 1997-31 DEc 1999***
Kesler, Morris P.; Maloney, Jim; Harms, Paul; Blalock, Stephen; Kuster, Eric; Feb. 29, 2000; 134p; In English
Contract(s)/Grant(s): N00014-97-1-0209
Report No.(s): AD-A374587; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report describes the results of a research program aimed at developing and demonstrating a technique for determining surface currents from a series of electromagnetic field measurements. Two back-propagation techniques were developed and validated through numerical simulations and measurements on laboratory-scale, conducting objects. The first technique is a planar spectral decomposition approach that utilizes magnetic field measurements on a plane in front of the body, and the second i a local back-propagation technique that operates using magnetic field measurements at a much smaller number of sample points. The back-propagation techniques were demonstrated through measurements on a series of laboratory-scale targets, including solid metallic plates, metallic plates with slots, and more complex objects, such as a scale-model ship and a frequency selective surface. The back-propagated results were compared to predictions of the surface current obtained using a finite difference time domain numerical code. The predicted and experimental results are in agreement, validating the back- propagation approaches for these targets. This report contains a description and analysis of the back-propagation techniques, details of the measurements, and representative results.
DTIC
Electric Current; Acoustical Holography; Microwave Holography; Wave Propagation; Electromagnetic Radiation; Finite Difference Time Domain Method; Computerized Simulation; Ships; Electromagnetic Fields

20000039379 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Linear Bicharacteristic Scheme for Computational Electromagnetics

Beggs, John H., NASA Goddard Space Flight Center, USA; Chan, Siew–Loong, LCC International, Inc., USA; Feb. 29, 2000; 20p; In English; Sponsored in party by the Southeastern Center for Electrical Engineering Education

Contract(s)/Grant(s): SCEEE-97-004; NSF EEC-89-07070; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The upwind leapfrog or Linear Bicharacteristic Scheme (LBS) has previously been implemented and demonstrated on electromagnetic wave propagation problems. This paper extends the Linear Bicharacteristic Scheme for computational electromagnetics to treat lossy dielectric and magnetic materials and perfect electrical conductors. This is accomplished by proper implementation of the LBS for homogeneous lossy dielectric and magnetic media, and treatment of perfect electrical conductors (PECs) are shown to follow directly in the limit of high conductivity. Heterogeneous media are treated through implementation of surface boundary conditions and no special extrapolations or interpolations at dielectric material boundaries are required. Results are presented for one-dimensional model problems on both uniform and nonuniform grids, and the FDTD algorithm is chosen as a convenient reference algorithm for comparison. The results demonstrate that the explicit LBS is a dissipation-free, second-order accurate algorithm which uses a smaller stencil than the FDTD algorithm, yet it has approximately one-third the phase velocity error. The LBS is also more accurate on nonuniform grids.

Author

Computational Electromagnetics; Computational Fluid Dynamics; Finite Difference Time Domain Method; Electromagnetic Scattering; Euler Equations of Motion; Upwind Schemes (Mathematics); Method of Characteristics

20000039428 Institute for Human Factors TNO, Soesterberg, Netherlands

Speech Intelligibility of Air-to-ground and Ground-to-Air Communications to the Air Bases Soesterberg and Deelen *Final Report De Spraakverstaanbaaheid van Grond/Lucht- en Lucht/Grondverbindingen op de Vliegbasis Soesterberg en MLT Deelen*

van Wijngaarden, S. J., Institute for Human Factors TNO, Netherlands; Agterhuis, E., Institute for Human Factors TNO, Netherlands; Steeneken, H. J. M., Institute for Human Factors TNO, Netherlands; Jan. 26, 1999; 42p; In Dutch

Contract(s)/Grant(s): A98/KLu/313; TNO Proj. 786.4

Report No.(s): TD99-0007; TM-99-A005; Copyright; Avail: Issuing Activity

Upon assignment of the Royal Netherlands Air Force, speech intelligibility of air-to-ground and ground-to-air radio communications was evaluated at the air bases Soesterberg and Deelen. The aim of this study was to identify any possible limitations of speech intelligibility caused by the radio equipment that is used. Air-to-ground and ground-to-air communications were investigated for the ground radio system types AN/ARC 186, ARC 164 and ECI, and aircraft radio types ARC 186 and ARC 164. None of these systems showed unacceptably low speech intelligibility. Not all systems were equipped with automatic modulation depth control. Especially with the ground sets, this makes proper adaptation and use of microphones necessary to achieve good speech intelligibility. The achieved speech intelligibility is qualified as 'fair' to 'excellent', depending on the type of system used. This applies only to those communications that are within the range of the ground radio systems.

Author

Radio Communication; Ground-Air-Ground Communication; Intelligibility; Radio Equipment; Airports; Speech Recognition

20000039429 Institute for Human Factors TNO, Soesterberg, Netherlands

Comparison of The Image Quality of The Viper 3 and f4949 Night Vision Systems *Final Report Een Vergelijk van de Beeldkwaliteit van de Viper 3 en de F4949 Nachtzichtsystemen*

Kooi, F. L., Institute for Human Factors TNO, Netherlands; Walraven, J., Institute for Human Factors TNO, Netherlands; Feb. 09, 1999; 19p; In English

Contract(s)/Grant(s): A97/KLu348; TNO Proj. 786.2

Report No.(s): TD99-0016; TM-99-A014; Copyright; Avail: Issuing Activity

The image quality of two night vision systems has been directly compared in the laboratory: the Viper 3 integrated helmet based on see-through HMD technology and a F4949 ITT binocular night vision goggle. Results show that the Viper 3 night vision system has highly significant advantages, namely a direct view of the HUD image and brightly lit areas at night, and continuous vision during twilight. A price is paid for this advantage in a reduction in resolution, image contrast, and simplicity of the field of view of the intensified image.

Author

Image Resolution; Night Vision; Visual Acuity; Image Contrast; Helmet Mounted Displays; Human Factors Engineering

20000042552 Communications Research Lab., Tokyo, Japan

Evaluation of Emergency Communication Test Bed Using Voice and Facsimile

Makihata, Kazuhisa, Communications Research Lab., Japan; Suzuki, Ryutaro, Communications Research Lab., Japan; Review of the Communications Research Lab.; December 1998; ISSN 0914-9279; Volume 44, No. 4, pp. 221-239; In Japanese; Copyright; Avail: Issuing Activity

Communication system using telephone network will be needed at disasters to inform their massages effectively. The authors built safety inquiry system and information providing system on servers where voice/FAX data are stored, connected to the telephone network. The system is evaluated about the abilities of man-machine interface and message transfer. Validities and problems of such the systems are inspected as well.

Author

Voice Communication; Test Stands

20000042553 Communications Research Lab., Tokyo, Japan

Personal Address Information System, PARIS

Iwama, Miki, Communications Research Lab., Japan; Kubota, Fumito, Communications Research Lab., Japan; Review of the Communications Research Lab.; December 1998; ISSN 0914-9279; Volume 44, No. 4, pp. 285-292; In English; Copyright; Avail: Issuing Activity

It is important in integrated and sophisticated telecommunication to get and store the correct address of one's communicator. We propose a personal address information system which is called PARIS. In this paper, first the characteristics of managing personal addresses are investigated. The result shows that there are two elements necessary to achieve a useful address management system. One is the data architecture of the address information, and the other is the ability to gather information. Next, we propose a new architecture of address information database for an electric address managing system. Last, we show an example of the PARIS system.

Author

Management Systems; Information Systems; Telecommunication

20000042555 Communications Research Lab., Tokyo, Japan

Emergency Communication Experimental Equipment

Kumai, Mitsuyuki, Communications Research Lab., Japan; Suzuki, Ryutaro, Communications Research Lab., Japan; Review of the Communications Research Lab.; December 1998; ISSN 0914-9279; Volume 44, No. 4, pp. 255-274; In English; Copyright; Avail: Issuing Activity

In the incident of Hansin-Awaji Great Earthquake, the necessary information could not transmit appropriately due to a large-scale damage on communication networks and concentration of safety confirming calls, which caused unprecedented congestion. Our experimental equipment is provided under consideration of the above issues objecting to study of the applied techniques for information storage/distributed systems and techniques for the effective use of multimedia data in case of disasters. As a part of the study, we had constructed safety inquiry system used moving pictures, disaster information service system, and TV conferencing system equipped with content-transfer function and VOD feature. After that, the evaluations of their performance and questionnaire concerning Graphical User Interface (GUI) were employed. As the result, it revealed some problems as to the GUI operability and the limits of hardware performance.

Author

Communication Networks; Communication Equipment

20000042556 Communications Research Lab., Tokyo, Japan

Personal Supporting System on Communication, -Userware-

Iwama, Miki, Communications Research Lab., Japan; Kubota, Fumito, Communications Research Lab., Japan; Review of the Communications Reseach Lab.; December 1998; ISSN 0914-9279; Volume 44, No. 4, pp. 275-284; In English; Copyright; Avail: Issuing Activity

Telecommunication users can use many conditions in integrated and sophisticated communication systems, but most of them feel it is difficult to choose appropriate communication methods. They feel not only at originating and also at receiving, For one solution, we propose the Userware: a user support system on both originating and receiving occasions. In this report, first, we clarify the requirements for supports on the communication occasions and propose the concept of Userware. Next, we point out

problems in today's public networks of call control when Userware is worked. Last, we give the results of a trial of Userware by making a sub-system for information gathering and supplying
Author
Telecommunication; Support Systems; Communication Satellites

20000042557 Communications Research Lab., Tokyo, Japan
Regenerative Process Gain at Rain Condition in the Satellite Communications Link
IIda, Takashi, Communications Research Lab., Japan; Review of the Communications Research Lab.; December 1998; ISSN 0914-9279; Volume 44, No. 4, pp. 293-306; In English; Copyright; Avail: Issuing Activity

The regenerative processing on the satellite transponder is expected to have a gain on its communication link budget. It seems that the discussion has not been conducted explicitly so far what gain of the onboard bit-by-bit processing can be obtained if the regenerative type transponder is used. This paper discusses the regenerative process gain analytically. It shows that the regenerative process gain is a function of the ratio of signal power to noise power density for the up-link and the down-link. It also clarifies that much bigger gain of regenerative processing than 3 dB, which has been expected so far, can be established when the rain margin becomes small due to the heavy rainfall.
Author
Satellite Communication; Data Links; Communication Networks

20000043539 Japan Broadcasting Corp., Tokyo, Japan
Search for the Possibility of New Broadcasting: A Discussion Concerning the Appeal of Digital Satellite Broadcasting
Broadcast Technology; 2000, No. 1, pp. 14-15; In English; Original contains color illustrations; Copyright; Avail: Issuing Activity

On Friday, May 28, 1999, a symposium was held with the participation of the presidents of five digital satellite broadcasters and an NHK Managing Director. The event was a great success with both the main location, the auditorium of the NHK Science & Technical Research Laboratories (300 seats), and the provisional monitor location (300 seats) completely filled. Announcer Sadatomo MATSUDAIRA of NHK was the symposium mediator for discussions concerning new services, diffusion strategies, and the future image of digital satellite broadcasting. The symposium was broadcast on HDTV and BS Channel One.
Derived from text
Broadcasting; Digital Television; High Definition Television

20000043540 Japan Broadcasting Corp., Tokyo, Japan
Digital Broadcast Re-Transmission Over Cable Networks
Broadcast Technology; 2000, No. 1, pp. 13; In English; Original contains color illustrations; Copyright; Avail: Issuing Activity

Digital satellite broadcasting is to begin in December, 2000, followed by digital terrestrial broadcasting. In order to make the new services that digital broadcasting will bring about, such as data broadcasts and EPG (Electronic Program Guide), available to cable TV network subscribers as well, the digitization of cable TV network broadcasting facilities and equipment is indispensable.
Derived from text
Broadcasting; Television Systems; Digital Television; Direct Broadcast Satellites

20000043541 Japan Broadcasting Corp., Tokyo, Japan
Digital Satellite Broadcasting Reception System Test Center Consortium
Nakamura, Hiroshi, Japan Broadcasting Corp., Japan; Broadcast Technology; 2000, No. 1, pp. 12; In English; Original contains color illustrations; Copyright; Avail: Issuing Activity

Digital satellite broadcasting is to begin in December this year. Broadcasters and broadcasting equipment manufacturers jointly established "The Digital Satellite Broadcasting Reception System Test Center Consortium" in April of lost year, in order to facilitate the immediate preparation of digital satellite broadcasting test signals necessary for reception device development. The number of participating companies was 34. NHK's Managing Director, Mr. Nakamura, has been appointed as the chairman of the Consortium.
Author
Broadcasting; Digital Television

20000043542 Japan Broadcasting Corp., Tokyo, Japan

Characteristics of the Japanese Digital BS Broadcasting System

Broadcast Technology; 2000, No. 1, pp. 10-11; In English; Original contains color illustrations; Copyright; Avail: Issuing Activity

Digital satellite television broadcasting began for the first time in the USA in 1994, followed by Europe and Asia around 1996. Japan also started digital CS broadcasting using communication satellites (CS) in 1996. These satellite digital broadcasts provide mainly multi-channel standard definition TV services. As for the technological development of digital satellite broadcasting using broadcast satellites (BS), the NHK Science & Technical Research Laboratories initiated the research for ISDB (Integrated Services Digital Broadcasting) around 1982. Thorough examinations were carried out from the perspective of efficient use of the limited frequency resources allotted to broadcasting. In the process, a new concept for broadcasting services, not simply replacing conventional analog services with the digital format, has been developed that makes the best use of the merits of digitization; the flexibility of service arrangements inherent to digital signals, the expansion capability for new services in the future, and the community of diverse media.

Derived from text

Broadcasting; Digital Techniques; Digital Television; Television Systems

20000043543 Japan Broadcasting Corp., Science and Technical Labs., Tokyo, Japan

Contributions to the World as COE of Broadcast Technology

Yamada, Osamu, Japan Broadcasting Corp., Japan; Broadcast Technology; 2000, No. 1, pp. 3; In English; Copyright; Avail: Issuing Activity

Digital satellite broadcasting, which the Laboratories have promoted for many years through their research, is to begin from the year 2000. We have been promoting research and development to improve this new broadcasting medium so that it will be more attractive, easy-to-use, and offer human-friendly services. In addition, we will be engaged in research for future dream broadcasting systems, presently not possible, such as three-dimensional broadcasts 20 to 30 years in the future. Digitization has drastically expanded the research field for broadcasting technology into the areas of computers, networking, telecommunications, and other technology that the Laboratories had not specialized in before, As ”the open laboratories,” it is indispensable that we cooperate with universities, research institutes, and broadcasters in Japan and overseas to promote better research. As the public broadcasting laboratories, we are determined to be a COE (Center of Excellence) which leads the world’s broadcast technology. We are going to make our research activities, research results, and the latest technologies known to the public in a plain and timely manner. I hope that this journal will be a great help to people worldwide seeking to understand our Laboratories’ activities and accomplishments.

Derived from text

Broadcasting; Digital Television

20000043544 Japan Broadcasting Corp., Tokyo, Japan

The Future of Media and Our Research Activities

Hasegawa, Toyoaki, Japan Broadcasting Corp., Japan; Broadcast Technology; 2000, No. 1, pp. 2; In English; Copyright; Avail: Issuing Activity

Digital satellite broadcasting is one of the outstanding results of our long research activities. We started the research after d the Tokyo Olympic in 1964 when studies on color television had matured and we were trying to find the next target for our research. I think that the current situation is similar to that in 1964, because digital technologies have matured and we have to find a new target that will support NHK’s services for a long time in the future. The driving force for new research is divided into two categories: needs-oriented research based on the desires of the society, and seeds-oriented research based on the foresight of research scientists. No matter which type of research we pursue, the following conditions must be a satisfied for its success: (1) The research must be based on social needs or scientists’ foresight, (2) Surrounding technologies must have high potential, (3) Break-through technologies must exist to make the new service a reality. The development of a television system was needs-oriented research, because there was a clear demand for television in society. The surrounding technology was high-frequency a technology such as radar and the vacuum tube, and the break-through technology was the pick-up tube. These factors jointly accelerated the research, and finally led to the great success of television broadcasting. On the other hand, satellite broadcasting and HDTV is seeds-oriented research. There was no interest among the people in satellite broadcasting or HDTV, but Scientists pushing the research were strongly motivated. The surrounding technology for satellite broadcasting was the space technology, and the break-through technologies were receiving circuits for the 12 GHz band and high-power TWT. However, no clear surrounding technologies existed for the HDTV, and, therefore, we started from the basic research. Also, there was no single clear break-through technology for the HDTV. Instead, camera, recording, and semiconductor technologies worked jointly as the break-through technology. Based on the considerations above, I would like to discuss the future of media and the direction of our research. There

are three kinds of media: broadcast, network, and package media. Broadcast media have the advantage of real-time transmission of high-quality video at low cost. Network media have interactive capability, and package media storage capability. I believe each medium will evolve by introducing the features that it does not have but other media have. In the case of broadcast media, this will gain interactive and storage capability, and will evolve from being a passive media toward becoming an active media.
Derived from text
Digital Television; High Definition Television; Television Transmission; Broadcasting

20000043545 Japan Broadcasting Corp., Tokyo, Japan
Worldwide Announcement of Research and Development Results
Ebisawa, Katsuji, Japan Broadcasting Corp., Japan; Broadcast Technology; 2000, No. 1, pp. 1; In English; Original contains color illustrations; Copyright; Avail: Issuing Activity

This year, the year 2000, is the 75th anniversary of the first broadcast in Japan. The progress of digital technology has brought the broadcasting world to a significant turning point in its history. Digital satellite broadcasting services are to commence initial December this year, and experimental digital terrestrial television broadcasts have been promoted throughout the country. It is HDTV, with its high quality picture, that will shoulder the burden of the digital age. NHK started research on HDTV in 1964, when the Tokyo Olympics were held. The development of HDTV is now moving forward worldwide and universally; in 1998, the U.S. space shuttle Discovery sent a clear picture from space with an HDTV camera, when one of the astronauts, Mukai Chiaki, used it to film images outside the spacecraft. Dynamic live relays of Mother Nature from the Grand Canyon and Monument Valley were also carried out last year. In May of last year, the many years of research and effort finally bloomed in success at the meeting of the ITU(International Telecommunication Union), with the adoption of NHK's Hi-Vision as the international production standard of HDTV. Leading the world, we will promote an experimental digital HDTV service in July of this year, using both satellite and terrestrial services, at the Okinawa Summit. It is our hope again to draw international attention to NHK's outstanding technical ability at an occasion where many of the world's leaders and news media will be convening.
Derived from text
High Definition Television; Digital Television; Broadcasting

20000043605 Japan Broadcasting Corp., Tokyo, Japan
HDTV-Based Digital Satellite Broadcasting
Broadcast Technology; 2000, No. 1, pp. 4-9; In English; Original contains color illustrations; Copyright; Avail: Issuing Activity

Japan is allotted eight satellite channels in the 12 GHz bond. A figure shows the channel assignment in this band. The BSAT-1 satellite was launched in April 1997. Currently, four of these channels are used for analog services, namely two NHK services (BS1 and BS2), JSB's service (WOWOW), and MUSE-HDTV, using BSAT-1. The remaining four channels will be used for digital services. In the autumn of this year, the next satellite, BSAT-2, will be launched, and we are planning to start digital satellite broadcasting using this satellite.
Author
Broadcasting; High Definition Television; Satellite Television; Television Transmission

20000044094 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Komunikasi HF Puslitbang Pengetahuan Ionosfer, Jakarta, Indonesia
Verification of ASAPS Method HF Communications Frequency Predictions by Manado-Sumedang Oblique Ionosonde Data ***Verifikasi Prediksi Frekuensi Komunikasi8 HF Metode ASAPS Dengan Data Ionosonde Oblique Manado-Sumedang***
Jiyo, Habirun, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Sjarifudin, M., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; July - September 1999; Volume 1, No. 3, pp. 12-17; In Malay-Indonesian; See also 20000044092; Copyright; Avail: Issuing Activity

The HF radio communication frequency prediction based on ASAPS (Advance Stand Alone Prediction Services) method using global T index is used to obtain MUF (Maximum Usable Frequency) and LUF (Lowest Usable Frequency). MUF and LUF prediction will differ from MUF and LUF oblique sounding observation. This is due to the T index which is not representing local ionospheric condition. Ionospheric condition depends on the local time, solar activities, and location. This needs to be verified from ionospheric observation over a circuit of a limited area, i.e Manado-Sumedang. The local T index based on critical frequency ionospheric layer over Indonesia is obtained by using continuous observation. The ASAPS method by using local T index input will produce HF frequency fitting suitable for local ionospheric condition.
Author
Frequencies; Ionosondes; Prediction Analysis Techniques; Ionospheric Sounding

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.

20000038753 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

A Digital Filter Applied to Initialize a Limited Area Numerical Model ***Uso de Filtro Didgital Para Iniciar um Modelo de Area Limitada***

Haerter, Fabricio Pereira, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 116p; In Portuguese; Original contains color illustrations

Report No.(s): INPE-7251-TDI/695; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

A Digital Filter Initialization (IFD) technique was used in a limited area model to suppress spurious high frequency oscillations caused by an unbalance between initial mass and wind fields. A linearized model supporting only gravity wave modes was used to test the performance of the IFD. The results showed that the IFD was highly efficient in attenuating, in the average, up to 50% of the amplitudes of the large-amplitude high frequency modes, and removing practically all those with smaller amplitude. Subsequently, the IFD was applied to a limited area model (LAM) designed originally at the Japan Meteorological Agency (JMA). The input fields were prepared from a global analysis of the National Centers for Environmental Prediction (NCEP) for 1200 UTC 31 December 1979 by interpolating them to the sigma levels and to the resolution of the LAM. This analysis was chosen because it contained already a cyclone over the southern Atlantic Ocean that would intensify in the hours. The LAM was then integrated 12 hours, with the IFD technique incorporated with four cutoff periods (1,2, 3 and 4 hours) to generate a new initial condition at 18 UTC, 31 December 1979. Starting off from this initial- state, the LAM was integrated for the next 24 hours, and it was possible to find out for that 12 hour series, the best cutoff period to filter the unwanted oscillations was that of 3 hours. A set of three 48 hour runs was carried out to study the impact of the filtering technique on the performance of the model basing on two subjective criteria proposed by Lynch(1992).These numerical experiments included one case of no initialization procedure, one with a dynamic initialization in which the integration started six hours before actual comparison began and, finally, one using the IFD. The third case showed that the IFD technique succeeded in removing the high frequency oscillations, with a slight increase in the integration time (15 minutes to 18 minutes for a 48 hour forecast). It is worthy mentioning that this technique is non-recursive, thus avoiding unnecessary efforts to store the data series to be filtered.

Author

Wind Velocity; Oscillations; Mathematical Models; High Frequencies; Frequencies; Digital Filters

20000038767 Institute of Environmental Sciences, Energy Research and Process Innovation TNO, Apeldoorn, Netherlands

Advanced Rechargeable Batteries, Phase 2 ***Final Report, 1 Jan. 1997 - 31 Dec. 1998 Geavanceerde Oplaadbare Batterijen, Fase 2***

Schmal, D., Institute of Environmental Sciences, Energy Research and Process Innovation TNO, Netherlands; terVeen, W. R., Institute of Environmental Sciences, Energy Research and Process Innovation TNO, Netherlands; Kluiters, C. E., Institute of Environmental Sciences, Energy Research and Process Innovation TNO, Netherlands; January 1999; 60p; In Dutch

Contract(s)/Grant(s): A97/KM/108; TNO Proj. 28826

Report No.(s): TD-98-0392-Phase-2; R-98/524-Phase-2; Copyright; Avail: Issuing Activity

In the framework of the program ”Advanced rechargeable batteries”, intended to evaluate the suitability, the applicability and possible problems of advanced batteries on naval ships (both surface and submarine) studies and tests have been performed on two promising battery types, not only from a technical point of view, but also because it was expected that they could become available commercially in the mid term. The batteries investigated were the nickel metalhydride battery (from DAUG) and the sodium nickel chloride battery (from AABH, part of AEG). The nickel meta[hyddde battery has been tested on a number of general aspects. The sodium nickel chloride battery has been tested especially for submarine application, as an alternative for the current lead acid battery. Both types of batteries performed well and in agreement With the expectations from brochures and supplier information. Further it was proved that the batteries can withstand abnormal conditions, like short circuiting and overcharge. At the end of the testing period, however, AABH announced that they will stop with the further development of the sodium nickel chloride battery. Therefore (as long as no other company takes over) it is advised to do further detailed testing only with the nickel metalhydride battery. Beside that, it is advised to pay also attention to the most interesting long term battery, viz. the lithium battery.

Author

Lead Acid Batteries; Lithium Batteries

20000038772 Building and Construction Research TNO, Centre for Mechanical Engineering, Delft, Netherlands
Shock Testing of Four Switches, Type QM40-172N1021/1031and 704.064.2, 704.406.0 and Two DC Supplies 24 Volt
vanBragt, F. J., Building and Construction Research TNO, Netherlands; Nov. 17, 1998; 39p; In English; Original contains color illustrations
Contract(s)/Grant(s): A96/KM/151; TNO Proj. 72376958
Report No.(s): TD-98-0376; TNO-98-CMC-R1729; Copyright; Avail: Issuing Activity

Four switches, type QM40-172N1021 - 1031 and 704.064.0 / 2 and two DC power supplies 24 volt, have been exposed to shock tests in accordance with the LCF shock specification for resiliently mounted equipment on wire rope mounts (type Polycal) and to shock grade D(F). No damage or malfunctioning was observed. The switches and DC power supplies satisfy the given shock requirements.
Author
Shock Tests; Switches; Damage

20000038774 Building and Construction Research TNO, Centre for Mechanical Engineering, Delft, Netherlands
Shock Testing of a Light Fitting, Type GIM 218: Manufacturer Glamox
vanBragt, F. J., Building and Construction Research TNO, Netherlands; Nov. 27, 1998; 25p; In English; Original contains color illustrations
Contract(s)/Grant(s): A96/KM/151; TNO Proj. 82376197
Report No.(s): TD-98-0358; TNO-98-CMC-R1345; Copyright; Avail: Issuing Activity

A light fitting for use in prefab ceiling have been exposed to shock tests, in accordance with the LCF shock specification. Damage occurred during the first series of shock tests. Modification of the attachment proved to be, although damage occurred, more successfully. The modified light fitting attachment meet the D(F) shock requirement if breaking of the fluorescent tubes is acceptable.
Author
Shock Tests; Fitting

20000039382 NASA Glenn Research Center, Cleveland, OH USA
The Electric Power System of the International Space Station: A Platform for Power Technology Development
Gietl, Eric B., Boeing Co., USA; Gholdston, Edward W., Boeing Co., USA; Manners, Bruce A., NASA Glenn Research Center, USA; Delventhal, Rex A., NASA Glenn Research Center, USA; [2000]; 7p; In English; ISBN 0-7803-5846; Copyright; Avail: Issuing Activity

The electrical power system developed for the International Space Station represents the largest spacebased power system ever designed and, consequently, has driven some key technology aspects and operational challenges. The full U.S.-built system consists of a 160Volt dc primary network, and a more tightly regulated 120Volt dc secondary network. Additionally, the U.S. system interfaces with the 28-Volt system in the Russian segment. The international nature of the Station has resulted in modular converters, switch-gear, outlet panels, and other components being built by different countries, with the' associated interface challenges. This paper provides details of the architecture and unique hardware developed for the Space Station, and examines the opportunities it provides for further long-term space power technology development, such as concentrating solar arrays and flywheel energy storage systems.
Author
Energy Storage; Flywheels; Space Platforms

20000039427 Building and Construction Research TNO, Centre for Mechanical Engineering, Delft, Netherlands
Shock Testing of Two Contactors, Type LC1-FG150 G6, LC1-FG500 F7, and Three Relays, Type C7-A20Fx, C3-A30D, C9-A41FX
vanBragt, F. J., Building and Construction Research TNO, Netherlands; Nov. 13, 1998; 34p; In English; Original contains color illustrations
Contract(s)/Grant(s): A96/KM/151; TNO Proj. 72376958
Report No.(s): TD98-0375; TNO-98-CMC-R1728; Copyright; Avail: Issuing Activity

Two contactors, type LC1-FG150 G6 - LC1-FG500 F7, and three relays, type C7-A20FX; C3-A30D, C9-A41 FX, have exposed to shock tests in accordance with the LCF shock specification for resiliently mounted equipment on wire rope mounts (type Polycal). The contactors and the relays satisfy the given shock requirements.
Author
Contactors; Shock Tests; Mechanical Engineering; Shock Measuring Instruments; Relay

20000039451 Little (Arthur D.), Inc., Washington, DC USA

Opportunity for Energy Savings in Residential and Commercial Sectors with High Efficiency Electric Motors ***Final Report***

Rivest, M.; Koszalinski, S.; Dickman, J.; Dec. 1, 1999; 134p; In English; Original contains color illustrations

Report No.(s): PB2000-101159; No Copyright; Avail: National Technical Information Service (NTIS)

Motors are ubiquitous, but unseen, in households and commercial buildings. A first-ever, government study estimates there are at least one billion motors in buildings in major service applications, and at least another billion very-small motors in applications of low-energy significance. Electricity consumption in buildings is about 22 quadrillion Btu (quad). Energy consumption by motors alone is about 8.8 quads, or the annual gasoline requirements of the U.S. fleet of automobiles. Influencing this large consumption are the efficiency levels of motors, which range from 10 percent up to the low nineties, depending upon the application. In addition, societal trends for increased comfort, convenience, and health will increase the number of motors and their hours of use in the future. With use of more efficient motors and variable speed drives, energy savings of over two quads are estimated to be technically achievable. Over one quad of savings is possible with consumer payback of less than five years, mainly in HVAC and commercial refrigeration applications. This study provides first-of-a-kind national characteristics on motors in households and in commercial buildings. to develop these estimates, data were collected on annual sales, installed population, horsepower ranges, efficiency levels, and operating hours for major service applications. Household motors were placed into 15 product groups, such as refrigerator and central air conditioner; and, commercial building motors were placed into 20 product groups, such as indoor blower fans and ice machines.

NTIS

Electric Motors; Energy Conservation; Space Heating (Buildings); Residential Areas

20000040157 Army Research Lab., Sensors Directorate, Adelphi, MD USA

Predicted Discharge Rate for gamma/beta-MnO2 versus lambda-MnO2 ***Interim Report, 1-21 Jan. 2000***

Wolfenstine, Jeff; Mar. 2000; 10p; In English

Report No.(s): AD-A374407; ARL-TN-160; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Recently, lambda-MnO2 has been proposed as an alternative cathode to gamma/beta-MnO2 in Li/MnO2 primary batteries because of its potential faster discharge rate. The results presented here suggest that (1) switching from gamma/beta-MnO2 to lambda-MnO2 of equal particle size will lead to a maximum increase in the discharge rate at room temperature of about an order of magnitude and (2) when formed by acid digestion, gamma-MnO2 and beta-MnO2 have a higher lithium diffusivity and hence a faster discharge rate than when they are produced by the usual commercial means, a difference that may result from the lower structural water content in the materials produced by acid digestion.

DTIC

Manganese Oxides; Primary Batteries; Lithium Batteries

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.

20000039415 Institute for Computer Applications in Science and Engineering, Hampton, VA USA

Non-Ideal Gas Effects on Shock Waves in Weakly Ionized Gases ***Final Report***

Rubinstein, Robert, Institute for Computer Applications in Science and Engineering, USA; Auslender, Aaron H., NASA Langley Research Center, USA; January 2000; 14p; In English

Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01

Report No.(s): NASA/CR-2000-210081; NAS 1.26:210081; ICASE-2000-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A shock wave in a weakly ionized gas can he preceeded by a charge separation region if the Debye length is larger than the shock width. It has been proposed that electrostatic contributions to pressure in the charge separation region can increase the sound speed ahead of the shock well above the sound speed in a neutral gas at the same temperature and therefore increase the shock propagation speed. This proposal is investigated numerically and theoretically. It is concluded that although the ion gas becomes strongly non-ideal in the charge separation region, there is no appreciable effect on the neutral shock.

Author

Ionized Gases; Polarization (Charge Separation); Shock Wave Propagation; Computerized Simulation

20000039436 Maryland Univ., Dept. of Mechanical Engineering, College Park, MD USA

Scale-Similar Models for Large-Eddy Simulations

Sarghini, F., Maryland Univ., USA; Physics of Fluids; June 1999; ISSN 1070-6631; Volume 11, No. 6, pp. 1596- 1607; In English Contract(s)/Grant(s): N00014-91-J-1638; NAG1-1828; NAG1-1880; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Scale-similar models employ multiple filtering operations to identify the smallest resolved scales, which have been shown to be the most active in the interaction with the unresolved subgrid scales. They do not assume that the principal axes of the strain-rate tensor are aligned with those of the subgrid-scale stress (SGS) tensor, and allow the explicit calculation of the SGS energy. They can provide backscatter in a numerically stable and physically realistic manner, and predict SGS stresses in regions that are well correlated with the locations where large Reynolds stress occurs. In this paper, eddy viscosity and mixed models, which include an eddy-viscosity part as well as a scale-similar contribution, are applied to the simulation of two flows, a high Reynolds number plane channel flow, and a three-dimensional, nonequilibrium flow. The results show that simulations without models or with the Smagorinsky model are unable to predict nonequilibrium effects. Dynamic models provide an improvement of the results: the adjustment of the coefficient results in more accurate prediction of the perturbation from equilibrium. The Lagrangian-ensemble approach [Meneveau et al., J. Fluid Mech. 319, 353 (1996)] is found to be very beneficial. Models that included a scale-similar term and a dissipative one, as well as the Lagrangian ensemble averaging, gave results in the best agreement with the direct simulation and experimental data.

Author

Scale Models; Large Eddy Simulation; Eddy Viscosity; Dynamic Models; Reynolds Averaging; Navier-Stokes Equation; Reynolds Stress

20000039706 NASA Ames Research Center, Moffett Field, CA USA

Measurement Requirements for Improved Modeling of Arcjet Facility Flows

Fletcher, Douglas G., NASA Ames Research Center, USA; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 3A-1 - 3A-27; In English; See also 20000039703; Copyright Waived; Avail: CASI; A03, Hardcopy

Current efforts to develop new reusable launch vehicles and to pursue low-cost robotic planetary missions have led to a renewed interest in understanding arc-jet flows. Part of this renewed interest is concerned with improving the understanding of arc-jet test results and the potential use of available computational-fluid- dynamic (CFD) codes to aid in this effort. These CFD codes have been extensively developed and tested for application to nonequilibrium, hypersonic flow modeling. It is envisioned, perhaps naively, that the application of these CFD codes to the simulation of arc-jet flows would serve two purposes: first. the codes would help to characterize the nonequilibrium nature of the arc-jet flows; and second. arc-jet experiments could potentially be used to validate the flow models. These two objectives are, to some extent, mutually exclusive. However, the purpose of the present discussion is to address what role CFD codes can play in the current arc-jet flow characterization effort, and whether or not the simulation of arc-jet facility tests can be used to eva1uate some of the modeling that is used to formu1ate these codes. This presentation is organized into several sections. In the introductory section, the development of large-scale, constricted-arc test facilities within NASA is reviewed, and the current state of flow diagnostics using conventional instrumentation is summarized. The motivation for using CFD to simulate arc-jet flows is addressed in the next section, and the basic requirements for CFD models that would be used for these simulations are briefly discussed. This section is followed by a more detailed description of experimental measurements that are needed to initiate credible simulations and to evaluate their fidelity in the different flow regions of an arc-jet facility. Observations from a recent combined computational and experiment.al investigation of shock-layer flows in a large-scale arc-jet facility are then used to illustrate the current state of development of diagnostic instrumentation, CFD simulations, and general knowledge in the field of arc-jet characterization. Finally, the main points are summarized and recommendations for future efforts are given.

Derived from text

Computational Fluid Dynamics; Diagnosis; Fluid Flow; Mathematical Models; Nonequilibrium Flow; Shock Layers; Simulation

20000039707 NASA Ames Research Center, Moffett Field, CA USA

Nonintrusive Diagnostic Strategies for Arcjet Stream Characterization

Fletcher, Douglas G., NASA Ames Research Center, USA; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 3B-1 - 3B-37; In English; See also 20000039703; Copyright Waived; Avail: CASI; A03, Hardcopy

In the previous lecture, the issues related to arcjet flow modeling were introduced, and the limitations of conventional instrumentation in addressing these issues were discussed. The general level of understanding of the arcjet flows was seen to preclude the use of arcjets as aerothermodynamic test facilities beyond the current role in aerothermal material testing, despite their long test duration capability. In this section, the focus will be on new developments in spectroscopic instrumentation and techniques

that can be brought to bear on the fundamental problem of arcjet stream characterization. Although a wide selection of arcjet facilities were introduced in the previous section, the discussion of nonintrusive diagnostic instrumentation will be restricted to the large-scale, segmented, constricted-arc heater facilities that are most widely used in thermal protection material testing for aerospace applications. After a brief review of the important features of arcjet flows, the topic of nonintrusive, optical diagnostics is introduced with a discussion of some of the basic aspects of radiative transitions. The lecture is then organized into two sections covering emission measurements and laser-induced fluorescence measurements. Emission measurements are presented next for different regions of arcjet flows, while the fluorescence measurements are presented for the free stream region only. Summaries are given for each of the two main sections, and observations on arcjet characterization by optical diagnostics in general are given at the end.
Author
Intrusion; Arc Heating; Aerothermodynamics; Characterization; Diagnosis

20000039710 Office National d'Etudes et de Recherches Aerospatiales, Departement Mesures Physiques, Chatillon, France
Molecular Diagnostics for the Study of Hypersonic Flows
Grisch, F., Office National d'Etudes et de Recherches Aerospatiales, France; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 5-1 - 5-19; In English; See also 20000039703; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

New laser-based diagnostic techniques offer considerable promise for measurements in hypersonic flows. In this paper, we overview optical techniques such as Rayleigh and Raman scattering, laser-induced fluorescence, electron beam fluorescence, coherent anti-Stokes Raman scattering and diode laser absorption. These methods have unique capabilities for nonintrusive measurements of flowfield parameters such as temperature, density, species concentration and velocity. The applicability of these techniques for the study of hypersonic flows is also presented.
Author
Diagnosis; Absorption Spectroscopy; Hypersonic Flow; Laser Spectroscopy; Fluorescence

20000039711 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Aerothermodynamics Section, Goettingen, Germany
Spectroscopic Techniques for Measurement of Velocity and Temperature in the DLR High Enthalpy Shock Tunnel HEG
Beck, W. H., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 7A-1 - 7A-14; In English; See also 20000039703; Copyright Waived; Avail: CASI; A03, Hardcopy

The theory of absorption techniques, including line broadening and shifts, along with a brief description of the spectroscopy of the seed species Rb, will be given. A brief overview of the diode laser itself and the experimental setup for the technique follow. Results are split into two parts: preparatory and calibration work in a test cell and a small test shock tube, followed by results in HEG, are presented. Here time profiles for gas temperature T(sub trans) and velocity u are given for various HEG run conditions.
Author
Spectroscopy; Procedures; Velocity Measurement; Temperature Measurement; Shock Tunnels

20000039712 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Aerothermodynamics Section, Goettingen, Germany
Rotational and Vibrational Temperature Measurements in the DLR High Enthalpy Shock Tunnel HEG Using LIF and Flash Lamp Absorption
Beck, W. H., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 7B-1 - 7B-26; In English; See also 20000039703; Copyright Waived; Avail: CASI; A03, Hardcopy

Use of LIF in two line thermometry TLT and of flash lamp absorption to examine high enthalpy flows is presented. The aim is to measure rotational and vibrational temperatures of nitric oxide NO in high temperature air in the Gottingen High Enthalpy Shock Tunnel HEG. Theory of NO (energy levels, spectroscopy, level populations), LIF and TLT are discussed. Results are given from a test cell to validate TLT with NO LIF as a quantitative technique. HEG results for rotational and vibrational temperatures in the free stream and around models are presented. Finally, flash lamp absorption results yielding these temperatures are given.
Author
Temperature Measurement; Rotation; Enthalpy; Shock Tunnels

20000039714 Academy of Sciences (USSR), Inst. for Problems in Mechanics, Moscow, USSR
Extrapolation from High Enthalpy Tests to Flight Based on the Concept of Local Heat Transfer Simulation
Kolenikov, A. F., Academy of Sciences (USSR), USSR; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 8B-1 - 8B-13; In English; See also 20000039703; Sponsored in part by RTA
Contract(s)/Grant(s): RTA-4329A; INTAS-95-1329; ISTC Proj. 036; Copyright Waived; Avail: CASI; A03, Hardcopy

The concept of the local heat transfer simulation (LHTS) of the high enthalpy flow action on a vehicle stagnation point formulated is based on the requirement to locally provide in a ground test the same boundary layer on the model at the stagnation point as at the re-entry conditions. The present methodology of the extrapolation from ground to flight consists of the three main parts: 1) the recalculation of the test conditions to flight parameters, 2) the prediction of the test conditions for the given hypersonic flight parameters and 3) the validation of the extrapolation procedure.
Author
Extrapolation; Enthalpy; Heat Transfer; Simulation; Ground Tests

20000039715 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Wind Tunnel div., Cologne, Germany
Heat Flux Measurements in High Enthalpy Flows
Guelhan, A., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 9A-1 - 9A-17; In English; See also 20000039703; Copyright Waived; Avail: CASI; A03, Hardcopy

This document describes the fundamentals of heat transfer measurement techniques in high enthalpy flows. After description of basic relations for the stagnation point heat flux rate to a spherical surface in a high enthalpy flow field, different heat flux measurement techniques are discussed. Attention is paid to design aspects, mathematical model for the heat flux rate evaluation and application limits of each sensor type, in order to provide a useful and practical script for the reader with respect to the choice of an adequate sensor type for different requirements. Sensor calibration and comparative measurements using different heat flux sensors in the arc heated facility LBK are described in the last two chapters.
Author
Heat Flux; Flow Measurement; Heat Measurement; Enthalpy; Heat Transfer

20000040155 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
Formulation of a Two-scale Model of Turbulence
Rubinstein, Robert; Feb. 2000; 14p; In English
Contract(s)/Grant(s): NAS1-97046
Report No.(s): AD-A374374; ICASE-2000-5; NASA-CR-2000-209853; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A two-scale turbulence model is derived by averaging the two-point spectral evolution equation. In this model, the inertial range energy transfer and the dissipation rate can be unequal. The model is shown to reduce to a standard two-equation model in decaying turbulence.
DTIC
Turbulent Flow; Energy Transfer; Method of Moments

20000040158 Delaware Univ., Dept. of Chemical Engineering, Newark, DE USA
Non-Linear Fluid Flow/Surfactant Interface Dynamics ***Final Report, 1 Oct. 1997-30 Nov. 1999***
Beris, Antony N.; Nov. 30, 1999; 7p; In English
Contract(s)/Grant(s): N00014-98-1-0008
Report No.(s): AD-A374422; 3-3-21-3110-03; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We are aiming to use a newly developed algorithm for direct numerical simulation of free surface flows with surfactants. We want to focus on improving the understanding of the nonlinear flow/free-surface/surfactant interactions of a surfactant-contaminated free surface with a vortex, with or without the presence of waves. Second through comparison with experimental data, we want to investigate the extent of microscopic detail needed to be present in the surfactant model in order to enable an at least qualitative description of the dynamic surfactant behavior.
DTIC
Two Dimensional Flow; Nonlinear Systems; Direct Numerical Simulation; Free Flow; Surfactants

20000043538 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
Formulation of a Two-Scale Model of Turbulence ***Final Report***
Rubinstein, Robert, Institute for Computer Applications in Science and Engineering, USA; February 2000; 16p; In English
Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01
Report No.(s): NASA/CR-2000-209853; NAS 1.26:209853; ICASE-2000-5; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A two-scale turbulence model is derived by averaging the two-point spectral evolution equation. In this model, the inertial range energy transfer and the dissipation rate can be unequal. The model is shown to reduce to a standard two-equation model in decaying turbulence.
Author
Mathematical Models; Turbulence; Turbulent Flow; Method of Moments

20000044539 North Carolina State Univ., Raleigh, NC USA
Control of Cavity Resonance Using Oscillatory Blowing
Scarfe, Alison Lamp, North Carolina State Univ., USA; Chokani, Ndaona, North Carolina State Univ., USA; [2000]; 98p; In English
Contract(s)/Grant(s): NCC1-335; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The near-zero net mass oscillatory blowing control of a subsonic cavity flow has been experimentally investigated. An actuator was designed and fabricated to provide both steady and oscillatory blowing over a range of blowing amplitudes and forcing frequencies. The blowing was applied just upstream of the cavity front Wall through interchangeable plate configurations These configurations enabled the effects of hole size, hole shape, and blowing angle to be examined. A significant finding is that in terms of the blowing amplitude, the near zero net mass oscillatory blowing is much more effective than steady blowing; momentum coefficients Lip two orders of magnitude smaller than those required for steady blowing are sufficient to accomplish the same control of cavity resonance. The detailed measurements obtained in the experiment include fluctuating pressure data within the cavity wall, and hot-wire measurements of the cavity shear layer. Spectral and wavelet analysis techniques are applied to understand the dynamics and mechanisms of the cavity flow with control. The oscillatory blowing, is effective in enhancing the mixing in the cavity shear layer and thus modifying the feedback loop associated with the cavity resonance. The nonlinear interactions in the cavity flow are no longer driven by the resonant cavity modes but by the forcing associated with the oscillatory blowing. The oscillatory blowing does not suppress the mode switching behavior of the cavity flow, but the amplitude modulation is reduced.
Author
Blowing; Cavity Flow; Cavity Resonators; Oscillations; Subsonic Flow; Active Control

20000044699 Commissariat a l'Energie Atomique, Dept. de Thermohydraulique et de Physique, Grenoble, France
Feasibility of using of the second gradient theory for the direct numerical simulation of liquid-vapor flows with phase-change
Jamet, D.; Dec. 31, 1998; 248p; In French; In English
Report No.(s): DE99-627781; CEA-R-5823; No Copyright; Avail: Department of Energy Information Bridge

One on the main difficulties encountered in the direct numerical simulation of two-phase flows in general and of liquid-vapor flows with phase-change in particular, is the interface tracking. The idea developed in this work consists in modeling a liquid-vapor interface as a volumetric zone across which physical properties vary continuously instead of a discontinuous surface. The second gradient theory allows to establish the evolution equations of the fluid in the whole system: bulk phases and interfaces. That means that the resolution of a unique system of partial differential equations is necessary to determine the whole two-phase flow, the interfaces and their evolution in time being a part of the solution of this unique system. We show in this work that it is possible to artificially enlarge an interface without changing its surface tension and the latent heat of vaporization. That means that it is possible to track all the interfaces of a liquid-vapor two-phase flow with phase-change on a mesh the size of which is imposed by the smallest Kolmogorov scale of the bulk phases for example. The artificial enlargement of an interfacial zone is obtained by modifying the thermodynamic behavior of the fluid within the bimodal. We show that this modification does not change the dynamics of an interface. However, although the thickness of an interface and its surface tension vary with the mass and heat fluxes that go though it, the thermodynamic modification necessary to the artificial enlargement of an interface drastically increases these variations. Consequently, the artificial enlargement of an interface must be made carefully to avoid a too much important variation of its surface tension during dynamic situations.
NTIS
Liquid-Vapor Interfaces; Two Phase Flow; Direct Numerical Simulation

35
INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gauges; 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.

20000038370 Alabama Univ., Huntsville, AL USA
NGST/XRCF Design and Build Wavescope System Pallet ***Final Report, 26 Oct. 1998 - 25 Oct. 199***
Geary, Joe, Alabama Univ., USA; Dec. 15, 1999; 4p; In English
Contract(s)/Grant(s): NAS8-97095; NASA Order H-30198-D; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Based on the successful Wavescope demonstration at MSFC at the end of March, the decision was made by the optical testing team to purchase an upgraded Wavescope from AOA. The MSFC version would include: a higher resolution camera (1000 x 1000 pixels); a higher density lenslet array (150 x 150); updated software; and longer cables (to accommodate the remote operation of the Wavescope optical head which was resident in the Beam Guide Tube). The AOA proposal for the new instrument was received in mid-April, and delivered to MSFC in mid-July. A considerable amount of effort was expended to provide the infrastructure needed for Wavescope operation, and to incorporate it into the overall test system. This was provided by the Wavescope System Pallet (WSP) built by UAH. The WSP is illustrated. Several instruments are incorporated on this pallet. These include the: Wavescope optical head; a PDI wavefront sensor; a point spread function sensor; a Leica light-based distance measuring sensor. In addition there is a single mode fiber point source (fed from a separate source pallet) which serves both as a reference for the Wavescope and as a source point for the test mirror. There is a dual function lens which both collimates the beam from the test image point, and images the test mirror onto the lenslet array. There is a high quality Collimator which can provide a flat input wavefront directly into the Wavescope. There are also various aids such as an alignment laser, an alignment telescope, alignment sticks and apertures. The WSP was delivered to MSFC on 7/28/99. An picture shows the WSP installed in the Guide Tube at the X-Ray Calibration Facility (XRCF).
Author
Collimators; Wave Fronts; Optical Measuring Instruments

20000038770 Institute of Industrial Technology TNO, Dept. of Surface Technology, Helder, Netherlands
Development of an Electrochemical Sensor for Impedance Measurements for Coating Assessment ***Interim Report Ontwikkeling Elektrochemische Sensor, "Metingen aan Praktische Systemen en Praktijkervaringen"***
vanWesting, E. P. M., Institute of Industrial Technology TNO, Netherlands; Dec. 15, 1998; 36p; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): A96/KM/114; TNO Proj. 1296.7.6026
Report No.(s): TD-98-0389; CA/98.9019; Copyright; Avail: Issuing Activity

In this report the validation and application are described of a sensor for in situ impedance measurements for coating assessment. The aim of the development is an in situ quantitative determination of the amount of weathering to enable prediction of service life. Basis to this is the behavior of the coating in immersion, where is observed that the individual coating layers have their own contribution to the coating impedance. The impedance of the coatings also clearly shows the water uptake, curing during immersion, and onset of delamination. In this part of the research the results of measurements with the sensor (dry) and in immersion with the electrochemical cell are described. The results show the validity of the sensor, but there is a non-systematic difference in these results, which originates from the difference in measurement conditions. This will be the subject for further investigations.
Author
Electrochemical Cells; Impedance; Impedance Measurement; Electrical Impedance; Corrosion; Coating

20000039375 NASA Marshall Space Flight Center, Huntsville, AL USA
Imaging Calorimeter for ACCESS Simulations with GEANT/FLUKA
Watts, John, NASA Marshall Space Flight Center, USA; Lee, Jeongin, National Academy of Sciences - National Research Council, USA; [2000]; 1p; In English; Cosmic Rays: Instrumentation and First Results, Session C16, 29 Apr. - 3 May 2000, Long Beach, CA, USA; Sponsored by American Physical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Imaging Calorimeter for ACCESS (ICA) is a candidate of the calorimeter for the NASA's ACCESS program to be flown on the International Space Station. The ICA studies the origin and acceleration mechanism of cosmic rays by measuring the elemental composition of the cosmic rays in the energy up to 10(exp 16) eV. For the past year, Monte Carlo simulation study for the ICA

has been conducted using GEANT/FLUKA to predict the detector performance and to design the system for match the scientific objectives. Simulation results will be shown for the detector response and the energy resolution for various configurations.
Author
Calorimeters; Monte Carlo Method; Simulation; Mathematical Models

20000039383 NASA Johnson Space Center, Houston, TX USA
Response of silicon-Based Linear Energy Transfer Spectrometers
Aman, A., NASA Johnson Space Center, USA; Bman, B.; Badhwar, G. D.; ONeill, P. M. O.; [2000]]; 1p; In English; 33rd; 33rd COSPAR Scientific Assembly, 16-23 Jul. 2000, Warsaw, Poland; Sponsored by Committee on Space Research, Unknown; No Copyright; Avail: Issuing Activity; Abstract Only

Silicon-based linear energy transfer (LET) telescope,(e. g., DOSTEL and RRMD) have recently been flown in space. LET spectra measured using tissue equivalent proportional counters show differences that need to be fully understood. A Monte Carlo technique based on: 1. radiation transport cluster intra-cascade model. 2. Landau-Vavilov distribution, 3. telescope geometry and detector coincidence & discriminator settings, 4. spacecraft shielding geometry, and 5. the external free space radiation environment, including recent albedo measurements, was developed.
Author
Linear Energy Transfer (LET); Telescopes; Proportional Counters; Extraterrestrial Radiation; Discriminators; Aerospace Environments

20000039688 Astro Technology, Inc., Houston, TX USA
Real-Time Structural Monitoring Using Fiber-Optic Sensors
Brower, David V., Astro Technology, Inc., USA; 49th JANNAF Propulsion Meeting; December 1999; Volume 1, pp. 147-154; In English; See also 20000039678; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Fiber-optic sensors and a new data acquisition system are being investigated as the means to provide real-time structural monitoring. This sensor technology has been significantly advanced recently by its application to solid rocket motors (SRM) and to deepwater drilling risers. The risers are used for offshore oil exploration. Limited data has been obtained from full-scale SRM static testing. Structural monitoring by use of fiber-optic sensors from the drilling riser study is well advanced and directly applicable to SRM usage. The possibility of deepwater riser fatigue failure is of concern due to vibration induced by vessel motion and ocean currents. SRM's and deepwater risers are candidate users of this technology. These fiber-optic sensors are ideally suited for deepwater applications for several reasons: they have multiplexing capability, they are immune to electromagnetic interference (EMI), they have very little signal loss, small size, corrosion resistance, and ease of use and handling. This paper outlines progress to date. Ruggedized sensors, cabling and connectors have been demonstrated. The first field trials with fiber-optic sensors on a drilling riser have been successfully completed with sensors attached near the water surface. A rig site fatigue monitoring tool has been developed which processes the measured data and displays fatigue information in real-time. Additional field trials will be conducted on a deepwater riser that has been instrumented with 100 sensors where real-time fatigue monitoring will be performed.
Author
Fiber Optics; Structural Reliability; Fault Detection; Underwater Structures; Fatigue (Materials); Solid Propellant Rocket Engines

20000039691 NASA White Sands Test Facility, NM USA
Recent Developments in Chemically Reactive Sensors for Propellants
Davis, Dennis D., Allied-Signal Technical Services Corp., USA; Mast, Dion J., Allied-Signal Technical Services Corp., USA; Baker, David L., NASA White Sands Test Facility, USA; 49th JANNAF Propulsion Meeting; December 1999; Volume 1, pp. 175-181; In English; See also 20000039678; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Propellant system leaks can pose a significant hazard in aerospace operations. For example, a leak in the hydrazine supply system of the Shuttle APU has resulted in hydrazine ignition and fire in the aft compartment of the Shuttle. Sensors indicating the location of a leak could provide valuable information required for operational decisions. White Sands Test Facility (WSTF) has developed a small, single use sensor for detection of propellant leaks. The sensor is composed of a thermistor bead coated with a substance which is chemically reactive with the propellant. The reactive thermistor is one of a pair of closely located thermistors, the other being a reference. On exposure to propellant the reactive coating responds exothermically to the propellant and increases the temperature of the coated-thermistor by several degrees. The temperature rise is sensed by a resistive bridge circuit and an

alarm registered by data acquisition software. The concept is general and has been applied to sensors for hydrazine, monomethylhydrazine, unsym-dimethylhydrazine, ammonia, hydrogen peroxide, ethanol and dinitrogen tetroxide. A multi-use sensor has also been developed for hydrazine based on its catalytic reactivity with noble metals. Responses of these sensors to humidity, propellant concentration, distance from the liquid leak, and ambient pressure levels are presented.
Author
Propellants; Reactivity; Thermistors; Warning Systems; Detection; Hydrazines

20000039701 Alabama Univ., Huntsville, AL USA
Three Dimensional Microgravity Accelerometer: 3-DMA
Bijvoet, Jan A., Alabama Univ., USA; Consortium for Materials Development in Space; Sep. 10, 1999; 24p; In English; See also 20000039700; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents 3- DMA (Three Dimensional Microgravity Accelerometer) missions and flight experience from 1989-1998. The topics include: 1) Versions; 2) Real-Time Microgravity Data to The Ground; 3) Need For Microgravity Measurements; 4) Measurement Sensitivity; and 5) Three, Simultaneous, Frequency Bands. The paper also presents typical 3-DMA flight configurations and 3-DMA Acceleration data.
CASI
Microgravity; Accelerometers; Space Transportation System; Space Shuttle Missions; Three Dimensional Models

20000039716 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Wind Tunnel Div., Cologne, Germany
Application of Pyrometry and IR-Thermography to High Surface Temperature Measurements
Guelhan, A., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 9B-1 - 9B-24; In English; See also 20000039703; Copyright Waived; Avail: CASI; A03, Hardcopy

In this document the non-intrusive temperature measurement techniques like pyrometry and IR-thermography and their application at high temperatures are described. For a better understanding first some basic relations of thermal radiation are discussed followed by the absorption behaviour of the atmosphere and optical glasses. Main properties of different IR detector types follows this chapter. Chapters five and six are devoted to the description of pyrometers and IR-cameras including a comparison of different detectors, data reduction and im- aging techniques. Based on the experience from application of IR devices at the arc heated facility LBK, some requirements on an IR-system for its use at high enthalpy facilities are defined. Results of comparative and complementary measurements of the surface temperature of several thermal protection materials using pyrometers and IR-cameras are presented in chapter nine.
Author
Pyrometers; Thermography; Temperature Measurement; Thermal Radiation; Infrared Instruments

20000040116 NASA Goddard Space Flight Center, Greenbelt, MD USA
Towards Development of Microcalorimeter Arrays of Mo/Au Transition-Edge Sensors with Bismuth Absorbers
Tralshawala, Nilesh, NASA Goddard Space Flight Center, USA; Brekosky, Regis, Swales Aerospace, USA; Figueroa–Feliciano, Enectali, Stanford Univ., USA; Li, Mary, NASA Goddard Space Flight Center, USA; Stahle, Carl, NASA Goddard Space Flight Center, USA; Stahle, Caroline, NASA Goddard Space Flight Center, USA; Feb. 09, 2000; 1p; In English; ASC-2000, 17-22 Sep. 2000, Virginia Beach, VA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We report on our progress towards the development of arrays of X-ray microcalorimeters as candidates for the high resolution x-ray spectrometer on the Constellation-X mission. The microcalorimeter arrays (30 x 30) with appropriate pixel sizes (0.25 mm. x 0.25 mm) and high packing fractions (greater than 96%) are being developed. Each individual pixel has a 10 micron thick Bi X-ray absorber that is shaped like a mushroom to increase the packing fraction, and a Mo/Au proximity effect superconducting transition edge sensor (TES). These are deposited on a 0.25 or 0.5 micron thick silicon nitride membrane with slits to provide a controllable weak thermal link to the sink temperature. Studies are underway to model, test and optimize the TES pixel uniformity, critical current, heat capacity and the membrane thermal conductance in the array structure. Fabrication issues and procedures, and results of our efforts based on these optimizations will be provided.
Author
Fabrication; Arrays; Molybdenum Alloys; Silver Alloys; Calorimeters

20000040156 Naval Postgraduate School, Dept. of Physics, Monterey, CA USA
Design and Construction of a Medium Resolving, Power Scanning, Grating Spectrometer
Hassett, James E.; Dec. 1999; 90p; In English
Report No.(s): AD-A374402; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A scanning Ebert-Fastie spectrometer was designed and built for the Optical Physics and Sensors Laboratory of the Naval Postgraduate School. Optical design was done with two commercially available optical design software packages, OSLO LT by Sinclair Optics, Inc., and Optica by Wolfram Research, Inc. Several components for the spectrometer were designed and built at the Naval Postgraduate School Physics Department machine shop to include grating mount, motor mount, entrance and exit slits, gearbox, and spacers. Electronic interfaces included the motor, motor controller, and personal computer to control the diffraction grating angle, and a detector, data logger, lock-in detection system, and personal computer to record data. Data was measured from a Fe hollow cathode source to demonstrate proper operation. The recorded spectral lines were graphed in Microsoft Excel and tentatively identified as those tabulated in the published literature. Future work includes optimization of the resolving power and of the fore optics. Upon completion, the spectrometer will prove to be a very useful instructional aid in the optics and optoelectronics classes taught at the school, and as a medium resolving power visible and near ultraviolet instrument for future student thesis research.
DTIC
Electro-Optics; Spectrometers; Design Analysis; Applications Programs (Computers); Line Spectra

20000040461 Caen Univ., UFR de Sciences, France
Study and building of a detection array for delayed neutrons: TONNERRE
Martin, T.; Nov. 09, 1998; 136p; In French; In English
Report No.(s): DE99-635259; LPCC-T-98-03; No Copyright; Avail: Department of Energy Information Bridge
This work has been undertaken within a French-Romanian collaboration in order to build a high efficiency detector array for delayed neutrons: barrel- shaped TONNERRE. Some neutron-rich nuclei decay through 1, 2 or 3 neutron emission after (beta)(sup -) decay. More exotic nuclei will be produced by SPIRAL at GANIL. An array with high efficiency and good resolution is then required. Thirty two BC400 plastic scintillators (160 x 20 x 4 cm(sup 3)) allow us to get the time of flight neutron spectra. They are bent for uniform flight path and viewed by a photomultiplier tube at both ends. Simulations have allowed to establish scintillator size and to minimize light attenuation. Intrinsic efficiency and crosstalk have been measured with (sup 252)Cf and compared to GEANT. 1 to 5 MeV neutrons are detected with good timing and position properties. Other counters will be built for neutrons from 300 keV to 1 MeV. Planned to run at several particle accelerators (GANIL, CERN, and others) , TONNERRE is modular and many geometries are possible.
NTIS
Research; Fabrication; Arrays; Neutron Spectra; Delay; Neutron Counters; Neutron Emission

20000040769 Paris II Univ., Inst. de Physique Nucleaire, Orsay, France
Study, development and clinical evaluation of a per-operative (gamma) imager
Menard, L.; Jan. 19, 1999; 131p; In French; In English
Report No.(s): DE99-635252; IPNO-T-99-01; No Copyright; Avail: Department of Energy Information Bridge
The precise localization and complete surgical ablation of tumors are one of the most important procedures in cancer treatment. In that context, the use, in operating room, of light hand-held detectors associated to radiopharmaceutical compounds for tumor labelling, plays a significant role in assisting surgeons in real-time detection of lesion. The POCI gamma imaging probe (Per-Operative Compact Imager), which is presented here, is precisely dedicated to improve the radio-guided operative cancer surgery efficiency by bringing a new tool discriminating between healthy and pathological tissues. To match the specifications of intra-operative detection, we chose to build our camera around an intensified position sensitive diode which appeared to be particularly suitable to achieve a high resolution small size imager. The optimal geometry of two gamma detection head modules, composed of parallel hole collimators and scintillation crystals, was then investigated by numerical simulations. From these technological solutions, a first prototype of POCI with a 24 mm diameter field of view has been developed. Its characterization has put forward a millimeter spatial resolution and a detection efficiency comparable to that of clinical gamma cameras and in agreement with the numerical predictions. Finally, in collaboration with Gustave Roussy, a first clinical evaluation of the POCI camera has been performed for sentinel ganglion pre-operative localization in patients afflicted by malignant melanomas or breast cancers. The preliminary results have already shown that the performances of POCI are compatible with intraoperative imaging purposes and suggest how this camera can boost the success rate of tumor removal surgeries for other cancerous diseases.
NTIS
Display Devices; Gamma Rays; Cancer; Mammary Glands

20000044004 Range Commanders Council, White Sands Missile Range, NM USA

Radar Cross Section (RCS) Measurement Facility Catalog

Mar. 1999; 74p; In English

Report No.(s): AD-A375509; RCC-801-98; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The purpose of this catalog is to provide basic information on the resources available and to provide points of contact for program managers in need of such capabilities to support their programs. These facilities can carry out the full range of activities required in the RCS measurement process, including test planning, test item preparation, collection of actual measurement data, processing, analysis, and post-test assessments.

DTIC

Radar Cross Sections; Radar Signatures; Signature Analysis; Radar Imagery

20000044005 Range Commanders Council, White Sands Missile Range, NM USA

Photography, Motion Picture Film Cores and Spools, Performances, and Other Technical Information

Jan. 2000; 52p; In English

Report No.(s): AD-A375524; RCC-451-00; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The information contained in this document is intended to provide a means of more rapidly identifying most of the cores and spools used throughout the motion picture industry. No attempt has been made to identify all of the various items that are available, but rather to list those items most widely used. The purpose of this document is to present camera technical information and representations of the types of film cores and spools that are currently available on the open market. At the present time, only one company, Eastman Kodak, is supplying the test range industry with these film products. Specific technical information about these products appears in this publication. Additionally, information is included that may be of value to data reduction analysts. Also provided herein are representations of special cores and spools that are required specifically for high-speed camera use. These specially manufactured devices are designed to withstand the torque generated in high-speed camera operations. In addition to the identification of these cores and spools, an attempt has been made to provide technical information regarding flange focal distances, timing displacement, aperture openings for cameras, and light transmission for prism cameras.

DTIC

High Speed Cameras; High Speed Photography; Photographic Recording; Motion Pictures; Cinematography

20000044697 Saclay Research Centre, Dept. d'Electronique et d'Instrumentation Nucleaire, Gif-sur-Yvette, France

Study of optically stimulated luminescence (OSL) for radiation detection: Application to an optical fibre gamma-radiation sensor

Roy, O.; Dec. 31, 1998; 244p; In French; In English

Report No.(s): DE99-627779; CEA-R-5806; No Copyright; Avail: Department of Energy Information Bridge

This work shows up the usefulness of the Optically Stimulated Luminescence (OSL) to resolve radioprotection problems. We study the use of OSL as a gamma dosimetric technique with respect to the ALARA's concept (As Low As Reasonably Achievable). A new approach based on optical fibers and luminescent materials showing OSL properties (closely related to Thermoluminescence phenomena) is presented in order to improve the remote real time dosimetry monitoring. The OSL phenomenon offers the same advantages as thermoluminescent materials (TLD) plus the interesting possibility of a remote optical stimulation. The end-user objective deals with the development of a gamma-radiation Optical Fiber Sensor (OFS) for dose measurement which can offer new functionalities based on OSL materials coupled with an optical fiber. Rare earth doped Alkaline Earth Sulphides (AES), BAFX:EU(sup 2+) (X = Cl, Br, I) and halogen alkaline have been studied (crystalline form, synthesis techniques, influence of dopants and color centers) . Their characteristics are presented and extensively discussed. A specific experimental set-up to characterize various OSL phosphors has been developed. It allows the study of sensitivity, linearity, time decay behaviour of OSL signal and zeroing time. A joint study of OSL and TL has shown the technical limitations as well as the thermal fading and the origin of the long zeroing time. An Optical Fiber Sensor (OFS) based on OSL and using MgS:Sm has been developed for practical applications on nuclear fields. Its specifications are presented and discussed as well as improvements are proposed. 320 refs.

NTIS

Radiation Protection; Thermoluminescence; Radiation Detectors

36
LASERS AND MASERS

Includes lasing theory, laser pumping techniques, maser amplifiers, laser materials, and the assessment of laser and maser outputs. For cases where the application of the laser or maser is emphasized see also the specific category where the application is treated. For related information see also 76 Solid-State Physics.

20000038361 Lebedev Physical Inst., Chemical and Electric-Discharge Laser Lab., Moscow, Russia
The Study of Supersonic COIL with Generation of Iodine Atoms from CH3I in DC and RF Discharges and New Methods of Active Medium Preparation ***Final Report***
Nikolaev, Valeri; Jan. 2000; 69p; In English
Contract(s)/Grant(s): F61775-99-W-E032
Report No.(s): AD-A374369; EOARD-SPC-99-4032; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The developed supersonic COIL with 5 cm gain length was driven by Verti Jet SOG having 0.28 liter of working volume. The oxygen was diluted by the primary nitrogen downstream from the JSOG. Two types of nozzles were tested: single throat nozzle with 10 mm throat height and double throat nozzle with total throat height 15 mm. The COIL with single throat nozzle operated at the primary nitrogen dilution O2:N2 = 1:1 and the chlorine flow rate less than 40 mmole/s to maintain the designed gas flow conditions in the reactor of JSOG. The maximum power 765 W has been achieved at 39 mmole/s of the chlorine molar flow rate. The using of double throat nozzle allowed to increase chlorine molar flow rate up to 75 mmole/s. In this case the maximum power 1.4 kW has been reached for primary nitrogen ratio O2:N2 = 1:1.28. The specific performances of 5 kW per 1 liter of the reactor volume, of 100 W/cm per unit of the stream cross section area in the cavity and of 2,7W/(liter/s) of the pump capacity were obtained.
DTIC
Iodine; Chemical Oxygen-Iodine Lasers; Continuous Wave Lasers; Gas Lasers

20000038362 United Telecommunications Products, Inc., Transmission Systems Div., Chalfont, PA USA
Radio Frequency Photonic Synthesizer ***Final Report, Nov 1996 - May 1998***
Logan, Ronald T., Jr.; Li, Ruo D.; Jan. 2000; 107p; In English
Contract(s)/Grant(s): F30602-96-C-0272; DARPA ORDER-D965; AF Proj. D965
Report No.(s): AD-A374373; AFRL-SN-RS-TR-1999-268; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

An electro-optic device that synthesizes RF frequencies photonically by selection of two individual frequency pulses from a comb of frequencies generated by an actively mode-locked laser. The two frequencies are then combined (heterodyned) to produce the desired optical frequency source. The highly phase stable optical signal can be utilized in the photonic domain or detected for use as an electronic signal source. The prototype unit is rack mounted and computer controlled. The research conducted on this program verified the concept, produced a working prototype, and proposed the miniaturization of the photonic synthesizer.
DTIC
Radio Frequencies; Frequency Synthesizers; Mixing Circuits; Integrated Circuits; Electro-Optics; Optoelectronic Devices; Photonics

20000039709 Rouen Univ., Centre National de la Recherche Scientifique, France
Laser Induced Fluorescence in High Enthalpy Facilities in the Tsniimach Center (Moscow - Russia)
Robin, L., Rouen Univ., France; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 4B-1 - 4B-18; In English; See also 20000039703; Copyright Waived; Avail: CASI; A03, Hardcopy

The requirements for accurate measurements, the higher sophistication in the design, the need for monitoring, control and diagnostics in difficult circumstances and the request for data bases to validate numerical codes have incited the advanced measurement techniques to the investigation of ground test facilities. This lecture presents an experimental work and the results obtained by Laser Induced Fluorescence (LIF) in continuous high enthalpy supersonic airflows. The test campaign is performed at the Central Research Institute of Machine Building (Tsniimach, Moscow region) in ground experimental facilities designed for aerodynamics and heat transfer studies of supersonic and hypersonic aircrafts. The main objective of this test campaign was to perform measurements of species concentrations, temperature and velocity in the incoming flow, and in the boundary and shock layers over a Thermal Protection System (TPS) model simulating a misalignment of tiles, by means of techniques developed by the plasma team from the University of Rouen. So, an original method using LIF diagnostic has been implemented to measure simultaneously the three parameters. Fluorescence of NO was induced in the high enthalpy air plasma flow by a tunable ArF-excimer laser via the epsilon-band system D(exp 2)sigma(+) (sub nu = 0) left arrow Chi(exp 2)Pi(sub nu = 1). Measurements of the rotational temperature and NO number density have been performed. The spatial resolution of the LIF technique permitted

accurate characterization of the boundary and shock layer, as well as shock thickness. Finally, flow velocity is deduced from the Doppler-shift measurements of excited rovibrational NOE band. Analysis of the results will allow to assess the validity of the computational tools in order to control the representativity of future industrial tests devoted to local aerodynamic studies.
Derived from text
Aerodynamic Heat Transfer; Diagnosis; Ground Tests; Laser Induced Fluorescence; Research Facilities; Software Development Tools; Temperature Measurement; Thermal Protection

20000044003 Arizona State Univ., Dept. of Mechanical and Aerospace Engineering, Tempe, AZ USA
Scanning Laser Vibrometer for MEMS Control Devices ***Final Report, 1 Jan. 1998 - 28 Feb. 1999***
Saric, William S., Arizona State Univ., USA; Mar. 2000; 8p; In English
Contract(s)/Grant(s): F49620-98-1-0259
Report No.(s): AD-A375480; AFRL-SR-BL-TR-00-0083; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

This grant purchased a Scanning Laser-Doppler Vibrometer which was used for the remote measurement of the dynamic displacement of MEMS actuators. The vibrometer is capable of measuring minimum displacements of 0.25 micrometer/s/square root Hz at a standoff distance of 2 m. The sample area can be made as small as 200 micrometer diameter and the frequency response is up to 20 kHz. The device is capable of either continuous or discrete scanning. Besides the displacement information, modal shapes can be obtained for more complicated structures. Digital and computer-graphic output is possible. Details of the equipment are given in the Appendix. The primary use is part of an existing research program that addresses flow control using quasi-static and dynamic roughness elements within a swept-wing boundary layer. The roughness actuators are spanwise distributed near the attachment line and it is important to measure the roughness height under the actual flow conditions. This equipment is also used in three other AFOSR supported research activities as well as in an undergraduate laboratory and a student project.
DTIC
Lasers; Vibration Meters; Remote Sensing; Displacement Measurement

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.

20000038740 Kyushu Univ., Graduate School of Engineering, Fukuoka, Japan
Drag Reduction of Darrieus-Type Runner Blade and Tentative Assessment of the Water Turbine Performance
Okuma, Kusuo, Kyushu Univ., Japan; Furukawa, Akinori, Kyushu Univ., Japan; Watanabe, Satoshi, Kyushu Univ., Japan; Technology Reports of Kyushu University; March 2000; ISSN 0023-2718; Volume 73, No. 2, pp. 195-201; In Japanese; Copyright; Avail: Issuing Activity

The Darrieus-type cross-flow turbine, set in a parallel walled duct casing, has been proposed for electricity generation utilizing low head water power. Considering the practical use in near future, the turbine efficiency must be improved up to almost the same as that of conventional type turbines. In the present paper, effects of drag reduction of Darricus blade on turbine performance are tentatively examined based on the fact that drag coefficient is reduced with increase in blade Reynolds number. Then, a guiding principle of the practical runner size is discussed to obtain higher efficiency.
Author
Drag Reduction; Aerodynamic Drag; Turbine Blades; Performance Tests; Aerodynamic Coefficients

20000038741 Kyushu Univ., Graduate School of Engineering, Fukuoka, Japan
Characteristics of Flow Fluctuation and Pumping-Up Flow Rate in Natural Circulation Air-Lift Pump
Matsumura, Kimiharu, Kyushu Univ., Japan; Fukano, Tohru, Kyushu Univ., Japan; Technology Reports of Kyushu University; March 2000; ISSN 0023-2718; Volume 73, No. 2, pp. 187-194; In Japanese; Copyright; Avail: Issuing Activity

A theoretical model was proposed to analyze the pumping characteristics of an air-lift system consisting of an air-water separator and a constant head tank which are connected by a 25.9 mm I.D. U-tube as a riser and a water-return tube. In the theory we assumed the flow phenomenon is steady, although this type of natural circulating system presents a significant fluctuation of flow; especially in some flow conditions with reduced pressure, there occurs a self excited oscillation. The theoretical model satisfactorily predicts the pumping-up flow rate of water under steady circulating conditions in the case of higher value of sigma(triple bonds

L(sub l)/L). The model also accounts for the reduction of the critical gas flow rate corresponding to the starting of the pumping-up of water from a riser pipe as the two-phase flow and the circulating flow become markedly unsteady in the case of lower sigma. Author

Mathematical Models; Flow Velocity; Pumping; Two Phase Flow; Critical Flow; Circulation

20000039354 NASA Marshall Space Flight Center, Huntsville, AL USA

Pin Load Control Applied to Retractable Pin Tool Technology and its Characterization

Oelgoetz, Peter A., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Aeromat Conference, 26-29 Jun. 2000, Seattle, WA, USA

Contract(s)/Grant(s): NASA Order H-31946-D; No Copyright; Avail: Issuing Activity; Abstract Only

Until the development of retractable pin tool (RPT) technology, friction stir welding (FSW) was limited to constant thickness joining of aluminum materials and the choices of keyhole elimination focused on traditional fusion and plug weld repair techniques. An invention, US Patent Number 5,893,507, "Auto-Adjustable Pin Tool for Friction Stir Welding" assigned to NASA, demonstrated an approach to resolve these serious drawbacks. This approach brings forth a technique that allows the crater, or keyhole, to be closed out automatically at the end of the weld joint without adding any additional equipment or material. Also the probe length can be varied automatically in the weld joint to compensate for material thickness changes, such as, in a tapered joint. This paper reports the effects of pin extension and retraction rates in the weld joint and its correlation to weld quality. The investigation utilized a pin load-detecting device that was integrated in the Phase 2A RPT designed by Boeing for NASA/MSFC. The RPT modification provided pin load data that was accessed and used to eliminate root side indications and determine pin manipulation rates necessary to produce consistence homogeneous joints.

Author

Loads (Forces); Pins; Welded Joints; Friction Welding; Maintenance; Plugs; Retractable Equipment

20000043600 Sunderland Univ., School of Computing, Engineering and Technology, Sunderland, UK

Current Thinking and Progress in the Development of Training and Accreditation Standards in Condition Monitoring and Diagnostics of Machinery

Rao, Raj B. K. N., Sunderland Univ., UK; International Journal of COMADEM; April 2000; ISSN 1363-7681; Volume 3, No. 2, pp. 24-30; In English; Copyright; Avail: Issuing Activity

There are some time-honored adages, which are so relevant to modern times. It is worth remembering a few of these words of wisdom, which have withstood the test of time. These are; 'Knowledge is power', 'Experience is the best teacher of all', 'Little knowledge is dangerous', 'prevention is better than cure', 'To seek the truth but not to yield', 'Time and tide waits for no man', 'What goes up must come down', 'Ignorance is the root cause of evil', 'An idle brain is a devil's workshop', 'Team spirit is good spirit', 'Health is wealth', etc. The relevance of these immortal phrases to the progress of the human race is clearly reflected by all serious thinkers, policy makers, strategists, academicians, trade unions, employer's federations, and economists all over the world. Quality of life, Continuous performance improvement, Wealth creation, Protection of Eco-life, and Sustaining manufacturing businesses in the competitive global markets, are on top of everyone's agenda. Advanced tools, techniques and strategies on its own (however beneficial they may be) have very little impact. A knowledgeable workforce creates the economic prosperity by adding values to the individual, business and to the community at large. The key to prosperity is implementing a proactive approach to the management of our industrial assets. Condition Monitoring and Diagnostic Engineering Management (COMADEM) philosophy and practices offers the best possible solutions to many real-life problems faced by industries. Many benchmark studies about the cost-effective benefits of this discipline have been reported in the technical literature. The International Standardization Organization (ISO), is now fully engaged in developing technical standards in this interdiscipline. The ISO/TC 108/SC 5 Sub-committee has set up a new Working Group (WG) 7 to develop an agreed, meaningful and harmonized international standard on "Training and Accreditation in the field of Condition Monitoring and Diagnostics Machines". This paper offers the current thinking and progress in the development of such a standard.

Author

Training Evaluation; Training Analysis; Certification; Education; Standardization; Diagnosis

20000043601 Bosch (Robert) G.m.b.H., Dept. FV/FLI, Stuttgart, Germany

Forecasting of Vibrational Signals for Machine Condition Monitoring Using Non-Parametric Kernel Based Approximation Techniques, Part 2, Applications

Jauch, Thomas W., Bosch (Robert) G.m.b.H., Germany; International Journal of COMADEM; April 2000; ISSN 1363-7681; Volume 3, No. 2, pp. 12-22; In English; Copyright; Avail: Issuing Activity

In this paper a novel approach for kernel design is presented. The technique will be called ”Optimal Subspace Kernel Design” (OSKD). One of the main drawbacks of many distance based parametric and nonparametric approaches is that they do not use a metric which has a certain kind of orientation, which suits best the given application. In the approach presented here a kernel based technique with a full covariance metric is used. The need for an optimal, task dependent covariance structure is important for the mapping performance. A technique based on Householder reflections is derived, which allows modelling of the covariance structure in an optimization procedure. The number of parameters used is only linearly dependent on the input dimension. it is possible to model a singular metric to obtain a subspace approach. Both the orientation and the kernel widths in each orthogonal dimension of the metric are adapted. To optimize the metric an error function based on the leave one out cross-validation technique is derived. The model is trained in a supervised manner, via extended Kalman filter technique, and is able to handle both classification and real world regression example. The theoretical framework used in this paper was developed in the first part of this work. Author

Forecasting; Expectation; Vibration; Regression Analysis; Covariance

38
QUALITY ASSURANCE AND RELIABILITY

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

20000039218 NASA Marshall Space Flight Center, Huntsville, AL USA

Manufacturing and NDE of Large Composite Aerospace Structures at MSFC

Whitaker, Ann, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 9th; ASNT’s 2000 Spring Conference, 27-31 Mar. 2000, Birmingham, AL, Birmingham, AL, USA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

NASA’s vision for transportation to orbit calls for new vehicles built with new materials technology. The goals of this new launch system development are to improve safety, dramatically reduce cost to orbit, and improve vehicle turn around time. Planned Space Shuttle upgrades include new reusable liquid propellant boosters to replace the solid propellant boosters. These boosters are to have wings and return to the launch site for a horizontal landing on an airport runway. New single and two stages to orbit concepts are being investigated. to reduce weight and improve performance composite materials are proposed for fuel and oxidizer tanks, fuel feedlines, valve bodies, aerostructures, turbomachinery components. For large composite structures new methods of fabrication are being proposed and developed. Containment of cryogenic fuel or oxidizer requires emphases on composite material densification and chemical compatibility. Ceramic matrix and fiber composites for hot rotating turbomachinery have been developed with new fabrication processes. The new requirements on the materials for launcher components are requiring development of new manufacturing and inspection methods. This talk will examine new and proposed manufacturing methods to fabricate the revolutionary components. New NDE methods under consideration include alternative X-ray methods, X-ray laminagraphy, advanced CT, Thermography, new ultrasonic methods, and imbedded sensors. The sizes, complexity, use environment, and contamination restrictions will challenge the inspection process. In flight self-diagnosis and rapid depot inspection are also goals of the NDE development.

Author

Composite Structures; Manufacturing; Nondestructive Tests; Aeronautical Engineering; Spacecraft Launching

20000040166 Alabama Univ., Research Inst., Huntsville, AL USA

Defect Characterization in a Thin Walled Composite RP-1 Tank: A Case Study

Langsing, Matthew D., Alabama Univ., USA; Walker, James L., II, NASA Marshall Space Flight Center, USA; Russell, Samual S., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 2000 ASNT Spring Conference, 27-31 Mar. 2000, Birmingham, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A full scale thin walled composite tank, designed and fabricated for the storage of pressurized RP- I rocket fuel, was fully inspected with digital infrared thermography (IR) during assembly and prior to proof testing. The tank featured a ”pill capsule” design with the equatorial bondline being overwrapped on both the inner and outer surfaces. A composite skirt was bonded to the aft dome of the tank to serve as a structural support when the tank was stood on end in service. Numerous anomalies were detected and mapped prior to proof testing, some along bondlines and some scattered throughout the acreage. After the tank was intentionally burst, coupons were cut from the regions including thermographic anomalies. These coupons were again inspected thermographically to document the growth of any indications due to proof testing. Ultrasonic inspections (UT) were also performed on

the coupons for comparison to thermography. Several coupons were dissected and micrographed. Relationships between IR and UT indications and the physical nature of the dissected material are presented.
Author
Full Scale Tests; Nondestructive Tests; Inspection; Fabrication; Tanks (Containers); Pressure Chambers

20000043599 National Inst. for Research and Development in Informatics, Bucharest, Romania
A Real Time Knowledge-Based Approach for Fault Diagnosis and Its Applications
Alexandru, Adriana, National Inst. for Research and Development in Informatics, Romania; International Journal of COMADEM; April 2000; ISSN 1363-7681; Volume 3, No. 2, pp. 32-38; In English; Copyright; Avail: Issuing Activity

This paper intends to Motivate the use of the knowledge-based approach for fault diagnosis within the supervisory systems used in the automatic control of the industrial processes. Some basic concepts related to the problem of supervision and diagnosis, as well as a presentation of the functions and the types of methods associated are briefly presented. Emphasis are given to the use of expert systems for diagnostic purposes. Some results obtained by the author in implementing an expert shell and using it in building real time expert systems for performance analysis and diagnosis are presented. This contribution shows how fault detection and accommodation can be achieved through a proper integration of in process on-line monitoring and a diagnosis expert system.
Author
Real Time Operation; Diagnosis; Error Analysis; Fault Detection; Fault Tolerance; Reliability Analysis

20000043602 Cardiff Univ., Systems Div., UK
Improving the Control of Compression Moulding: An Industrial Case Study
Davies, A., Cardiff Univ., UK; Usener, M., Cardiff Univ., UK; International Journal of COMADEM; April 2000; ISSN 1363-7681; Volume 3, No. 2, pp. 5-11; In English; Copyright; Avail: Issuing Activity

This paper outlines the development of an expert integrated machine control system. The system is designed to supervise and improve the manufacturing efficiency of a twin machine compression moulding cell, together with the required ancillary equipment and the necessary human operator interaction. The paper also outlines the work done to define and analyze existing patterns, prior to undertaking the design of the appropriate monitoring and control equipment. It should be noted that the improvement in production efficiency is based on maximizing labor utilization, via a computer based expert adaptive machine control system. This equipment is providing guidance to the cell operator and thereby allowing the control of two independent compression moulding machines. The monitoring and analysis software, permits the system to guide the operator into achieving a personal best production efficiency in respect of the manufacturing process, production rate and quality target.
Author
Adaptive Control; Control Equipment; Expert Systems; Machine Learning

20000044324 Alabama Univ., Huntsville, AL USA
Thermographic Analysis of Composite Cobonds on the X-33
Russell, Samual S., NASA Marshall Space Flight Center, USA; Lansing, Mathew D., Alabama Univ., USA; Walker, James L., II, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 2000 ASNT Spring Conference, 27-31 Mar. 2000, Birmingham, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The methods utilized to perform an infrared thermography inspection of the bondline of structural reinforcing caps on X-33 liquid hydrogen (LH2) tank during the manufacture are described in this presentation. A total of thirty-six caps were bonded to the tank using a wet cobond process with vacuum bagging and low temperature curing. The thermal map of each bondline was acquired through the vacuum bag by applying heat to the cap and then viewing it during cool down. Poorly bonded regions, or voids, were characterized by localized hot spots in the thermal image. These regions were marked on the tank by referring to a live thermal image, then hand massaged in an attempt to remove the entrapped air. The cap was then reinspected and, if it was determined that the entrapped air could not be removed, the cap was removed and the adhesive cleaned away before it cured. Measures were then taken to better match the surface of the cap to the tank and the process repeated. After the bondline had cured sufficiently to allow vacuum bag removal, a ”flash heating” thermographic Investigation was performed to verify that the cap had bonded properly to the tank. Any regions that had opened up after the preliminary inspection were marked and filled by drilling small holes in the cap and injecting resin. A final inspection was then performed to ensure the quality of the bondline.
Author
Thermography; X-33 Reusable Launch Vehicle; Adhesives; Bonded Joints; Infrared Inspection

39
STRUCTURAL MECHANICS

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structure. For applications see 05 Aircraft Design, Testing and Performance and 18 Spacecraft Design, Testing and Performance.

20000038518 Building and Construction Research TNO, Centre for Mechanical Engineering, Delft, Netherlands
Vibrational Response of a Multi-Purpose Floating Floor (MPFF) ***Final Report***
vanAnahold, J. E., Building and Construction Research TNO, Netherlands; Feb. 01, 1999; 81p; In English; Original contains color illustrations
Contract(s)/Grant(s): A98/KM/133; A98/KM/151; TNO Proj. 82376209; TNO Proj. 82376263
Report No.(s): TD-99-0076; TNO-98-CMC-R1822; Copyright; Avail: Issuing Activity

A model has been developed for describing the damping behaviour of wire rope springs. This so-called enhanced dry friction model is focussed on modelling the behaviour for small amplitude vibrations, but is also valid for large amplitudes such as under shock conditions. Parameters been determined for one particular wire rope spring (Sebert K19 100-02) means quasistatic tests. This revealed a large variation of spring properties. Frequency response analyses have been carried out based on these 'quasistatic fit' properties. Comparison against sweep tests on a shaker showed that the model describes the behaviour of wire rope springs very well in a qualitative way. However, a large quantitative mismatch between analyses and tests exists. A much better correlation could be obtained by using different damping parameters ('dynamic fit'). Based on the 'dynamic fit' properties, an estimate has been made of the frequency response of the paging room/switchboard Multi-Purpose Floating Floor (MPFF) of the LCF frigate. These analyses, which are based on realistic excitation levels, show that the MPFF response levels are likely to exceed the ISO 6954 standard.
Author
Vibration; Vibrational Stress; Vibration Damping; Wire; Springs (Elastic)

20000039680 Aerospace Corp., El Segundo, CA USA
Residual Burst Strength Evaluation of Composite Overwrapped Pressure Vessels After Impact
Chen, Harn C., Aerospace Corp., USA; Chiu, Stanley T., Aerospace Corp., USA; Chang, James B., Aerospace Corp., USA; 49th JANNAF Propulsion Meeting; December 1999; Volume 1, pp. 11-20; In English; See also 20000039678; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

A series of impact experiments have been performed at various energy levels on composite overwrapped pressure vessels in an effort to understand and characterize both the damage mechanism and the reduction in burst strength. In this study, dynamic finite element analyses of the impact experiments are performed to evaluate the current analytical methodology for the prediction of residual burst strength of composite overwrapped pressure vessels. As the impact deflections recorded in these experiments are not small compared to the pressure vessel's wall thickness, large deflection theory is used in the finite element analyses in order to obtain more accurate dynamic response predictions. In addition, the recorded peak contact forces are used to estimate the contact energy associated with the local indentation and to assess the effect of neglecting this local indentation in the dynamic finite element models. The dynamic finite element analysis results are used to predict damage modes and extents in the composite laminate using a modified maximum strain failure theory. Empirical degradation factors are then used to quantify the damage caused by the impact, and a progressive failure analysis procedure is used to predict the residual burst strengths. The results obtained from the described analytical approach are in good agreement with experimental data for the residual burst strength.
Author
Composite Wrapping; Failure Analysis; Filament Winding; Finite Element Method; Residual Strength; Pressure Vessels; Cylindrical Tanks

20000040161 Naval Postgraduate School, Monterey, CA USA
Active Vibration Control Method for Space Truss Using Piezoelectric Actuators and Finite Elements
Pantling, Carey M.; Dec. 1999; 211p; In English
Report No.(s): AD-A374451; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This thesis created an analytical model for active vibration control of the NPS space truss using ANSYS. The NPS space truss is a 3.7-meter long truss that simulates a space-borne appendage with sensitive equipment at its extremities. With the use of a dSPACE data acquisition and processing system, quartz force transducer and piezoelectric actuator, active controls using an integral plus double integral control law were used to damp out the vibrations caused by a linear proof mass actuator. Vibration reductions on the order of 15-20 dB were obtained with experiment. The ANSYS finite element model used SOLIDS elements to model

the piezoelectric characteristics and ANSYS Parametric Design Language to provide for an iterative approach to an active controls analysis. Comparative data runs were performed with the ANSYS model to determine its similarity to experiment. The analytical model produced power reductions of 18- 22 dB, demonstrating the ability to model the control authority with a finite element model. This technique can be used and modified to enhance its flexibility to many types of controls and vibration reduction applications. An analytical model for active control of the NPS space truss using MATLAB/Simulink was also developed as an alternative to the ANSYS model.
DTIC
Vibration; Actuators; Finite Element Method; Piezoelectricity; Quartz Transducers; Trusses; Active Control

20000040430 NASA Langley Research Center, Hampton, VA USA
Residual Strength Analyses of Riveted Lap-Splice Joints
Seshadri, B. R., NASA Langley Research Center, USA; Newman, J. C., Jr., NASA Langley Research Center, USA; April 2000; 29p; In English; Published in Fatigue and Fracture Mechanics, Volume 31, ASTM 1389, G. R. Halford and J. P. Gallagher, Eds., American Society for Testing and Materials, West Conshohocken, PA, 1999
Contract(s)/Grant(s): RTOP 538-02-10-01
Report No.(s): NASA/TM-2000-209856; L-17948; NAS 1.15:209856; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this paper was to analyze the crack-linkup behavior in riveted-stiffened lap-splice joint panels with small multiple-site damage (MSD) cracks at several adjacent rivet holes. Analyses are based on the STAGS (STructural Analysis of General Shells) code with the critical crack-tip-opening angle (CTOA) fracture criterion. to account for high constraint around a crack front, the ”plane strain core” option in STAGS was used. The importance of modeling rivet flexibility with fastener elements that accurately model load transfer across the joint is discussed. Fastener holes are not modeled but rivet connectivity is accounted for by attaching rivets to the sheet on one side of the cracks that simulated both the rivet diameter and MSD cracks. Residual strength analyses made on 2024-T3 alloy (1.6-mm thick) riveted-lap-splice joints with a lead crack and various size MSD cracks were compared with test data from Boeing Airplane Company. Analyses were conducted for both restrained and unrestrained buckling conditions. Comparison of results from these analyses and results from lap-splice-joint test panels, which were partially restrained against buckling indicate that the test results were bounded by the failure loads predicted by the analyses with restrained and unrestrained conditions.
Author
Lap Joints; Riveted Joints; Structural Analysis; Rivets; Cracks; Crack Propagation; Fracturing; Holes (Mechanics); Residual Strength; Computer Programs

20000040861 Japan Nuclear Cycle Development Inst., Tokai, Japan
Approach to reconstruction of a natural crack using signals of eddy current testing, 1, Reconstruction of an idealized natural crack
Chen, Z.; Dec. 31, 1998; 48p; In English
Report No.(s): DE99-757513; JNC-TN-9400-99-009; No Copyright; Avail: Department of Energy Information Bridge

In this paper, an approach to the reconstruction of an idealized natural crack of non-vanishing conductivity is proposed with use of signals of eddy current testing. Two numerical models are introduced at first for modeling a Stress Corrosion Crack (SCC) in order it possibly to be represented by a set of crack parameters. A method for rapid prediction of the eddy current testing signals arisen from these idealized cracks is given then by extending a knowledge based fast forward solver developed by authors to the case of a non- vanishing conductivity. On the other hand, the inverse algorithm of conjugate gradient method is improved to reconstruct the crack parameters and is implemented with the pick-up signals and gradients calculated by using the rapid forward solver. Several examples are presented finally for validating the proposed strategy. The results verified that both of the models can give reasonable reconstruction results in case of a low noise level. The model concerning the touch of crack surfaces with a conducting band region surrounded by the crack edge, however, is proved more efficient that the model using a conductivity distribution from the point of view of both reconstruction speed and accuracy.
NTIS
Cracks; Eddy Currents; Mathematical Models; Stress Corrosion; Computerized Simulation

20000040862 Technische Hochschule, Staatliche Materialpruefungsanstalt, Stuttgart, Germany

MPA-seminar: safety and reliability of plant technology with special emphasis on integrity and life management, Volume 1

Dec. 31, 1999; 363p; In German; In English

Report No.(s): DE99-755045; INIS-DE-0031; No Copyright; Avail: Department of Energy Information Bridge

The first volume is dedicated to the safety and reliability of plant technology with special emphasis on the integrity and life management. The main topic in the volume is the contribution of nondestructive testing to the reactor safety from an international point of view. All 20 papers are separately analyzed for this database.

NTIS

Reactor Safety; Reliability; Risk; Service Life; Industrial Plants

20000043815

Effect of hot isostatic pressing on the strain tolerance of the critical current density found in modified jelly roll Nb sub(3)Sn wires

Keys, S. A., Univ. of Durham, UK; Cheggour, N.; Hampshire, D. P.; IEEE Transactions on Applied Superconductivity; 1999; ISSN 1051-8223; Volume 9, 2 II, pp. 1447-1450; In English; The 1998 Applied Superconductivity Conference, ASC-98, 09/13-09/18/98, Palm Desert, CA, USA; Copyright; Avail: Issuing Activity

The critical current density of Hot Isostatic Pressed (HIP'ed) and unHIP'ed Nb sub(3)Sn Modified Jelly Roll wires has been measured as a function of magnetic field and of strain at 4.2 K. The reversibility of critical current density was investigated for both wires. The critical current and upper critical field were decreased for the HIP'ed sample. The reduced upper critical field of the HIP'ed wire was found to be less sensitive to strain than the unHIP'ed wire. The index (m) of the flux pinning scaling law is found to have increased from 0.86 to 2.14 as a result of the HIP processing.

Author (CSA)

Superconductors (Materials); Wire; Hot Isostatic Pressing; Strain Distribution; Niobium Compounds; Magnetic Fields; Grain Boundaries; Electric Current; Critical Current; Current Density; Flux Pinning; Scaling Laws

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 41 through 48.

20000039360 NASA Goddard Space Flight Center, Greenbelt, MD USA

Visions of Our Planet's Atmosphere, Land and Oceans: Electronic-Theater 2000

Hasler, A. F., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; Satellites in Education Conference, 9 Mar. 2000, Chester, PA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The NASA/NOAA/AMS Earth Science Electronic Theater presents Earth science observations and visualizations in a historical perspective. Fly in from outer space to the Delaware Bay and Philadelphia area. Go back to the early weather satellite images from the 1960s see them contrasted with the latest International global satellite weather movies including killer tropical cyclones & tornadic thunderstorms. See the latest spectacular images from NASA, NOAA & UMETSAT remote sensing missions like GOES, Meteosat, NOAA, TRMM, SeaWiFS, LANDSAT7, & new Terra which will be visualized with state-of-the art tools. Shown in High Definition TV resolution (2048 x 768 pixels) are visualizations of hurricanes Lenny, Floyd, Georges, Mitch, Fran and Linda. see visualizations featured on covers of magazines like Newsweek, TIME, National Geographic, Popular Science and on National & International Network TV. New Digital Earth visualization tools allow us to roam & zoom through massive global images including LANDSAT tours of the US, and Africa with drill downs of major global cities using 1 m resolution commercialized spy-satellite technology from the Space Imaging IKONOS satellite. Spectacular new visualizations of the global atmosphere & oceans are shown. See massive dust storms sweeping across Africa. see ocean vortexes and currents that bring up the nutrients to feed tiny plankton and draw the fish, giant whales and fisherman. See the how the ocean blooms in response to these currents and El Nino/La Nina climate changes. The demonstration is interactively driven by a SGI Octane Graphics Supercomputer with dual CPUs, 5 Gigabytes of RAM and Terabyte disk using two projectors across a super sized panoramic screen.

Author

Earth Sciences; Oceans; Land; Earth Atmosphere; Remote Sensing; Visual Observation; Meteorological Satellites

20000039445 Geological Survey, Water Resources Div., Honolulu, HI USA

Water Resources Data for Hawaii and other Pacific Areas, Water Year 1990, Volume 2, Guam, Northern Mariana Islands, Federated States of Micronesia, Palau, and American Samoa ***Annual Report, 1 Oct. 1989 - 30 Sep. 1990***

Hill, B. R.; Fontaine, R. A.; Feb. 2000; 142p; In English

Report No.(s): PB2000-103390; USGS/WDR/HI-90/2-Vol-2; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Water resources data for the 1990 water year for other Pacific areas consist of records of discharge, and water quality of streams and stage of a lake and reservoir; springs; and water levels and quality of water wells. These data include: Water discharge for 20 gaging stations and stage only for 2 gaging stations; Discharge data for 11 low-flow partial-record stations; Tide stages for one tide gage station; Water-quality data for 3 gaging stations and 41 wells; Water levels for 7 observation wells; and Rainfall data for 10 rainfall stations.

NTIS

Water Resources; Surface Water; Ground Water; Hydrology; Lakes; Reservoirs; Streams; Wells; Rivers

20000039446 Geological Survey, Water Resources Div., Denver, CO USA

Comparison of Two Approaches for Determining Ground-Water Discharge and Pumpage in the Lower Arkansas River Basin, Colorado, 1997-98

Dash, R. G.; Troutman, B. M.; Edelmann, P.; 1999; 50p; In English; Original contains color illustrations

Report No.(s): PB2000-103125; USGS/WRI-99-4221; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The report provides a comparison of two approaches for determining ground-water discharge and pumpage. Specifically, this report: evaluates differences in instantaneous discharge between TFM's and three portable flowmeters used with the PCC approach, and determines if differences in instantaneous discharge for the TFM and PCC approach are statistically significant; evaluates short- and long-term variations in PCC's, including whether seasonal variations in PCC's were evident; evaluates differences in ground-water pumpage estimated with the TFM and PCC approaches, and determines if differences in ground-water pumpage estimated with the TFM and PCC approaches are statistically significant; evaluates potential sources of discrepancy between pumpage estimates; and estimates differences in total network pumpage using the two approaches.

NTIS

Ground Water; Water Flow; Aquifers; Flow Measurement; Flowmeters

20000039447 Geological Survey, Water Resources Div., Northborough, MA USA

Distribution of Salinity in Ground Water from the Interpretation of Borehole-Geophysical Logs and Salinity Data, Calf Pasture Point, Davisville, Rhode Island

Church, P. E.; Brandon, W. C.; 1999; 56p; In English; Original contains color illustrations

Report No.(s): PB2000-103124; USGS/WRI-99-4153; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The distribution of salinity in ground water at Calf Pasture Point, a small coastal peninsula bounded by Narragansett Bay on the east and Allen Harbor on the west, in Davisville, Rhode Island, was interpreted from borehole-geophysical data and previously collected salinity data to help identify potential flowpaths of contaminated ground water to surface-water bodies. Borehole-geophysical data indicate that fresh ground water is present in all surficial units in the northern and northwestern part of the site. In the central and eastern parts of the site, where most of the current land surface is composed of dredged fill placed in a small salt-water embayment, brackish and saline ground water predominate.

NTIS

Salinity; Fresh Water; Ground Water; Surface Water; Aquifers; Spatial Distribution

20000039448 Geological Survey, Water Resources Div., Carson City, NV USA

River-Operations Model for Upper Carson River Basin, California and Nevada

Hess, G. W.; Taylor, R. L.; 1999; 50p; In English

Report No.(s): PB2000-103102; USGS/WRI-98-4240; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this report is to (1) briefly describe operational practices of the upper Carson River; (2) describe the modeling system; (3) document the construction of the daily operations model for the upper Carson River including flow-routing model, data used to simulate operations; and the operational logic and assumptions; and (4) discuss selected applications of the operations model.

NTIS

Hydrology Models; Streams; Water Flow; River Basins; Mathematical Models

20000039449 Geological Survey, Water Resources Div., Honolulu, HI USA

Geohydrology and Numerical Simulation of the Ground-Water Flow System of Kona, Island of Hawaii

Oki, D. S.; 1999; 80p; In English

Report No.(s): PB2000-103101; USGS/WRI-99-4073; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The purpose of this report is to describe (1) the geologic and hydrologic setting of the Kona area, (2) the numerical ground-water flow model developed, (3) the results of the model simulations that qualitatively assess the hydrologic effects of withdrawals at rates in excess of the average 1977 rates, and (4) data needs. A numerical ground-water flow model of the Kona area was used to refine the conceptual framework and to estimate the effects of different withdrawal scenarios on regional ground-water levels and ground-water discharge. The numerical model used data from the period 1991 through 1993 to estimate hydraulic properties of the volcanic rocks. Average ground-water withdrawals for 1997 and estimated long-term average natural recharge were used in the model to simulate ground-water levels and discharge, which in turn were used as the base to computed simulated water-level drawdown and change in freshwater coastal discharge for three withdrawal scenarios.

NTIS

Ground Water; Water Flow; Hydrogeology; Hydrology Models; Computerized Simulation; Hawaii

20000040058 Geological Survey, Water Resources Div., Albuquerque, NM USA

Numerical Simulation of Vertical Ground-Water Flux of the Rio Grande from Ground-Water Temperature Profiles, Central New Mexico

Bartolino, J. R.; Niswonger, R. G.; 1999; 42p; In English

Report No.(s): PB2000-103127; USGS/WRI-99-4212; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes a study designed to determine the direction and rate of vertical flux between the Rio Grande and underlying Santa Fe Group aquifer system, and to determine the vertical hydraulic conductivity of the aquifer system. This study uses temperature-profile, ground-water-level, and piezometer-core data to model the flux and determine effective vertical hydraulic conductivity of the Rio Grand inner-valley alluvium that underlies the river.

NTIS

Base Flow; Water Temperature; Computerized Simulation; Piezometers; Ground Water

20000040393 Lembaga Penerbangan dan Antariksa Nasional, Jakarta, Indonesia

Warta LAPAN, Volume 1

April - June 1999; ISSN 0126-9754; 36p; In Malay-Indonesian; See also 20000040394 through 20000040398; Copyright; Avail: Issuing Activity

This paper presents Warta LAPAN (Indonesian National Institute of Aeronautics and Space). Volume 1, No. 2. April-June 1999. The topics include: 1) A Study of the Literature Needed by LAPAN Researchers; 2) Constructing foF2 Contours for the Central Indonesia Region; 3) Distribution of Longitudinal Flares in the Sun from November 1990 to October 1993 as Observed from the Watukosek SPD; 4) Estimates of Polybutadiene Diffusion Values in Various Solvents Using the Free Volume Theory; and 5) An Analysis of an Initial Design Economy for a 50,000-ton per year capacity Polybutadiene Plant in Indonesia.

CASI

Indonesian Space Program; Research and Development; Information Systems; Solar Activity; Diffusion

20000040856 Ohio State Univ., School of Natural Resources, Columbus, OH USA

Reducing Nutrient Loads, Especially Nitrate-Nitrogen, to Surface Water, Ground Water, and the Gulf of Mexico

Mitsch, W. J.; Day, J. W.; Gilliam, J. W.; Groffman, P. M.; Hey, D. L.; May 1999; 136p; In English

Report No.(s): PB2000-104024; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The goal of this report to identify and evaluate approaches for solving the problem of the hypoxia in the Gulf of Mexico. This zone of low dissolved oxygen, which covers an area from 13,000 to 20,000 sq km off the shore of Louisiana, has been shown to be due to excess nutrients, particularly nitrate-nitrogen, being transported to the Gulf from the Mississippi River Basin. to accomplish thier goal, the authors (1) reviewed appropriate literature on methods for controlling nutrients, particularly nitrate-nitrogen, from entering waterways; (2) evaluated these methods to reduce the amount of nitrogen released to streams and rivers; (3) put the methods in the context of the entire Mississippi River Basin and the significance of the sources; and (4) presented recommendations for the most reasonable combination of approaches that would be necessary to solve the problem.

NTIS

Ground Water; Gulf of Mexico; Nitrates; Nitrogen; Surface Water; Nutrition; Hypoxia

20000040870 Geological Survey, Reston, VA USA

Magma Migration and Resupply during the 1974 Summit Eruptions of Kilauea Volcano, Hawaii

Lockwood, J. P.; Tilling, R. I.; Holcomb, R. T.; Klein, F.; Okamura, A. R.; Apr. 1999; 50p; In English

Report No.(s): PB2000-103657; USGS/PP-1613; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Three brief eruptions - the longest lasting 3 days, the shortest only 6 hours - took place in the summit region of Kilauea Volcano during the last half of 1974: July 19-22, September 19, and December 31. These eruptions followed an inferred constriction of the upper East Rift Zone (ERZ) supply conduits to the long-lived Mauna Ulu eruption in early 1974, causing magma and excess pressure to accumulate beneath Kilauea's summit.

NTIS

Magma; Migration; Volcanoes; Geochemistry; Hawaii

20000044092 Lembaga Penerbangan dan Antariksa Nasional, Jakarta, Indonesia

Majalah LAPAN, Volume 1

July - September 1999; ISSN 0126-0480; 52p; In Malay-Indonesian; See also 20000044093 through 20000044097; Copyright; Avail: Issuing Activity

This is the official journal of the Indonesian Space Agency, LAPAN. This issue contains articles summarizing research and developments in several areas. These include: Active vibration control of rocket payload structures; (2) Effects of Solar Luminosity on Global Equator SST; (3) The existence of Kelvin-Atmosphere Waves; (4) TEC determination using Code data and phase data from GPS satellites. and the verification of Asaps Method Hf communication frequency Predictions by Manado Sumedang Oblique Ionosonde Data.

CASI

Indonesian Space Program; Periodicals; Research and Development

20000044098 Lembaga Penerbangan dan Antariksa Nasional, Jakarta, Indonesia

Majalah LAPAN, Volume 1, *Apr. - Jun. 1999*

Meja, Dari, Editor, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; April 1999; ISSN 0126-0480; 68p; In Malay-Indonesian; See also 20000044099 through 20000044103; Original contains color illustrations; Copyright; Avail: Issuing Activity

This paper presents Majalah LAPAN (Indonesian National Institute of Aeronautics and Space) Volume 1, number 2. The topics include: 1) Application of a Riceplant Age Estimate Model for Predicting the Extent of the Riceplant Harvest on Java from January to April 1998; 2) The effects of Operating the International Space Station on Future National Space Activities; 3) The Impact of Flares on August 21 and 25 on the Earth's Magnetic Field and the Ionosphere F2 Layer; 4) Wind variability Based on 1357.5 MHZ Boundary Layer Radar Observations in Serpong; and 5) Ozone Behavior on Java.

CASI

Indonesian Space Program; Geomagnetism; Wind (Meteorology); Forecasting; Mathematical Models

43
EARTH RESOURCES AND REMOTE SENSING

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

20000038329 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Geoprocessing Applied to Volume and Area Determination of Serra Da Mesa Hydroelectrical Reservoir Using JERS-1/SAR Images *Geoprocessamento Aplicado a Determinacao de Volume e Area do Reservatorio Hidreletrico de Serra da Mesa Com Imagens Jers-1/Sar*

deSousaJunior, Wilson Cabral, Instituto Nacional de Pesquisas Espacias, Brazil; 2000; 98p; In Portuguese; Original contains color illustrations

Report No.(s): INPE-7509-TDI/723; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

This paper presents a method for the determination of flooding parameters in hydroelectrical reservoirs. The method is based on the integration of Digital Terrain Model (DTM) and Remote Sensing data derived from JERS-1/SAR. The area and volume of the reservoir, considering different water levels, were determined using SPRING, a Geographical Information System software developed by the National Institute for Space Research (INPE). The method was applied to the Serra da Mesa reservoir - which

has been in operation since April 1998. The results showed a systematic error in reservoir project. The volume and area values are 30% smaller than those projected. The results, if validated, shows that the generation of energy is below the previously predicted, and that the flooding area is smaller than that announced.
Author
Volume; Area; Reservoirs

20000038358 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
JERS Data Analysis to Monitoring Deforested Areas: Tapajos National Forest Region ***Analise de Dados Sar Para Monitoramento de Areas Antropizadas: Regiao da Floresta Nacional do Topajos***
Filho, Pedro Hernandez, Instituto Nacional de Pesquisas Espacias, Brazil; Dutra, Luciano Vieira, Instituto Nacional de Pesquisas Espacias, Brazil; Mazzocato, Maria Eugenia, Instituto Nacional de Pesquisas Espacias, Brazil; 2000; 30p; In Portuguese; Original contains color illustrations
Report No.(s): INPE-7506-RPQ/711; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This study evaluated multitemporal JERS-1 images, for change detection purpose, for the period of 1995 to 1996. The test site is the Tapajos National Forest and surroundings, located in Para State. LANDSAT data and ground information about this area were also used to help the assessment of JERS-1 results. Automatic land use/cover classification, change detection of classified maps, digital analysis techniques and the Caesar segmentation software, were used. Forest, regrowth areas, bare soil, pasture and dirt pasture were the classes considered to this study. In extensive areas, the SPRING segmentation software performed better than the Caesar software. The deforestation results obtained from change detection analysis were compared with deforestation results from PRODES project. Near 93% of the evaluated areas obtained through visual methods were detected by digital methods. Some problems, such as, shadow due to slope and precision in image registration, are discussed.
Author
Data Processing; Change Detection; Image Processing; Land Use; Image Classification; Deforestation

20000038365 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Vulnerability Landscape Natural of Soil Lost Map of Bico do Papagaio Region: Tocantins State ***Carta de Vulnerabilidade de Paisagem Natural a Perda de Solo da Regiao do Bico do Papagaio: Estado do Tocantins***
Crepani, Edison, Instituto Nacional de Pesquisas Espacias, Brazil; Filho, Pedro Hernandez, Instituto Nacional de Pesquisas Espacias, Brazil; Florenzano, Teresa Gallotti, Instituto Nacional de Pesquisas Espacias, Brazil; Duarte, Valdete, Instituto Nacional de Pesquisas Espacias, Brazil; Barbosa, Claudio Clemente Faria, Instituto Nacional de Pesquisas Espacias, Brazil; 2000; 72p; In Portuguese; Original contains color illustrations
Report No.(s): INPE-7498-PRP/221; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This study introduces a methodology to produce the natural vulnerability map of soil erosion of Bico do Papagaio region , located in Tocantins State, Brazil. This region comprises the Imperatriz, Maraba, Tocantinopolis and Xambioa topographic sheets, at the scale of 1:250,000. The methodology is based on the Ecodynamic concept which considers the transformation of the following landscape elements: geology, soil, geomorphology, vegetation and land use. Color composites of LANDSAT-TM images in the bands 3, 4 and 5, with blue, green and red filters respectively, allows synoptic and holistic understanding of the landscape, which helped these scenes to be interpreted in order to defined fundamental territorial units (FTUs). Taking in account the landscape elements, information field, and ancillary data, a vulnerability index is assigned to each unit. The Remote Sensing Image Processing System (SPRING) developed at INPE were used for doing the spatial analyzes and spatial data bank manipulation necessary to accomplish this project.
Author
Vulnerability; Terrain; Topography; Soil Mapping; Soil Erosion; Terrain Analysis

20000038374 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Application of Remote Sensing to the Study of Geologic Structures With the Occurrence of Deposits in the Central-North Part of Paraiba State ***Sensoriamento Remoto Aplicado no Estudo de Estruturas Geologicas Com Ocorrencias de Depositos Minerais, na Porcao Centro-Norte do Estado da Paraiba***
deAraujoSousa, Manoel, Jr., Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 128p; In Portuguese; Original contains color illustrations
Report No.(s): INPE-7257-TDI/700; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The Paraiba State includes part of the Borborema Pegmatitic Province. The Serido Group occurs in this Province and has economic importance as host of several metallic (sheelite, beryl, cassiterite and tantalite) and non-metallic (barite, limestone, kaolinite and fluorite) deposits. This work aims to identify structural geologic patterns that may be associated with mineral deposits.

Potentially mineralized areas in the northern central part of the Paraiba State, using remote sensing and Geographic Information System techniques. Analog LANDSAT-5/TM data were used to identify linear features in the terrain that represent lineaments. Digital images processing techniques such as contrast enhancement, filtering, principal component transformation and IHS transformation were used on the SPRING and ENVI softwares to complement the visual interpretation. The results obtained show that the linear contrast stretching and filtering are useful tools to identify lineaments in optical remote sensing imagery. The analysis of the maps of lineaments, fractures and lithology as well as the LANDSAT-5/TM imagery interpretation with the mineral deposit's data, led to the identification structural patterns. The directions N30 deg-60 deg E, N30 deg-50 deg W and N60 deg-80 deg W were recognized as the main favorable directions for mineral deposits formation.
Author
Remote Sensing; Geographic Information Systems; LANDSAT 5; Satellite Imagery; Image Analysis; Imaging Techniques

20000038417 Hokkaido Univ., Div. of Earth and Planetary Sciences, Sapporo, Japan
Geochemical Characteristics of River Water in the Upper Reaches of the Toyohira River, Hokkaido
Yoshimura, Hiraku, Hokkaido Univ., Japan; Urakami, Koichi, Hokkaido Univ., Japan; Geophysical Bulletin of Hokkaido University; March 2000; ISSN 0439-3503, No. 63, pp. 65-75; In Japanese; Copyright; Avail: Issuing Activity

Geochemical and hydrological measurements were made in July and August 1999 in the upper reach of Toyohira river in the southwestern Hokkaido. Discharge and chemical constituents in river water are observed in main stream and tributary streams of Toyohira river to investigate the relationship between the geology and the geological characteristic of river water. The basin is mainly underlain by volcanic rocks of Miocene to Pleistocene age. Chemical concentrations of river waters sampled in August, particularly in small basins of main stream, are higher than those sampled in July. It suggests that the groundwater having low-chemical concentration inflows rivers through near surface due to precipitation before the observation in July. The results of chemical analyses show that river waters in main stream have mostly uniform proportion of Cl in anions. However, in small basin of main stream where quartz porphyry is exposed at surface, river waters have higher proportions of Cl as compared with, river waters in main stream.
Author
Geochemistry; Rivers; Surface Water; Japan

20000038809 Norwegian Defence Research Establishment, Kjeller, Norway
Presentation of Recognized Land Picture ***Presentasjon av Etablert Landstridsbilde (ELS)***
Bjerke, Pal, Norwegian Defence Research Establishment, Norway; Mar. 13, 2000; 38p; In Norwegian; Original contains color illustrations
Contract(s)/Grant(s): FFIE Proj. 745/111
Report No.(s): FFI/RAPPORT-2000/01167; Copyright; Avail: Issuing Activity

The military decision-makers need information about the battlefield to do their planning. A project has been started to develop an information system which will collect, analyze, distribute and present a recognized land picture to the army executives. This report gives some views on the presentation of a recognized land picture to users.
Author
Decision Making; Command and Control; Armed Forces; Information Systems; Military Operations; Selective Dissemination of Information; Management Planning; Information Flow

20000039351 NASA Marshall Space Flight Center, Huntsville, AL USA
The Urban Fabric of the City as Its Affects Thermal Energy Responses Derived from Remote Sensing Data
Quattrochi, Dale A., NASA Marshall Space Flight Center, USA; Luvall, Jeffrey C., NASA Marshall Space Flight Center, USA; Estes, Maurice G., Jr., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English, 4 Apr. 2000, Pittsburg, PA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The physical geography of the city affects numerous aspects of its interlinked biophysical, social, and land-atmosphere characteristics - those attributes that come together to form the total urban environment. One approach to studying the multitude of interactions that occur as a result of urbanization is to view the city from a systems ecology perspective, where energy and material cycle into and out of the urban milieu. Thus, the urban ecosystem is synergistic in linking land, air, water, and living organisms in a vast network of interrelated physical, human, and biological process. Given the number and the shear complexity of the exchanges and, ultimately, their effects, that occur within the urban environment, we are focusing our research on looking at how the morphology or urban fabric of the city, drives thermal energy exchanges across the urban landscape. The study of thermal energy attributes for different cities provides insight into how thermal fluxes and characteristics are partitioned across the city landscape in response to each city's morphology. We are using thermal infrared remote sensing data obtained at a high spatial

resolution from aircraft, along with satellite data, to identify and quantify thermal energy characteristics for 4 U.S. cities: Atlanta, GA, Baton Rouge, LA, Salt Lake City, UT, and Sacramento, CA. Analysis of how thermal energy is spatially distributed across the urban landscapes for these cities provides a unique perspective for understanding how the differing morphology of cities forces land-atmosphere exchanges, such as the urban heat island effect, as well as related meteorological and air quality interactions. Keyword: urban ecosystems, remote sensing, urban heat island
Author
Cities; Ecosystems; Heat Islands; Thermal Energy; Urban Research; Heat

20000039353 NASA Marshall Space Flight Center, Huntsville, AL USA
Far Ultraviolet Imaging from the Image Spacecraft, 2, Wideband FUV Imaging
Mende, S. B., NASA Marshall Space Flight Center, USA; Heetderks, H., NASA Marshall Space Flight Center, USA; Frey, H. U., NASA Marshall Space Flight Center, USA; Geller, S. P., NASA Marshall Space Flight Center, USA; Abiad, R., NASA Marshall Space Flight Center, USA; Siegmund, O. H. W., NASA Marshall Space Flight Center, USA; Tremsin, A. S., NASA Marshall Space Flight Center, USA; Spann, J., NASA Marshall Space Flight Center, USA; Dougani, H., Tala Advanced Applications, Inc., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Abstract. The Far Ultraviolet Wideband Imaging Camera (WIC) complements the magnetospheric images taken by the IMAGE satellite instruments with simultaneous global maps of the terrestrial aurora. Thus, a primary requirement of WIC is to image the total intensity of the aurora in wavelength regions most representative of the aurora] source and least contaminated by dayglow, have sufficient field of view to cover the entire polar region from spacecraft apogee and have resolution that is Sufficient to resolve auroras on a scale of 1 to 2 latitude degrees, The instrument is sensitive in the spectral region from 140- 190 nm. The WIC is mounted on the rotating, IMAGE spacecraft viewing radially outward and has a field of view of 17 deg in the direction parallel to the spacecraft spin axis. Its field of view is 30 deg in the direction perpendicular to the spin axis, although only a 17 deg x 17 deg image of the Earth is recorded. The optics was an all-reflective, inverted Cassegrain Burch camera using concentric optics with a small convex primary and a large concave secondary mirror. The mirrors were coated by a special multi-layer coating, which has low reflectivity in the visible and near UV region, The detector consists of a MCP-Intensified CCD. The MCP is curved to accommodate the focal surface of the concentric optics. Tile phosphor of the image intensifier is deposited on a concave fiberoptic window, which is then Coupled to the CCD with a fiberoptic taper. The camera head operates in a fast frame transfer mode with the CCD being read approximately 30 full frames (512 by 256 pixel) per second with an exposure time of 0.033 s. The image motion (file to the satellite spin is minimal during such a short exposure. Each image is electronically distortion corrected using the look up table scheme. An offset is added to each memory address that is proportional to the image shift due to satellite rotation, and the charge signal is digitally summed in memory. On orbit, approximately 300 frames will be added to produce one WIC image in memory. The advantage of the electronic motion compensation and distortion correction is that it is extremely flexible, permitting several kinds of corrections including motions parallel and perpendicular to the predicted axis of rotation. File instrument was calibrated by applying ultraviolet light through a vacuum monochromator and measuring the absolute responsivity of the instrument. to obtain the data for the distortion look up table the camera was turned through various angles and the input angles corresponding to a pixel matrix were recorded. It was found that the spectral response peaked at 150 nm and fell off in either direction. The equivalent aperture of the camera, including mirror reflectivities and effective photocathode quantum efficiency, is about 0.04 sq cm. Thus, a 100 Rayleigh LBH aurora is expected to produce 23 equivalent counts per pixel per 10 s exposure at the peak of instrument response.
Author
Ultraviolet Imagery; Calibrating; Cameras; Cassegrain Optics; Charge Coupled Devices; Correction; Far Ultraviolet Radiation; Fiber Optics; Viewing; Ultraviolet Spectra

20000039363 Computer Sciences Corp., Lanham, MD USA
Subsetting and Formatting LANDSAT-7 LOR ETM+ and Data Products
Reid, Michael R., Computer Sciences Corp., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The LANDSAT-7 Processing System (LPS) processes LANDSAT-7 Enhanced Thematic Mapper (ETM+) instrument data into large, contiguous segments called ”subintervals” and stores them in Level OR (LOR) data files. The LPS processed subinterval products must be subsetted and reformatted before the Level I processing systems can ingest them. The initial full subintervals produced by the LPS are stored mainly in HDF Earth Observing System (HDF-EOS) format which is an extension to the Hierarchical Data Format (HDF). The final LOR products are stored in native HDF format. Primarily the EOS Core System (ECS) and alternately the DAAC Emergency System (DES) subset the subinterval data for the operational LANDSAT-7 data processing systems. The HDF and HDF-EOS application programming interfaces (APIs) can be used for extensive data subsetting and data reorganization. A stand-alone subsetter tool has been developed which is based on some of the DES code. This tool makes use of the

HDF and HDFEOS APIs to perform LANDSAT-7 LOR product subsetting and demonstrates how HDF and HDFEOS can be used for creating various configurations of full LOR products. How these APIs can be used to efficiently subset, format, and organize LANDSAT-7 LOR data as demonstrated by the subsetter tool and the DES is discussed.
Author
Format; LANDSAT 7; Thematic Mappers (LANDSAT); Data Processing Equipment; Earth Observing System (EOS)

20000039785 NASA Goddard Space Flight Center, Greenbelt, MD USA
MM-Wave Radiometric Measurements of Low Amounts of Precipitable Water Vapor
Racette, P.; Westwater, Ed; Han, Yong; Manning, Will; Jones, David; Gasiewski, Al; [2000]; 1p; In English; International Geoscience and Remote Sensing Symposium (IGARSS '00), 24-28 Jul. 2000, USA; No Copyright; Avail: Issuing Activity; Abstract Only

An experiment was conducted during March, 1999 to study ways in which to improve techniques for measuring low amounts of total-column precipitable water vapor (PWV). The experiment was conducted at the DOE's ARM program's North Slope of Alaska/Adjacent Arctic Ocean Cloud and Radiation Testbed site (DoE ARM NSA/AAO CaRT) located just outside Barrow, Alaska. NASA and NOAA deployed a suite of radiometers covering 25 channels in the frequency range of 20 GHz up to 340 GHz including 8 channels around the 183 GHz water vapor absorption line. In addition to the usual CaRT site instrumentation the NOAA Depolarization and Backscatter Unattended Lidar (DABUL), the SUNY Rotating Shadowband Spectroradiometer (RSS) and other surface based meteorological instrumentation were deployed during the intensive observation period. Vaisala RS80 radiosondes were launched daily as well as nearby National Weather Service VIZ sondes. Atmospheric conditions ranged from clear calm skies to blowing snow and heavy multi-layer cloud coverage. Measurements made by the radiosondes indicate the PWV varied from approx. 1 to approx. 5 mm during the experiment. The near-surface temperature varied between about -40 C to - 15 C. In this presentation, an overview of the experiment with examples of data collected will be presented. Application of the data for assessing the potential and limitations of millimeter-wave radiometry for retrieving very low amounts of PWV will be discussed.
Author
Experimentation; Meteorological Instruments; Meteorological Services; Millimeter Waves; Radiometers; Water Vapor

20000040104 NASA Goddard Space Flight Center, Greenbelt, MD USA
Generating Accurate Urban Area Maps from Nighttime Satellite (DMSP/OLS) Data
Imhoff, Marc, NASA Goddard Space Flight Center, USA; Lawrence, William, Bowie State Univ., USA; Elvidge, Christopher, National Oceanic and Atmospheric Administration, USA; [2000]; 1p; In English; 28th; 28th International Symposium on Remote Sensing, 7-31 Mar. 2000, CapeTown, South Africa; No Copyright; Avail: Issuing Activity; Abstract Only

There has been an increasing interest by the international research community to use the nighttime acquired "city-lights" data sets collected by the US Defense Meteorological Satellite Program's Operational Linescan system to study issues relative to urbanization. Many researchers are interested in using these data to estimate human demographic parameters over large areas and then characterize the interactions between urban development , natural ecosystems, and other aspects of the human enterprise. Many of these attempts rely on an ability to accurately identify urbanized area. However, beyond the simple determination of the loci of human activity, using these data to generate accurate estimates of urbanized area can be problematic. Sensor blooming and registration error can cause large overestimates of urban land based on a simple measure of lit area from the raw data. We discuss these issues, show results of an attempt to do a historical urban growth model in Egypt, and then describe a few basic processing techniques that use geo-spatial analysis to threshold the DMSP data to accurately estimate urbanized areas. Algorithm results are shown for the USA and an application to use the data to estimate the impact of urban sprawl on sustainable agriculture in the US and China is described.
Author
Urban Development; Night; Errors; Demography; Algorithms

20000040105 NASA Goddard Space Flight Center, Greenbelt, MD USA

VHF Radar Measurements of Tropical Forests in Panama: Results from the BioSAR Deployment in Central America

Imhoff, Marc, NASA Goddard Space Flight Center, USA; Lawrence, William, Bowie State Univ., USA; Condit, Richard, Smithsonian Tropical Research Inst., Panama; Wright, Joseph, Smithsonian Tropical Research Inst., Panama; Johnson, Patrick, Zimmerman Associates, Inc./American Electronics, Inc., USA; Holford, Warren, Zimmerman Associates, Inc./American Electronics, Inc., USA; Hyer, Joseph, Zimmerman Associates, Inc./American Electronics, Inc., USA; May, Lisa, Zimmerman Associates, Inc./American Electronics, Inc., USA; Carson, Steven, Science Applications International Corp., USA; [2000]; 1p; In English; 28th; 28th International Symposium on Remote Sensing, 27-31 Mar. 2000, Cape Town, South Africa; No Copyright; Avail: Issuing Activity; Abstract Only

A synthetic aperture radar sensor operating in 5 bands between 80 and 120 MHz was flown over forested areas in the canal zone of the Republic of Panama in an experiment to measure biomass in heavy tropical forests. The sensor is a pulse coherent SAR flown on a small aircraft and oriented straight down. The doppler history is processed to collect data on the ground in rectangular cells of varying size over a range of incidence angles fore and aft of nadir (+45 to - 45 degrees). Sensor data consists of 5 frequency bands with 20 incidence angles per band. Sensor data for over 12+ sites were collected with forest stands having biomass densities ranging from 50 to 300 tons/ha dry above ground biomass. Results are shown exploring the biomass saturation thresholds using these frequencies, the system design is explained, and preliminary attempts at data visualization using this unique sensor design are described.

Author

Tropical Regions; Biomass; Forests; Radar Measurement; Scientific Visualization

20000040106 NASA Goddard Space Flight Center, Greenbelt, MD USA

Landstat 7 Views the World

Williams, Darrel L., NASA Goddard Space Flight Center, USA; Irons, James R., NASA Goddard Space Flight Center, USA; Barker, John L., NASA Goddard Space Flight Center, USA; Markham, Brian L., NASA Goddard Space Flight Center, USA; Pedelty, Jeffrey A., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; 28th; 28th International Symposium on Remote Sensing, 27-31 Mar. 2000, Cape Town, South Africa; No Copyright; Avail: Issuing Activity; Abstract Only

The technical innovations of precise numerical radiometry, spectral differentiation and seasonally repetitive monitoring, introduced by the LANDSAT series of satellites, created a new measurement approach for terrestrial monitoring. The LANDSAT 7 mission, successfully initiated on April 15, 1999, reflects significant progress in realizing the scientific potential of this measurement strategy. Substantial improvements in calibration procedures, both prior to launch and during normal operations, have been accomplished to insure long-term stability in the acquired spectral radiometry. For the first time, LANDSAT 7 will be operated with a long-term data acquisition plan that will insure, barring national emergencies, that substantially cloud-free, seasonal coverage will be recorded and archived in the US for all land areas of the globe. The expected outcome of these efforts is a rapid improvement in our understanding of the Earth system, as well as conceptual knowledge that will underpin commercial application of this technology. The Cape Town 2000 Symposium will take place approximately nine months after the LANDSAT 7 satellite and instrument completed its engineering checkout phase and was placed in its final orbit in late June, 1999. Thus, this presentation will provide a timely status report, in a significant international setting, regarding the early on-orbit performance of the LANDSAT 7 spacecraft, the ETM+ instrument, and the long-term data acquisition strategy that has been implemented. The latest data display and visualization techniques will be utilized to present this significant new source of Earth observation data.

Author

Radiometers; Numerical Analysis; Data Acquisition; LANDSAT 7; Numerical Differentiation; Spacecraft Instruments

20000040108 NASA Goddard Space Flight Center, Greenbelt, MD USA

Implications of RFI at L-Band on Passive Microwave Remote Sensing of Soil Moisture from Space: Experience with ESTAR During SGP97

LeVine, David M., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; 26th; 26th General Assembly of the International Union of Radio Science (URSI), 15-21 Aug. 1999, Ottawa, Ontario, Canada; No Copyright; Avail: Issuing Activity; Abstract Only

Passive microwave remote sensing in the protected band at 1.413 GHz (L-band) is important for monitoring parameters of the ocean and land surface such as soil moisture and sea surface salinity. These parameters are needed for understanding energy exchange between the surface and atmosphere and therefore are important for improving our understanding of weather and climate change. Although the band at 1.413 GHz is protected for passive use, airborne radiometers experience problems with RFI. For example, during the Southern Great Plains Experiment (1997) the ESTAR radiometer experienced significant RFI associated with

airports, presumably air traffic control radar. This is a potential problem for future sensors in space planned for remote sensing of the earth surface in this frequency band.
Author
Airborne Equipment; Climate Change; Earth Surface; Microwave Imagery; Ocean Surface; Radiometers; Remote Sensing

20000040169 NASA Marshall Space Flight Center, Huntsville, AL USA
Video Based Sensor for Tracking 3-Dimensional Targets
Howard, R. T., NASA Marshall Space Flight Center, USA; Book, Michael L., NASA Marshall Space Flight Center, USA; Bryan, Thomas C., NASA Marshall Space Flight Center, USA; [2000]; 2p; In English; Remote Sensing Symposium, 25-29 Sep. 2000, Barcelona, Spain; No Copyright; Avail: Issuing Activity; Abstract Only

Video-Based Sensor for Tracking 3-Dimensional Targets The National Aeronautics and Space Administration's (NASAs) Marshall Space Flight Center (MSFC) has been developing and testing video-based sensors for automated spacecraft guidance for several years, and the next generation of video sensor will have tracking rates up to 100 Hz and will be able to track multiple reflectors and targets. The Video Guidance Sensor (VGS) developed over the past several years has performed well in testing and met the objective of being used as the terminal guidance sensor for an automated rendezvous and capture system. The first VGS was successfully tested in closed-loop 3-degree-of-freedom (3- DOF) tests in 1989 and then in 6-DOF open-loop tests in 1992 and closed-loop tests in 1993-4. Development and testing continued, and in 1995 approval was given to test the VGS in an experiment on the Space Shuttle. The VGS flew in 1997 and in 1998, performing well for both flights. During the development and testing before, during, and after the flight experiments, numerous areas for improvement were found. The VGS was developed with a sensor head and an electronics box, connected by cables. The VGS was used in conjunction with a target that had wavelength-filtered retro-reflectors in a specific pattern, The sensor head contained the laser diodes, video camera, and heaters and coolers. The electronics box contained a frame grabber, image processor, the electronics to control the components in the sensor head, the communications electronics, and the power supply. The system works by sequentially firing two different wavelengths of laser diodes at the target and processing the two images. Since the target only reflects one wavelength, it shows up well in one image and not at all in the other. Because the target's dimensions are known, the relative positions and attitudes of the target and the sensor can be computed from the spots reflected from the target. The system was designed to work from I meter out to I 10 meters. The VGS was mounted on the Space Shuttle while its target was mounted on the Spartan free-flyer carried on the same Shuttle flight. The VGS tracked the Spartan at ranges up to 170m, and the VGS range data very closely matched the range data from the Hand-Held Laser- Rangefinder used by the astronauts on board the Shuttle. While the VGS was designed primarily as a terminal guidance sensor for an automated spacecraft, it could be applied to other uses. It could be used as an alignment aid for an operator of a remote system (giving position and attitude feedback data, as well as a camera view of the target), as a feedback system for a robotic arm, or for automated vehicle guidance. The next generation VGS, with its higher tracking rates, smaller size, and lower power could be used in more places than the original VGS, and by using LED's instead of laser diodes, the system would be eye-safe at any range. Other possible uses include tracking 3-dimensional objects with retro-reflectors mounted at various locations or motion analysis by placing several retro-reflectors on the moving object and tracking them at high speeds. There are few sensors capable of performing tasks similar to those the VGS can perform, and the next generation VGS will be even more capable than the original. Some of this work is previously presented in the papers.
Author
Automatic Control; Fabrication; Performance Tests; Sensors; Guidance Sensors; Laser Range Finders

20000040395 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Komunikasi HF, Jakarta, Indonesia
Constructing foF2 Contours for the Central Indonesia Region *Pembuatan Kontur foF2 Untuk Kawasan Tengah Indonesia*
EdiRusnadi, Iyus, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Saroso, Sarmoko, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Mahmud, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; April - June 1999; Volume 1, No. 2, pp. 6-10; In Malay-Indonesian; See also 20000040393; Copyright; Avail: Issuing Activity

The foF2 contour map of Middle Indonesia Region has been derived from the monthly median value of foF2 at Manado (1.48 N, 124.85 E) on September 1995. It based on assumption that the foF2 monthly median data of Manado represent data of 500 km radius area or 5 deg. latitude from Manado. The foF2 measured by IPS-51 digital ionosonde, which has been operated since 15 of August 1995. The griding methods are Invers distance of Power, Kriging, Minimum curvature, and Shepard's method which operated in SURFER contour map software. The results are five almost be the same contour maps except Invers distance of Power method. The results show a good correlation by 0.65 to 0.87. Further research to used transformation by model at equatorial latitude, which deviation this paper is 3.3 MHz maximum.
Author
Contours; Indonesia; Relief Maps; F 2 Region

20000040792 NASA Johnson Space Center, Houston, TX USA

Using Digitized Handheld Space Shuttle Photography for Terrain Visualization

Eckardt, F. D., Oxford Univ., UK; Wilkinson, M. J., NASA Johnson Space Center, USA; Lulla, K. P., NASA Johnson Space Center, USA; 2000; 5p; In English

Contract(s)/Grant(s): RTOP 250-90-22; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Digital terrain models are becoming increasingly available and are readily generated at a whole range of scales. However, the lack of realistic colour and tone in images of terrains remains a problem. Realistic colour and tone are very desirable attributes because they contribute significantly to a powerful visualization of landscapes, both for scientists (Kam's ref) and for the general public. But these attributes are generally still unavailable because few sensors, air- or space-borne, provide true colour, and even fewer do so at a realistic cost. The exception is the growing and accessible archive of US Space Shuttle photography which provides a wealth of potential data suited for more realistic visualization of landscapes.

Derived from text

Photography; Space Shuttles; Terrain; Visual Observation; Remote Sensing

20000043535 NASA Goddard Space Flight Center, Greenbelt, MD USA

Sensitivity of MODIS 2.1-(micrometers) Channel for Off-Nadir View Angles for Use in Remote Sensing of Aerosol

Gatebe, C. K., Universities Space Research Association, USA; King, M. D., NASA Goddard Space Flight Center, USA; Tsay, S.–C., NASA Goddard Space Flight Center, USA; Ji, Q., Science Systems and Applications, Inc., USA; Arnold, T., SM and A Corp., USA; [2000]; 4p; In English; 28th; 28th International Symposium on Remote Sensing of Environment, 27-31 Mar. 2000, Cape Town, South Africa; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this sensitivity study, we examined the ratio technique, the official method for remote sensing of aerosols over land from Moderate Resolution Imaging Spectroradiometer (MODIS) DATA, for view angles from nadir to 65 deg. off-nadir using Cloud Absorption Radiometer (CAR) data collected during the Smoke, Clouds, and Radiation-Brazil (SCAR-B) experiment conducted in 1995. For the data analyzed and for the view angles tested, results seem to suggest that the reflectance (rho)0.47 and (rho)0.67 are predictable from (rho)2.1 using: (rho)0.47 = (rho)2.1/6, which is a slight modification and (rho)0.67 = (rho)2.1/2. These results hold for target viewed from backscattered direction, but not for the forward direction.

Author

Aerosols; Imaging Spectrometers; Remote Sensing; Sensitivity; Spectroradiometers; Imaging Techniques

20000044099 Lembaga Penerbangan dan Antariksa Nasional, Jakarta, Indonesia

Application of a Riceplant Age Estimate Model for Predicting the Extent of the Riceplant Harvest on Java from January to April 1998 ***Aplikasi model pendugaan umur padi untuk peramalan luas panen padi di pulau jawa***

Dirgahayu, Dede, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Arief, Hamzah, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Parsa, I. Made, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Arifin, Samsul, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; April 1999; Volume 1, No. 2, pp. 1-14; In Malay-Indonesian; See also 20000044098; Original contains color illustrations; Copyright; Avail: Issuing Activity

Forecasting of paddy harvest area should be done in order to produce information of harvest area before the harvest occurred. The potentials of harvest area paddy each district can be known quickly based on that prediction. Prediction of paddy harvest area can be obtained by using LANDSAT TM data based on estimation model of paddy's age plant. The model use vegetation index (VI) parameter, which have high correlation with plant during its growth. The Sigmoid equation model can be used for estimating paddy's ages from I until 12 week with form : IVt=160/(1+1.549*exp(-0.l 1028*U)). The Quadratic equation model can be used for estimating paddy's ages from I until 12 week with form : IV = 1.1604 + 0,07827*U - 0,00134*U squared. That models are model development from model before which was produced by I M. Parsa,et al, 1977. Based on analysis result onto LANDSAT TM data on December 1997 and January 1998 indicate that most harvest area at Java island in period I will be occurred at February. The harvest area paddy at West Java (including Jakarta) is 577,692 Ha, at Middle Java is 657,540 Ha, at Yogyakarta is 49,343 Ha, and 636,536 Ha at east Java. The information is useful as input material for Agricultural Department, BULOG, and BPS for planning strategic of main food stock (rice).

Author

Estimating; Mathematical Models; Chronology; Annual Variations; Predictions; Rice

20000044667 NASA Marshall Space Flight Center, Huntsville, AL USA

Archaeological and Environmental Research of the Peten, Guatemala, Using Remote Sensing/GIS Research

Sever, Thomas L., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; A Culbert Festival: The State of Agriculture and Collapse of States, Part 2, 7 Apr. 2000, Philadelphia, PA, USA; Sponsored by Society of American Archaeology, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Peten, northern Guatemala, was once inhabited by a population of several million Maya before their collapse in the 9th century AD. Although the seventh and eight centuries were a time of crowning glory for millions of Maya; by 930 A.D. only a few scattered houses remained. What is known, is that at the time of their collapse, the Maya had cut down most of their trees. After centuries of regeneration the Peten now represent the largest remaining tropical forest in Central America but is experiencing rapid deforestation in the wake of an invasion of settlers. The successful adaptive techniques of the indigenous population are being abandoned in favor of the destructive techniques of monoculture and cattle raising. These techniques also contribute to the destruction and looting of unrecorded archeological sites. Remote sensing and GIS analysis are being used to address issues in Maya archeology as well as monitor the effects of increasing deforestation in the area today. One thousand years ago the forests of the Peten were nearly destroyed by the ancient Maya, who, after centuries of successful adaptation, finally overused their resources. Current inhabitants are threatening to do the same thing today in a shorter time period with a lesser population. Through the use of remote sensing/GIS analysis we are attempting to answer questions about the past in order to protect the resources of the future.

Author

Archaeology; Populations; Guatemala; Forests; Destruction

44
ENERGY PRODUCTION AND CONVERSION

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

20000044328 NASA Marshall Space Flight Center, Huntsville, AL USA

Preliminary Results From NASA's Space Solar Power Exploratory Research and Technology Program

Howell, Joe T., NASA Marshall Space Flight Center, USA; Mankins, John C., NASA, USA; [2000]; 1p; In English; 51st; 51st International Astronautics Congress, 2-6 Oct. 2000, Rio de Janeiro, Brazil; No Copyright; Avail: Issuing Activity; Abstract Only

Large solar power satellite (SPS) systems that might provide base load power into terrestrial markets were examined extensively in the 1970s by the US Department of Energy (DOE) and the National Aeronautics and Space Administration (NASA). Following a hiatus of about 15 years, the subject of space solar power (SSP) was reexamined by NASA from 1995-1997 in the "fresh look" study, and during 1998 in an SSP "concept definition study". As a result of these efforts, during 1999-2000, NASA has been conducting the SSP Exploratory Research and Technology (SERT) program. The goal of the SERT activity has been to conduct preliminary strategic technology research and development to enable large, multi-megawatt SSP systems and wireless power transmission (WPT) for government missions and commercial markets (in-space and terrestrial). In pursuing that goal, the SERT: (1) refined and modeled systems approaches for the utilization of SSP concepts and technologies, ranging from the near-term (e.g., for space science, exploration and commercial space applications) to the far-term (e.g., SSP for terrestrial markets), including systems concepts, architectures, technology, infrastructure (e.g. transportation), and economics; (2) conducted technology research, development and demonstration activities to produce "proof-of-concept" validation of critical SSP elements for both nearer and farther-term applications; and (3) engendered the beginnings of partnerships (nationally and internationally) that could be expanded, as appropriate, to pursue later SSP technology and applications. Through these efforts, the SERT should allow better informed future decisions regarding further SSP and related technology research and development investments by both NASA and prospective partners, and guide further definition of technology roadmaps - including performance objectives, resources and schedules, as well as "multi-purpose" applications (e.g., commerce, science, and government). This paper presents preliminary results from the SERT effort at a summary level, including the study approach, SPS concepts, applications findings, and concludes with a revised assessment of the prospects for solar power satellites using SSP technologies and systems.

Author

Experimentation; Loads (Forces); Market Research; Refining; Solar Power Satellites; Space Exploration; Technology Utilization

20000044694 ARCADIS Geraghty and Miller, Inc., Mountain View, CA USA
Evaluation of Fuel Cell Reformer Emissions ***Final Report***
Unnasch, S.; Drunert, V.; Jun. 1999; 218p; In English
Report No.(s): PB2000-103879; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Emission estimates from fuel-cell reformers using simulation models and actual emissions testing are reported. Light and heavy-duty fuel-cell vehicle case studies were used to evaluate vehicle emissions and assess effects of different fuels, fuel processors, and vehicle configurations. Reformer gas inlet and exit compositions, carbon monoxide removal, gas humidification, fuel-cell hydrogen reaction, water recovery, excess anode hydrogen combustion, and compressor/expander performance were estimated. Light-duty vehicles were configured as pure cell powered vehicles or serial hybrids with battery, flywheel, or ultracapacitor. Light-duty vehicle fuel-cell technologies considered were proton exchange membrane fuel cells (PEMFCs) and direct methanol fuel cells in combination with steam reformers, partial oxidation reformers (POX) and autothermal reactors. Heavy-duty vehicles fuel cell technology considered included PEMFCs, phosphoric acid fuel cells (PAFCs), and solid oxide fuel cells, in combination with POX and low and high temperature steam reformers. Fuels evaluated were gasoline, diesel, methonal, ethanol, compressed natural gas (CNG), and liquefied petroleum gas (LPG). A PAFC bus and an underoxidized burner were tested to help determine composition of hydrocarbon emissions, evaluate effect of load changes, and quantify emissions from burning waste gas.
NTIS
Evaluation; Phosphoric Acid Fuel Cells; Solid Oxide Fuel Cells; Thermal Emission; Exhaust Emission; Air Pollution; Pollution Monitoring

45
ENVIRONMENT POLLUTION

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

20000038381 Centre National de la Recherche Scientifique, Paris, France
Background maritime contribution to atmospheric pollution in Europe
Dec. 31, 1999; 50p; In English
Report No.(s): DE99-636282; ENV-SRAE-94142; No Copyright; Avail: Department of Energy Information Bridge

sup 222 Rn is generally considered as a suitable indicator of the continental influence from which it is then possible to identify the origin of air masses. Otherwise, the measurement of peroxy-acetyl-nitrate (PAN) may constitute an alternative solution. In this aim, simultaneous measurements of (sup 222)Rn activity concentration and PAN were routinely carried out at Porspder, in 1995, in the framework of the EU BOA project. (’Budget of Ozone over North-Atlantic’). Hundred of simulations hourly data of PAN and (sup 222)Rn were collected and compared with the five-day back-trajectories. Their analysis revealed that, in about 80% of cases, there is a good correlation in the results of measurements depending of the location of couples of data either below 0.8 Bq.m(sup-3) for (sup 222)Rn and 60 ppt for PAN under purely oceanic conditions or above these figures in the other cases. In fact,thanks to this study, it was emphasized that using such tracers in the identification of air mass of oceanic origin is of the highest interest when compared to the systematic use of back-trajectories whose handling is often tedious and costly and moreover can lead to potential inaccuracy.
NTIS
Air Pollution; Trace Elements

20000038781 Nippon Telegraph and Telephone Public Corp., Tokyo, Japan
The Environment and Energy: The Situation for New Energy Sources in an Age of Zero Emissions
NTT Review; Mar. 2000; ISSN 0915-2334; Volume 12, No. 2, pp. 100-113; In English; Copyright; Avail: Issuing Activity

The ”zero emission” campaign proposed by the United Nations University in Japan does not merely involve reducing waste to zero; rather, it means thoroughgoing pursuit of every possibility for boosting energy efficiency, saving energy and conserving natural resources. Meanwhile, vigorous efforts are under way to develop new energy sources, including solar and wind power generation systems and fuel cells, with the aim of escaping from the present dependence on fossil fuels. Two years have now passed since the Kyoto conference on preventing global warming was held. Full-scale efforts have been initiated in the information sharing field toward the formation of an environmentally-concerned society through activities to address energy issues, prevent air pollution, reduce waste and promote recycling, among other objectives.
Author
Energy Conservation; Fossil Fuels; Global Warming; Windpower Utilization; Waste Management; Waste Treatment; Emission

20000039368 Universities Space Research Association, Seabrook, MD USA

Coupled-Circulation-Chemistry Studies with the Finite-Volume CCM: Trace Gas Transport in the Tropopause Region

Pawson, Steven, NASA Goddard Space Flight Center, USA; Lin, Shian–Jiann, NASA Goddard Space Flight Center, USA; Rood, Richard B., NASA Goddard Space Flight Center, USA; Nebuda, Sharon, NASA Goddard Space Flight Center, USA; Nielsen, J. Eric, NASA Goddard Space Flight Center, USA; Douglass, Anne R., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English, 30 May - 4 Jun. 2000, Washington, DC, USA; Sponsored by American Geophysical Union, USA

Contract(s)/Grant(s): NAS5-98181; No Copyright; Avail: Issuing Activity; Abstract Only

A joint project between the Data Assimilation Office at NASA GSFC and NCAR involves linking the physical packages from the Community Climate Model (CCM) with the flux-form semi-Lagrangian dynamical core developed by Lin and Rood in the DAO. A further development of this model includes the implementation of a chemical package developed by Douglass and colleagues in the Atmospheric Chemistry and Dynamics Branch at NASA GSFC. Results from this coupled dynamics-radiation-chemistry model will be presented, focussing on trace gas transport in the tropopause region.

Author

Climate Models; Finite Volume Method; Trace Contaminants; Tropopause; Gas Transport; Radiation Chemistry; Atmospheric Chemistry

20000039435 NASA Ames Research Center, Moffett Field, CA USA

Radiative Forcing of the Pinatubo Aerosol as a Function of Latitude and Time

Bergstrom, R. W., Bay Area Environmental Research Inst., USA; Kinne, S., Bay Area Environmental Research Inst., USA; Russell, P. B., NASA Ames Research Center, USA; Bauman, J. J., Bay Area Environmental Research Inst., USA; Minnis, P., NASA Langley Research Center, USA; November 1996; 12p; In English

Contract(s)/Grant(s): NCC2-817; NCC2-946; NAG5-2784; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present calculations of the radiative forcing of the Mt. Pinatubo aerosols as a function of latitude and time after the eruption and compare the results with GOES satellite data. The results from the model indicate that the net effect of the aerosol was to cool the earth-atmosphere system with the most significant radiative effect in the tropics (corresponding to the location of the tropical stratospheric reservoir) and at latitudes greater than 60 deg. The high-latitude maximum is a combined effect of the high-latitude peak in optical depth (Trepte et al 1994) and the large solar zenith angles. The comparison of the predicted and measured net flux shows relatively good agreement, with the model consistently under predicting the cooling effect of the aerosol.

Author

Radiative Heat Transfer; Volcanoes; Aerosols

20000039443 National Inst. of Standards and Technology, Building and Fire Research Lab., Gaithersburg, MD USA

Measurement and Simulation of the IAQ Impact of Particle Air Cleaners in a Single-Zone Building

Emmerich, S. J.; Nabinger, S. J.; Feb. 2000; 54p; In English

Report No.(s): PB2000-103406; NISTIR-6461; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report describes the initial phase of an effort to evaluate the ability of multizone airflow and pollutant transport models to predict the impact of residential IAQ control technologies. Measurements of the performance of several particulate air cleaning devices and related particle transport parameters were performed in a one-room test house. These measurements were used to calculate building air change rates, particle deposition rates and penetration factors, and air cleaner removal efficiencies. Two separate 24 h tests were performed with two of the tested air cleaners, and the measured air change rates and particle concentrations were compared to predicted values obtained with the CONTAM model. For both tests, simulated 24 h average air change rates were within 5% of measured air change rates and simulated 24 h average particle concentrations were within 30% of measurements for all particle sizes. Simulations were also performed to predict the impact of the air cleaners compared to a typical furnace filter.

NTIS

Air Quality; Pollution Control; Indoor Air Pollution; Particulates; Pollution Transport; Buildings

20000039450 Midwest Research Inst., Kansas City, MO USA

Emission Measurements of Particle Mass and Size Emission Profiles from Construction Activities ***Final Report, Mar. 1998 - Jun. 1999***

Muleski, G. E.; Cowherd, C.; Oct. 1999; 324p; In English

Report No.(s): PB2000-102011; No Copyright; Avail: National Technical Information Service (NTIS)

The report gives results from field tests that characterize the amount and size distribution of particulate matter (PM) emissions from operations at construction sites. of particular interest is the movement of earth by scraper loading and unloading, grading,

transit vehicular movement on unpaved roads, and truck loading and unloading. Major results from the field tests are: (1) emissions of PM with aerodynamic diameter less than 10 micrometers (PM-10) from the loading/unloading of scrapers vary from about 1 to 1000 lb/1000 cu yd. depending on the soil properties and type of scraper used; (2) PM-10 emissions due to scraper travel between the cut and fill areas can be expected to exceed those due to removal and replacement of earth, if the transit distance is greater than 150 ft; (3) scraper loading/unloading emissions exhibit PM-2.5/PM-10 ratios of about 0.6, approximately twice the average ratio of 0.25 for scrapers and transit.
NTIS
Particle Emission; Air Pollution; Pollution Monitoring; Particulates; Particle Size Distribution

20000039787 NASA Marshall Space Flight Center, Huntsville, AL USA
Diagnosing Warm Season Precipitation Over the GCIP Region from a GCM and Reanalysis
Oglesby, Robert, NASA Marshall Space Flight Center, USA; Marshall, Susan, NASA Marshall Space Flight Center, USA; Roads, John, NASA Marshall Space Flight Center, USA; Robertson, Franklin R., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A 45 year simulation using a global general circulation model (GCM), the National Center for Atmospheric Research (NCAR) Community Climate Model v.3 (CCM3), forced with observed sea surface temperatures (SST), and 39 years of global National Centers for Environmental Prediction (NCEP) reanalyses were analyzed to determine Mississippi River basin warm season (May, June, July or MJJ) wet and dry year composites in the water and energy budgets. Years that have increased MJJ soil moisture over the GEWEX (Global Water and Energy Experiment) Continental Interior Project (GCIP) region also have high precipitation, lower surface temperature, decreased Bowen ratio, and reduced 500 hPa geopotential height (essentially reduced MJJ ridging). The reverse is true for years that have reduced MJJ soil moisture. Wet years are also accompanied by a general increase in moisture transport from the Gulf of Mexico into the central U.S. There is some indication (though weaker) that soil moisture may then affect precipitation and other quantities and be affected in turn by 500 hPa geopotential heights. The correlations are somewhat low, however, demonstrating the difficulty in providing definitive physical links between the remote and local effects. Analysis of two individual years with an extreme wet event (1993) and an extreme dry event (1988) yields the same general relationships as with the wet and dry composites. The composites from this study are currently serving as the basis for a series of experiments aimed at determining the predictability of the land surface and remote SST on the Mississippi River basin and other large-scale river basins.
Author
Atmospheric Circulation; Precipitation (Meteorology); Mississippi River (US); High Temperature; Climate Models; River Basins

20000040114 NASA Goddard Space Flight Center, Greenbelt, MD USA
Is There an Arctic Ozone Hole?
Newman, Paul A., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English, 14-15 Apr. 2000, Kansas City, MO, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Total ozone observations from the Total Ozone Mapping Spectrometer (TOMS) instruments during March 1997 revealed an extensive region of low column densities in the Arctic region centered near the north pole. Values were below 250 Dobson units for nearly a two week period during this period, and were correlated with the position of the northern lower stratospheric polar vortex. The March 1997 average total ozone column densities were more than 30% lower than the average of column densities observed during the 1979-1982 March period. Both the northern spring seasons of 1998 and 1999 have shown much higher levels of total ozone. In this presentation, we will discuss the causes of the low total ozone values in 1997 and contrast those low values with the higher 1998 and 1999 observations. I will additionally discuss the just completed SOLVE campaign and the March 2000 ozone values.
Author
Arctic Regions; Ozone Depletion; Total Ozone Mapping Spectrometer

20000040162 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Sorption of the Aircraft Deicing Fluid Component Methyl-Benzotriazole in Soil
Kellner, David L.; Mar. 1999; 216p; In English
Report No.(s): AD-A374457; AFIT/GEE/ENV/99M-11; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The air transportation industry requires deicing/anti-icing (ADAF) fluids to maintain flight operations in cold weather conditions. Additives to the ADAF aid in the performance of these agents. Approximately 52M liters of concentrated aircraft deicing fluid are used in North America per year in an attempt to correct this safety problem. Among the additives to ADAF are corrosion inhibitors flame retardants, wetting agents, and thickening agents. Some of these agents are known to be toxic to microorganisms.

Identification of the transport processes of these agents in the environment is a necessary first step to understanding how to remediate ADAF. Methyl-Benzotriazole (MeBT) is a corrosion inhibitor/flame retardant toxic additive in ADAF. This study investigates the sorption characteristics of MeBT in various soils. Three soil types were used to evaluate the sorption characteristics of MeBT at 1000 mg/L, 100 mg/L, and a mixture of MeBT and propylene glycol (PG). A High Pressure Liquid Chromatograph (HPLC) was used to conduct the recovery experimentation after the samples had reached equilibrium. Resulting sorption coefficients revealed that MeBT did not sorb well to any of the soils types used. The organic carbon content affects the sorption coefficient by slightly raising the sorbed amount of MeBT.
DTIC
Aircraft Maintenance; Airframes; Sorption; Methyl Compounds; Soils; Propylene

20000040478 Swedish Meteorological and Hydrological Inst., Norkoeping, Sweden
First Rossby Centre regional climate scenario - Dynamical downscaling of CO2-induced climate change in the HadCM2 GCM
Raeisaenen, J.; Rummukainen, M.; Ullerstig, A.; Bringfelt, B.; Hansson, U.; Feb. 28, 1999; 66p; In English
Report No.(s): DE99-763829; SMHI-RMK-85; No Copyright; Avail: Department of Energy Information Bridge
Results of the first 10-year climate change experiment made with the Rossby Centre regional climate model (RCA) are described. The boundary data for this experiment were derived from two simulations with the global HadCM2 ocean- atmosphere GCM, a control run and a scenario run with 150% higher equivalent CO2 and 2.6 deg C higher global mean surface air temperature. Some of the climate changes (scenario run - control run) simulated by RCA are substantial. The annual mean temperature in the Nordic region increases by roughly 4 deg C, with largest warming in winter. Annual absolute minimum temperatures increase even more than the winter mean temperature, presumably due to greatly reduced snow and ice cover. Precipitation is also simulated to increase in northern Europe, locally by 40% in the annual mean in Swedish Lappland. The larger time mean precipitation is accompanied by a marked increase in the number of days with heavy precipitation.
NTIS
Carbon Dioxide; Climate Change; Atmospheric General Circulation Models; Climate Models; Dynamical Systems

20000040851 National Oceanic and Atmospheric Administration, Office of Oceanic and Atmospheric Research, Rockville, MD USA
Health of the Atmosphere: the First Five Years 1995-1999 ***Progress Report***
2000; 48p; In English; Original contains color illustrations
Report No.(s): PB2000-104349; No Copyright; Avail: National Technical Information Service (NTIS)
Air quality in the USA has improved dramatically in almost all respects during the three decades since the Clean Air Act was passed. Much of the oppressive pollution that characterized the Nations cites is a distant memory. The Nation now enjoys better air quality than at any time in recent memory. However, there are still areas of the country where the Public is exposed to unhealthy levels of air pollutants and damage to sensitive ecosystems is occurring. The Air Quality Research Subcommittee of the White Houses Committee on the Environment and Natural Resources (CENR) has identified 1 the five most pressing air quality issues that face the Nation today. It is in these areas that new and innovative approaches are most urgently needed if we are to manage air quality while sustaining economic growth.
NTIS
Air Quality; Air Pollution

20000040868 Hagler, Bailly, Inc., Arlington, VA USA
Markets for Climate Change Mitigation Technologies and Services in Developing Countries
2000; 86p; In English
Report No.(s): PB2000-103665; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
;Bibliography: Appendix A: Summary of Principal Donor-Sponsored Climate Change Mitigation Projects in Selected Countries; and Appendix B: Useful Contacts.
NTIS
Climate Change; Developing Nations; Market Research; Technology Assessment

20000042032 Army Construction Engineering Research Lab., Champaign, IL USA
Process Energy and Pollution Reduction (PEPR) Level I Review at the Watervliet Arsenal, New York ***Final Report***
Lin, Mike C., Army Construction Engineering Research Lab., USA; Smith, Walter P., Army Construction Engineering Research Lab., USA; Darcy, Philip, Army Construction Engineering Research Lab., USA; Dunstan, Steve, Army Construction Engineering

Research Lab., USA; Byrne–Kelly, Darcy, Army Construction Engineering Research Lab., USA; Nov. 1999; 56p; In English
Report No.(s): AD-A372654; CERL-TR-99/92; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The U.S. Army Construction Engineering Research Laboratory (CERL) held a Process Optimization (PO) workshop and performed a Level I Process Energy and Pollution Reduction (PEPR) Audit 1-5 February 1999 at the Watervliet Arsenal, NY. The primary objective of the audit was to financially and technically review the Arsenal's manufacturing steps and to identify process changes that will significantly increase performance and efficiencies. A corollary objective was to transfer process optimization techniques to WVA's team to analyze other processes. A significant number of process improvements were identified for the heat treat, plating, and energy systems. The combined value from process changes could potentially improve WVA's operating margins by approximately $5.8 million per year, with a $683K capital investment. Ideas requiring such investment, however, must be developed further, tested, and re- analyzed based on a Level II (in-depth) analysis in which all assumptions are verified. The Level II analysis will generate "appropriation grade" process improvement projects for submission to top management for funding.
DTIC
Pollution Control; Manufacturing; Armed Forces; Research Facilities; Dilution

20000043537 NASA Goddard Space Flight Center, Greenbelt, MD USA
Interannual Variability of Ozone and Ultraviolet Exposure
Herman, J. R., NASA Goddard Space Flight Center, USA; Piacentini, R. D., Instituto de Fisica Rosario, Argentina; Ziemke, J., Software Corp. of America, USA; Celarier, E., Software Corp. of America, USA; Larko. D., Raytheon ITSS Corp., USA; [1999]; 11p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Annual zonal averages of ozone amounts from Nimbus-7/TOMS (Total Ozone Mapping Spectrometer) (1979 to 1992) are used to estimate the interannual variability of ozone and UVB (290 - 315 nm) irradiance between plus or minus 60 deg. latitude. Clear-sky interannual ozone and UVB changes are mainly caused by the Quasi Biennial Oscillation (QBO) of stratospheric winds, and can amount to plus or minus 15% at 300 nm and plus or minus 5% at 310 nm (or erythemal irradiance) at the equator and at middle latitudes. Near the equator, the interannual variability of ozone amounts and UV irradiance caused by the combination of the 2.3 year QBO and annual cycles implies that there is about a 5-year periodicity in UVB variability. At higher latitudes, the appearance of the interannual UVB maximum is predicted by the QBO, but without the regular periodicity. The 5-year periodic QBO effects on UVB irradiance are larger than the currently evaluated long-term changes caused by the decrease in ozone amounts.
Author
Annual Variations; Ultraviolet Radiation; Irradiance; Exposure; Ozone

20000044103 Lembaga Penerbangan dan Antariksa Nasional, Jakarta, Indonesia
Ozone Behavior on Java *Perilaku ozon di pulau jawa*
Manik, Timbul, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Rosida, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Partomo, Sri Wahyu, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Sani, Syafei, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Naitutu, Rosalina, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Samiaji, Toni, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Sumardi, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Sunardi, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; April 1999; Volume 1, No. 2, pp. 53-63; In Malay-Indonesian; See also 20000044098; Copyright; Avail: Issuing Activity

Although ozone concentration represents only a tiny fraction of the atmospheric gases, ozone is crucial in atmosphere and for life on earth. Ozone behaviour over Indonesia, especially over Java island, during wet and dry season has been studied by means ozonesonde borned by balloon in Ciater (6.7 S, 107.7 E) on July 1996 and January 1997 and in Watukosek (7.5 S, 112.5 E) on August 1996 and Januari 1997. Maximum ozone concentration over Java Island is observed in around 26 km altitude from mean sea level. Analysis results show that concentration in troposphere and stratosphere observed during wet season were higher than dry season. The difference of ozone concentration is basically due to position of the sun during observation. The changes of ozone in stratosphere which influence atmospheric temperature profile proves that ozone contributes to atmospheric temperature structure.
Author
Gas Composition; Indonesia; Ozone; Atmospheric Composition

20000044693 California Dept. of Pesticide Regulation, Environmental Hazards Assessment Program, Sacramento, CA USA
Procedures for Developing a Depth-to-Ground Water Database
Spurlock, F.; Jan. 2000; 28p; In English
Report No.(s): PB2000-103673; EH-00-02; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Enviornmental Hazards Assessment Program of the Department of Pesticides Regulation (DPR) has developed statistical procedures for identifying soil and climatic characteristics of sections of land that are vulnerable to ground water contamiantion by pesticides. Analysis of historical ground water monitoring data has also shown that depth to ground water (DGW, distance from the ground surface to first unconfined water, if any) is related to frequency of pesticide detection in ground water, especially for shallower DGW. Consequently, EHAP's proposed CALVUL model to describe California's spatial vulnerability to ground water contamination includes DGW as one condition for determining spatial vulnerability. The CALVUL model has been used to focus EHAP's monitoring efforts and as the basis for identifying areas where modification of pesticide use practices will be required to mitigate ground water contamiantion by pesticides.
NTIS
Water Resources; Ground Water; Contamination; Water Pollution; Pesticides

20000044695 Energy Information Administration, Office of Integrated Analysis and Forecasting, Washington, DC USA
Emissions of Greenhouse Gases in the USA, 1998
Oct. 1999; 164p; In English
Report No.(s): PB2000-103957; DOE/EIA-0573(98); No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
Total U.S. emissions of greenhouse gases in 1998 increased by 0.2 percent from their 1997 level, below the average growth rate of the 1990's (1.2 percent). During 1998, crude oil prices dropped by one-third and the U.S. economy expanded at a 3.9-percent annual rate. The slowing of growth in emissions resulted in part from a much warmer-than-usual winter in 1998 and in part from lower emissions from the industrial sector. Overall, 1998 U.S. greenhouse gas emissions were about 10 percent higher than 1990 emissions. Since 1990, U.S. emissions have increased at an annual rate of 1.2 percent, slightly faster than population (1.1 percent) but more slowly than energy consumption (1.4 percent), electricity consumption (2.2 percent), or gross domestic product (GDP) (2.6 percent).
NTIS
Greenhouses; Exhaust Gases; Exhaust Emission; Global Air Pollution; Pollution Transport; Airglow; Air Pollution

20000044696 Energy Information Administration, Office of Integrated Analysis and Forecasting, Washington, DC USA
Analysis of the Climate Change Technology Initiative
Apr. 1999; 102p; In English
Report No.(s): PB2000-103959; SR/OIAF99-01; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
In February 1999, the Administration sent its fiscal year 2000 budget request to the U.S. Congress. The Administration's budget includes more than $4 billion in programs related to climate change. Nearly $1.8 billion of the funding consists of tax incentives, research, development, and deployment, and other spending for the Climate Change Technology Initiative (CCTI). CCTI includes tax credits to serve as incentives for deploying energy efficiency improvements and renewable technologies for buildings, light-duty vehicles, industry, and electricity generation. Other funding covers research, development, and deployment for energy-efficient and renewable technologies, appliance standards, and carbon sequestration research. One focus of these programs is climate change, but they often have additional benefits for improved air quality due to reductions in other emissions, energy security, and international competitiveness. Although the tax incentives are largely new initiatives, many of the other programs are continuations or expansions of ongoing research, development, and deployment programs. The total budget request for CCTI programs for all Federal agencies comprises almost $1.4 billion for research, development, and deployment (representing an increase of $347 million over the estimated fiscal year 1999 budget) and nearly $400 million for tax incentives. The analysis described in this report examines all the CCTI programs with the exception of $4 million proposed for electricity restructuring programs at the U.S. Environmental Protection Agency (EPA); $14 million for management, planning, and analysis programs at the U.S. Department of Energy (DOE) and EPA; $3 million for EIA; and $10 million for carbon sequestration programs within EPA and the U.S. Department of Agriculture (USDA). The most detailed analysis in this report is for the tax incentives proposed in CCTI, which are new initiatives or extensions of current tax credits.
NTIS
Climate Change; Energy Conservation; Environment Protection; Technology Assessment

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.

20000038332 Hokkaido Univ., Inst. of Seismology and Volcanology, Sapporo, Japan
Reexamination of Seismic Gaps Before the 1952 Tokachi-Oki Earthquake and the 1973 Nemuro-Hante-Oki Earthquake and the 1973 Nemuro-Hanto-Oki Earthquake
Motoya, Yoshinobu, Hokkaido Univ., Japan; Geophysical Bulletin of Hokkaido University; March 2000; ISSN 0439-3503, No. 63, pp. 23-32; In Japanese; Copyright; Avail: Issuing Activity

Seismic gaps before the 1952 Tokachi-oki Earthquake (M 8.2) on March 4, 1952 and the 1973 Nemuro-hanto-oki Earthquake (M 7.4) on June 17, 1973 had been found out by Utsu. As seismic gap is a promising tool for large earthquake forecast in long or intermediate term, we reexamined these two gaps using the new Earthquake Catalog issued in 1982 by Japan Meteorological Agency (JMA). We confirmed that the seismic gap before the 1952 event suggested by Utsu is open to question due to poor hypocenter accuracy before 1960's. However, the new data set reveals that a distinct seismic gap appeared in the focal region of the 1952 event seven years prior to its occurrence. Far southwest off the Nemuro peninsula, near the inner wall of the Kuril trench, a rather wide gap had held from June, 1952 to the time when the 1973 event occurred. Northern half of this gap coincides with southern part of the focal region of the 1973 event. However, no seismic gap was found out near both places where the 1973 main shock and its largest aftershock (M 7.1) occurred.
Author
Earthquakes; Seismology; Annual Variations; Japan

20000038367 Alabama Univ., Huntsville, AL USA
Quantification of Neutral Wind Variability in the Upper Thermosphere ***Final Report, 1 Jul. 1996 - 31 Jan. 2000***
Richards, Philip G., Alabama Univ., USA; [2000]; 3p; In English
Contract(s)/Grant(s): NAG5-6053; NAGW-4455; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The overall objective of this grant was to: 1) Quantify thermospheric neutral wind behavior in the ionosphere. This was to be achieved by developing an improved empirical wind model. 2) Validating the procedure for obtaining winds from the height of the peak density. 3) Improving the model capabilities and making updated versions of the model available to other scientists. The approach is to use neutral winds derived from ionosonde measurements of the height of the peak electron density (h(sub m)F(sub 2)). One of the proposed first year tasks was to perform some validation studies on the method. Substantial progress has been made with regard to both the empirical model and the validation study. Funding from this grant has also enabled a number of fruitful collaborations with other researchers; one of the stated aims in the proposal. Graduate student Mayra Martinez has developed the mathematical formulation for the empirical wind model as part of her dissertation. As proposed, authors continued validation studies of the technique for determining winds from h(sub m)F(sub 2). They are submitted a paper to the Journal of Geophysical Research in December 1996 entitled "Therinospheric neutral winds at southern mid-latitudes: comparison of optical and ionosonde h(sub m)F(sub 2) methods. A second paper entitled "Ionospheric behavior at a southern mid-latitude in March 1995" has come out of the March 1995 data set and was published in The Journal of Geophysical Research. A new algorithm was developed. The ionosphere also have been modeled.
Derived from text
Winds Aloft; Variability; Neutral Atmospheres; Electron Density (Concentration); Algorithms

20000038373 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Total Electron Content Observations With GPS Data ***Observacoes do Conteudo Eletronico Total com Dados do GPS***
Fedrizzi, Mariangel, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 150p; In Portuguese; Original contains color illustrations
Report No.(s): INPE-7259-TDI/703; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

A method to determine the Total Electron Content (TEC) from Global Positioning System (GPS) observables is presented. This method takes advantage of the dispersive characteristic of the ionospheric medium to determine the TEC from differential pseudo-ranges and carrier phases. Most of the available TEC data, in the South American region, has been taken by measurements of Faraday rotation, which only contains the contribution of electrons up to heights of approximately 2,000 km. However, TEC measurements obtained from GPS data include the plasmaspheric electron content. Diurnal, latitudinal and seasonal TEC variations, during solar minimum and quiet ionosphere conditions, were obtained and analysed for International GPS Service (IGS) stations, located at South America and Antarctic Peninsula. These results were compared with ionospheric IRI-95 and plasma-

spheric Gallagher-88 empirical models. The TEC diurnal behavior for disturbed conditions and the presence of fluctuations on TEC observations offer an excellent means to monitor magnetic storm effects on GPS measurements and ionospheric irregularities.
Author
Electron Density (Concentration); Atmospheric Composition; Electrons; Global Positioning System

20000038390 NASA Marshall Space Flight Center, Huntsville, AL USA
Investigating the Role of the Earth's Ionosphere in Space Weather: Modeling and Observations of High-Latitude Ionospheric Outflows
Horwitz, J. L., Alabama Univ., USA; Zeng, W., Alabama Univ., USA; Stevenson, B. A., Alabama Univ., USA; Wu, X., Alabama Univ., USA; Germany, G., Alabama Univ., USA; Su, Y.–J., Los Alamos National Lab., USA; Craven, P. D., NASA Marshall Space Flight Center, USA; Rich, F. J., Air Force Research Lab., USA; Moore, T. E., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; Space Storms and Space Weather Hazards, 19-29 Jun. 2000, Crete, Greece; No Copyright; Avail: Issuing Activity; Abstract Only

We will present what we believe to be the first reported observations of up- and downflows of topside ionospheric thermal plasmas from multiple near-simultaneous tracks through the high-latitude topside ionosphere. From several Southern polar passes, it has been possible to construct plots of field-aligned flows of 0+ observed by the Thermal Ion Dynamics Experiment(TIDE) on the POLAR spacecraft near 5000 km altitude together with vertical ion flow observations from one or more DMSP spacecraft near 800 km altitude. We also will present simultaneous observations of POLAR auroral LTVI images with field-aligned flows. We will further show new fluid-kinetic simulations of auroral ionospheric flows in the altitude range 120 km to several R-E as subjected to the synergistic auroral effects of soft electron precipitation, transverse wave-driven ion heating, and hot plasma-driven electric potentials.
Author
Auroras; Earth Ionosphere; High Temperature Plasmas; Polar Regions; Thermal Plasmas; Field Aligned Currents; Ionospheric Currents

20000038416 Hokkaido Univ., Div. of Earth and Planetary Sciences, Sapporo, Japan
Seismic Response of Sedimentary Layers in Sapporo Derived from Borehole Seismometer Array
Yoshida, Kunikazu, Hokkaido Univ., Japan; Sasatani, Tsutomu, Hokkaido Univ., Japan; Geophysical Bulletin of Hokkaido University; March 2000; ISSN 0439-3503, No. 63, pp. 43-64; In Japanese; Copyright; Avail: Issuing Activity

Three borehole seismic arrays have been in operation since 1997 in Sapporo City. These are located on the NW, NE and SW parts of the city. Each seismic array consists of one surface (uphole) sensor and one borehole sensor extending to a depth of 500 meters. The boreholes are logged for their P- and S- wave velocities by using the suspension method. The velocity structures are different from site to site. We use these array data to investigate the seismic response of sedimentary layers in Sapporo City. First we examine the velocity structures from PS_ logging by using the borehole -to-surface travel times of P- and S- waves from natural earthquakes. The travel times are well explained by the PS-logging velocity structures. We determine the polarities of the borehole horizontal sensors by comparing the surface records with the borehole-ones for long-period Rayliegh waves from two large events. Next we investigate effects of sedimentary layers on seismic motion at three sites. Spectral ratios of the surface S-waves to the borehole S-waves from near-by, moderate-size earthquakes are calculated. The spectral ratios are different from site to site, reflecting the different velocity structures. We interpret the spectral ratios by using the I-D multiple reflection theory. The average Qs values for the whole sedimentary layers are estimated by fitting the theoretical transfer function to the observed spectral ratios. The estimated Qs values have a frequency dependency of Q = Q,,fn (Q. = 8 - 20 and n = 0.4 - 1.5). We confirm our estimations of Qs values though the time domain analysis. Finally, we calculate amplification function for incident S waves at three sites, based on the velocity structures and the estimated Qs values, and compare them with the observed ones by the reference site technique (Takeda, 1998). The calculated amplifications at frequencies less than about 1 Hz are considerably small compared with the observed ones. This indicates that we have to take into account more deep structure in estimation of the seismic response of the Sapporo basin.
Author
Boreholes; S Waves; Seismographs; Earthquakes; Sediments

20000038712 NASA Marshall Space Flight Center, Huntsville, AL USA
Coincident POLAR/UVI and WIND Observations of Pseudobreakups
Fillingim, M. O., NASA Marshall Space Flight Center, USA; Parks, G. K., NASA Marshall Space Flight Center, USA; Chen, L. J., NASA Marshall Space Flight Center, USA; Brittnacher, M. J., NASA Marshall Space Flight Center, USA; Germany, G. A.,

NASA Marshall Space Flight Center, USA; Spann, J. F., Jr., NASA Marshall Space Flight Center, USA; Larson, D. E., NASA Marshall Space Flight Center, USA; Lin, R. P., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Using POLAR/UVI global images, we have identified a period of successive minor auroral activations during which WIND was making a perigee pass (X approx. - 11Re). These auroral brightenings are interpreted to be pseudobreakups due to the lack of global expansion. Large magnetic field fluctuations and high earthward ion velocity moments measured by the WIND spacecraft show a nearly one-to-one correspondence with the auroral intensifications. Analysis of the plasma parameters indicates that there is no difference in the behavior of the plasma during pseudobreakups as compared to substorm expansive phase onset. Inspection of the ion distribution functions during high velocity moment events reveals the presence of a two component plasma. The particles contributing to the large mean velocities are energetic ions from approx. 2-27 keV. We conclude that pseudobreakups are the ionospheric signature of high velocity moment events.

Author

Auroras; Ultraviolet Imagery; Plasmas (Physics); Aerospace Vehicles; Observation

20000038713 NASA Marshall Space Flight Center, Huntsville, AL USA

Evolution of Plasmaspheric Refilling from Comparisons of Satellite Observations with Simulations by an Interhemispheric Plasmasphere Model

Comfort, Richard H., Alabama Univ., USA; Liao, Jin–Hua, Alabama Univ., USA; Craven, Paul, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English, 30 May - 3 Jun. 2000, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The evolution of the plasmasphere is closely coupled to processes governing flux tube refilling and transport. In this study we follow this evolution through a series of sequential ion observations made by the Retarding Ton Mass Spectrometer (RIMS) on the Dynamics Explorer 1 (DE1) satellite and with the intervening time intervals filled in by simulations made with the Field Line Interhemispheric Plasma (FLIP) model. The period of DE1 (approx. 7 hours) is such that nearly the same flux tubes are observed every second day, or every sixth orbit. The intervening observations provide additional information regarding longitudinal variations. Since the observations are necessarily restricted to two local time passes through the plasmasphere per orbit, the FLIP code will follow the observed flux tubes as they corotate and convect through the other local times. The simulations use the initial plasmasphere observations to define initial conditions of where the plasmapause is located and the extent of filling in the plasma trough. The composite of observations and simulations allows assessment of the degree to which the FLIP simulations accurately describe the processes which govern flux tube refilling over the two-day period between observations on the same flux tubes. to the extent that the convection electric field model in the FLIP code is accurate, this composite also provides a global picture of what is happening in and near the plasmasphere during the period. of particular interest are changes in plasma composition as refilling proceeds.

Author

Dynamics Explorer 1 Satellite; Plasmas (Physics); Plasmasphere; Satellite Observation; Evolution (Development); Atmospheric Models

20000038752 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Study of Variations of the Weighting Functions Over Brazil, Using the ATM Model *Estudo Das Variacoes Das Funcoes-Peso em Microondas Sobre o Brasil, Utilizando o Modelo ATM*

Siqueira, Jose Ricardo, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 118p; In Portuguese; Original contains color illustrations

Report No.(s): INPE-7256-TDI/699; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The weighting functions of the ten Advanced Microwave Sounding Unit (AMSU) channels of Advanced TIROS-N/NOAA Operational Vertical Sounder (ATOVS), calculated from the Atmosphere Transmission at Millimetric and Submillimetric Wavelengths (ATM) model, were compared with those from the AMSU/ATOVS. Among the ten channels, five refer to the oxygen absorption lines around 57,29 GHz, that constitute the AMSU-A (channels 2, 4, 5, 6 and 8), while the other five are associated to water vapor absorption lines around 183,31 GHz, that compose the AMSU-B (channels 16, 17, 18, 19 and 20). Standard atmospheric vertical profiles (tropical and midlatitudes in summer and winter) implicit in the ATM model and the temperature and humidity climatological vertical profiles of regions in Brazil were utilized. The current version of the ATM model calculates the absorption coefficient of the atmospheric gases in microwave spectrum utilizing atmospheric vertical profiles of pressure, temperature, humidity and concentration of gases. Some input parameters are also included, such as surface emissivity, sensor view angle and central frequency of the channel. The weighting functions calculated from the standard atmospheric vertical profiles of the model were compared with those from the AMSU and Brazil. Moreover, spacial and seasonal variations of the weighting functions

over Brazil were studied; the influence of the surface emissivity and of the sensor view angle in the calculation of weighting functions was verified. The results show consistency among the weighting functions for the majority of the AMSU-A channels. For the AMSU-B channels, a discrepancy among the weighting functions obtained with the climatological profiles was observed. This suggests a more specific definition of the weighting functions for Brazil. The surface emissivity and the sensor view angle exerted strong influence on some of the weighting functions of AMSU-A and AMSU-B channels.
Author
Variations; Weighting Functions; Advanced Microwave Sounding Unit; Atmospheric Temperature; Atmospheric Pressure; Atmospheric Composition; Humidity

20000038889 Vanguard Research, Inc., Fairfax, VA USA
Spatial-Spectral Sensor Techniques for Detection of Atmospheric Turbulence ***Final Report, 30 Apr. 1998 - 29 Nov. 1999***
Sears, Robert D.; Broadfoot, Lyle; Mar. 03, 2000; 70p; In English
Contract(s)/Grant(s): DASG60-98-M-0073
Report No.(s): AD-A374531; VRI-99-02; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

This report addresses the problem of utilizing spatial-hyperspectral imaging capabilities of spaceborne sensors to detect and characterize regions of atmospheric turbulence and cirrus cloud clutter which may impact employment and/or performance of space based laser and airborne high energy laser weapons systems. Our concept for worldwide detection, characterization and mapping of atmospheric turbulence and cirrus clouds involves use of satellite-borne (and possibly airborne) spectral and hyperspectral imagers operated in the UV to MWIR spectral range in virtual triangulation geometry. Spectral and hyperspectral imagery allows altitude sounding of atmospheric clutter from turbulence and cirrus clouds. Triangulation geometry allows precise attitude selection by cross correlation of the backscatter signals. The combination of attitude and Fourier-space background spectral discrimination will provide an attitude resolved measurement of atmospheric clutter from the clear air turbulence and from cirrus clouds, both of which may affect performance of the SBL (Space Based Laser) and the Airborne Laser (ABL) systems.
DTIC
Imaging Techniques; Satellite Imagery; Clear Air Turbulence; FLIR Detectors

20000039220 NASA Marshall Space Flight Center, Huntsville, AL USA
TIDE Observations of Cusp and Cleft Multiple Ion Populations
Coffey, Victoria N., NASA Marshall Space Flight Center, USA; Chandler, Michael O., NASA Marshall Space Flight Center, USA; Moore, Thomas E., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English, 30 May - 3 Jun. 2000, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The southern pole pass of Polar/TIDe at 5000 km allows a study of the distributions of the cusp and cleft. We discuss observations of TIDE (Thermal Ion Dynamics Experiment) as it passes the southern pole on March 29, 1999. A mixture of several cold outflowing ions (0.3-10 eV) are measured simultaneously with magnetospheric precipitation (greater than 100 eV). We will show a study of these multiple plasma distributions, their source, and their interaction.
Author
Plasmas (Physics); Cold Plasmas; Polar Cusps; Ion Distribution

20000039365 NASA Wallops Flight Facility, Wallops Island, VA USA
Stratospheric Temperature Trends from Small Rockets Between 1969-1995
Schmidlin, F. J., NASA Wallops Flight Facility, USA; [2000]; 1p; In English, 9-14 Jan. 2000, Long Beach, CA, USA; Sponsored by American Meteorological Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Between 1958-1995 a significant number of small meteorological rocketsondes were launched by USA (US) agencies from as many as 30 sites to as few as 3-4 sites in 1995. Stratospheric temperature trends were derived for many of the sites for the period 1969-1995. Similar long-term trends also were derived using rocketsondes launched from sites of the Former Soviet Union (FSU). The advantage of these two particular sets of rocket temperature measurements is the internal consistency of the data. All measurements were made with the same instrument, i.e., Datasonde in the case of the US sites and the M100B in the case of the FSU sites. Data from each instrument type were processed using its unique reduction method. Thus, all data were processed in the same manner including the method of applying corrections (necessary because of thermal heating of the thermistor from the high fall velocities experienced and from radiation effects). Straight-line least squares fit to the data made to monthly-mean measurements gave a downward change of 2-3 K per decade. A more complex fitting algorithm would have resulted in finer results but the straight-line fit was adequate for the analysis presented. Trend data are presented for 50 km, 40 km, and 25 km altitude levels. Trends for the

US and FSU sites are quite similar. The 25km (50-hPa) level data are compared with radiosonde temperatures. Temperature trends over the 25-year period is different at each of the sites and not always in the same direction.
Author
Atmospheric Temperature; Stratosphere; Sounding Rockets; Temperature Measurement; Trends; Radio Meteorology

20000039367 Universities Space Research Association, Seabrook, MD USA
Performance of the GEOS-3/Terra Data Assimilation System in the Northern Stratospheric Winter 1999/2000
Pawson, S., NASA Goddard Space Flight Center, USA; Lamich, David, NASA Goddard Space Flight Center, USA; Ledvina, Andrea, NASA Goddard Space Flight Center, USA; Conaty, Austin, NASA Goddard Space Flight Center, USA; Newman, Paul A., NASA Goddard Space Flight Center, USA; Lait, Leslie R., General Sciences Corp., USA; Waugh, Darryn, Johns Hopkins Univ., USA; [2000]; 1p; In English, 30 May - 4 Jun. 2000, Washington, DC, USA; Sponsored by American Geophysical Union, USA
Contract(s)/Grant(s): NAS5-98181; No Copyright; Avail: Issuing Activity; Abstract Only

As part of NASA's support for the Terra satellite, which became operational in January 2000, the Data Assimilation Office introduced a new version of the GEOS data assimilation system (DAS) in November 1999. This system, GEOS-3/Terra, differs from its predecessor in several ways, notably through an increase in horizontal resolution (from 2-by-2.5 degrees to 1-by-1 degree), a slightly lower upper boundary (0.1 instead of 0.01hPa) with fewer levels (48 as opposed to 70), and substantial changes to the tropospheric physics package. This paper will address the performance of the GEOS-3/Terra DAS in the stratosphere. it focusses on the analyses (produced four times daily) and the five-day forecasts (produced twice daily). These were important for the meteorological support of the SAGE-3 Ozone Loss and Validation Experiment, based in Kiruna, Northern Sweden, in the winter of 1999/2000. It is shown that the analyses of basic meteorological fields (temperature, geopotential height, and horizontal wind) are in good agreement with those from other centers. The analyses captured the cold polar vortex which persisted through most of the winter. It is shown that forecasts (up to five days) tend to have a warm bias, which is important for the prediction of polar stratospheric clouds, which are triggered by temperatures of 195K (or lower). The importance of accurate upper tropospheric forecasts in predicting the stratospheric flow is highlighted in the context of the evolution of the shape of the stratospheric polar vortex. A prominent blocking high in the Atlantic region in January was an important factor determining the shape of the distorted lower stratospheric vortex; the predictive skill of these features was strongly coupled in the GEOS-3/Terra system.
Author
Stratosphere; Winter; GEOS 3 Satellite; Terra Spacecraft; Meteorological Parameters; Weather Forecasting; Data Acquisition

20000039773 Instituto Geografico Nacional, Subdirection General de Geodesiay Geofisica, Madrid, Spain
Magnetic Observations in the Observatories of San Pablo (Toledo) and Guimar (Tenerife) ***Annual Report, 1996 Anuarios de Geomagnetismo Observatorios de: San Pablo - Toledo (SPT) Guimar - Tenerife (GUI)***
[1996]; ISSN 0210-8917; 132p; In Spanish; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This yearbook is a compilation of the results of magnetic observations carried out during 1996 in the San Pablo-Toledo Observatory, located 50 km southwest of the city of Toledo. In 1982, this observatory replaced the one in Toledo (1934-1981).
Derived from text
Magnetic Measurement; Observatories; Visual Observation; Visual Perception

20000040057 Boston Univ., Center for Space Physics, Boston, MA USA
CUSP: A New Acceleration Region of the Magnetosphere
Chen, J., Boston Univ., USA; Fritz, T. A., Boston Univ., USA; Kudela, K., Slovak Academy of Sciences, Slovak Republic; Czechoslovak Journal of Physics; 1999; Volume 49, No. 4a, pp. 667-673; In English; Coordinated Studies of the Solar wind-Magnetosphere-Ionosphere Interaction: Interball Observations, 7-11 Sep. 1998, Kosice, Czechoslovakia
Contract(s)/Grant(s): NAG5-2578; NAG5-7841; Copyright; Avail: Issuing Activity; Abstract Only

A new magnetospheric phenomenon called a cusp energetic particle (CEP) event has been discovered by the POLAR spacecraft in 1996. The events were detected in the dayside polar cusp near the apogee of POLAR and could last for hours, in which the measured helium ions had energies up to 8 MeV. All of these events were associated with a dramatic decrease in the magnitude of the local magnetic field. A fundamental question is where do the cusp MeV ions come from? To answer this question, we have compared the ion flux in the September 18, 1996 CEP events with that in the upstream from the bow shock and found that bow shock acceleration cannot explain the measured ion flux in the CEP events. We have further determined the parallel power spectra of the local magnetic field turbulence calculated over the CEP event periods for fluctuations in the ultra-low frequency (ULF) ranges, corresponding to periods of about 0.33-500s. It is found that the mirror parameter, defined as the ratio of the square root of the integration of the parallel turbulent spectral component over the ULF ranges to the local mean field, is correlated with the

intensity of the MeV helium flux. These new results represent a discovery that the high-altitude dayside cusp is a new acceleration region of the magnetosphere.
Author
Magnetic Fields; Polar Cusps; Earth Magnetosphere; Geomagnetism; Particle Acceleration

20000040060 Boston Univ., Center for Space Physics, Boston, MA USA
May 4, 1998 Storm: Observations of Energetic Ion Composition by POLAR
Chen, Jiasheng, Boston Univ., USA; Fritz, Theodore A., Boston Univ., USA; Geophysical Research Letters; 1999; ISSN 0094-8276; Volume 26, No. 19, pp. 2921-2924; In English
Contract(s)/Grant(s): NAG5-2578; NAG5-7841; NAG5-7677
Report No.(s): Paper-199GL003582; Copyright; Avail: Issuing Activity

A major geomagnetic storm occurred at 5:00-12:05 UT on May 4, 1998. During this period, the magnetosphere was compressed and eroded; POLAR traveled in its outbound orbit from the equatorial radiation belt to the cusp and crossed the magnetopause into the magnetosheath. Two CEP-like (Cusp Energetic Particle) events with two to three orders of magnitudes enhancements of MeV ion fluxes were measured. The first event had a peak flux higher than that of the intense outer radiation belt in the equatorial plane. The shape of the measured energy spectra (in the unit of keV/e) were ion species dependent. For He+/He++ ratio at 18-269 keV/e, the difference between the radiation belt and the magnetosheath can be by a factor of as large as 62. In the magnetosheath, the 18-269 keV/e ion composition are variable, indicating a mass dependent acceleration process. These MeV ions may be energized by a mechanism in the cusp responsible for the CEP events previously reported.
Author
Energetic Particles; Magnetic Storms; Magnetosheath; Geomagnetism; Solar Storms; Solar Terrestrial Interactions; Earth Magnetosphere; Magnetic Disturbances; Solar Wind

20000040061 Boston Univ., Center for Space Physics, Boston, MA USA
The CUSP as a Source of Magnetospheric Particles
Fritz, Theodore A., Boston Univ., USA; Chen, Jiasheng, Boston Univ., USA; Radiation Measurements; 1999; ISSN 1350-4487; Volume 30, pp. 599-608; In English; Space Radiation Environment Modeling: New Phenomena and Approaches, 7-9 Oct. 1997, Moscow, Russia
Contract(s)/Grant(s): NAG5-2578; NAG5-7677; NAG5-7841; Copyright; Avail: Issuing Activity

Observations made by the Polar satellite have shown that plasma of solar wind magnetosheath origin is rammed into the high altitude polar cusp creating a diamagnetic cavity of large dimensions. The Earth's dipole field can be excluded from this region in it turbulent manner with the magnitude of the field strength reaching close to zero nT at times. At such times energetic particles are produced in this region in intensities which exceed those measured in the trapping regions of the magnetosphere beyond L = 6.5. These particles can then flow back out of the cusp along field lines that form the magnetopause. A fraction of these particles can enter the magnetosphere along the magnetopause on the dusk and dawn flanks. Due to existing gradients in the geomagnetic field, cusp accelerated ions can enter the magnetosphere along the dawn flank and electrons along the dusk flank. For those particles entering near the geomagnetic equatorial plane with pitch angles close to ninety degrees they will drift along contours of constant magnetic field strength reaching deep into the nightside inner magnetosphere. From observations made by the Polar ATS-6, and ISEE satellites it is argued that this cusp source appears to be capable of providing energetic ions to the magnetosphere and possibly energetic electrons which form the source population of the Subsequent radial diffusion and formation of the radiation belts.
Author
Energetic Particles; Geomagnetism; Magnetopause; Magnetosheath; Solar Terrestrial Interactions; Solar Activity Effects; Solar Wind

20000040062 Boston Univ., Center for Space Physics, Boston, MA USA
CUSP Energetic Particles: Confinement, Acceleration and Implications, *Jan. - Dec. 1999*
Chen, Jiasheng, Boston Univ., USA; [1999]; 3p; In English
Contract(s)/Grant(s): NAG5-7841; No Copyright; Avail: Issuing Activity; Abstract Only

The cusp energetic particle (CEP) event is a new magnetospheric phenomenon. The events were detected in the dayside cusp for hours, in which the measured helium ions had energies up to 8 MeV. All of these events were associated with a dramatic decrease and large fluctuations in the local magnetic field strength. During January 1999 - December 1999 covered by this report, I have studied the CEP events by analyzing the POLAR, GEOTAIL, and WIND particle and magnetic field data measured during the geomagnetic quiet periods in 1996 and one geomagnetic storm period in 1998. The simultaneous observations indicated that

the ion fluxes in the CEP events were higher than that in both the upstream and the downstream from the bow shock. The pitch angle distribution of the helium ions in the CEP events was found to peak around 90 deg. It was found that the mirror parameter, defined as the ratio of the square root of the integration of the parallel turbulent power spectral component over the ultra-low frequency (ULF) ranges to the mean field in the cusp, is correlated with the intensity of the cusp MeV helium flux, which is a measure of the influence of mirroring interactions and an indication of local effect. It was also found that the turbulent power of the local magnetic field in the ultra-low frequency (ULF) ranges is correlated with the intensity of the cusp energetic helium ions. Such ULF ranges correspond to periods of about 0.33-500 seconds that cover the gyroperiods, the bounce periods, and the drift periods of the tens keV to MeV charged particles when they are temporarily confined in the high-altitude dayside cusp. These observations represent a discovery that the high-altitude dayside cusp is a new acceleration and dynamic trapping region of the magnetosphere. The cusp geometry is connected via gradient and curvature drift of these energized ions to the equatorial plasma sheet as close as the geostationary orbit at local midnight. It implies that the dayside cusp is potentially an important source of magnetospheric particles. The discovery of the CEP events has been recognized as one of the most significant results from POLAR. I was invited to give a talk at 1999 IUGG meeting to interpret the CEP events. This discovery has also been written into the web-based Space Physics Text Book (http://www.oulu.fi/- spaceweb/textbook/cusp.html).
Author
Magnetic Fields; Magnetic Flux; Magnetic Storms; Earth Magnetosphere; Geomagnetism; Energetic Particles; Atmospheric Physics

20000040110 NASA Marshall Space Flight Center, Huntsville, AL USA
Far Ultraviolet Imaging from the Image Spacecraft
Mende, S. B., California Univ., USA; Heetderks, H., California Univ., USA; Frey, H. U., California Univ., USA; Lampton, M., California Univ., USA; Geller, S. P., California Univ., USA; Stock, J. M., California Univ., USA; Abiad, R., California Univ., USA; Siegmund, O. H. W., California Univ., USA; Tremsin, A. S., California Univ., USA; Habraken, S., Liege Univ., Belgium; [2000]; 1p; In English; Publilcation Spring AGU Meeting, 30 May - 3 Jun. 2000, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Direct imaging of the magnetosphere by the IMAGE spacecraft will be supplemented by observation of the global aurora. The IMAGE satellite instrument complement includes three Far Ultraviolet (FUV) instruments. The Wideband Imaging Camera (WIC) will provide broad band ultraviolet images of the aurora for maximum spatial and temporal resolution by imaging the LBH N2 bands of the aurora. The Spectrographic Imager (SI), a novel form of monochromatic imager, will image the aurora, filtered by wavelength. The proton-induced component of the aurora will be imaged separately by measuring the Doppler-shifted Lyman-a. Finally, the GEO instrument will observe the distribution of the geocoronal emission to obtain the neutral background density source for charge exchange in the magnetosphere. The FUV instrument complement looks radially outward from the rotating IMAGE satellite and, therefore, it spends only a short time observing the aurora and the Earth during each spin. to maximize photon collection efficiency and use efficiently the short time available for exposures the FUV auroral imagers WIC and SI both have wide fields of view and take data continuously as the auroral region proceeds through the field of view. To minimize data volume, the set of multiple images are electronically co-added by suitably shifting each image to compensate for the spacecraft rotation. In order to minimize resolution loss, the images have to be distort ion-corrected in real time. The distortion correction is accomplished using high speed look up tables that are pre-generated by least square fitting to polynomial functions by the on-orbit processor. The instruments were calibrated individually while on stationary platforms, mostly in vacuum chambers. Extensive ground-based testing was performed with visible and near UV simulators mounted on a rotating platform to emulate their performance on a rotating spacecraft.
Author
Far Ultraviolet Radiation; Imaging Techniques; Satellite Instruments; Earth Magnetosphere

20000040115 NASA Goddard Space Flight Center, Greenbelt, MD USA
Refinement of Models for VLBI Analysis
Ma, C., NASA Goddard Space Flight Center, USA; [1999]; 1p; In English, 12-18 Dec. 1999, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Continual refinement of models and estimation methods is an integral part of improving VLBI measurements of Earth orientation and position along with advances in instrumentation and observing strategy. The modeling of the troposphere continues to be challenging with recent improvements in treating the mean gradient and gradient variations affecting the terrestrial reference frame scale and celestial declinations near the current limits of accuracy. Revised models of nutation and solid Earth tides are implemented in CALC 9.0 to conform to the latest IERS Conventions along with other changes to facilitate use by VLBI correlators. Using data since 1995 the celestial reference frame has been extended and improved consistent with the definition and 0.25

mas accuracy limit of the ICRF. The current definition of the VLBI terrestrial reference frame places a floor on the accuracy of station velocities at the 0.4 mm/yr level. The establishment of the IVS (International VLBI Service for Geodesy and Astrometry) in the past year will provide a forum for further improvements of VLBI data analysis.
Author
Very Long Base Interferometry; Earth Orientation; Plasma Heating; Ion Cyclotron Radiation; Correlators

20000040119 NASA Marshall Space Flight Center, Huntsville, AL USA
POLAR Observations of Field Aligned O+ Flows at 5000 km Altitude Over the Polar Regions with Comparison to Auroral Images
Stevenson, B. A., Alabama Univ., USA; Horwitz, J. L., Alabama Univ., USA; Germany, G., Alabama Univ., USA; Craven, Paul D., NASA Marshall Space Flight Center, USA; Moore, Thomas E., NASA Goddard Space Flight Center, USA; Giles, B. L., NASA Goddard Space Flight Center, USA; Parks, G. K., Washington Univ., USA; Su, Y. J., Los Alamos National Lab., USA; [2000]; 1p; In English, 1 Jun. 2000, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Measurements of thermal 0+ ion parameters from the Thermal Ion Dynamics Experiment (TIDE) on POLAR obtained near 5000 km altitude are compared with auroral images from the Ultra Violet Imager (UVI), for southern perigee passes. Ion parameters, including parallel velocity, density, and flux are combined with multiple dayside and nightside auroral images to investigate relationships between O+ field aligned flows and the structure and brightness seen in the auroral forms. Results indicate field aligned upflowing O+ ions over regions of bright auroral activity and downward flows over dark regions. These and other relationships will be presented for several POLAR passes when both ion measurements and auroral images are observed under favorable conditions for comparison.
Author
Auroras; Ions; Polar Regions; Oxygen Ions; Field Aligned Currents

20000040790 NASA Johnson Space Center, Houston, TX USA
Preliminary Examination of Sahara 99555: Mineralogy and Experimental Studies of a New Angrite
Mikouchi, T., NASA Johnson Space Center, USA; McKay, G., NASA Johnson Space Center, USA; Le, L., Lockheed Martin Corp., USA; Mittlefehldt, D. W., Lockheed Martin Corp., USA; 2000; 2p; In English; 31st, 13-17 Mar. 2000, Houston, TX, USA; Sponsored by NASA, USA
Contract(s)/Grant(s): RTOP 344-31-00-05; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A 2710 g meteorite, Sahara 99555 (Sah99), was recently recovered from the Sahara and reported to be the 5th angrite. It is the largest angrite ever found and may offer useful information to better understand the unusual petrogeneses of this rare achondrite group. It may also allow us to examine the chronological record of igneous activity in the very early solar system. We obtained a 2.6 g chip of Sah99 and here present a preliminary report of its petrology and mineralogy in conjunction with a crystallization experiment on an analogue composition.
Derived from text
Meteorites; Mineralogy; Petrology; Achondrites

20000040791 Arizona Univ., Lunar and Planetary Lab., Tucson, AZ USA
Geochemical Constraints on Core Formation in the Earth
Jones, John H., Arizona Univ., USA; Drake, Michael J., Arizona Univ., USA; Nature; Jul. 17, 1986; Volume 322, pp. 221-228; In English; Geology Coloquium at Arizona State University, 19 Apr. 2000, Tempe, AZ, USA
Contract(s)/Grant(s): RTOP 344-31-00-05; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

New experimental data on the partitioning of siderophile and chalcophile elements among metallic and silicate phases may be used to constrain hypotheses of core formation in the Earth. Three current hypotheses can explain gross features of mantle geochemistry, but none predicts siderophile and chalcophile element abundances to within a factor of two of observed values. Either our understanding of metal-silicate interactions and/or our understanding of the early Earth requires revision.
Author
Earth Core; Geochemistry; Constraints; Earth Mantle; Chemical Composition

20000043158 NASA Marshall Space Flight Center, Huntsville, AL USA
Different Types of LLBL as Observed by Interball Tail Probe
Vaisberg, O. L., NASA Marshall Space Flight Center, USA; Smirnov, V. N., Space Research Center Kosmos, Russia; Avanov, L. A., Space Research Center Kosmos, Russia; Borodkova, N. L., Space Research Center Kosmos, Russia; Waite, J. H., Jr., Sout-

hwest Research Inst., USA; Burch, J. L., Southwest Research Inst., USA; Feb. 22, 2000; 14p; Revision, Feb. 22, 2000; In English; Original contains color illustrations; No Copyright; Avail: Issuing Activity

Interball-Tail probe is crossing dayside magnetopause during late winter-middle autumn months. High-latitude magnetopause is crossed on outbound orbit while low- latitude magnetopause is crossed on inbound orbit. We analyze 32 low-latitude magnetopause/LLBL crossings recorded in 1996 in fast mode of SCA-1 ion spectrometer. Data of MIF/FM-3 magnetometers and ELECTRON spectrometer are also used. Magnetopause/LLBL crossing are separated in 4 basic groups: 1. Magnetopause without a boundary layer (1 case); 2. Highly structured LLBL (14 cases), 3.Weakly-structured LLBL (15 cases), 4. LLBL at oscillating magnetopause (1 case). The highly-structured LLBL usually consists of short-time transients including fast-moving plasma as well as transients that are nearly stationary relative to the magnetospheric plasma. Observed ensemble of transients show evolution of plasma parameters from magnetosheath-like to magnetosphere-like. Fast-moving transients frequently have FTE magnetic signatures. This type of LLBL (Low Latitude Boundary Layer) is usually accompanied by different reconnection signatures, and is more frequently observed when IMF and/or magnetosheath magnetic field has negative Bz component. The weakly-structured LLBL shows significantly smaller variation of number density and higher plasma energy. Strong velocity shear is frequently observed at the magnetopause. Dispersed ion signatures and bursts of low-energy (ionospheric) ions are often seen within this type of LLBL indicating, the cusp reconnection. This type of LLBL has a tendency to occur at positive IMF and/or magnetosheath magnetic field Bz. Interball-Tail observations are compared to previous results and with different models of LLBL origin. Magnetopause without a boundary layer and LLBL at oscillating magnetopause are discussed elsewhere.
Author

Magnetopause; Boundary Layers; Space Probes; Space Plasmas; Tropical Regions

20000043159 NASA Marshall Space Flight Center, Huntsville, AL USA

Raman Lidar Measurements of Water Vapor and Cirrus Clouds During the Passage of Hurricane Bonnie

Whiteman, D. N., NASA Marshall Space Flight Center, USA; Evans, K. D., NASA Marshall Space Flight Center, USA; Demoz, B., NASA Marshall Space Flight Center, USA; Starr, O C., NASA Marshall Space Flight Center, USA; Tobin, D., NASA Marshall Space Flight Center, USA; Feltz, W., NASA Marshall Space Flight Center, USA; Jedlovec, G. J., NASA Marshall Space Flight Center, USA; Gutman, S. I., NASA Marshall Space Flight Center, USA; Schwemmer, G. K., NASA Marshall Space Flight Center, USA; Cadirola, M., NASA Marshall Space Flight Center, USA; Melfi, S. H., NASA Marshall Space Flight Center, USA; Schmidlin, F., NASA Marshall Space Flight Center, USA; [2000]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The NASA/GSFC Scanning Raman Lidar (SRL) was stationed on Andros Island in the Bahamas during August - September, 1998 as a part of the third Convection and Moisture Experiment (CAMEX-3) which focussed on hurricane development and tracking. During the period August 21 - 24, hurricane Bonnie passed near Andros Island and influenced the water vapor and cirrus cloud measurements acquired by the SRL. Two drying signatures related to the hurricane were recorded by the SRL and other sensors. Cirrus cloud optical depths (at 351 nm) were also measured during this period. Optical depth values ranged from approximately 0.01 to 1.4. The influence of multiple scattering on these optical depth measurements was studied with the conclusion that the measured values of optical depth are less than the actual value by up to 20%. The UV/lR cirrus cloud optical depth ratio was estimated based on a comparison of lidar and GOES measurements. Simple radiative transfer model calculations compared with GOES satellite brightness temperatures indicate that satellite radiances are significantly affected by the presence of cirrus clouds if IR optical depths are approximately 0.02 or greater. This has implications for satellite cirrus detection requirements.
Author

Cirrus Clouds; Hurricanes; Radar Measurement; Water Vapor; Optical Radar

20000043992 NASA Marshall Space Flight Center, Huntsville, AL USA

Near-Simultaneous POLAR and DMSP Measurements of Topside Ionospheric Up and Down Flows at High Latitudes

Zeng, W., Alabama Univ., USA; Horwitz, J. L., Alabama Univ., USA; Stevenson, B. A., Alabama Univ., USA; Wu, X., Alabama Univ., USA; Su, Y.–J., Los Alamos National Lab., USA; Craven, Paul D., NASA Marshall Space Flight Center, USA; Rich, F. J., Air Force Research Lab., USA; Moore, Thomas E., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English, 1 Jun. 2000, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We will present what we believe to be the first reported observations of up- and downflows of topside ionospheric thermal plasmas from multiple near-simultaneous tracks through the high-latitude topside ionosphere. From several Southern polar passes, it has been possible to construct plots of field-aligned flows of 0+ observed by the Thermal Ion Dynamics Experiment(TIDE) on the POLAR spacecraft near 5000 km altitude together with vertical ion flow observations from one or more DMSP spacecraft near 800 km altitude. These observations provide a glimpse of the wide-spread upward and downward ionospheric ion flows over the broad polar region along multiple distinct satellite tracks. For the instances where DMSP and POLAR cross nearly

the same field lines at the 800 and 5000 kin altitudes, we will show ion parameter measurements at these to altitudes in comparison to Dynamic Fluid-Kinetic(DyFK) transport simulations of anticipated altitude profiles of these parameters.
Author
DMSP Satellites; Flow Distribution; Thermal Plasmas; Polar Regions; Earth Ionosphere

20000044097 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Standar Atmosfer Puslitbang Pengetahuan Atmosfer, Jakarta, Indonesia
The Existence of Kelvin-Atmosphere Waves Above Bandung ***Keberadaan Gelombang Kelvin-Atmosfer di atas Bandung***
Wirasamita, Mulyana, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Tjasyono, Bayong H. K., Institute of Technology Badang, Indonesia; Maulana, Moch. Erwin, Institute of Technology Badang, Indonesia; Majalah LAPAN; July - September 1999; Volume 1, No. 3, pp. 41-48; In Malay-Indonesian; See also 20000044092; Copyright; Avail: Issuing Activity

The research of climate disturbances by using radiosonde data in stratosphere needs to be developed. The atmospheric disturbance which was analysed is the wave. Setting meridional wind component to zero, the zonal component will give a disturbance which propagates the phase eastward, the amplitude decreases exponentially out of the equator, and energy is propagated eastward and upward. The disturbance is called the Kelvin wave. Analysing radiosonde data obtained from soundings at LAPAN Bandung (6.90 S, 107.600 E) for three months (April - June 1994), it is found there are two dominant periods of Kelvin waves at 50 mb and 30 mb level with the period of zonal wind of 10.5 and 11.6 days, respectively.
Author
Kelvin Waves; Meridional Flow; Atmospheric Circulation; Equatorial Atmosphere; Tropical Regions

20000044346 NASA Langley Research Center, Hampton, VA USA
The Ceres S'COOL Project: Two Years After First Launch
Chambers, Lin H., NASA Langley Research Center, USA; Young, David F., NASA Langley Research Center, USA; Green, Carolyn J., Science Applications International Corp., USA; Haberer, Susan J., Computer Sciences Corp., USA; Racel, Anne M., Computer Sciences Corp., USA; [2000]; 4p; In English; Ninth Symposium on Education, 9-14 Jan. 2000, Long Beach, CA, USA; Sponsored by American Meteorological Society, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The idea for the Students' Cloud Observations OnLine (S'COOL) project as an outreach and education element of NASA's Clouds and the Earth's Radiant Energy System (CERES) research program was conceived in late 1996 during a conversation with a middle school science teacher. S'COOL was implemented in a series of increasingly developed test phases during 1997, as the launch of the first CERES instrument approached. Even before launch, the reception of the project in schools far exceeded expectations. After several delays the first instrument, on the Tropical Rainfall Measuring Mission (TRMM) spacecraft, was launched on Thanksgiving Day, 1997. Since the first launch, development and expansion of the project has continued with expectations for launch of Terra carrying two CERES instruments into a polar orbit in mid-1998. That launch is now expected in fall 1999, and will finally provide overflight of all participating schools. In two years, the project has grown from three initial test participants to over 300 schools now participating in 23 countries on five continents. Students from first grade through university level are involved (most participants are ages 10-15). S'COOL is also being used by a few education professors to teach about Internet use in the classroom. The project continues to grow through word of mouth, presentations at teacher workshops, and now increasingly through teachers who find it during web searches. Participants in the S'COOL project are part of the CERES validation team. They provide ground truth measurements at the time the CERES instrument flies over their location, to be compared with the retrieval of cloud properties by remote sensing from CERES. Quantities reported include cloud type, height, fraction and opacity; information on contrails; surface temperature, pressure and relative humidity; and ground cover (snow/ice, wet, dry; leaves on trees or not). in addition, a comment field on the report form serves as a catch-all for all kinds of interesting observations, including similes written by some classes to describe more exactly the clouds they see. Several not totally unexpected complications with the CERES instrument and processing software mean that the CERES team has not yet reached the point of computing the cloud properties, a high level product at the end of the processing stream. However, progress is being made and we anticipate that we will soon be populating the S'COOL database with a large number of satellite retrievals for comparison with the students' observations. Some satellite retrievals from the initial test phases are already available in the database, The CERES instruments are planned to operate at least through 2006, and the S'COOL Project is planned to continue at least that long, providing motivational learning to as many students as possible. This paper reports on the first several years of the S'CCOL project. It further reports on some of the noteworthy observations and comparisons made possible by this project. Schools are often located in interesting places, in terms of the clouds found there and the satellite's ability to observe these clouds. The paper also reports on the learning

opportunities delivered by this project, and on new questions about the planet and its climate which arise in the students' minds as a result of their active participation.
Author
Cloud Physics; Clouds (Meteorology); Education; Schools; Cloud Cover; NASA Programs

20000044645 Texas Univ. at Dallas, Physics Program, Richardson, TX USA
Singular Plasma Disturbance in the Low-Latitude F Region
Singh, Sardul, Texas Univ. at Dallas, USA; Johnson, F. S., Texas Univ. at Dallas, USA; Heelis, R. A., Texas Univ. at Dallas, USA; Journal of Geophysical Research; Mar. 01, 1999; ISSN 0148-0227; Volume 104, No. A3, pp. 4337-4350; In English; Sponsored in part by the Welch Foundation
Contract(s)/Grant(s): NAG5-4465; NSF ATM-96-15064
Report No.(s): Paper-1998JA900061; Copyright; Avail: Issuing Activity

We describe here a new phenomenon characterized by unusual patterns of ion drifts inside ion density depletion regions observed by the AE-E satellite in the low-latitude F region. In about 30 depletions, vertical ion drift relative to the background was upward on the western sides, downward on the eastern sides, and zero near the middle where the density depletion was greatest. These drift characteristics are distinct from those observed in plasma bubble depletions. The structures reported here were observed on circular orbits below 300 km altitude and had density depletions of up to 2 orders of magnitude or more below the ambient ion density. The upward and downward drift excursions were up to 200 m/s relative to the background. Almost all these structures were observed over oceans or near coasts and largely between +/- 10 deg and +/- 30 deg clip latitude. The structures were observed mostly as isolated, single depletion regions with the majority of them about 250 km wide in the east-west direction. They occurred during quiet magnetic conditions with near-equal occurrence frequencies in the premidnight and postmidnight periods. The characteristic density and drift signatures indicate westward propagating disturbances in which the bottomside F layer is first lifted and then returned back to its original position, leaving the ionosphere undisturbed after the disturbance passes by. The estimated speed of these disturbances is of the order of 200 m/s. These unique solitary plasma disturbances, which we designate as singular plasma disturbances, are associated with a propagating source of E x B drift, not driven by neutral perturbations at the altitude of observation.
Author
Plasmas (Physics); Plasma Bubbles; F Region; Plasma Density; Plasma Drift; Depletion; Ion Density (Concentration)

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification

20000038330 Hokkaido Univ., Div. of Earth and Planetary Sciences (Geophysics), Sapporo, Japan
Microphysical Process of Snowfall Formation in Orographic Areas
Harimaya, Toshio, Hokkaido Univ., Japan; Murai, Shigeki, Hokkaido Univ., Japan; Hashimoto, Akihiro, Hokkaido Univ., Japan; Geophysical Bulletin of Hokkaido University; March 2000; ISSN 0439-3503, No. 63, pp. 1-14; In Japanese; Copyright; Avail: Issuing Activity

Observations of orographic snowfall were carried out at Sagurigawa-dam in Niigata Prefecture, Japan in January 1997. Specially, the riming amount collected by ice crystals was measured as the riming proportion, and the relationships of riming proportion to the snowfall intensity, wind velocity and liquid water content were investigated. The riming growth process was found to be predominant in the snowfall formation in orographic areas of Japan facing the Japan Sea during winter. The degree of contribution was related to the strength of the winter monsoon, and the riming proportion became greater with increase in wind speed at 850hPa. The above results were-analyzed in detail. It was shown that the riming proportion was higher in the case of a strong wind under the condition of a constant ice crystal intensity. In the figure in which the abscissa represents the wind speed on the ground and the ordinate represents the riming proportion, the lower limit of the riming proportion tended to increase with increase in wind speed. The lower limit shows the amounts of cloud droplets newly formed by the topographic updraft when the advection effect of cloud droplets was subtracted. The liquid water content in snow clouds became less with increase in the ice crystal intensity under the condition of constant wind speed. The liquid water content in snow clouds became greater with increase in wind speed under the condition of constant ice crystal intensity. The increase ratio of liquid water content in snow cloud became greater with increase in wind speed under the condition of less ice crystal intensity. Therefore, the observations showed quantitatively that the

liquid water content in snow clouds depended on both the production rates of cloud droplets and the ice crystal intensity. The results solidified the foundation of artificial seeding experiments conducted in orographic areas.
Author
Orography; Snow; Topography; Geophysics; Meteorology

20000038739 Kyushu Univ., Graduate School of Engineering, Fukuoka, Japan
Analyses of Local Thunderstorms Using the Present Meteorological Observational Systems
Nishiyama, Koji, Kyushu Univ., Japan; Jinno, Kenji, Kyushu Univ., Japan; Wakimizu, Kenji, Kyushu Univ., Japan; Suzuki, Yoshinori, Kyushu Univ., Japan; Imatani, Kazumichi, Kyushu Univ., Japan; Haneda, Takashi, Kyushu Univ., Japan; Matsubayashi, Yoshinori, Kyushu Univ., Japan; Technology Reports of Kyushu University; March 2000; ISSN 0023-2718; Volume 73, No. 2, pp. 203-211; In Japanese; Copyright; Avail: Issuing Activity

A heavy local thunderstorm occurred in the south of the Fukuoka urban area oil August 8, 1996, under the influence of the Pacific high pressure. The environment in which the thunderstorm occurred was investigated using the present observational systems (AMeDAS and upper air observation measured routinely by Japan Meteorological Agency) based on the meteorological radar equipped at Kyushu University, The observation shows that before the heavy rain, mixing layer developed and the atmosphere above Fukuoka became more and more unstable with increasing in temperature near surface due to sun radiation and the subsequent sea breeze intruded into the urban area of Fukuoka from Genkai sea. These observational facts mean that AMeDAS and upper air observational system may have the possibility to specify the area and the time range of a local thunderstorm in summer. Therefore, a local thunderstorm may be predicted using the present observational networks without special observation.
Author
Thunderstorms; Research; Mixing Layers (Fluids); Upper Atmosphere

20000038754 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Some Theoretical and Experimental Aspects of the Surface Layer Above the "Pantanal Matogrossense" ***Alguns Aspectos Teoricos e Experimentais da Camada Limite Superficial Acima do Pananal Matogrossense***
Filho, Edson Pereira Marques, Instituto Nacional de Pesquisas Espacias, Brazil; 2000; 160p; In Portuguese
Contract(s)/Grant(s): CNPq-139.164/96-0; CNPq-300329/96-2; CNPq-381699/97-8; FAESP Proj. 98/00105-5; FAESP Proj. 98/11246-9
Report No.(s): INPE-7501-TDI/716; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

In this study data was used from the micrometeorological tower located at Miranda city (19 deg 6 min S 57 deg 0 W), in the Pantanal Matogrossense, in order to characterize aspects of the structure of turbulence in the atmospheric boundary layer, in the transition period between wet and dry seasons. The Wavelet Transform was used in the analysis of the turbulent signals, which allowed the high-pass filtering of the turbulent data and the obtained time-scale diagrams showed interesting aspects of the variability of covariance contribution to turbulent fluxes in different scales. It is possible that the semi-flooded Pantanal characteristics favor the presence of local circulations, and as a consequence, low-frequency fluctuations, makes difficult to define accurately the spectral flaw and the separation between the average and turbulent fluctuation. The data taken from the slow response instruments showed some discrepancy compared to the relations established by the Monin-Obukov Similarity Theory, specially concerning the momentum exchanges under unstable conditions, probably due to the transition sublayer. The data measured from fast response instruments, taken above the transition sublayer, presented good agreement compared to the parameterizations of turbulent momentum of second order. The complex characteristics of the terrain were not totally isotropic and the displacement height of the zero-plane, calculated by the De-Bruin and Verhoef method, changed according to the average wind direction. The information given by the turbulent spectra of the horizontal components of velocity allowed a good estimation of the mixed layer height for unstable conditions, utilizing the methodology proposed by Liu and Ohtaki.
Author
Atmospheric Boundary Layer; Boundary Layer Flow; Boundary Layer Transition; Turbulent Boundary Layer; Turbulence; Turbulent Flow

20000039361 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Global Precipitation Mission
Braun, Scott, NASA Goddard Space Flight Center, USA; Kummerow, Christian, NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; USWRP Science Symposium, 27-29 Mar. 2000, Boulder, CO, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Global Precipitation Mission (GPM), expected to begin around 2006, is a follow-up to the Tropical Rainfall Measuring Mission (TRMM). Unlike TRMM, which primarily samples the tropics, GPM will sample both the tropics and mid-latitudes. The

primary, or core, satellite will be a single, enhanced TRMM satellite that can quantify the 3-D spatial distributions of precipitation and its associated latent heat release. The core satellite will be complemented by a constellation of very small and inexpensive drones with passive microwave instruments that will sample the rainfall with sufficient frequency to be not only of climate interest, but also have local, short-term impacts by providing global rainfall coverage at approx. 3 h intervals. The data is expected to have substantial impact upon quantitative precipitation estimation/forecasting and data assimilation into global and mesoscale numerical models. Based upon previous studies of rainfall data assimilation, GPM is expected to lead to significant improvements in forecasts of extratropical and tropical cyclones. For example, GPM rainfall data can provide improved initialization of frontal systems over the Pacific and Atlantic Oceans. The purpose of this talk is to provide information about GPM to the USWRP (U.S. Weather Research Program) community and to discuss impacts on quantitative precipitation estimation/forecasting and data assimilation.
Author
Precipitation (Meteorology); Tropical Regions; Temperate Regions; Weather Forecasting

20000039364 Science Systems and Applications, Inc., Greenbelt, MD USA
The Impact of Sea-Surface Winds on Meteorological Conditions in Israel: An Initial Study
Otterman, J., NASA Goddard Space Flight Center, USA; Saaroni, H., Tel-Aviv Univ., Ramat-Aviv, Israel; Atlas, R., NASA Goddard Space Flight Center, USA; Ardizzone, J., General Sciences Corp., USA; Ben–Dor, E., Tel-Aviv Univ., Ramat-Aviv, Israel; Druyan, L., NASA Goddard Space Flight Center, USA; Jusem, C. J., General Sciences Corp., USA; Karnieli, A., Ben Gurion Univ. of the Negev, Israel; Terry, J., General Sciences Corp., USA; [2000]; 1p; In English, Mar. 2000, Lihron Yaacov, Israel; Sponsored by Congress of the Israel Meteorological Society, Israel; No Copyright; Avail: Issuing Activity; Abstract Only

The SSM/I (Spectral Sensor Microwave Imager) dataset is used to monitor surface wind speed and direction at four locations over the Eastern Mediterranean during December 1998 - January 1999. Time series of these data are compared to concurrent series of precipitation, surface temperature, humidity and winds at selected Israeli stations: Sde Dov (coastal), Bet Dagan (5 km. inland), Jerusalem (Judean Hills), Hafetz Haim (3 km. inland) and Sde Boker (central Negev). December 1998 and the beginning of January 1999 were dry in Israel, but significant precipitation was recorded at many stations during the second half of January (1999). SSM/I data show a surge in westerly surface winds west of Israel (32 N, 32.5 E) on 15 January, coinciding with the renewal of precipitation. We discuss the relevant circulation and pressure patterns during this transition in the context of the evolving meteorological conditions at the selected Israeli locations. The SSM/I dataset of near ocean surface winds, available for the last 12 years, is described. We analyze lagged correlation between these data and the Israeli station data and investigate possibility of predictive skill. Application of such relationships to short-term weather prediction would require real-time access to the SSM/I observations. Author
Israel; Ocean Surface; Wind (Meteorology); Meteorological Parameters; Precipitation (Meteorology)

20000040059 Geological Survey, Water Resources Div., Columbus, OH USA
Floods of June 28-29, 1998 in Ohio
Koltun, G. F.; 1999; 32p; In English; Original contains color illustrations
Report No.(s): PB2000-103126; USGS/WRI-99-4192; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Storms during June 26-30, 1998, resulted in flooding and widespread damage throughout much of central, east-central, and southeastern Ohio. This report describes the floods that occurred in Ohio in late June 1998. Peak-streamflow, estimated recurrence interval and (or) high-water elevation or stage data are presented for selected locations within the State. The meteorologic factors contributing to the floods are described, and information is provided on the resulting damages.
NTIS
Floods; Damage; Estimating; Storms

20000040107 NASA Goddard Space Flight Center, Greenbelt, MD USA
Application of a Reduced Order Kalman Filter to Initialize a Coupled Atmosphere-Ocean Model: Impact on the Prediction of El Nino
Ballabrera–Poy, J., NASA Goddard Space Flight Center, USA; Busalacchi, A., NASA Goddard Space Flight Center, USA; Murtugudde, R., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A reduced order Kalman Filter, based on a simplification of the Singular Evolutive Extended Kalman (SEEK) filter equations, is used to assimilate observed fields of the surface wind stress, sea surface temperature and sea level into the nonlinear coupled ocean-atmosphere model of Zebiak and Cane. The SEEK filter projects the Kalman Filter equations onto a subspace defined by the eigenvalue decomposition of the error forecast matrix, allowing its application to high dimensional systems. The Zebiak and

Cane model couples a linear reduced gravity ocean model with a single vertical mode atmospheric model of Zebiak. The compatibility between the simplified physics of the model and each observed variable is studied separately and together. The results show the ability of the model to represent the simultaneous value of the wind stress, SST and sea level, when the fields are limited to the latitude band 10 deg S - 10 deg N In this first application of the Kalman Filter to a coupled ocean-atmosphere prediction model, the sea level fields are assimilated in terms of the Kelvin and Rossby modes of the thermocline depth anomaly. An estimation of the error of these modes is derived from the projection of an estimation of the sea level error over such modes. This method gives a value of 12 for the error of the Kelvin amplitude, and 6 m of error for the Rossby component of the thermocline depth. The ability of the method to reconstruct the state of the equatorial Pacific and predict its time evolution is demonstrated. The method is shown to be quite robust for predictions up to six months, and able to predict the onset of the 1997 warm event fifteen months before its occurrence.
Author
Wind Shear; Shear Stress; Sea Surface Temperature; Ocean Models; Forecasting; Error Analysis; Atmospheric Models; Air Water Interactions

20000040120 NASA Goddard Space Flight Center, Greenbelt, MD USA
MHD-Based Specification of Magnetotail Plasma and Fields: Possibilities and Limitations
Hesse, M., NASA Goddard Space Flight Center, USA; Birn, J., Los Alamos National Lab., USA; [2000]; 1p; In English; Chapman Conference on Space Weather, Clearwater, FL, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Magnetohydrodynamics (MHD) constitutes the simplest comprehensive and self-consistent formulation of the properties of space plasmas. As such, it has been applied with large success to the dynamics of solar system plasmas. For the nightside region of the Earth, the magnetotail, MHD simulations have led to new understanding of the structure and dynamics of the plasmas, in response to both changes in boundary conditions as well as internal dynamical processes. As a result, substantial knowledge of the structure and dynamics of the nightside region have been accumulated. In basic MHD conservation laws on magnetospheric structure, as well as the role of non-MHD processes in the initiation and evolution of dynamical processes of the magnetotail. This presentation will consist of three parts, the first of which addresses the basic constraints on magnetotail structure as well as their consequences for magnetotail specification and forecasting. We will then review some examples of magnetotail structural changes brought about by solar-wind-like boundary conditions. Last, we consider the role of non-MHD processes in magnetotail specification and forecasting. The emphasis here will be on inclusion of these processes into MHD models, and their impact on the overall structure and dynamics.
Author
Plasmas (Physics); Magnetohydrodynamics; Specifications; Plasma Dynamics; Solar Wind; Geomagnetic Tail

20000040165 NASA Goddard Space Flight Center, Greenbelt, MD USA
Methods of Attenuation Correction for the TRMM Precipitation Radar Data
Meneghini, Robert, NASA Goddard Space Flight Center, USA; Iguchi, Toshio, Communications Research Lab., Japan; Kozu, Toshiaki, Communications Research Lab., Japan; Okamoto, Kenichi, Communications Research Lab., Japan; Jones, Jeffrey, HSTX, USA; Liao, Liang, Caelum Research Corp., USA; [2000]; 1p; In English; 26th; 26th General Assembly of the International Union of Radio Science, 15-20 Aug. 1999, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The surface reference technique (SRT) has been studied extensively both theoretically and experimentally over the last decade. It is only with the launch of the Tropical Rain Measuring Mission (TRMM) Precipitation Radar, however, that we can begin to test directly whether the technique provides a reliable means of attenuation correction for spaceborne weather radars. Preliminary results indicate that the method yields results that are qualitatively reasonable when the rain rate is moderate or high and when the surface provides a stable reference value. The structure of the normalized radar cross section of the surface (NRCS), however, is highly complex in the sense that the statistics change with background type, incidence angle, location, and season. As a consequence of this, the reliability of the path attenuation estimate is not proportional simply to the amount of rain attenuation but to the rain attenuation relative to the inherent variability of the reference target. To illustrate the behavior of the SRT, several overpasses of the Hurricane Bonnie are shown. We also show that the proper choice of reference data set (spatial, temporal and global) can be critical to the success of the method.
Derived from text
Meteorological Radar; Tropical Regions; Rain; Radar Data; Precipitation (Meteorology)

20000040170 NASA Marshall Space Flight Center, Huntsville, AL USA

Lightning Activity within a Tornadic Thunderstorm Observed by the Optical Transient Detector (OTD)

Buechler, D. E., Alabama Univ., USA; Driscoll, K. T., Alabama Univ., USA; Goodman, S. J., NASA Marshall Space Flight Center, USA; Christian, H. J., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The first storm-scale, total lightning observations during tornadogenesis from space are presented. The NASA (National Aeronautics and Space Administration) OTD (Optical Transient Detector) overpass of an Oklahoma supercell, just minutes prior to tornado touchdown on 17 April 1995, detected a lightning flash rate of 45 flashes/ min. The total lighting activity was at least 15 times greater than the cloud-to-ground lightning activity detected by the National Lightning Detection Network (NLDN), indicating most of the lightning was intracloud. Total lightning rates were decreasing rapidly prior to tornadic touchdown. These observations are consistent with the limited results from recent ground based measurements of total lightning activity in tornadic storms, suggesting significant intracloud lightning and rapidly decreasing flash rates prior to tornado touchdown.

Author

Lightning; Tornadoes; Thunderstorms; Detection

20000043164 Meteorological Satellite Center, Kiyose, Japan

Monthly Report of the Meteorological Satellite Center: January 2000

January 2000; 1p; In English; CD-ROM conforms to the ISO 9660 standard for volume and file structure; Copyright; Avail: Issuing Activity

The CD-ROM concerning the January 1999 Monthly Report of the Meteorological Satellite Center (MSC) contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the Polar Orbital Meteorological Satellites operated by NOAA. The CD-ROM contains the following observation data: Full Disk Earth's Cloud Image; Cloud Image of Japan and its vicinity; Cloud Amount; Sea Surface Temperature; Cloud Motion Wind; Water Vapor Motion Wind; Equivalent Blackbody Temperature; OLR (Out-going Longwave Radiation), Solar Radiation; Snow and Ice Index; Orbit Data; Attitude Data; VISSR Image Data Catalog (Cartridge Magnetic Tape (CMT), Micro Film); TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water; and TOVS Total Ozone Amount.

Derived from text

Satellite Observation; Satellite Sounding; Atmospheric Sounding; Meteorological Parameters; Satellite Imagery; Japan

20000043534 Meteorological Satellite Center, Kiyose, Japan

Monthly Report of the Meteorological Satellite Center: December 1999

December 1999; 1p; In English; CD-ROM conforms to the ISO 9660 standard for volume and file structure; Copyright; Avail: Issuing Activity

The CD-ROM concerning the December 1999 Monthly Report of the Meteorological Satellite Center (MSC) contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the Polar Orbital Meteorological Satellites operated by NOAA. The CD-ROM contains the following observation data: Full Disk Earth's Cloud Image; Cloud Image of Japan and its vicinity; Cloud Amount; Sea Surface Temperature; Cloud Motion Wind; Water Vapor Motion Wind; Equivalent Blackbody Temperature; OLR (Out-going Longwave Radiation), Solar Radiation; Snow and Ice Index; Orbit Data; Attitude Data; VISSR Image Data Catalog (Cartridge Magnetic Tape (CMT), Micro Film); TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water; and TOVS Total Ozone Amount.

Derived from text

Satellite Observation; Satellite Sounding; Atmospheric Sounding; Meteorological Parameters; Satellite Imagery; Japan

20000043546 Meteorological Satellite Center, Kiyose, Japan

Monthly Report of the Meteorological Satellite Center: November 1999

November 1999; 1p; In English; CD-ROM conforms to the ISO 9660 standard for volume and file structure; Copyright; Avail: Issuing Activity

The CD-ROM concerning the November 1999 Monthly Report of the Meteorological Satellite Center (MSC) contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the Polar Orbital Meteorological Satellites operated by NOAA. The CD-ROM contains the following observation data: Full Disk Earth's Cloud Image; Cloud Image of Japan and its vicinity; Cloud Amount; Sea Surface Temperature; Cloud Motion Wind; Water Vapor Motion Wind; Equivalent Blackbody Temperature; OLR (Out-going Longwave Radiation), Solar Radiation; Snow and Ice Index; Orbit Data; Attitude

Data; VISSR Image Data Catalog (Cartridge Magnetic Tape (CMT), Micro Film); TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water; and TOVS Total Ozone Amount.
Derived from text
Satellite Observation; Satellite Sounding; Atmospheric Sounding; Meteorological Parameters; Satellite Imagery; Japan

20000043547 Meteorological Satellite Center, Kiyose, Japan
Monthly Report of the Meteorological Satellite Center: August 1999
August 1999; 1p; In English; CD-ROM conforms to the ISO 9660 standard for volume and file structure; Copyright; Avail: Issuing Activity

The CD-ROM concerning the August 1999 Monthly Report of the Meteorological Satellite Center (MSC) contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the Polar Orbital Meteorological Satellites operated by NOAA. The CD-ROM contains the following observation data: Full Disk Earth's Cloud Image; Cloud Image of Japan and its vicinity; Cloud Amount; Sea Surface Temperature; Cloud Motion Wind; Water Vapor Motion Wind; Equivalent Blackbody Temperature; OLR (Out-going Longwave Radiation), Solar Radiation; Snow and Ice Index; Orbit Data; Attitude Data; VISSR Image Data Catalog (Cartridge Magnetic Tape (CMT), Micro Film); TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water; and TOVS Total Ozone Amount.
Derived from text
Satellite Observation; Satellite Sounding; Atmospheric Sounding; Meteorological Parameters; Satellite Imagery; Japan

20000044007 Naval Surface Warfare Center, Hydromechanics Directorate, Bethesda, MD USA
A Study of Singapore Harbor-Changi Airport Wave Climatology as Determined by a New Coastal Wave Model ***Final Report, Oct. 1999 - Mar. 2000***
Lin, Ray Q., Naval Surface Warfare Center, USA; Silver, Andrew L., Naval Surface Warfare Center, USA; Mar. 2000; 32p; In English
Report No.(s): AD-A375608; NSWCCD-50-TR-2000/015; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

A study of the wave climatology at Singapore Harbor near Changi Airport is presented to aid in determining the safety of US Navy ships in the area. Since Major wave events in Singapore Harbor mostly occur during the Northeast Monsoon season (November - March), our study focuses on this period. In order to choose a suitable wave model to generate the climatology , a comparison of results between the State-of-Art Wave Model (WAM) and the New Coastal Wave Model (WM) during the period of December 11, 1985 and Jan 13, 1986 was preformed. In deep water, the difference between the results of the two models is not significant. However,in shallow water the results differ significantly. The significant wave height at Singapore Harbor calculated by the NCWM is about 3 times greater than at calculated by AM. The buoy data agree well with the NCWM Model results. As Lin and Huan (1996b) pointed out, WAM misrepresents the coastal-trapped waves. The coastal trapped waves are highly dependent on both wave-current and wave-wave interactions. Based on the above test, the NCWM was chosen to generate the wave climatology. The wind input and current distribution for the model are based on thirty years of data. The climatology shows that the highest an longest waves occur during the month of February.
DTIC
Ocean Currents; Climatology; Ocean Models; Ocean Dynamics; Ocean Surface; Tidal Waves

20000044096 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Matahari dan Lingkungan Antariksa, Jakarta, Indonesia
Effects of Solar Luminosity Variations on Global Equator SSTs and Surface Air Temperature in Indonesia ***Pengaruh Variasi Luminositas Matahari Pada SST Ekuator Global dan Temperatur Udara Permukaan di Indonesia***
Sinambela, Wilson, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Kilowasid, L. Muh. Musafar, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Cahyono, Waluyo Eko, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; July - September 1999; Volume 1, No. 3, pp. 26-40; In Malay-Indonesian; See also 20000044092; Copyright; Avail: Issuing Activity

By analyzing the data of Sea Surface mean Temperature (SST) at the global equator and mean surface air temperature of the Ambon and Padang and comparing with data of solar luminosity variations during the period (1978 - 1992), we obtained an obvious effect of solar luminosity variations on the SST at the global equator, and on surface air temperature in Indonesia. The influence of long-term solar luminosity variations to the SST is not as strong, with a correlation coefficient 0.58, while the influence to surface air temperature of Ambon and Padang are very strong with correlation coefficient 0.94, and 0.86 respectively.

Besides the influence of solar luminosity variations, the influence of seasons, and the ENSO Phenomena on the SST of global equator and surface air temperature in Indonesia is also examined.
Author
Atmospheric Temperature; Indonesia; Luminescence; Sea Surface Temperature; Solar Radiation; Luminosity

20000044102 Lembaga Penerbangan dan Antariksa Nasional, Jakarta, Indonesia
Wind Variability Based on 1357.5 MHz Boundary Layer Radar Observations in Serpong ***Variabilitas angin berdasarkan pengamatan radar boundary layer 1357.5 Mhz di Serpong***
Widiyatmi, Ipuk, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Wirasasmita, Mulyana, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Hashiguchi, Hiroyuki, Kyoto Univ., Japan; Fukao, Shoichiro, Kyoto Univ., Japan; Hamada, Junichi, Kyoto Univ., Japan; Yamanaka, Manabu D., Kobe Univ., Japan; Wiryosumarto, Harsono, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Harijono, Sri Woro B., Badan Pengkajian dan Penerapan Teknologi, Indonesia; Majalah LAPAN; April 1999; Volume 1, No. 2, pp. 44-52; In Malay-Indonesian; See also 20000044098; Copyright; Avail: Issuing Activity

A spectral analyses of wind variability based on the Boundary Layer Radar observation at Serpong revealed daily, four day, 30 - 60 day and annual variations. The daily variation is associated with sea - land breeze circulation, the four day variation is associated with Rossby - gravity wave like disturbance, the 30 - 60 day is associated with Kelvin wave like disturbance and the annual variation is associated with the alternation between an Indian ocean monsoon and the Pacific trade wind.
Author
Boundary Layers; Radar Tracking; Wind Variations; Spectrum Analysis; Atmospheric Circulation

20000044321 NASA Marshall Space Flight Center, Huntsville, AL USA
Water Vapor Transport Over the Tropical Oceans During ENSO as Diagnosed from TRMM and SSM/I Data
Robertson, Franklin R., NASA Marshall Space Flight Center, USA; Smith, Eric A., NASA Marshall Space Flight Center, USA; Sohn, Byung–Ju, Seoul National Univ., Korea, Republic of; [2000]; 1p; In English, 30 May - 3 Jun. 2000, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Traditionally, large-scale water vapor transport [div Q] has been derived directly from circulation statistics in which transport processes are often depicted by mean and eddy motions. Thus detailed and accurate calculations of moisture transport terms over the globe are required. Notably, the lack of systematically spaced conventional measurements of meteorological variables over oceans has hindered understanding of the distribution and transport of water vapor. This motivates the use of indirect calculation methods in which horizontal divergence of water vapor is balanced by the evaporation minus precipitation, assuming the rate of changes of precipitable water and condensates is small over a sufficiently long time period. In order to obtain the water vapor transport, we need evaporation rate minus precipitation (E-P). Focussing on the differences in water vapor transport between El Nino and La Nina periods and their influences on atmospheric circulations, we study January, February, and March of 1998 and 1999 periods which represent El Nino and La Nina respectively. SSM/I-derived precipitation and evaporation rate from SSM/I wind and total precipitable water, in conjunction with NCEP SST and surface air temperature, are used for the calculation of the transport potential function. For the retrieval of evaporation we use a stability-dependent aerodynamic bulk scheme developed by Chou (1993). It was tested against aircraft covariance fluxes measured during cold air outbreaks over the North Atlantic Ocean. Chou et al. (1997) reported that the SSM/I retrieved latent heat flux over the western Pacific warm pool area were found to be comparable with daily mean fluxes of a ship measurements during TOGA/COARE.
Derived from text
Water Vapor; Atlantic Ocean; Condensates; Evaporation Rate; Meteorological Parameters; Microwave Imagery; Vortices

20000044331 NASA Marshall Space Flight Center, Huntsville, AL USA
On The Bimodality of ENSO Cycle Extremes
Wilson, Robert M., NASA Marshall Space Flight Center, USA; February 2000; 1p; In English
Report No.(s): NASA/TP-2000-209961; NAS 1.60:209961; M-965; No Copyright; Avail: Issuing Activity; Abstract Only

On the basis of sea surface temperature in the El Nino 3.4 region (5N.-5S., 120-170W.) during the interval of 1950-1997, Kevin Trenberth previously has identified some 16 El Nino and 10 La Nina, these 26 events representing the extremes of the quasi-periodic El Nino-Southern Oscillation (ENSO) cycle. Runs testing shows that the duration, recurrence period, and sequencing of these extremes vary randomly. Hence, the decade of the 1990's, especially for El Nino, is not significantly different from that of previous decadal epochs, at least, on the basis of the frequency of onsets of ENSO extremes. Additionally, the distribution of duration for both El Nino and La Nina looks strikingly bimodal, each consisting of two preferred modes, about 8- and 16-months long for El Nino and about 9- and 18-months long for La Nina, as does the distribution of the recurrence period for El Nino, consisting of two preferred modes about 21- and 50- mo long. Scatterplots of the recurrence period versus duration for El Nino are found

to be statistically important, displaying preferential associations that link shorter (longer) duration with shorter (longer) recurrence periods. Because the last onset of El Nino occurred in April 1997 and the event was of longer than average duration, onset of the next anticipated El Nino is not expected until February 2000 or later.
Author
El Nino; Periodic Variations; Sea Surface Temperature; Southern Oscillation; Climatology; Air Water Interactions; Tropical Meteorology

20000044332 NASA Marshall Space Flight Center, Huntsville, AL USA
El Nino During the 1990s: Harbinger of Climatic Change or Normal Fluctuation
Wilson, Robert M., NASA Marshall Space Flight Center, USA; February 2000; 1p; In English
Report No.(s): NASA/TP-2000-209960; NAS 1.60:209960; M-964; No Copyright; Avail: Issuing Activity; Abstract Only

Today, El Nino refers to the extreme warming episodes of the globally effective, coupled ocean-atmospheric interaction commonly known as ENSO (i.e., "El Nino-Southern Oscillation"). Concerning its observed decadal frequency and severity, El Nino during the 1990's has often been regarded as being anomalous. Results of analysis reported herein; however, appear to mitigate this belief.
Author
El Nino; Periodic Variations; Southern Oscillation; Air Water Interactions

48
OCEANOGRAPHY

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

20000038406 NASA Goddard Space Flight Center, Greenbelt, MD USA
Evolution of Nonlinear Internal Waves in China Seas
Liu, Antony K., NASA Goddard Space Flight Center, USA; Hsu, Ming–K., National Taiwan Ocean Univ., Taiwan, Province of China; Liang, Nai K., National Taiwan Univ., Taiwan, Province of China; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 233-234; Repr. from Proceedings of the 3rd ERS Symposium on Space at the Service of Our Environment, May 1997; In English; 3rd; Space at the Service of Our Environment, 17-21 Mar. 1997, Florence, Italy; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Synthetic Aperture Radar (SAR) images from ERS-I have been used to study the characteristics of internal waves of Taiwan in the East China Sea, and east of Hainan Island in the South China Sea. Rank-ordered packets of internal solitons propagating shoreward from the edge of the continental shelf were observed in the SAR images. Based on the assumption of a semidiurnal tidal origin, the wave speed can be estimated and is consistent with the internal wave theory. by using the SAR images and hydrographic data, internal waves of elevation have been identified in shallow water due to a thicker mixed layer as compared with the bottom layer on the continental shelf. The generation mechanism includes the influences of the tide and the Kuroshio intrusion across the continental shelf for the formations of elevation internal waves. The effects of water depth on the evolution of solitons and wave packets are modeled by nonlinear Kortweg-deVries (KdV) type equation and linked to satellite image observations. The numerical calculations of internal wave evolution on the continental shelf have been performed and compared with the SAR observations. For a case of depression waves in deep water, the solitons first disintegrate into dispersive wave trains and then evolve to a packet of elevation waves in the shallow water area after they pass through a turning point of approximately equal layer depths has been observed in the SAR image and simulated by numerical model.
Author
Continental Shelves; Korteweg-Devries Equation; Synthetic Aperture Radar; Taiwan; Radar Imagery; Internal Waves; Shallow Water

20000038761 Washington Univ., Applied Physics Lab., Seattle, WA USA
Interdisciplinary Research in Physics: Mathematical Aspects of Hamiltonian Theories for the Ocean, Environmentally Adaptive Sonar Controller, Influence of Local Variation in Surficial Sediment Porosity on the Spacial Distribution of Bacterial Numbers ***Final Report, 1 Sep. 1995 - 31 Dec. 1999***
Spindel, Robert C.; Henyey, Frank; Anderson, Gregory; Miyarnoto, Robert; Marks, Robert; Mar. 06, 2000; 11p; In English
Contract(s)/Grant(s): N00014-96-1-0246
Report No.(s): AD-A374430; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The purpose of this grant was to create a program of high quality fundamental research which brings together collaborative research between APL and other academic units of the University of Washington. The research was in four major areas: (1) to determine the usefulness of the Hamiltonian formalism for numerical modeling of ocean flow fields, including internal waves and to clarify the nature of conservation laws. (2) to build a ship sonar controller that will automatically tune onboard systems to maximize the performance of the sonar for undersea detection of threat submarines in the face of changing ocean environmental conditions. (3) to obtain the spatial heterogeneity of sediment porosity on the centimeter scale in order to interpret high frequency bottom backscatter acoustic data and to access the impacts of biological activities on the variation of sediment heterogeneity. (4) to obtain, through experimental measurements, the fundamental physical and acoustical properties of stabilized gas-filled microbubbles (ultrasound contrast agents).
DTIC
Hamiltonian Functions; Sonar; Oceans; Controllers; Sediments; Porosity; Ocean Models

20000039366 NASA Goddard Space Flight Center, Greenbelt, MD USA
Changes in the Areal Extent of Arctic Sea Ice: Observations from Satellites
Parkinson, Claire L., NASA Goddard Space Flight Center, USA; Jan. 22, 2000; 1p; In English, 28 Feb. 2000, Washington, DC, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Wintertime sea ice covers 15 million square kilometers of the north polar region, an area exceeding one and a half times the area of the U. S. Even at the end of the summer melt season, sea ice still covers 7 million square kilometers. This vast ice cover is an integral component of the climate system, being moved around by winds and waves, restricting heat and other exchanges between the ocean and atmosphere, reflecting most of the solar radiation incident on it, transporting cold, relatively fresh water equatorward, and affecting the overturning of ocean waters underneath, with impacts that can be felt worldwide. Sea ice also is a major factor in the Arctic ecosystem, affecting life forms ranging from minute organisms living within the ice, sometimes to the tune of millions in a single ice floe, to large marine mammals like walruses that rely on sea ice as a platform for resting, foraging, social interaction, and breeding. Since 1978, satellite technology has allowed the monitoring of the vast Arctic sea ice cover on a routine basis. The satellite observations reveal that, overall, the areal extent of Arctic sea ice has been decreasing since 1978, at an average rate of 2.7% per decade through the end of 1998. Through 1998, the greatest rates of decrease occurred in the Seas of Okhotsk and Japan and the Kara and Barents Seas, with most other regions of the Arctic also experiencing ice extent decreases. The two regions experiencing ice extent increases over this time period were the Bering Sea and the Gulf of St. Lawrence. Furthermore, the satellite data reveal that the sea ice season shortened by over 25 days per decade in the central Sea of Okhotsk and the eastern Barents Sea, and by lesser amounts throughout much of the rest of the Arctic seasonal sea ice region, although not in the Bering Sea or the Gulf of St. Lawrence. Concern has been raised that if the trends toward shortened sea ice seasons and lesser sea ice coverage continue, this could entail major consequences to the polar climate and to the lifestyles (and perhaps even the survivability) of polar bears and other polar species.
Author
Arctic Ocean; Arctic Regions; Climate; Satellite Observation; Sea Ice; Ecosystems

20000040855 Louisiana Univ. Marine Consortium, Chauvin, LA USA
Characterization of Hypoxia ***Final Report***
Rabalais, N. N.; Turner, R. E.; Justic, D.; Dortch, Q.; Wiseman, W. J.; May 1999; 194p; In English
Report No.(s): PB2000-104026; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

Nutrient overenrichment from human activities is one of the major stresses affecting coastal ecosystems. There is increasing concern in many areas around the world than an oversupply of nutrients from multiple sources is having pervasive ecological effects on shallow coastal and estuarine areas. These effects include reduced light penetration, loss of aquatic habitat, harmful algal blooms, a decrease in dissolved oxygen (or hypoxia), and impacts on living resources. The largest zone of oxygen-depleted coastal waters in the United States, and the entire western Atlantic Ocean, is found in the northern Gulf of Mexico on the Louisiana-Texas continental shelf. This zone is influenced by the freshwater discharge and nutrient flux of the Mississippi River system. This paper describes the seasonal, interannual, and long-term variability in hypoxia in the northern Gulf of Mexico and its relationship to nutrient loading. It also documents the relative roles of natural and human-induced factors in determining the size and duration of the hypoxic zone.
NTIS
Hypoxia; Ecosystems; Annual Variations; Gulf of Mexico; Nutrition

20000041716 Virginia Inst. of Marine Science, Gloucester Point, VA USA

Ecological and Economic Consequences of Hypoxia ***Final Report***

Diaz, R. J.; Solow, A.; May 1999; 66p; In English

Report No.(s): PB2000-104023; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In this report, the authors have attempted to evaluate the ecological and economic consequences of hypoxia in the northern Gulf of Mexico. For the economic analysis, the authors developed a conceptual model of how hypoxia-related impacts could affect fisheries. The authors' model included both supply and demand components. The supply model had two components: (1) a physical production function for fish or shrimp, and (2) the cost of fishing. The demand model considered how hypoxia might affect the quality of landed fish or shrimp. In particular, the market value per pound is lower for small shrimp than for large shrimp. NTIS

Hypoxia; Economics; Fisheries; Gulf of Mexico; Environment Effects

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.

20000038342 Universities Space Research Association, Huntsville, AL USA

Over-Expression, Purification and Crystallization of Human Dihydrolipoamide Dehydrogenase

Hong, Y. S., Universities Space Research Association, USA; Ciszak, Ewa, Universities Space Research Association, USA; Patel, Mulchand, State Univ. of New York, USA; [2000]; 1p; In English; 8th International Conference on Crystallization of Biological Macromolecules, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Dehydrolipoamide dehydrogenase (E3; dihydrolipoan-tide:NAD+ oxidoreductase, EC 1.8.1.4) is a common catalytic component found in pyruvate dehydrogenase complex, alpha-ketoglutarate dehydrogenase complex, and branched-chain cc-keto acid dehydrogenase complex. E3 is also a component (referred to as L protein) of the glycine cleavage system in bacterial metabolism (2). Active E3 forms a homodimer with four distinctive subdomain structures (FAD binding, NAD+ binding, central and interface domains) with non-covalently but tightly bound FAD in the holoenzyme. Deduced amino acids from cloned full-length human E3 gene showed a total of 509 amino acids with a leader sequence (N-terminal 35 amino acids) that is excised (mature form) during transportation of expressed E3 into mitochondria membrane. So far, three-dimensional structure of human E3 has not been reported. Our effort to achieve the elucidation of the X-ray crystal structure of human E3 will be presented. Recombinant pPROEX-1 expression vector (from GIBCO BRL Life Technologies) having the human E3 gene without leader sequence was constructed by Polymerase Chain Reaction (PCR) and subsequent ligation, and cloned in E.coli XL1-Blue by transformation. Since pPROEX-1 vector has an internal His-tag (six histidine peptide) located at the upstream region of a multicloning site, one-step affinity purification of E3 using nickelnitriloacetic acid (Ni-NTA) agarose resin, which has a strong affinity to His-tag, was feasible. Also a seven-amino-acid spacer peptide and a recombinant tobacco etch virus protease recognition site (seven amino acids peptide) found between His-tag and first amino acid of expressed E3 facilitated the cleavage of His-tag from E3 after the affinity purification. by IPTG induction, ca. 15 mg of human E3 (mature form) was obtained from 1L LB culture with overnight incubation at 25C. Over 98% of purity of E3 from one-step Ni-NTA agarose affinity purification was confirmed by SDS-PAGE analysis. For crystallization, E3 samples were prepared with and without His-tag. to minimize the aggregation of E3, apo- and holo- forms of E3s were tested, as well as a mutated E3. Dynamic light scattering measurements revealed that the E3 preparations without His-tag and substrate are highly monodispersive with regard to homodimers. Consequent crystallization trials of this E3 preparation led to single crystals of E3 grown by the vapor diffusion method. Crystals were obtained within a few days from solution containing poly (ethylene glycol) monomethyl ether 5000 as a precipitant. Autoindexing and integration of the X-ray diffraction data showed that E3 crystals belong to an orthorhombic system with unit cell parameters a-- 123. 1, b= 165.3 and c=214.3A. Further optimization of protein preparation and crystallization experiments for the structural determination will be discussed. Author

Amino Acids; Crystallization; Enzymes; Peptides; X Ray Diffraction; Protein Crystal Growth; Purification; Biochemistry

20000039369 NASA Marshall Space Flight Center, Huntsville, AL USA

The Effects of pH on the Growth and Aspect Ratio of Chicken Egg White Lysozyme Crystals Prepared in Different Buffers

Gibson, U. J., Dartmouth Coll., USA; Horrell, E. E., Dartmouth Coll., USA; Kou, Y., Dartmouth Coll., USA; Pusey, Marc, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 8th; ICCBM 8, 15 May 2000, SanDestin, FL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We have measured the nucleation and aspect ratio of CEWL crystals grown by vapor diffusion in acetate, butyrate, carbonate, succinate, and phosphate buffers in a range of pH spanning the pK(sub a) of these buffers. The nucleation numbers drop off significantly in the vicinity of pK(sub a) for each of the buffers except the phosphate system, in which we used only the pH range around the second titration point(pK2). There is a concomitant increase in the sizes of the crystals. Some typical nucleation number results are shown. These data support and extend other observations. In addition, we have examined changes in aspect ratio which accompany the suppression of nucleation within each buffer system. The length of the face in the [001] direction was measured, and compared to the width of the (110) face in the [110] type directions. We find that while the aspect ratio of the crystals is affected by pH, it is dominated by a correlation with the size of the crystals. Small crystals are longer in the [0011 direction than crystals that are larger (higher pH within a buffer system). This relationship is found to hold independent of the choice of buffer. These results are consistent with those of Judge et al, who used a batch process which resulted in uniform sizing of crystals at each pH. In these experiments, we specifically avoid agitating the protein/salt buffer mixture when combining the two. This permits the formation of a range of sizes at a given pH. The results for a .05 M acetate 5% NaCl buffer are also shown. We will discuss these results in light of a growth model.

Author

Crystal Growth; Crystals; Lysozyme; Nucleation; pH; Titration; Buffers (Chemistry)

20000039370 NASA Marshall Space Flight Center, Huntsville, AL USA

Cross-Linking Studies of Lysozyme Nucleation

Forsythe, Elizabeth, NASA Marshall Space Flight Center, USA; Pusey, Marc, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 8th; ICCBM 8, 15 May 2000, SanDestin, FL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Tetragonal chicken egg white crystals consist of 4(sub 3) helices running in alternating directions, the helix rows having a two fold symmetry with each other. The unit cell consists of one complete tetrameric turn from each of two adjacent helices (an octamer). PBC analysis indicates that the helix intermolecular bonds are the strongest in the crystal, therefore likely formed first. AFM analysis of the (110) surface shows only complete helices, no half steps or bisected helices being found, while AFM line scans to measure the growth step increments show that they are multiples of the 4(sub 3) helix tetramer dimensions. This supports our thesis that the growth units are in fact multiples of the four molecule 4(sub 3) helix unit, the ”average” growth unit size for the (110) face being an octamer (two turns about the helix) and the (101) growth unit averaging about the size of a hexamer. In an effort to better understand the species involved in the crystal nucleation and growth process, we have initiated an experimental program to study the species formed in solution compared to what is found in the crystal through covalent cross-linking studies. These experiments use the heterobifunctional cross-linking agent aminoethyl-4-azidonitroanaline (AEANA). An aliphatic amine at one end is covalently attached to the protein by a carbodiimide-mediated reaction, and a photo reactive group at the other can be used to initiate crosslinking. Modifications to the parent structure can be used to alter the distance between the two reactive groups and thus the cross-linking agents ”reach”. In practice, the cross-linking agent is first coupled to the asp101 side chain through the amine group. Asp101 lies within the active site cleft, and previous work with fluorescent probes had shown that derivatives at this site still crystallize in the tetragonal space group. This was also found to be the case with the AEANA derivative, which gave red tetragonal crystals. The protein now has a reactive group that can be photoactivated at a specific point in the nucleation or crystal growth process to ”capture” protein molecules bound within reach of the crosslinking agent. If those bound protein molecules have a defined geometric relationship with the capturing molecule, such as would be found in a crystal, then the photoreacted cross-linking site should be consistent. Random protein interactions, typical of an amorphous precipitate or interaction, would show a random cross-linking reaction. The results of these and other experiments will be presented.

Author

Crosslinking; Crystal Growth; Crystals; Lysozyme; Nucleation; Proteins; Microstructure

20000039371 NASA Marshall Space Flight Center, Huntsville, AL USA

Size Exclusion Chromatography Studies of the Initial Self-Association Steps of Chicken Egg White Lysozyme Nucleation

Ewing, Felecia, Universities Space Research Association, USA; Donovan, David, Raytheon Co., USA; Pusey, Marc, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 8th; ICCBM 8, 15 May 2000, SanDestin, FL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Nucleation is one of the least understood aspects of crystallogenesis. In the case of macromolecule nucleation, this understanding is further hampered by uncertainty over what precisely is being discussed. We define the process of solute self-association (aggregation, oligomerization, interaction, clustering, etc.) whereby n-mers (n is greater than or = 2) having a crystallographic or nascent crystallographic arrangement leading to the critical nucleus reversibly form in the solution, to be part of the nucleation process. This reversible self-association process is a fundamental part of the nucleation process, and occurs as a function of the solute concentration. In the case of chicken egg white lysozyme, a considerable body of experimental evidence leads us to the conclusion that it also forms the crystal growth units. Size exclusion chromatography is a simple and direct method for determining the equilibrium constants for the self-association process. A Pharmacia FPLC system was used to provide accurate solution flow rates. The column, injection valve, and sample loop were all mounted within a temperature-controlled chamber. Chromatographically re-purified lysozyme was first dialyzed against the column equilibration buffer, with injection onto the column after several hours pre-incubation at the running temperature. Preliminary experiments, were carried out using a Toyopearl HW-50F column (1 x 50cm), equilibrated with 0.1 M sodium acetate, 5% sodium chloride, pH 4.6, at 15C. Protein concentrations from 0.1 to 4 mg/ml were employed (C(sub sat) = 1.2 mg/ml). The data from several different protein preparations consistently shows a progressively decreasing elution volume with increasing protein concentration, indicating that reversible self-association is occurring. The dotted line indicates the monomeric lysozyme elution volume. However, lysozyme interacts with the column matrix in these experiments, which complicates data analysis.Accordingly, we are testing silica-based HPLC columns in an effort to eliminate this problem and substantially reduce the column volume and experimental run time. The results and data analysis from these and subsequent experiments will be presented.

Author

Crystal Growth; Lysozyme; Nucleation; Crystallography; Crystals

20000040112 NASA Marshall Space Flight Center, Huntsville, AL USA

Preparation and Characterization of Fluorescent Derivatives of Chicken Egg White Lysozyme

Sumida, John, Universities Space Research Association, USA; Forsythe, Elizabeth, Universities Space Research Association, USA; Pusey, Marc, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 8th; ICCBM 8, 15 May 2000, Sandestin, FL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Fluorescence is one of the most versatile and powerful tools for the study of macromolecules. While most proteins are intrinsically fluorescent, working at crystallization concentrations require the use of covalently prepared derivatives added as tracers. This approach requires derivatives that do not markedly affect the crystal packing. We have prepared a number of fluorescent derivatives of chicken egg white lysozyme with probes bound to one of two different sites on the protein molecule. Lucifer yellow, cascade blue, and 5-(2-aminoethyl)aminonapthalene-l-sulfonic acid (EDANS) have been attached to the side chain carboxyl of asp101 using a carbodiimide coupling procedure. asp101 lies within the active site cleft, and it is believed that the probes are at least partially ”buried” within that cleft. Lucifer yellow and MANS probes with iodoacetamide reactive groups have been bound to hisl5, located on the ”back side” of the molecule relative to the active site. The fluorescently labeled protein is readily purified from the starting material by cation exchange chromatography. All the derivatives fluoresce in both the solution and the crystalline states. Fluorescence characterization has focused on determining the bound probe quantum yields, lifetimes, absorption and emission spectra, and quenching by added solutes in comparison to the free probe. No appreciable changes are found in the lifetimes of any of the probes except for cascade blue, where Tau(sub free) = 3.52 ns vrs Tau(sub bound) = 2.8 ns. Spectral shifts are found in most cases. Particularly strong quenching upon binding is found in the case of the cascade blue derivative, likely due to probe interactions with the active site cleft. While none of the asp101 bound probes are well quenched by commonly employed solutes, such as potassium and sodium iodide, acrylamide, primuline, the chloride salts of manganese, cesium, and cobalt, trifluoroacetamide, trichloroethanol, and thallium iodide, in those cases where quenching is observed the bound probe is less efficiently quenched relative to the free probe. This indicates that the bound probes are less accessible to the bulk solution, an expected finding for attachment within the active site cleft. Attempts have been made to bind other molecules to these sites, with varying success. Interestingly, all three probes contain one or more sulfonate ((Ar-S03)-) groups. We have not been successful in binding analogous probes without sulfate groups such as pyrene, or with derivatized sulfonate groups such as dansyl type probes, analogous to MANS but where the sulfonate group is derivatized, Ar-S02-N2C2H7. None of the probes is rigidly bound to the protein, i.e., they all have a probe motion superimposed on that of the protein.

Author

Fluorescence; Lysozyme; Albumins; Biochemistry

20000041376 NASA Johnson Space Center, Houston, TX USA

A Robust Biomarker

Westall, F., NASA Johnson Space Center, USA; Steele, A., NASA Johnson Space Center, USA; Toporski, J., Portsmouth Univ., UK; Walsh, M. M., Lousiana State Univ., USA; Allen, C. C., Lockheed Martin Corp., USA; Guidry, S., Houston Univ., USA; McKay, D. S., NASA Johnson Space Center, USA; Gibson, E. K., NASA Johnson Space Center, USA; Chafetz, H. S., Houston Univ., USA; 2000; 1p; In English; 1st; Astrobiology Science, 3-5 Apr. 2000, Mountain View, CA, USA; Sponsored by NASA Ames Research Center, USA

Contract(s)/Grant(s): RTOP 344-50-92; No Copyright; Avail: Issuing Activity; Abstract Only

Polymers of bacterial origin, either through cell secretion or the degraded product of cell lysis, form isolated mucoidal strands as well as well-developed biofilms on interfaces. Biofilms are structurally and compositionally complex and are readily distinguishable from abiogenic films. These structures range in size from micrometers to decimeters, the latter occurring as the well-known, mineralised biofilms called stromatolites. Compositionally bacterial polymers are greater than 90 % water, with while the majority of the macromolecules forming the framework of the polymers consisting of polysaccharides (with and some nucteic acids and proteins). These macromolecules contain a vaste amount of functional groups, such as carboxyls, hydroxyls, and phosphoryls which are implicated in cation-binding. It is the elevated metal- binding capacity which provides the bacterial polymer with structural support and also helps to preserves it for up to 3.5 b.y. in the terrestrial rock record. The macromolecules, thus, can become rapidly mineralised and trapped in a mineral matrix. Through early and late diagenesis (bacterial degradation, burial, heat, pressure and time) they break down, losing the functional groups and, gradually, their hydrogen atoms. The degraded product is known as ”kerogen”. With further diagenesis and metamorphism, all the hydrogen atoms are lost and the carbonaceous matter becomes graphite. until the remnant carbonaceous material become graphitised. This last sentence reads a bit as if ALL these macromolecules break down and end up as graphite., but since we find 441 this is not true for all of the macromolecules. We have traced fossilised polymer and biofilms in rocks from throughout Earth’s history, to rocks as old as the oldest being 3.5 b.y.-old. Furthermore, Time of Flight Secondary Ion Mass Spectrometry has been able to identify individual macromolecules of bacterial origin, the identities of which are still being investigated, in all the samples containing fossil biofilm, including the 3.5 b.y..-old carbonaceous cherts from South Africa and Australia. As a result of the unique compositional, structural and ”mineralisable” properties of bacterial polymer and biofilms, we conclude that bacterial polymers and biofilms constitute a robust and reliable biomarker for life on Earth and could be a potential biomarker for extraterrestrial life.

Author

Abiogenesis; Polymers; Bacteria; Geochemistry; Metamorphism (Geology)

20000041378 Sussex Univ., Brighton, UK

[Research Award providing funds for a tracking video camera] ***Final Report***

Collett, Thomas, Sussex Univ., UK; 2000; 1p; In English

Contract(s)/Grant(s): NAG2-1260; No Copyright; Avail: Issuing Activity; Abstract Only

The award provided funds for a tracking video camera. The camera has been installed and the system calibrated. It has enabled us to follow in real time the tracks of individual wood ants (Formica rufa) within a 3m square arena as they navigate singly in-doors guided by visual cues. to date we have been using the system on two projects. The first is an analysis of the navigational strategies that ants use when guided by an extended landmark (a low wall) to a feeding site. After a brief training period, ants are able to keep a defined distance and angle from the wall, using their memory of the wall’s height on the retina as a controlling parameter. by training with walls of one height and length and testing with walls of different heights and lengths, we can show that ants adjust their distance from the wall so as to keep the wall at the height that they learned during training. Thus, their distance from the base of a tall wall is further than it is from the training wall, and the distance is shorter when the wall is low. The stopping point of the trajectory is defined precisely by the angle that the far end of the wall makes with the trajectory. Thus, ants walk further if the wall is extended in length and not so far if the wall is shortened. These experiments represent the first case in which the controlling parameters of an extended trajectory can be defined with some certainty. It raises many questions for future research that we are now pursuing.

Author

Cameras; Trajectories; Wood; Visual Stimuli; Real Time Operation; Insects; Formica

20000043993 NASA Marshall Space Flight Center, Huntsville, AL USA

Developmental Changes is Expression of Beta-Adrenergic Receptors in Cultures of C2C12 Skeletal Muscle Cells

Young, Ronald B., NASA Marshall Space Flight Center, USA; Bridge, K. Y., NASA Marshall Space Flight Center, USA; Vaughn, J. R., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; In Vitro Biology Conference, 11 Jun. 2000, San Diego, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

beta-Adrenergic receptor (bAR) agonists have been reported to modulate growth in several mammalian and avian species, and bAR agonists presumably exert their physiological action on skeletal muscle cells through this receptor. Because of the importance of bAR regulation on muscle protein metabolism in muscle cells, the objectives of this study were to determine the developmental expression pattern of the bAR population in C2C12 skeletal muscle cells, and to analyze changes in both the quantity and isoform expression of the major muscle protein, myosin. The number of bAR in mononucleated C2C12 cells was approximately 8,000 bAR per cell, which is comparable with the population reported in several other nonmuscle cell types. However, the bar population increased after myoblast fusion to greater than 50,000 bAR per muscle cell equivalent. The reasons for this apparent over-expression of bAR in C2C12 cells is not known. The quantity of myosin also increased after C2C12 myoblast fusion, but the quantity of myosin was less than that reported in primary muscle cell cultures. Finally, at least five different isoforms of myosin heavy chain could be resolved in C2C12 cells, and three of these exhibited either increased or decreased developmental regulation relative to the others. Thus, C2C12 myoblasts undergo developmental regulation of bAR population and myosin heavy chain isoform expression.
Author
Adrenergics; Musculoskeletal System; Cells (Biology); Chemoreceptors; Culture Techniques

20000044666 San Jose State Univ., Dept. of Biological Sciences, CA USA
Circadian Behavioral Study: LED vs Cool White Fluorescent - 0.1, 1, 10, 40, 80 lux, Part 2
Holley, Daniel C., San Jose State Univ., USA; Syrkin, N., San Jose State Univ., USA; Mele, G., San Jose State Univ., USA; Dec. 31, 2000; 30p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Currently, the light source most commonly used in animal habitat lighting is cool white fluorescent (CWF) light. It was the objective of this study to evaluate a novel LED light source for use in animal habitat lighting by comparing its effectiveness to CWF light in producing and maintaining a normal circadian entrainment. The LED and CWF lights had similar spectral power distributions. Sprague-Dawley rats (175-350 g) were kept individually in metabolic cages, under a strict lighting control: 4 days of acclimation at 12:12 LD, 14 days of 12:12 LD, 14 days of 24:0 LD (free-run), and finally 12:12 LD. Food and water were provided ad libitum. Three behavioral parameters were monitored continuously: gross locomotor activity, drinking, and feeding. Combined mean free run periods (tau) were (mean +/- SEM): 24.6 +/- 0.1 and 24.7 +/- 0.2 at 0.1 lux, 25.5 +/- 0.1 and 25.7 +/- 0.1 at 1.0 lux, 25.3 +/- 0.2 and 25.4 +/- 0.2 at 10 lux, 25.8 +/- 0.1 and 25.9 +/- 0.1 at 40 lux, and 25.9 +/- 0.1 and 25.9 +/- 0.1 at 80 lux, CWF and LED respectively. ANOVA found a significant effect (p is less than 0.05) due to light level, but no difference in tau between rats exposed to constant CWF light and rats exposed to constant LED light. This study has shown that LED light can produce the same entrainment pattern as a conventional CWT light at similar intensities (0.1, 1, 10, 40, and 80 lux). LED light sources may be a suitable replacement for conventional light sources used in animal habitat lighting while providing many mechanical and economical advantages.
Author
Circadian Rhythms; Activity Cycles (Biology); Animals; Habitats

20000044668 San Jose State Univ., Dept. of Biological Sciences, CA USA
Light-Emitting Diodes and Cool White Fluorescent Light Similarly Suppress Pineal Gland Melatonin and Maintain Retinal Function and Morphology in the Rat, Part 1
Holley, Daniel C., San Jose State Univ., USA; Heeke, D., San Jose State Univ., USA; Mele, G., San Jose State Univ., USA; Dec. 31, 1999; 63p; In English
Contract(s)/Grant(s): NCC2-779; HS-R07049; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Currently, the light sources most commonly used in animal habitat lighting are cool white fluorescent or incandescent lamps. We evaluated a novel light-emitting diode (LED) light source for use in animal habitat lighting by comparing its effectiveness to cool white fluorescent light (CWF) in suppressing pineal gland melatonin and maintaining normal retinal physiology and morphology in the rat. Results of pineal melatonin suppression experiments showed equal suppression of pineal melatonin concentrations for LED light and CWF light at five different light illuminances (100, 40, 10, 1 and 0.1 lux). There were no significant differences in melatonin suppression between LED and CWF light when compared to unexposed controls. Retinal physiology was evaluated using electroretinography. Results show no differences in a-wave implicit times and amplitudes or b-wave implicit times and amplitudes between 100-lux LED-exposed rats and 100-lux CWF-exposed rats. Results of retinal histology assessment show no differences in retinal thickness rod outer segment length and number of rod nuclei between rats exposed to 100-lux LED and 100-lux CWF for days. Furthermore, the retinal pigmented epithelium and rod outer segments of all eyes observed were in good condition and of normal thickness. This study indicates that LED light does not cause retinal damage and can suppress pineal melatonin at similar intensities as a conventional CWF light source. These data suggest that LED light sources may be suitable

replacements for conventional light sources used in the lighting of rodent vivariums while providing many mechanical and economical advantages.
Author
Pineal Gland; Retarding; Light Emitting Diodes; Luminescence; Light Sources; Illuminating; Fluorescence; Retina; Electroretinography

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 Science. For the effects of space on animals and plants see 51 Life Sciences.

20000039414 NASA Johnson Space Center, Houston, TX USA
A Pilot Study for Applying an Extravehicular Activity Exercise Prebreathe Protocol to the International Space Station
Woodruff, Kristin K., Wyle Labs., Inc., USA; Johnson, Anyika N., National Space Biomedical Research Inst., USA; Lee, Stuart M. C., Wyle Labs., Inc., USA; Gernhardt, Michael, NASA Johnson Space Center, USA; Schneider, Suzanne M., NASA Johnson Space Center, USA; Foster, Philip P., Baylor Coll. of Medicine, USA; April 2000; 42p; In English
Report No.(s): NASA/TM-2000-210132; S-858; NAS 1.15:210132; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Decompression sickness (DCS) is a serious risk to astronauts performing extravehicular activity (EVA). to reduce this risk, the addition of ten minutes of moderate exercise (75% VO2pk) during prebreathe has been shown to decrease the total prebreathe time from 4 to 2 hours and to decrease the incidence of DCS. The overall purpose of this pilot study was to develop an exercise protocol using flight hardware and an in-flight physical fitness cycle test to perform prebreathe exercise before an EVA. Eleven subjects volunteered to participate in this study. The first objective of this study was to compare the steady-state heart rate (HR) and oxygen consumption (VO2) from a submaximal arm and leg exercise (ALE) session with those predicted from a maximal ALE test. The second objective was to compare the steady-state HR and V02 from a submaximal elastic tube and leg exercise (TLE) session with those predicted from the maximal ALE test. The third objective involved a comparison of the maximal ALE test with a maximal leg-only (LE) test to conform to the in- flight fitness assessment test. The 75% VO2pk target HR from the LE test was significantly less than the target HR from the ALE test. Prescribing exercise using data from the maximal ALE test resulted in the measured submaximal values being higher than predicted VO2 and HR. The results of this pilot study suggest that elastic tubing is valid during EVA prebreathe as a method of arm exercise with the flight leg ergometer and it is recommended that prebreathe countermeasure exercise protocol incorporate this method.
Author
Astronauts; Extravehicular Activity; International Space Station; Physical Exercise; Decompression Sickness; Oxygen Breathing

53
BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

20000038769 Institute for Human Factors TNO, Soesterberg, Netherlands
Innovation of Maintenance Training at the Naval Air Training Centre on the Basis of the Method Structured Troubleshooting: Task- and Training Analysis *Interim Report Innovatie van Functie-Opleidingen van de Marine Luchtvaartschool/ Opleidingen Valkenburgop Basis van de Methode GSZ: Taak- en Opleidingsanalyse*
Schaafstal, A. M., Institute for Human Factors TNO, Netherlands; Bots, M. J., Institute for Human Factors TNO, Netherlands; Feb. 23, 1999; 40p; In Dutch
Contract(s)/Grant(s): A98/KM/338; TNO Proj. 730.2
Report No.(s): TD-99-0022; TM-99-A019; Copyright; Avail: Issuing Activity

Within the Naval Air Training School there is a very strong interest in the continuous improvement of training. As part of this interest, there is a need to start with the implementation of computer-based training. The TNO Human Factors Research Institute has been asked to support this process of innovation among others, by introducing the method ”Structured Troubleshooting”. As an example for the innovation, the function course for maintaining the Automatic Flight Control System of the P3-C Orion has been chosen. A cognitive task analysis and training analysis have been carried out on the basis of which strengths and weak-

nesses with respect to knowledge and skill were determined, while taking into account that after the theoretical training, there is still a practical period in the Maintenance Department to come. It is concluded that the Naval Air Training School is doing a fine job in establishing a firm factual knowledge base. However, the training of system knowledge needs more attention. Trainees, who just finished their theoretical course at the Naval Air Training School still have problems in troubleshooting. They lack a systematic approach, have difficulties in the application of system knowledge, and also taking measurements is not a flawless process. In the improvement of the whole training process, and as a start, the improvement of the preparation of the theoretical course at the Naval Air Training School for the practical period afterwards, there are various possibilities for the use of Computer-Based Training. They will be elaborated upon, resulting in a demonstration-prototype, in the next part of the project.
Author
Flight Training; Maintenance Training; Training Analysis; Personnel Development; Automatic Flight Control; Computer Techniques

20000038773 Institute for Human Factors TNO, Soesterberg, Netherlands
Team Training for Team Performance: Models of Team Task Performance ***Interim Report Teamtraining voor Teamfunctioneren: Modellen van Teamfunctioneren***
vanBerlo, M. P. W., Institute for Human Factors TNO, Netherlands; Dec. 09, 1998; 33p; In English
Contract(s)/Grant(s): B98-052; TNO Proj. 730.2
Report No.(s): TD-98-0279; TM-98-8014; Copyright; Avail: Issuing Activity

The objective of any training system is to change the competencies of the trainees so they can perform their tasks in the operational environment more effectively and efficiently. The conditions for the instructional systems development process with respect to team training are the tasks performed by the team, the way these tasks are performed, the knowledge, skills and attitudes that are required, the kind of environments in which the tasks are performed, the conditions of adequate task performance, the tools and equipments to be used, and especially the relationships and interdependencies between the tasks of the team members. It is important to know what constitutes good team task performance, and which factors influence team task performance. Without this knowledge designing adequate team training is hardly possible, resulting in ineffective operational performance. In this report several models and dimensions of team task performance and team leader effectiveness will be described. It is not the purpose to present a detailed discussion of all factors affecting team task performance, or all models encompassing these factors; such overviews can be found elsewhere. Rather, the reader will gain insight in these factors that should be accounted for in team training system design. In this report a final model is presented that can be regarded as a summary of the described models. This summarizing model is very broad and encompasses many factors influencing team performance. Because of the complexity of team performance, it is important to note that training is not the sole contributor to enhance team effectiveness. But carefully identifying and analysing the variables affecting team performance, and taking into account these factors in the process of training system design, will have a positive effect on the effectiveness of the team training.
Author
Education; Human Performance; Performance Prediction; Teams

20000039424 Institute for Human Factors TNO, Soesterberg, Netherlands
The Functionality of Training Support Packages Supporting Tactical Team Training in TACTIS ***Interim Report De Functionaliteit van Training Support Packages ten Behoeve van Tactische Eenheidstrainingen met Behulp van TACTIS***
vanBerlo, M. P. W., Institute for Human Factors TNO, Netherlands; Riemersma, J. B. J., Institute for Human Factors TNO, Netherlands; Mar. 11, 1999; 28p; In Dutch
Contract(s)/Grant(s): A97/KL/330; TNO Proj. 730.2
Report No.(s): TD-99-0025; TM-99-A022; Copyright; Avail: Issuing Activity

TACTIS will be a virtual distributed training environment for executing combat actions by mechanized manoeuvre units (up to the company level) and for training individual crew members. During the organization, preparation, execution and evaluation of tactical team training in TACTIS, the training staff and to be trained team/unit are offered support in the form of Training Support Packages (TSP's). This report describes the tasks of the various users of a TSP and, based on this description, and a first design concerning the functionality of a Training Support Package. However, it is very important to definitely define the size of the training staff, as well as the tasks the members have to perform: the more various tasks have to be performed by one member, the more support should be offered. It is further recommended to develop different versions of a TSP for each category of users in order to provide for optimal support of the specific tasks that have to be performed.
Author
Education; Tactics; Military Operations

20000039426 Institute for Human Factors TNO, Soesterberg, Netherlands

Effects of Three-Dimensional Auditory Information on Spatial Situation Awareness of Pilots ***Final Report De rol van stereo-zien bij het besturen van pantservoetuigen in ruw terrein***

Oving, A. B., Institute for Human Factors TNO, Netherlands; vanBreda, L., Institute for Human Factors TNO, Netherlands; Werkhoven, P. J., Institute for Human Factors TNO, Netherlands; Dec. 14, 1998; 44p; In English; Original contains color illustrations

Contract(s)/Grant(s): A97/KLu/308; TNO Proj. 788.1

Report No.(s): TD98-0284; TM-98-A069; Copyright; Avail: Issuing Activity

The potential benefits of a three-dimensional (3D) auditory display in enhancing the spatial situation awareness (SA) of a pilot were investigated in a flight simulation experiment. The study was aimed at the application of 3D audio in the cockpit of civil aircraft. Participants were required to follow a specific route that was presented on a map display. This display also contained information pertaining to that route. Primary flight information was available on another visual display. to increase the task load during a flight, the participants had to perform a secondary cognitive task now and then. This task required the participants to respond to target letters that were presented either visually or orally. to assess the spatial SA of the participants, the simulation was stopped on two occasions during a single flight run by blanking the outside imagery and all displays in the cockpit. Subsequently, a questionnaire was presented to the participants on one of the visual displays with three different sets of questions, regarding knowledge about elements in the environment and elements of the flight task. In the experiment, 3D audio was used to present spatial information about the environment and specific elements of the route. The auditory messages were presented in clusters of four with 40 s between the start of each cluster. In half of the experimental flight runs, 3D audio was available to the participants. SA-performance was measured by the response times to the questions and the accuracy of the answers. It was hypothesized that the use of 3D audio would result in a better SA of the participants, because 3D audio contains spatial information. Results showed no effects of 3D audio on spatial SA. The only significant effects of 3D audio were related to the performance on the secondary cognitive task, with worst performance on the visual secondary task and when 3D audio was present. Based on these results, it is hypothesized that the participants preferred to use the visual displays instead of the 3D audio messages to acquire the needed spatial information for answering the SA-questions. This preference may be due to limitations in the level of integration with 3D audio, because the 3D audio messages were presented sequentially. Also, constraints in the availability and accessibility of the 3D audio messages in the present experimental setup, may have biased the participants to use the visual displays.

Author

Auditory Signals; Display Devices; Flight Simulation; Three Dimensional Models; Human Factors Engineering; Aircraft Pilots; Spatial Dependencies

20000041707 British Airways Safety Services, London, UK

Situational Awareness: Has EFIS Delivered?

OLeary, Mike, British Airways Safety Services, UK; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment: Proceedings; [2000], pp. 9.1 - 9.6; In English; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment, 23 Mar. 2000, London, UK; Sponsored by Royal Aeronautical Society, UK; ISBN 1-85768-186-X; Copyright; Avail: Issuing Activity

This paper considers whether the introduction into the flight deck of modem digital technology has been beneficial to the level of flight crew situation awareness. Modem technology has dramatically changed the way aircraft are operated. Much of the physical work has now been eliminated, theoretically allowing the flight crew more time for higher level planning and supervisory activities. However, accidents caused by situation awareness failures have not gone away as a consequence. Accident and serious incident rate statistics suggest that these have been fairly stable over the last decade during which time more and more of the latest generation of aircraft have been brought into operation. Incidents of a less serious nature also occur but are normally less frequently catalogued and categorized as less effort is applied to these cases than is the norm for their more serious brothers. Data from the British Airways Human Factors reporting programme is presented here indicating that modem technology does not necessarily augment situation awareness. The author suggests that the reduced requirement for both physical and cognitive data gathering activity on the flight deck may be partly responsible. Alleviation of this may require changes to both training and operating procedures.

Author

Cognition; Human Factors Engineering; Stability; Technology Assessment; Flight Safety

20000041708 Thomson-CSF Sextant, Meudon-la-Foret, France

Situational Awareness on the Flight Deck Current Solutions Contributions: HFDS(R), FMS, GCAS/TAWS

Adams, Hal E., Thomson-CSF Sextant, France; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment: Proceedings; [2000], pp. 8.1 - 8-5; In English; Situational Awareness on the Flight Deck: The Current

and Future Contribution by Systems and Equipment, 23 Mar. 2000, London, UK; Sponsored by Royal Aeronautical Society, UK; ISBN 1-85768-186-X; Copyright; Avail: Issuing Activity

Controlled Flight Into Terrain (CFIT) remains as the primary contributor to the aircraft accident rate. The aviation industry has taken the challenge to reduce the fatal aircraft accident rate by 80% by the year 2000. Development of functionality that is designed to reduce CFIT accidents is an evolutionary, continuous process. The evolutionary process involves the interaction of diverse interests such as infrastructure, funding, cost, timing, safety, intellectual rights protection, technology, resources, etc. Imaginative, revolutionary CFIT solutions are restrained by interest interaction and by how expensive or technically challenging the solution. However, the change rate of the solutions process is tempered by public sensitivity. Currently there are available three avionics elements that contribute to improving the CIFIT situation but are not widely utilized as an integrated solution. These three key elements are Heads Up Flight Display System (HFDSO), advanced Flight Management System (FMS) and Ground Collision Avoidance System (GCAS Terrain Awareness & Warning System/ TAWS). These elements are evolving and being constantly refined. The expectation of HFDS 0 is that the flight crew can operate in instrument meteorological conditions as if they are operating in visual meteorological conditions. This allows coupling of the external environment with awareness of aircraft state within bounded parameters. The expectation of advanced FMS is that the flight crew can operate in a non-FANS (Future Air Navigation System) as if they were operating in a FANS environment. This allows for use of tactical ”FANS tools” to manage the flight deck tasks more efficiently. The expectation of GCAS/TAWS is that terrain can be made ”visible” to the flight deck when the terrain is not physically or mentally ”visible.” This allows the inclusion of unrecognized, potentially and, or actually hazardous operations as part of the flight deck decision process. Revolutionary CFIT solutions are apparently required but it will require more awareness and drive by industry for revolutionary solutions to be employed.

Author

Flight Control; Terrain; Warning Systems; Safety Devices; Flight Management Systems; Display Devices; Aircraft Accidents

20000041709 Airbus Industrie, Toulouse, France

New Approaches Towards Maintaining Situational Awareness: The Contribution of a Fatigue Countermeasures Interface

Speyer, J.–J., Airbus Industrie, France; Elsey, A., Page Aerospace, UK; Cabon, P., Paris V Univ., France; Mollard, R., Paris V Univ., France; Bourgeois–Bougrine, S., Paris V Univ., France; Parriaux, N., Pharos; Perrinet, M., Pharos; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment: Proceedings; [2000], pp. 7.1 - 7.6; In English; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment, 23 Mar. 2000, London, UK; Sponsored by Royal Aeronautical Society, UK; ISBN 1-85768-186-X; Copyright; Avail: Issuing Activity

This paper reviews the specification and evaluation of a support system aimed at monitoring the vigilance and alertness of aircrews subject to sleep pressure. Visual and audio alert warnings timely inform the pilot of any reductions in vigilance hence inducing planned naps to alleviate sleep pressure. Aircrew fatigue during long-haul flights is recognised as one of the major constraints that can impair performance and situational awareness. Using physiological recordings on 156 flights, previous work has shown that reductions in alertness are frequent during flights, including the descent phase. Most decreases in alertness occur during the monotonous part of the cruise and were often observed simultaneously on both pilots in two person crews. Based on these results specific operational recommendations have been designed. Further studies have shown the positive effects of these recommendations. These recommendations were gathered into a booklet for the use of long-haul aircrews. Currently, this booklet is available in French, English and Chinese. One of the main recommendations promoted in these guidelines is based on the alternation of crew rest and activities, including cockpit napping. The efficiency of cockpit napping was first emphasised by Graeber et al (1990). However, one of the main drawbacks of cockpit napping is that it could contribute to increase the monotony inside the cockpit (reduced communications, lower light intensity ...) and thus could decrease the alertness and awareness of the other pilot remaining at the controls. Therefore fail-safe monitoring of the non-napping pilot should avoid simultaneous sleepiness of the two pilots. The Electronic Pilot Activity and Alertness Monitor (EPAM) is intended to provide this support.

Derived from text

Alertness; Fatigue (Materials); Specifications; Evaluation; Support Systems; Warning Systems

20000041710 Honeywell, Inc., Airline Avionics, Redmond, WA USA

Flight Safety Improvements Through Advanced Avionics Solutions

Carman, Mike, Honeywell, Inc., USA; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment: Proceedings; [2000], pp. 6.1 - 6.6; In English; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment, 23 Mar. 2000, London, UK; Sponsored by Royal Aeronautical Society, UK; ISBN 1-85768-186-X; Copyright; Avail: Issuing Activity

There has been continuous improvement in’the effectiveness of individual flight safety-related systems. Originally, these systems did not communicate with each other; more recently there has been a trend for systems to be coordinated (e.g. prioritization

of alert messages). In the future, to gain the benefits of improved performance and reduced cost, the trend will continue towards complete functional integration of these systems.
Author
Flight Safety; Technology Assessment; Functional Integration; Communication

20000041711 Smiths Industries Aerospace and Defence Systems Ltd., Cheltenham, UK
Free Flight Operational Scenarios
Leeson, Michael J., Smiths Industries Aerospace and Defence Systems Ltd., UK; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment: Proceedings; [2000], pp. 5.1 - 5.4; In English; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment, 23 Mar. 2000, London, UK; Sponsored by Royal Aeronautical Society, UK; ISBN 1-85768-186-X; Copyright; Avail: Issuing Activity

Any movement towards a free flight operational scenario will introduce more information onto the flight deck and generate a higher workload for the crew. Unless this increase is managed, it will compromise the safety of the aircraft and reduce the likelihood that this new technology will be accepted. This paper introduces the concept of free flight and the new roles of the crew in future free flight environments. The impact of these changing roles and evolving scenarios on the demand for situational awareness is discussed within the framework of a probable future operational scenario.
Author
Free Flight; Safety; Technological Forecasting

20000041712 Airbus Industrie, Toulouse, France
Integration of Situational Awareness on Airbus Flight Decks
Wainwright, William, Airbus Industrie, France; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment: Proceedings;]2000], pp. 4.1 - 4.9; In English; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment, 23 Mar. 2000, London, UK; Sponsored by Royal Aeronautical Society, UK; ISBN 1-85768-186-X; Copyright; Avail: Issuing Activity

The need for situational awareness is not new, but enormous progress has been made since the introduction of the first real ”glass cockpit” aircraft - the A320. Where we have been able to improve situational awareness is in giving the pilot an uncluttered cockpit, with an unobstructed view of his primary displays, where all the information needed is concentrated directly in front of his eyes. Situational awareness includes awareness in the horizontal & vertical planes, as well as awareness of energy. I will describe the history of situational awareness in Airbus Flight Decks up to & including the introduction of EGPWS (Enhanced Ground Proximity System). I will then discuss the near future with the ”Peaks” display & vertical cut, & how awareness of energy is treated at Airbus is discussed. Finally, our method for ensuring a good Human/Machine interface & future technological advances, including navigation on the ground is discussed.
Author
Cockpits; Display Devices; Field of View

20000041713 Rockwell Collins, Inc., Cedar Rapids, IA USA
Situational Awareness: A Systems Approach
Heinrich, Richard E., Rockwell Collins, Inc., USA; Castelberry, Daniel, Rockwell Collins, Inc., USA; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment: Proceedings; [2000], pp. 3.1 - 3.10; In English; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment, 23 Mar. 2000, London, UK; Sponsored by Royal Aeronautical Society, UK; ISBN 1-85768-186-X; Copyright; Avail: Issuing Activity

Improved situational awareness on the flight deck relies on many information sources. These sources are part of an ever-expanding set of sensors and database inputs that must be managed. It is the intent of this paper to explore the various data types and illustrate how a systems perspective is intended to help support information management.
Author
Information Management; Information Systems; Support Systems

20000041714 Boeing Co., Seattle, WA USA

Vertical Situation Awareness Display

Jacobsen, Alan R., Boeing Co., USA; Chen, Sherwin S., Boeing Co., USA; Wiedemann, John, Boeing Co., USA; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment: Proceedings; [2000], pp. 2.1 - 2.8; In English; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment, 23 Mar. 2000, London, UK; Sponsored by Royal Aeronautical Society, UK; ISBN 1-85768-186-X; Copyright; Avail: Issuing Activity

Of the more than 200 heavy air transport accidents involving hull loss and/or fatalities over the last 10 years, more than 50% have been associated with either Controlled Flight Into Terrain (CFIT) or the Approach and Landing phases of flight. A large portion of these accidents have resulted from inadequate or loss of vertical situation awareness on the part of the flight crew. Over the past several years, various types of interventions have been investigated in an attempt to address this issue on the flight deck. While many new, and often high-priced, technology items promise to deliver improved situation awareness, cost effective solutions that are relatively easy to retro-fit must be found to significantly enhance safety in the world-wide fleet. Presenting flight crews with a side looking profile of the vertical dimension is one such solution. While not the final answer to overall situation awareness, the vertical situation display (VSD) has been shown to be an effective format for significantly enhanced vertical awareness on the part of the flight crew and can be implemented into today's flight decks in a cost effective manner. It is expected that this type of display concept can significantly reduce the accident rate over the next 5 to 10 years. The VSD complements and enhances the overall effectiveness of other systems like the Terrain Avoidance Warning System. By allowing flight crews to more easily acquire and maintain a stable flight path the VSD also yields other benefits such as decreased occurrences of landing incidents and missed approaches.

Author

Terrain Analysis; Safety; Losses; Landing; Flight Control; Cost Effectiveness; Air Transportation; Accident Prevention

20000041722 British Aerospace Aircraft Group Systems North America, Rockville, MD USA

Enhancing Situational Awareness in the Civil Aircraft Cockpit

Tucker, Brian G. S., British Aerospace Aircraft Group Systems North America, USA; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment: Proceedings; [2000], pp. 1.1 - 1.33; In English; Situational Awareness on the Flight Deck: The Current and Future Contribution by Systems and Equipment, 23 Mar. 2000, London, UK; Sponsored by Royal Aeronautical Society, UK; ISBN 1-85768-186-X; Copyright; Avail: Issuing Activity

Contents include the following: impact of increased traffic; the advantages of visual guidance systems (VGS); controlled flight into terrain-statistics;runway inclusion; and future benefits of VGS.

CASI

Cockpits; Flight Control

54
MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human factors engineering; bionics, man-machine, life support, space suits and protective clothing. For related information see also 16 Space Transportation and 52 Aerospace Medicine..

20000038777 Institute for Human Factors TNO, Soesterberg, Netherlands

Use of Adaptable Displays for Fighter Aircraft Flight Support *Final Report Gebruik van Aanpasbare Displays met Gezichtspunt ter Ondersteuning van Vliegtaken in Gevechtsvliegtuigen*

deVries, S. C., Institute for Human Factors TNO, Netherlands; Veltman, J. A., Institute for Human Factors TNO, Netherlands; vanBreda, L., Institute for Human Factors TNO, Netherlands; Feb. 02, 1999; 46p; In English; Original contains color illustrations

Contract(s)/Grant(s): A95/KLu/341; TNO Proj. 788.1

Report No.(s): TD-99-0013; TM-99-A011; Copyright; Avail: Issuing Activity

In a flight simulator experiment pilots were subjected to a large range of tasks, namely waypoint flying, interception of intruders, threat zone detection and object localization. The set of tasks was chosen to cover all aspects of local and global navigation. The pilots were aided in their task by displays providing them with the necessary information. Goal of the research was to determine which type of display is optimal for which task and whether pilots choose the most optimal display when given a choice of displays. Five types of displays were used: a 2D north-up display, a 2D north/south-up display, a 2D heading- up display, a 3D egocentric display and a 3D exocentric (wi.igman) display. The experimental conditions allowed the pilots either the full choice of all display types, a choice of display types one and four only, display type one only or display type four only. The results show

that for global navigation tasks (object localization) the use of the 2D north-up display leads to a significantly better performance than the use of the 3D egocentric display while the variable display conditions show intermediate results. Local guidance tasks are best served with the 3D egocentric display and worst with the 2D north-up display. Again, the use of variable displays yields intermediate results. A remarkable finding is that most pilots rarely adjusted their displays to the flight phase they were in. Apparently, a preference for a certain display is quickly adopted. This behaviour is probably sub-optimal and attention should be paid to this whenever a multiple-representation display like the one tested here will be implemented in an actual fighter aircraft. Worrisome was the finding that when using the five-choices option the number of crashes increased threefold. Though this effect was not significant, the sheer size calls for further research.
Author
Detection; Display Devices; Flight Simulators

20000039303 Pennsylvania State Univ., Center for Locomotion Studies, University Park, PA USA
Ground Reaction Forces in 1G and Simulated Zero-Gravity Running
McCrory, Jean L., Pennsylvania State Univ., USA; Derr, Janice, Pennsylvania State Univ., USA; Cavanagh, Peter R., Pennsylvania State Univ., USA; [1996]; 2p; In English
Contract(s)/Grant(s): NAGW-4421; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This research compared ground reaction forces during overground (1G) running and zero-gravity ty (0G) simulated treadmill running at a full body weight load in two restraint harness designs.
Author
Loads (Forces); Running; Biological Effects; Harnesses

20000039304 Pennsylvania State Univ., Center for Locomotion, University Park, PA USA
The Implications of Reduced Ground Reaction Forces During Space Flight for Bone Strains
Peterman, Marc M., Pennsylvania State Univ., USA; Hamel, Andrew J., Pennsylvania State Univ., USA; Sharkey, Neil A., Pennsylvania State Univ., USA; Piazza, Stephen J., Pennsylvania State Univ., USA; Cavanagh, Peter R., Pennsylvania State Univ., USA; [1998]; 2p; In English
Contract(s)/Grant(s): NAGW-4421; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

The specific mechanisms regulating bone mass are not known, but most investigators agree that bone maintenance is largely dependent upon mechanical demand and the resultant local bone strains. During space flight, bone loss such as that reported by LeBlanc et al. may result from failure to effectively load the skeleton and generate sufficient localized bone strains. In microgravity, a gravity replacement system can be used to tether an exercising subject to a treadmill. It follows that the ability to prevent bone loss is critically dependent upon the external ground reaction forces (GRFs) and skeletal loads imparted by the tethering system. to our knowledge, the loads during orbital flight have been measured only once (on STS 81). Based on these data and data from ground based experiments, it appears likely that interventions designed to prevent bone loss in micro-gravity generate GRFs substantially less than body weight. It is unknown to what degree reductions in external GRFs will affect internal bone strain and thus the bone maintenance response. to better predict the efficacy of treadmill exercise in micro-gravity we used a unique cadaver model to measure localized bone strains under conditions representative of those that might be produced by a gravity replacement system in space.
Author
Bone Demineralization; Loads (Forces); Musculoskeletal System; Treadmills; Countermeasures

20000039305 Pennsylvania State Univ., Center for Locomotion Studies, University Park, PA USA
Exercise Countermeasures for Bone Loss During Space Flight: A Method for the Study of Ground Reaction Forces and Their Implications for Bone Strain
Peterman, M., Pennsylvania State Univ., USA; McCrory, J. L., Pennsylvania State Univ., USA; Sharkey, N. A., Pennsylvania State Univ., USA; Piazza, S., Pennsylvania State Univ., USA; Cavanagh, P. R., Pennsylvania State Univ., USA; [1999]; 4p; In English; 1st; Space Biomedical Investigators', 11-13 Jan. 1999, League City, TX, USA; Sponsored by NASA, USA
Contract(s)/Grant(s): NAGW-4421; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The human zero-gravity locomotion simulator and the cadaver simulator offer a powerful combination for the study of the implications of exercise for maintaining bone quality during space flight. Such studies, when compared with controlled in-flight exercise programs, could help in the identification of a strain threshold for the prevention of bone loss during space flight.
Derived from text
Countermeasures; Physical Exercise; Bone Demineralization; Physiological Effects; Weightlessness; Biological Effects; Feet (Anatomy)

20000039307 Pennsylvania State Univ., Center for Locomotion Studies, University Park, PA USA

The Biomechanics of Exercise Countermeasures ***Final Report***

Cavanagh, Peter R., Pennsylvania State Univ., USA; Sharkey, Neil, Pennsylvania State Univ., USA; Wu, Ge, Pennsylvania State Univ., USA; [1999]; 7p; In English

Contract(s)/Grant(s): NAGW-4421; NAG5-6199; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Penn State Zero-gravity Simulator (PSZS) is a device developed by the Center for Locomotion Studies (CELOS) to enable ground studies of exercise countermeasures for the bone loss that has been shown to occur during long-term exposure to zero gravity (0G). The PSZS simulates 0G exercise by providing a suspension system that holds an individual in a horizontal (supine) position above the floor in order to enable exercise on a wall-mounted treadmill. Due to this orientation, exercise performed in the PSZS is free of the force of -ravity in the direction that would normally contribute to ground reaction forces. In order for movements to be more similar to those in 0G, a constant force suspension of each segment (equal to the segment weight) is provided regardless of limb position. During the preliminary development of the PSZS, CELOS researchers also designed an optional gravity-replacement simulation feature for the PSZS. This feature was a prototype tethering system that consisted of a spring tension system to pull an exercising individual toward the treadmill. The immediate application of the tethering system was to be the provision of gravity-replacement loading so that exercise in 0G- and 1G-loading conditions could be compared, and the PSZS could then be used to evaluate exercise countermeasures for bone loss during space flight. This tethering system would also be a model for the further refinement of gravity-replacement systems provided for astronaut usage while performing prescribed exercise countermeasures for bone loss during long-term space flights.

Author

Physical Exercise; Simulation; Simulators; Treadmills; Weightlessness; Biodynamics; Countermeasures

20000039308 Pennsylvania State Univ., Center for Locomotion Studies, University Park, PA USA

Subject Load-Harness Interaction During Zero-Gravity Treadmill Exercise

McCrory, Jean L., Pennsylvania State Univ., USA; Baron, Heidi A., Pennsylvania State Univ., USA; Derr, Janice A., Pennsylvania State Univ., USA; Davis, Brian L., Cleveland Clinic Foundation, USA; Cavanagh, Peter R., Pennsylvania State Univ., USA; [1996]; 2p; In English

Contract(s)/Grant(s): NAGW-4421; Copyright; Avail: Issuing Activity

When astronauts exercise on orbit, a subject load device (SLD) must be used to return the subject back to the supporting surface. The load in the SLD needs to be transferred the body by a harness which typically distributes this load between the pelvis and We shoulders. Through the use of a zero-gravity simulator, this research compared subject comfort and ground reaction forces during treadmill running at three levels of subject load (60%,80%, and 100% of body weight) in two harness designs (”shoulder only” and ”waist ”and shoulder ”).

Author

Harnesses; Physical Exercise; Simulators; Treadmills; Weightlessness

20000039421 Institute for Human Factors TNO, Soesterberg, Netherlands

Human Factors Issues and Advanced Interface Design in Maritime Unmanned Aerial Vehicles: A Project Overview 1995-1998 ***Final Report Technisch Menskundige Aspecten en Innovatieve Voor Maritieme Onbemande Luchtvaartuigen : Een Projectoverzicht 1995-1998***

vanErp, J. B. F., Institute for Human Factors TNO, Netherlands; vanBreda, L., Institute for Human Factors TNO, Netherlands; Jan. 25, 1999; 29p; In English

Contract(s)/Grant(s): A95/KM/372; TNO Proj. 788.1

Report No.(s): TD-99-0006; TM-99-A004; Copyright; Avail: Issuing Activity

This report presents an overview of the studies conducted for the Royal Netherlands Navy under contract A95/KM/372 on the human-machine interface for steering Maritime Unmanned Aerial Vehicles (MUAVS) and controlling their remote cameras. While manual control is preferable for specific tasks, the operator misses critical sensory information, such as proprioceptive feedback on camera viewing direction. Furthermore, the information on the remote environment which is presented, namely the payload images, is of degraded quality due to the restricted data-link. This may result in camera images with low temporal and spatial resolution, and a small field of view. The six studies performed mainly focussed on the negative effects of the degraded visual information (including low update rates, transmission delays and zoomed-in camera images), and the possibilities to compensate these effects by innovative human-machine interface design. An important point of departure was that the improvements did not result in additional claims on the data-link. The applied techniques included the use of graphical overlays, ecological interface design, head-coupled control, and prediction techniques. The results show that carefully designed human-machine interfaces are able to partially compensate specific image degradations. The studies also served as a contribution to NATO Project Group 35

(PG35). The current report includes an overview of the progress within this Project Group. PG35 activities resulted in the identification of near-term research areas, e.g. interoperability, combined MUAV/heli operations, and the MUAV tactical information display.
Author
Cameras; Human Factors Engineering; Pilotless Aircraft; Remote Control; Human-Computer Interface; Design Analysis

20000039422 Institute for Human Factors TNO, Soesterberg, Netherlands
Remotely Controlled Flying Aided by a Head-Slaved Camera and HMD: Effects of MMD Type, Vehicle References and Stereo ***Interim Report Afstandsbestuurd Vliegen Ondersteund Door een Hoofdgekoppelde Camera en HMD: Effecten van HMD Type, Voertuigreferenties en Stereo***
deVries, S. C., Institute for Human Factors TNO, Netherlands; Padmos, P., Institute for Human Factors TNO, Netherlands; Dec. 14, 1998; 27p; In English
Contract(s)/Grant(s): B97-032; TNO Proj. 788.1
Report No.(s): TD-98-0282; TM-98-B016; Copyright; Avail: Issuing Activity

In the simulator experiment reported here we examined several parameters influencing the performance of the operator of a (simulated) Unmanned Aerial Vehicle (UAV). This operator was fitted with an HMD which showed images from the (virtual) camera onboard of the UAV. The camera was slaved to the operator's head so that the camera movements mimicked the head movements. We examined steering performance for two HMD types: the low-end, LCD-based Virtual I0 i-glasses, and the high-end, CRT-based n-vision Datavisor. Additional parameters were the presence of vehicle references in the images as an indication of camera orientation and the presence of stereo and hyper-stereo (large baseline stereo). Performance with the n-vision HMD was considerably better than with the i-glasses HMD, a difference which could not be attributed solely to the difference in field-of-view. The presence of vehicle references led to a modest improvement in performance. Stereo and hyper-stereo did not improve performance for this particular task.
Author
Pilotless Aircraft; Head-Up Displays; Flight Simulators; Cameras; Human Factors Engineering; Remote Control

20000039760 Pennsylvania State Univ., Center for Locomotion Studies, University Park, PA USA
In-Shoe Force Measurements From Locomotion in Simulated Zero Gravity During Parabolic Flight
McCrory, Jean L., Pennsylvania State Univ., USA; Schwass, John P., Pennsylvania State Univ., USA; Connell, Richard B., Krug Life Sciences, Inc., USA; Cavanagh, Peter R., Pennsylvania State Univ., USA; [1995]; 1p; In English
Contract(s)/Grant(s): NAG5-6199; No Copyright; Avail: Issuing Activity; Abstract Only

No effective countermeasure for space-induced bone loss has yet been identified. it has been hypothesized that an effective exercise regimen would elicit loads on the lower extremity which resemble those encountered on Earth. Although a treadmill has been used on shuttle flights, the loads to which the lower extremity was exposed have not yet been quantified. It is believed that these loads are much less than the loads experienced in 1G. The purpose of this study was to determine the magnitude of lower extremity loading during tethered treadmill exercise in a 0G environment.
Author
Physical Exercise; Treadmills; Weightlessness; Gravitational Physiology; Impact Loads

20000039762 NASA Johnson Space Center, Houston, TX USA
Evaluation of a Treadmill with Vibration Isolation and Stabilization (TVIS) for Use on the International Space Station
McCrory, Jean L., Pennsylvania State Univ., USA; Lemmon, David R., Pennsylvania State Univ., USA; Sommer, H. Joseph, Pennsylvania State Univ., USA; Prout, Brian, Pennsylvania State Univ., USA; Smith, Damon, Lockheed Martin Engineering and Sciences Co., USA; Korth, Deborah W., Wyle Labs., Inc., USA; Lucero, Javier, Wyle Labs., Inc., USA; Greenisen, Michael, NASA Johnson Space Center, USA; Moore, Jim, NASA Johnson Space Center, USA; Journal of Applied Biomechanics; 1999; Volume 15, pp. 292-302; In English; Copyright; Avail: Issuing Activity

A treadmill with vibration isolation and stabilization designed for the International Space Station (ISS) was evaluated during Shuttle mission STS-81. Three crew members ran and walked on the device, which floats freely in zero gravity. For the majority of the more than 2 hours of locomotion studied, the treadmill showed peak to peak linear and angular displacements of less than 2.5 cm and 2.5 deg, respectively. Vibration transmitted to the vehicle was within the microgravity allocation limits that are defined for the ISS. Refinements to the treadmill and harness system are discussed. This approach to treadmill design offers the possibility

of generating 1G-like loads on the lower extremities while preserving the microgravity environment of the ISS for structural safety and vibration free experimental conditions.
Author
Microgravity; Treadmills; Vibration Isolators; Kinematics; Astronaut Locomotion

20000039763 Pennsylvania State Univ., University Park, PA USA
Clues to Better Space Exercise: Faking Weightlessness
Health and Human Development News; 1992; Volume 6, No. 1, pp. 1 and 13; In English; Copyright; Avail: Issuing Activity

Of all the adverse effects that zero gravity has on the body, especially during long space flights, calcium loss may threaten astronauts' health the most. Studies suggest that the way shuttle astronauts exercise in space now may not be as helpful for slowing calcium loss as it could be. As part of a study on space exercise, the researchers developed a weightlessness simulator. The simulator consists of a treadmill mounted to a wall, in a manner that the subject is running horizontally to the wall. The subject is suspended horizontally to the floor by a series of cords. The simulator is designed to emulate the exercise desired in the microgravity of space. The goal of study using the Penn State Zero Gravity Locomotion Simulator is to give enough stress to the bones required for the deposition of calcium.
CASI
Locomotion; Treadmills; Weightlessness; Physical Exercise; Bone Demineralization; Countermeasures; Exercise Physiology; Physiological Effects

20000039764 Pennsylvania State Univ., University Park, PA USA
Doing the Locomotion
Pacchioli, David, Pennsylvania State Univ., USA; Health and Human Development; [1997], pp. 15-19; In English; Copyright; Avail: Issuing Activity

This article describes the research being done in how people move, how they maintain balance, and how they learn to do this. The article also describes the work being done to design footwear for diabetics to assist in avoiding complications due to ulcerations in the feet caused by neuropathy a common side effect of diabetes. Other research in the ways people fall and recover is also reviewed.
CASI
Walking; Falling; Human Reactions; Human Body; Sensorimotor Performance; Feet (Anatomy); Limbs (Anatomy); Shoes

20000040789 NASA Johnson Space Center, Houston, TX USA
Thermal Insulation Performance of Textile Structures for Spacesuit Applications at Martian Pressure and Temperature
Orndoff, Evelyne, NASA Johnson Space Center, USA; Trevino, Luis A., NASA Johnson Space Center, USA; 2000; 13p; In English; 2nd; Safety and Protective Fabrics, 26-28 Apr. 2000, Arlington, VA, USA; Sponsored by Industrial Fabrics Association International
Contract(s)/Grant(s): RTOP 131-20-95; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Protection of astronauts from the extreme temperatures in the space environment has been provided in the past using multilayer insulation in ultra-high vacuum environments of low earth orbit and the lunar surface. For planetary environments with residual gas atmospheres such as Mars with ambient pressures between 8 to 14 hPa (8 to 14 mbar), new protection techniques are required because of the dominating effect of the ambient gas on heat loss through the insulation. At Mars ambient pressure levels, the heat loss can be excessive at expected suit external temperatures of 172 K with state-of-the-art suit insulation, requiring an active heat source and its accompanying weight and volume penalties. Micro-fibers have been identified as one potential structure to reduce the heat losses, but existing fundamental data on fiber heat transfer at low pressure is lacking for integrated fabric structures. This baseline study presents insulation performance test data at different pressures and fabric loads for selected polyesters and aramids as a function of fiber density, fiber diameter, fabric density, and fabric construction. A set of trend data of thermal conductivity versus ambient pressure is presented for each fiber and fabric construction design to identify the design effects on thermal conductivity at various ambient pressures, and to select a fiber and fabric design for further development as a suit insulation. The trend data also shows the pressure level at which thermal conductivity approaches a minimum, below which no further improvement is possible for a given fiber and fabric design. The pressure levels and resulting thermal conductivities from the trend data can then be compared to the ambient pressure at a planetary surface, Mars for example, to determine if a particular fiber and fabric design has potential as a suit insulation.
Author
Aerospace Environments; Planetary Temperature; Space Suits; Thermal Insulation; Gas Pressure

20000041705 State Univ. of New York, Dept. of Mechanical Engineering, Binghamton, NY USA

Motion Cueing Algorithm Development: Initial Investigation and Redesign of the Algorithms

Telban, Robert J., State Univ. of New York, USA; Wu, Weimin, State Univ. of New York, USA; Cardullo, Frank M., State Univ. of New York, USA; March 2000; 286p; In English

Contract(s)/Grant(s): NAS1-20454; RTOP 992-30-11-01

Report No.(s): NASA/CR-2000-209863; NAS 1.26:209863; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

In this project four motion cueing algorithms were initially investigated. The classical algorithm generated results with large distortion and delay and low magnitude. The NASA adaptive algorithm proved to be well tuned with satisfactory performance, while the UTIAS adaptive algorithm produced less desirable results. Modifications were made to the adaptive algorithms to reduce the magnitude of undesirable spikes. The optimal algorithm was found to have the potential for improved performance with further redesign. The center of simulator rotation was redefined. More terms were added to the cost function to enable more tuning flexibility. A new design approach using a FORTRAN/Matlab/Simulink setup was employed. A new semicircular canals model was incorporated in the algorithm. With these changes results show the optimal algorithm has some advantages over the NASA adaptive algorithm. Two general problems observed in the initial investigation required solutions. A nonlinear gain algorithm was developed that scales the aircraft inputs by a third-order polynomial, maximizing the motion cues while remaining within the operational limits of the motion system. A braking algorithm was developed to bring the simulator to a full stop at its motion limit and later release the brake to follow the cueing algorithm output.

Author

Algorithms; Cues; Motion Perception; Software Engineering; Motion Simulators; Human Factors Engineering

59
MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

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

20000044707 Royal Inst. of Tech., Dept. of Mathematics, Stockholm, Sweden

Removability: First Order Sobolev Space, PDE Solutions, Holomorphic Functions. Sobolev Space Constructed in a New Way

Wannebo, A.; Jun. 1999; 20p; In English

Report No.(s): PB2000-103208; TRITA-MAT-99-MA-14; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Condition for removability for sets with respect to first order Sobolev space functions, holomorphic functions and other solutions to first order PDE:s - also nonlinear - are provided. A new kind of representation formula for first order Sobolev space is proved.

NTIS

Analytic Functions; Partial Differential Equations; Sobolev Space

20000044708 Royal Inst. of Tech., Dept. of Mathematics, Stockholm, Sweden

Adapted Bases of Time-Frequency Local Cosines

Villemoes, L. F.; Jun. 1999; 30p; In English

Report No.(s): PB2000-103212; TRITA-MAT-99-MA-10; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The authors develop and analyze a best basis algorithm for orthonormal bases of local cosines which satisfy a uniform bound on their time-frequency concentration. All waveforms are obtained from three elementary window functions by shifts, rescaling, and modulation.

NTIS

Cosine Series; Orthonormal Functions; Algorithms; Time Functions

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.

20000038884 Naval Postgraduate School, Monterey, CA USA
Risk Assessment in Incremental Software Development
Matsuo, Eric K.; Dec. 1999; 114p; In English
Report No.(s): AD-A374495; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Cost overruns, schedule slips, and projects with fewer features or functions than originally specified are some of the difficulties that the software community faces in almost all software projects. The application of proper risk management throughout the lifecycle of the software development can drastically improve the chances of success. Risk management is an essential skill that many good mangers possess. Utilizing proper risk management provides early risk detection, which in turn gives the manager more flexibility to mitigate and resolve the risks within the software development project. This thesis presents a disciplined and systematic risk management tool that can be utilized to assess risk in incremental software development projects from cradle to grave. This methodology can be applied with limited resources, and is adaptable and flexible enough to be used on all software intensive projects. The methodology incorporates the Software Engineering Institute's proven risk taxonomy and questionnaire. It also provides a project manager or project decision-maker an efficient way of assessing risk in incremental software development. Further, this thesis implements the risk assessment framework on a software development project and validates the validity and usefulness as a risk management tool.
DTIC
Software Engineering; Risk; Computer Programs; Computer Programming

20000038888 Naval Postgraduate School, Monterey, CA USA
Addressing the USA Navy Need for Software Engineering Education
Bok, Michael J.; Sep. 1999; 211p; In English
Report No.(s): AD-A374507; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Computer technology use as a highly effective tool is ever increasing in the modem world, including the warfare arena. Manning issues due to budget concerns mandate a smaller future military workforce, while theater conflicts will continually grow in complexity. Computers are powerful tools that can aid the warrior's ability to fight amidst this onslaught of information. Unfortunately, a computer cannot simply be dropped onto a ship to create miracles on its own. Computers are only as intelligent and useful as they are engineered to be. The costs of this highly difficult and expensive task can be mitigated by proper utilization of personnel specifically educated to plan and produce these systems and the associated software. The Navy can produce these personnel from within its ranks, via a curriculum in Software Engineering at the Naval Postgraduate School; however the effectiveness of this program is not currently being maximized. This thesis develops and implements a program to address the Navy's needs for software engineering, helping successfully combat the Navy's current void in software engineering education. This should ultimately lead to an increase in the Navy's knowledge assets, and subsequently to better opportunities for Naval utilization of the technology available to improve warfare abilities.
DTIC
Software Engineering; Computer Programs; Computer Systems Design; Warfare

20000038897 Naval Postgraduate School, Monterey, CA USA
Design of Advanced Analysis Software for IT-21 Compliant Networks
Demille, David R.; Dec. 1999; 63p; In English
Report No.(s): AD-A374578; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The cornerstone to achieving battlefield dominance, as defined by Joint Vision 2010, is establishing and maintaining information superiority. This new paradigm of network centric warfare has shifted computer networking from an administrative support system to a tactical necessity. Recognizing this critical requirement for inter operable networking, the Department of the Navy promulgated the Information Technology for the Twenty-First Century (IT-2l) computing standards. This thesis investigates the synergetic interactions between application software, the Windows(TM) NT operating system, and the underlying networks. The insight gained is then exploited to develop performance analysis software in C++. The resulting application provides a valuable asset for existing, troubleshooting, and optimizing IT-2l information systems.
DTIC
Applications Programs (Computers); Software Engineering; Reliability Analysis; Warfare

20000038899 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA

Accelerating Exact k-means Algorithms with Geometric Reasoning

Pelleg, Dan; Moore, Andrew; Jan. 2000; 22p; In English

Report No.(s): AD-A374582; CMU-CS-00-105; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present new algorithms for the k-means clustering problem. They use the kd-tree data structure to reduce the large number of nearest-neighbor queries issued by the traditional algorithm. Sufficient statistics are stored in the nodes of the kd-tree. Then an analysis of the geometry of the current cluster centers results in great reduction of the work needed to update the centers. Our algorithms behave exactly as the traditional k-means algorithm. Proofs of correctness are included. The kd-tree can also be used to initialize the k-means starting centers efficiently. Our algorithms can be easily extended to provide fast ways of computing the error of a given cluster assignment regardless of the method in which those clusters were obtained. We also show how to use them in a setting which allows approximate clustering results, with the benefit of running faster. We have implemented and tested our algorithms on both real and simulated data. Results show a speedup factor of up to 170 on real astrophysical data, and superiority over the naive algorithm on simulated data in up to 5 dimensions. Our algorithms scale well with respect to the number of points and number of centers allowing for clustering with tens of thousands of centers.

DTIC

Algorithms; Applications of Mathematics; Set Theory; Computational Geometry

20000039695 Nova Southeastern Univ., Fort Lauderdale, FL USA

Multiple Expert Evaluations of a PC Computer-Based Aviation Flight Training Device

Forrest, Jeffrey S., Nova Southeastern Univ., USA; Collegiate Aviation Review; October 1999; Volume 17, No. 1, pp. 15-30; In English; See also 20000039693; Copyright; Avail: Issuing Activity

The usability of a personal computer based aviation-training device (PCATD) was investigated by conducting multiple expert evaluations. One group of experts performed a heuristic evaluation of the PCATD system. Experts in a second group evaluated the PCATD by conducting a cognitive-walkthrough analysis. An ethnographic analysis was also carried out by directly observing and interviewing the participating experts during the evaluations. Experts evaluated the usability of the PCATD as applied to various practical test standards used for instrument flight training. Strong consensus by the experts in both groups indicated that the PCATD was usable for fundamental flight training as required by the Federal Aviation Administration's Instrument Rating curriculum. Issues concerning various PCATD simulation fidelities and related inconsistencies in interface design were discovered. These issues caused concern over using the PCATD for training that could be applied to actual flight time.

Author

Evaluation; Training Devices; Simulation; Management; Heuristic Methods; Flight Training

20000040473 Institute for Computer Applications in Science and Engineering, Hampton, VA USA

Aircraft Trajectory Modeling and Alerting Algorithm Verification

Munoz, Cesar, Institute for Computer Applications in Science and Engineering, USA; Carreno, Victor, NASA Langley Research Center, USA; April 2000; 25p; In English

Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01

Report No.(s): NASA/CR-2000-210097; NAS1.26:210097; ICASE-2000-16; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Airborne Information for Lateral Spacing (AILS) program at NASA Langley Research Center aims at giving pilots the information necessary to make independent approaches to parallel runways with spacing down to 2500 feet in Instrument Meteorological Conditions. The AILS concept consists of accurate traffic information visible at the navigation display and an alerting algorithm which warns the crew when one of the aircraft involved in a parallel landing is diverting from the intended flight path. In this paper we present a model of aircraft approaches to parallel runways. Based on this model, we analyze the alerting algorithm with the objective of verifying its correctness. The formalization is conducted in the general verification system PVS.

Author

Navigation Aids; Algorithms; Flight Paths; Trajectories; Spacing

20000041718 Special Committee on the Year 2000 Technology Proble (U.S. Senate), Washington, DC USA

Y2K Aftermath: Crisis Averted. Final Committee Rport. Summary of Committee Findings

Feb. 29, 2000; 60p

Report No.(s): PB2000-103666; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Committee's final report is comprised of three sections. The first describes how well the nation and the world transitioned to the Year 2000, including examples of reported computer problems. The second section describes lessons learned and benefits

derived from Y2K. Finally, the third section examines how these benefits and lessons might be used to better address future information technology (IT) challenges.
NTIS
Information Systems; Computer Programming; Computer Program Integrity; Computer Programs

20000042026 National Defence Research Establishment, Dept. of Command and Control Warfare Technology, Linkoeping, Sweden
Mobile Code and Computer Security. Security Mechanisms in the Java Virtual Machine ***Mobil kod och Datasaekerhet: Saekerhetsmekanismer i Javas Virtuella Maskin***
Lindahl, D.; Jun. 1999; 88p; In Swedish
Report No.(s): PB2000-102579; FOA-R-99-01166-503-SE; No Copyright; Avail: National Technical Information Service (NTIS)

During the last decade the use of computers connected into networks, so called distributed systems, have increased dramatically. One effect of this has been the use of a new type of program, mobile code. A typical example is a program embedded within a webpage distributed via the WWW. The language Java is used to a great extent to write programs within this category. When mobile code written in Java is executed, it is normally run in what is called a Virtual Machine. This system contains mechanisms that work as insulation against potentially harmful intrusions in the program. This report addresses what these functions are and lists them. The conclusion drawn in the report is that the security mechanisms within Java offer good protection against the destruction of hard- and software but have limits in the area of protection against denial of service attacks.
NTIS
Java (Programming Language); Computer Networks; Computer Programming; Computer Information Security

20000042554 Communications Research Lab., Tokyo, Japan
Evaluation of Multimedia Application Programming Interface
Kobayashi, Youichi, Communications Research Lab., Japan; Suzuki, Ryutaro, Communications Research Lab., Japan; Review of the Communications Research Lab.; December 1998; ISSN 0914-9279; Volume 44, No. 4, pp. 241-253; In English; Copyright; Avail: Issuing Activity

On today's Internet, multimedia such as moving pictures and sound are getting commonly used. In order to cope with these increases in traffic, the technical progress will not end. Higher definition multimedia data could be easily available in the near future. On the broadband communication infrastructure, applications that operate high definition multimedia data have already realized. However, they could not expect a wide use under present circumstances so that they usually run depending on such environments as hardware platforms, operating systems, or protocols. Then, we manufactured MMAPI (Multimedia Application Programming Interface) by way of trial, which is independent of above environments and easily to program applications. The result of connecting experiments conducted under multi-platform, multi-OS, and multi-protocol environments and their evaluations are reported here.
Author
Multimedia; Interfaces; Computer Programming

20000042896 SRI International Corp., Menlo Park, CA USA
Reusable Tools for Knowledge Base and Ontology Development ***Final Report, Sep. 1996 - Jul. 1999***
Chaudhri, Vinay K., SRI International Corp., USA; Feb. 2000; 35p; In English
Contract(s)/Grant(s): F30602-96-C-0332; AF Proj. 2532
Report No.(s): AD-A375399; AFRL-IF-RS-TR-2000-12; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

In the construction of a new knowledge base (KB), significant productivity gains can be obtained by reusing existing knowledge components. These components include pieces of domain knowledge and KB development tools. To support reuse of domain knowledge, the knowledge sharing community has undertaken various efforts, including the development of shared portable anthologies and the development of well-defined languages for knowledge interchange. There has been, however, less emphasis on the reuse of KB development tools. A significant amount of effort is invested in building customized tools for specific knowledge representation systems (KRSs). These tools work only with a single KRS, and the development effort is wasted if the KRS is no longer used. A KRS developer usually does not have the choice of using off-the-shelf tools and is forced to develop custom tools. Open knowledge base connectivity (OKBC) is an application programming interface (API) for KPRSs that has been developed to address the problem of KB tools reusability. The name OKBC was chosen to be analogous to ODBC (Open Database Connectivity), as used in the database community. This work experimented with several KB development tools to test the ability

of OKBC to enable the construction of reusable tools. These tools included GKB-editor, a graphical tool for browsing and editing KBs, and PERK, a system for storing KBs in Oracle and for controlling multiuser access to KBs.
DTIC
Knowledge Based Systems; Knowledge Representation; Knowledge Bases (Artificial Intelligence); Artificial Intelligence; Relational Data Bases

20000044001 Defence Science and Technology Organisation, Information Technology Div., Canberra Australia
An Approach for Identifying and Characterizing Problems in the Iterative Development of C3I Capability
Kingston, Gina, Defence Science and Technology Organisation, Australia; Henderson, Derek, Defence Science and Technology Organisation, Australia; Vernik, Rudi, Defence Science and Technology Organisation, Australia; Nov. 1999; 36p; In English
Contract(s)/Grant(s): Proj-N9505/17/175
Report No.(s): AD-A375433; DSTO-TN-0238; DODA-AR-011-148; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This report presents a research approach that has been used to determine the key problems faced by the Australian Defense Organization (ADO) in the iterative development of C3I (Command, Control, Communication and Intelligence) capability. Repeated application of the approach, combined with knowledge of strategic and technological changes, could be used assess process improvement activities. The approach uses interviews of the stakeholders in the Iterative Capability Development (ICD) process to gather information about the perceived problems. As well as documenting the approach used in a study of the key problems with the ICD process, this report illustrates the application of study design principles, such as methods for minimizing potential biases in an interview-based study.
DTIC
Defense Program; Australia; Decision Making; Command and Control; Communication; Intelligence

20000044006 Wisconsin Univ., Dept. of Industrial Engineering, Madison, WI USA
FATCOP: A Fault Tolerant Condor-PVM Mixed Integer Program Solver
Chen, Qun, Wisconsin Univ., USA; Ferris, Michael C., Wisconsin Univ., USA; Mar. 17, 1999; 24p; In English
Contract(s)/Grant(s): F49620-98-1-0417; NSF-CDA97-26385
Report No.(s): AD-A375528; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

We describe FATCOP, a new parallel mixed integer program solver written in PVM. The implementation uses the Condor resource management system to provide a virtual machine composed of otherwise idle computers. The new solver differs from previous parallel branch-and-bound work by implementing a general purpose parallel mixed integer programming algorithm in an opportunistic multiple processor environment as opposed to a convectional dedicated environment. It shows how to make effective use of resources as they become available while ensuring the program tolerates resource retreat. The solver performs well on test problems arising from real applications, and is particularly useful for solving long-running hard mixed integer programming problems.
DTIC
Fault Tolerance; Parallel Processing (Computers)

62
COMPUTER SYSTEMS

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

20000038642 Nippon Telegraph and Telephone Public Corp., Access Network Service Systems Labs., Tokyo, Japan
Optical Access System for New Internet Services
Tamaki, Norio, Nippon Telegraph and Telephone Public Corp., Japan; Murakami, Katsumi, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 2000; ISSN 0915-2334; Volume 12, No. 2, pp. 73-77; In English; Copyright; Avail: Issuing Activity

To support the increasing demands of the Internet access, new optical access systems for the middle/high-speed computer communication have been developed. These system are based on passive double star (PDS) system, which can be provide low

speed services such as telephone and ISDN economically. In this article, we show the outline of these optical access technologies and the smooth installation of the optical access system into the metallic network.
Author
Interprocessor Communication; Internets; Support Systems; Optical Communication

20000038643 Nippon Telegraph and Telephone Public Corp., Service Integration Labs., Tokyo, Japan
Perspective of a Photonics Network Testbed
Shibata, Nori, Nippon Telegraph and Telephone Public Corp., Japan; Miyaho, Noriharu, Nippon Telegraph and Telephone Public Corp., Japan; Yamamoto, Hideo, Nippon Telegraph and Telephone Public Corp., Japan; Fujii, Nobuo, Nippon Telegraph and Telephone Public Corp., Japan; Itaya, Yoshio, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 2000; ISSN 0915-2334; Volume 12, No. 2, pp. 60-64; In English; Copyright; Avail: Issuing Activity

Developed as a testbed for demonstrating data distribution network capabilities focusing mainly on megamedia contents, Global Enhanced Multifunctional Network (GEMnet) will serve to verify the functions of R&D products and ensure the global compatibility of those products. As media that is delivered over networks makes the quantitative leap from mega- to giga-scale data capacities, a new data distribution testbed will be required. Eventually, a photonic network that performs opto-electrical conversions only on the edges of the network will be considered as a candidate for handling gigamedia. From the standpoint of developing and deploying new services and applications, the access systems are at the front line of the network in making these services available. This article will provide an overview of the system and component technologies needed to configure and deploy a testbed seeking to implement an access system-aware photonic network.
Author
Computer Networks; Deployment; Photonics; Test Stands

20000038644 Nippon Telegraph and Telephone Public Corp., Information Sharing Platform Labs., Tokyo, Japan
Implementation and Operation of IPv6 Global Internet Using GEMnet
Mikami, Hirohide, Nippon Telegraph and Telephone Public Corp., Japan; Mogi, Kazuo, Nippon Telegraph and Telephone Public Corp., Japan; Fujisaki, Tomohiro, Nippon Telegraph and Telephone Public Corp., Japan; Ota, Kenji, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 2000; ISSN 0915-2334; Volume 12, No. 2, pp. 33-37; In English; Copyright; Avail: Issuing Activity

Real networks using the next-generation Internet protocol IPv6 are emerging worldwide. NTT has implemented and operated the experimental environment NTTv6net using GEMnet to demonstrate the development process of global IPv6 Internet service technologies. This article introduces the configuration of NTTv6net and progress of the experiment.
Author
Internets; Protocol (Computers); Experimentation

20000038760 Alabama Univ., Research Inst., Huntsville, AL USA
Networking Capabilities for the Missile Research, Development, and Engineering Center ***Final Report, 23 Jul. 1998 - 31 Dec. 1999***
Maddux, Gary A.; Jan. 2000; 7p; In English
Contract(s)/Grant(s): DAAH01-98-D-R001
Report No.(s): AD-A374418; UAH-TR-5-20257; UAH-TR-5-20258; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

The Systems Simulation and Development Directorate has the responsibility for coordinating the research, development, and management of Local Area Networks (LANs) activities within the Missile Research, Development and Engineering Center. Directorates and offices within MRDEC require local computer networks with other LANs and Wide Area Networks (WANs). Networking is essential to evaluate missile computer systems and allow MRDEC access to technology at other DOD sites and worldwide. In support of this effort, UAH was contracted to perform research and analysis of computer networking capabilities within the MRDEC. UAH provided to the Center capabilities for LANs and WANs for missile systems and advanced missile manufacturing.
DTIC
Missile Design; Local Area Networks; Wide Area Networks

20000038775 Institute for Human Factors TNO, Soesterberg, Netherlands

Effects of Internal and External Delays on Task Performance on Networked Simulators ***Interim Report Effecten van Interne en Externe Vertragingen op de Taakprestatie in Genetwerkte Simulatoren***

deVries, S. C., Institute for Human Factors TNO, Netherlands; Feb. 04, 1999; 42p; In English

Contract(s)/Grant(s): A96/KL/354; TNO Proj. 788.1

Report No.(s): TD-99-0014; TM-99-A012; Copyright; Avail: Issuing Activity

Distributed interactive Simulation (DIS) is a collection of protocols used to connect various simulators. DIS is not free of complications because those simulators may be quite heterogeneous and geographically dispersed. Important are the effects of delays, which are encountered in several ways in the context of DIS. First of all, we have the classic internal simulator delays: user actions are delayed due to input delays, synchronization problems, vehicle model calculations and image generation. Typical delays are in the range of 100 - 150 ms. to this-internal-problem, DIS adds two related external issues. First, every participating unit doesn't update its status continuously. It sends an update only when the difference between the own position and its representation in the rudimentary extrapolation model with which the other units calculate its position exceeds a pre-determined threshold. This generally results in a low update rate, which means that information about the other participants is not always up-to-date, a problem which is increased by a second difficulty DIS has to deal with: communication or external delays. For instance, a typical surface level connection between Europe and the US experiences a minimal transport delay of 100 ms, due purely to distance and the finite speed of light. to reduce the update and delay problem DIS utilizes delay compensation ("dead reckoning") methods. of course, these methods can not be perfect and therefore specifications for maximum acceptable delays are delineated in DIS. For the so-called 'tightly coupled interactions' a delay of 100 ms is deemed acceptable. However, there are reasons to question the validity of this rule of thumb. Resolving this question was the main focus of the research reported here. We also examined the interaction of internal and external delays, an issue instigated by a model study which suggested that for a given amount of external delay a certain amount of internal delay could be beneficial. Lastly, we studied the effects of an alternative to the DIS delay compensation method described in the literature. In the experiment, a system of two connected simulators was simulated. Two subjects were each provided with a display that showed a (delayed) top view of the vehicle they controlled, driving on a schematically depicted, winding road. The display also showed the (delayed) vehicle of their colleague. The subjects' task was to follow the road as closely as possible while remaining lined up with the other vehicle. The results show the external delay to have effects in the same order of magnitude as the internal delay. The contribution per ms delay of the internal delay to the total error was about 2/3 while the external delay contributed for about 1/3. Deviation speeds varied stronger with external delays than with internal delays. If the error magnitude is used as the only criterion then the above mentioned guideline for the maximum acceptable communication delay of 100 ms is valid for a fast simulator with a maximum internal delay of about 70 ms. A non-linear relation between the effects of internal and external delays was found, as the model study predicted, albeit rather difficult to interpret and it will be hard to use these particular results for general guidelines. Finally, it was found that the alternative "dead reckoning" algorithm suggested in the literature did not improve the standard DIS method.

Author

Algorithms; Distributed Interactive Simulation; Delay; Human Performance

20000038782 Nippon Telegraph and Telephone Public Corp., Access Network Service Systems Labs., Tokyo, Japan

Optical Fiber Cable Related Technologies Focused on Cost Reduction

Tomita, Nobuo, Nippon Telegraph and Telephone Public Corp., Japan; Hirahara, Toshiyuki, Nippon Telegraph and Telephone Public Corp., Japan; Hogari, Kazuo, Nippon Telegraph and Telephone Public Corp., Japan; Niimi, Kazuyoshi, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 2000; ISSN 0915-2334; Volume 12, No. 2, pp. 90-99; In English; Copyright; Avail: Issuing Activity

The economical installation of optical access networks is the first step in constructing advanced access networks that can ensure a quick and flexible response to changing and diversifying user needs. This article introduces optical fiber cable related technologies designed to achieve greater economy.

Author

Optical Fibers; Communication Cables; Technology Assessment; Cost Reduction

20000038783 Nippon Telegraph and Telephone Public Corp., Access Network Service Systems Labs., Tokyo, Japan

Network Architecture Technology for a Highly Versatile and Economical Optical Access Network

Sato, Kiminori, Nippon Telegraph and Telephone Public Corp., Japan; Takasugi, Hidetoshi, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 2000; ISSN 0915-2334; Volume 12, No. 2, pp. 85-89; In English; Copyright; Avail: Issuing Activity

Network architecture technology refers to technology which clearly defines the functions and equipment configurations needed for the efficiently construction and utilization of the optical access network. This article will examine the work that has been undertaken to date to make FTTH a reality, and report on efforts that have been made to develop new network architecture technologies for economic and highly versatile networks that will be able to flexibly accommodate IP services, etc., in the future. Author

Networks; Architecture (Computers); Technology Assessment

20000038786 Nippon Telegraph and Telephone Public Corp., Information Sharing Platform Labs., Tokyo, Japan

Implementation and Assessment of an IP/ATM Hybrid WWW System

Abe, Hirofumi, Nippon Telegraph and Telephone Public Corp., Japan; Kawashima, Masahisa, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 2000; ISSN 0915-2334; Volume 12, No. 2, pp. 46-51; In English; Copyright; Avail: Issuing Activity

An IP/ATM hybrid system for the WWW is developed that achieves very high speed file transfers. The system uses ATM more efficiently than existing switched virtual circuit (SVC) systems that invoke IP over ATM, because it examines the file size and service type in deciding whether to invoke SVCs or not. In this work we develop a hybrid MPEG video delivery system that employs narrowband permanent VCs (PVCs) to retrieve and display thumbnail samples and uses broadband time-metered ATM-SVCs to download large files and specific video files. The performance of the system is evaluated in a deployment over GEMnet. Author

Deployment; High Speed; Product Development; Internets; Data Transfer (Computers)

20000038787 Nippon Telegraph and Telephone Public Corp., Information Sharing Platform Labs., Tokyo, Japan

Global Collaboration Environment on GEMnet

Takahashi, Kenji, Nippon Telegraph and Telephone Public Corp., Japan; Yana, Eiji, Nippon Telegraph and Telephone Public Corp., Japan; Shigematsu, Mitsuhiro, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 2000; ISSN 0915-2334; Volume 12, No. 2, pp. 38-45; In English; Copyright; Avail: Issuing Activity

We have developed and evaluated an environment for global collaboration between knowledge workers on Global Enhanced Multifunctional Network (GEMnet). GEMnet is an experimental network developed by NTT. The environment fully utilizes and integrates InterPOD and TeamSmart to seamlessly support various collaboration styles used even in a single global project, including synchronous and asynchronous, and collocated and dispersed collaboration. InterPOD is a system that enables participants in meetings to access and share multimedia information from various sources. TeamSmart is a hypermedia tool for supporting collaboration on document production. The evaluation revealed that the environment built on GEMnet enables global collaboration over the barriers of time difference and distance. Problems in using the environment were also analyzed. Author

Evaluation; Product Development; Employee Relations

20000038890 Naval Postgraduate School, Monterey, CA USA

Extensible Interest Management for Scalable Persistent Distributed Virtual Environments

Abrams, Howard Allan; Dec. 1999; 237p; In English

Report No.(s): AD-A374541; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

Eventually there will exist virtual environments inhabited by millions, but as virtual environments grow in size and number of entities, many problems emerge. Because of these problems, increasing attention is being brought to the issue of filtering data that is not of interest to a given client. Such filtering is known as interest management. This dissertation outlines a Three Tiered approach to interest management. The first tier breaks the world into manageable pieces. The second tier uses the data from the first to create a protocol independent perfect match between a client's interests and the environment. The third tier, building on the second, adds protocol dependence allowing the client to receive only the data from the protocol it needs. At the same time, separating out the protocol from the core interest management can allow multiple protocols to simultaneously exist within the same environment, while using the same underlying filtering mechanism. Results from this work have shown that it is possible to create an interest management software architecture that allows bandwidth, packets per second, and CPU time to scale dependent only on the number of entities a given client is interested in at any one time.

DTIC

Distributed Processing; Virtual Reality; Configuration Management; Computer Systems Design

20000038892 Carnegie-Mellon Univ., Dept. of Computer Science, Pittsburgh, PA USA
Combining Theory Generation and Model Checking for Security Protocol Analysis
Hopper, Nicholas J.; Seshia, Sanjit A.; Wing, Jeannette M.; Jan. 2000; 23p; In English
Contract(s)/Grant(s): MDA904-99-C-5020; NSF-CCR95-23972
Report No.(s): AD-A374554; CMU-CS-00-107; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper reviews two relatively new tools for automated formal analysis of security protocols. One applies the formal methods technique of model checking to the task of protocol analysis, while the other utilizes the method of theory generation. which borrows from both model checking and automated theorem proving. For purposes of comparison. the tools are both applied to a suite of sampIe protocols with known laws. including the protocol used in an earlier study to provide a baseline. We then suggest a heuristic for combining the two approaches to provide a more complete analysis than either approach can provide alone.
DTIC
Computer Information Security; Heuristic Methods

20000038895 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
Packet Fair Queueing Algorithms for Wireless Networks with Location-Dependent Errors
Ng, T. S.; Stoica, Ion; Zhang, Hui; Feb. 2000; 41p; In English; Sponsored in part by Grant NSF-NCR96-24979
Contract(s)/Grant(s): N66001-96-C-8528; N00174-96-K-0002
Report No.(s): AD-A374575; CMU-CS-00-112; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

While Packet Fair Queueing (PFQ) algorithms provide both bounded delay and fairness in wired networks they cannot be applied directly to wireless networks. The key difficulty is that in wireless networks sessions can experience location-dependent channel errors. This may lead to situations in which a session receives significantly less service than it is supposed to, while another receives more. This results in large discrepancies between the sessions virtual times, making it difficult to provide both delay-guarantees and fairness simultaneously. Our contribution is twofold. First, we identify a set of properties, called Channel-condition Independent Fair (CIF), that a Packet Fair Queueing algorithm should have in a wireless environment: (1) delay and throughput guarantees for error-free sessions, (2) long term fairness for error sessions, (3) short term fairness for error-free sessions, and (4) graceful degradation for sessions that have received excess service. Second, we present a methodology for adapting PFQ algorithms for wireless networks and we apply this methodology to derive a novel algorithm based on Start-time Fair Queueing called Channel-condition Independent packet Fair Queueing (CIF-Q), that achieves all the above properties. to evaluate the algorithm we provide both theoretical analysis and simulation results.
DTIC
Queueing Theory; Internets; Systems Analysis; Packet Switching; Wireless Communication

20000038896 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
Toward Compositional Analysis of Security Protocols Using Theorem Proving
Sheyner, Oleg; Wing, Jeannette; Jan. 2000; 29p; In English
Contract(s)/Grant(s): MDA904-99-C-5020; NSF-CCR95-23972
Report No.(s): AD-A374576; CMU-CS-00-106; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Complex security protocols require a formal approach to ensure their correctness. The protocols are frequently composed of several smaller, simpler components. We would like to take advantage of the compositional nature of such protocols to split the large verification task into separate and more manageable pieces. Various formalisms have been used successfully for reasoning about large protocol compositions by hand. However hand proofs are prone to error. Automated proof systems can help make the proofs more rigorous. The goal of our work is to develop an automated proof environment for compositional reasoning about systems. This environment would combine the power of compositional reasoning with the rigor of mechanically-checked proofs. The hope is that the resulting system would be useful in verification of security protocols of real-life size and complexity. Toward this goal we present results of a case study in compositional verification of a private communication protocol with the aid of automated proof tool Isabelle/IOA.
DTIC
Computer Information Security; Distributed Processing; Systems Analysis

20000044691 Executive Office of the President, Washington, DC USA
Defending America's Cyberspace: National Plan for Information Systems Protection. An Invitation to a Dialogue. Executive Summary, 1.0
2000; 44p; In English
Report No.(s): PB2000-103668; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Table of Contents: Message from the President; Message from the National Coordinator; Introduction: Program (1) Identify Critical Infrastructure Assets and Shared Interdependencies and Address Vulnerabilities; Program (2) Detect Attacks and Unauthorized Intrusions; Program (3) Develop Robust Intelligence and Law Enforcement Capabilities to Protect Critical Information Systems, Consistent with Law; Program (4) Share Attack Warnings and Information in a Timely Manner; Program (5) Create Capabilities for Response, Reconstitution, and Recovery; Program (6) Enhance Research and Development in Support of Programs 1-5; Program (7) Train and Employ Adequate Numbers of Information Security Specialists; Program (8) Conduct Outreach to Make Americans Aware of the Need for Improved Cyber-Security; Program (9) Adopt Legislation and Appropriations in Support of Programs 1-8; Program (10) In Every Step and Component of the Plan, Ensure the Full Protection of American Citizens' Civil Liberties, Their Rights to Privacy, and Their Rights to the Protection of Proprietary Data.
NTIS
Information Systems; Computer Information Security; USA; Computer Networks

20000044692 Executive Office of the President, Washington, DC USA
Defending America's Cyberspace: National Plan for Information Systems Protection. An Invitation to a Dialogue, 1.0
2000; 204p; In English
Report No.(s): PB2000-103669; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Topics include: (1) The Threat to America's Critical Infrastructures; (2) Protecting Privacy and Civil Liberties; (3) The Plan, Goals and Scope; (4) Federal Government's Critical Infrastructure Assurance Plan -- (4A) Federal Government Organization for Critical Infrastructure Protection, (4B) Civilian Agency Protection and Government-Wide Initiatives, (4C) Department of Defense Infrastructure Assurance Plan; (5) and Framework for Critical Infrastructure Assurance by Private Sector and State and Local Government.
NTIS
Information Systems; Computer Information Security; Selective Dissemination of Information; Privacy; Computer Networks

63
CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

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

20000038731 NASA Goddard Space Flight Center, Greenbelt, MD USA
An Optical Bit-Counting Algorithm
Mack, Marilyn, NASA Goddard Space Flight Center, USA; Lapir, Gennadi M., ZERES, Germany; Berkovich, Simon, George Washington Univ., USA; [2000]; 4p; In English; CYSYI 2000, 2000, Atlantic City, NJ, Atlantic City, NJ, USA, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper addresses the omnipresent problem of counting bits - an operation discussed since the very early stages of the establishing of computer science. The need for a quick bit-counting method acquires a special significance with the proliferation of search engines on the Internet. It arises in several other computer applications. This is especially true in information retrieval in which an array of binary vectors is used to represent a characteristic function (CF) of a set of qualified documents. The number of "I"s in the CF equals the cardinality of the set. The process of repeated evaluations of this cardinality is a pivotal point in choosing a rational strategy for deciding whether to constrain or broaden the search criteria to ensure selection of the desired items. Another need for bit-counting occurs when trying to determine the differences between given files, (images or text), in terms of the Hamming distance. An Exclusive OR operation applied to a pair of files results in a binary vector array of mismatches that must be counted.
Derived from text
Algorithms; Computer Techniques; Counting; Bits; Information Retrieval

20000038732 NASA Goddard Space Flight Center, Greenbelt, MD USA
Approximate Matching as a Key Technique in Organization of Natural and Artificial Intelligence
Mack, Marilyn, NASA Goddard Space Flight Center, USA; Lapir, Gennadi M., ZERES, Germany; Berkovich, Simon, George Washington Univ., USA; [2000]; 4p; In English; JCIS 2000, 2000, Atlantic City, NJ, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The basic property of an intelligent system, natural or artificial, is "understanding". We consider the following formalization of the idea of "understanding" among information systems. When system I issues a request to system 2, it expects a certain kind

of desirable reaction. If such a reaction occurs, system I assumes that its request was ”understood”. In application to simple, ”push-button” systems the situation is trivial because in a small system the required relationship between input requests and desired outputs could be specified exactly. As systems grow, the situation becomes more complex and matching between requests and actions becomes approximate.
Author
Artificial Intelligence; Information Systems

20000038763 Nippon Telegraph and Telephone Public Corp., Network Service System Labs., Tokyo, Japan
AWA High-Speed Multimedia Application Experiments Using GEMnet
Furuya, Norio, Nippon Telegraph and Telephone Public Corp., Japan; Horisawa, Shingo, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 2000; ISSN 0915-2334; Volume 12, No. 2, pp. 52-54; In English; Copyright; Avail: Issuing Activity

NTT is conducting research and development on Advanced Wireless Access (AWA), with the aim to apply this technology to high-speed Internet and multimedia mobile systems. This paper describes the AWA system concept and presents results of application experiments on GEMnet utilizing prototype AWA equipment.
Author
Internets; Research and Development; Wireless Communication

64
NUMERICAL ANALYSIS

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

20000039413 Norwegian Defence Research Establishment, Kjeller, Norway
IEEE-754 Floating-Point Complex Multiplier Without Rounding of Partial Products ***Multiplikasjonskrets for Komplekse IEEE-754 Flyttall Uten Avrunding av Mellomresultatene***
Gundersen, Rune, Norwegian Defence Research Establishment, Norway; Blom, Harald, Norwegian Defence Research Establishment, Norway; Feb. 04, 2000; 206p; In Norwegian
Contract(s)/Grant(s): FFIE Proj. 726/170
Report No.(s): FFI/RAPPORT-2000/00704; Copyright; Avail: Issuing Activity

This report contains a description of a complex floating-point multiplier optimized for throughput rather than latecy. It is confirmed with IEEE-754 standard for binary floating-point arithmetic. The design is fully tested and verified. Synthesis results for the Alcatel Mietec MTC45000 technology are presented,
Author
Floating Point Arithmetic; Multipliers; Mathematical Logic

20000039951 Norwegian Defence Research Establishment, Kjeller, Norway
IEEE-754 Floating Point Multiplier Optimized for Throughput ***Multiplikasjonskrets for IEEE-754 Flyttall Optimalisert for Gjennomstromning***
Gundersen, Rune, Norwegian Defence Research Establishment, Norway; Blom, Harald, Norwegian Defence Research Establishment, Norway; Jan. 27, 2000; 123p; In Norwegian
Contract(s)/Grant(s): FFIE Proj. 726/170
Report No.(s): FFI/RAPPORT-2000/00491; Copyright; Avail: Issuing Activity

This report contains a description of a floating point adder optimized for throughput, rather than latency. It is confirm with IEEE-754 standard for binary floating-point arithmetic. The design is fully tested and verified. Synthesis results for the Alcatel Mietec MTC45000 technology is presented.
Author
Floating Point Arithmetic; Arithmetic; Integrated Circuits; Design Analysis

20000042897 Colorado Univ., Dept. of Applied Mathematics, Boulder, CO USA
Nonlinear Wave Propagation ***Final Report, 1 Jan. 1997 - 31 Dec. 1999***
Ablowitz, Mark J., Colorado Univ., USA; Mar. 17, 2000; 19p; In English
Contract(s)/Grant(s): F49620-97-C-0017
Report No.(s): AD-A375402; 153-4527; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This research effort involves the study of the nonlinear wave propagation arising in physical problems. There were a number of significant accomplishments during the period of the grant. Since January 1, 1997, 15 papers were published or accepted, 10 book chapters and papers in conference proceedings were published or accepted, 2 preprints were written and 21 invited lectures were given. Research in quadratically polarized nonlinear optical materials was carried out with novel systems of equations and new classes of stable, localized pulses obtained. Studies of discrete optical waveguides led to a new class of coupled discrete nonlinear systems and the general solution to the associated initial value problem with decaying data was obtained. Research in optical communications has yielded a number of important results including novel equations governing dispersion managed optical systems and an analytical theory governing the timing jitter and four wave mixing due to soliton collisions in NDM systems. The chaotic dynamics of a class of fluid dynamical waves, theoretically predicted by the PI based on earlier work involving numerical chaos, has been observed experimentally. A new class of reflectionless potentials of the nonstationary Schrodinger scattering problem and localized solutions of the Kadomtsev-Petviashvili equation have been obtained.
DTIC
Nonlinear Systems; Wave Propagation; Nonlinear Optics; Optical Communication

70
PHYSICS (GENERAL)

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

20000039437 Air Force Research Lab., Directed Energy Directorate, Kirkland AFB, NM USA
A Stability Analysis of the Perfectly Matched Layer Method ***Final Report, 1 Jul. - 12 Nov. 1999***
Yakura, S. J.; Dietz, David; Greenwood, Andy; Baca, Ernest; Nov. 12, 1999; 16p; In English
Contract(s)/Grant(s): Proj-5797
Report No.(s): AD-A374530; AFRL-DE-TR-1999-1090; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

We perform a detailed stability analysis based on the unsplit-field uniaxial perfectly matched layer (PML) formulation. Our finding shows that it is essential to have transverse field gradients present at all times to stabilize PML calculations. In the absence of transverse field gradients, the PML method becomes unstable with the axial field components growing linearly in time.
DTIC
Perfectly Matched Layers; Computational Electromagnetics

71
ACOUSTICS

Includes sound generation, transmission, and attenuation. For noise pollution see 45 Environment Pollution. For aircraft noise see also 02 Aerodynamics and 07 Aircraft Propulsion Propulsion and Power.

20000038898 Naval Postgraduate School, Monterey, CA USA
Acoustic Room De-reverberation Using Time-Reversal Acoustics
Liddy, David W.; Holmes, John F.; Sep. 1999; 63p; In English
Report No.(s): AD-A374579; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This thesis probes the performance of one-channel time-reversal acoustics in a chamber in terms of the geometry of the cavity. In particular, a rectangular chamber is compared to an enclosure that has a stadium shape. The mode structure in the rectangular cavity is highly symmetric, while it is highly irregular in the stadium-shaped cavity. Time- reversal acoustic techniques produce an improved focus in the latter. The focusing quality is determined as a function of frequency, time-reversal window size, and spatial extent. A scheme for encrypted acoustic communication, both in air and underwater, that uses multiple broadband signals with identical bandwidth, Hanning window source spectra, and center frequencies separated by half the bandwidth, allowing for null detection between adjacent signals, is successfully investigated.
DTIC
Communication; Frequencies; Underwater Acoustics; Sound Transmission

20000039433 Virginia Polytechnic Inst. and State Univ., Dept. of Aerospace and Ocean Engineering, Blacksburg, VA USA
Turbulence Measurements and Computations for the Predication of Broadband Noise in High Bypass Ratio Fans ***Final Report, 1 Feb. 1996 - 31 Jan. 2000***
Devenport, William J., Virginia Polytechnic Inst. and State Univ., USA; Ragab, Saad A., Virginia Polytechnic Inst. and State Univ., USA; April 2000; 5p; In English
Contract(s)/Grant(s): NAG1-1801; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Work was performed under this grant with a view to providing the experimental and computational results needed to improve the prediction of broadband stator noise in large bypass ratio aircraft engines. The central hypothesis of our study was that a large fraction of this noise was generated by the fan tip leakage vortices. More specifically, that these vortices are a significant component of the fan wake turbulence and they contain turbulent eddies of a type that can produce significant broadband noise. to test this hypothesis we originally proposed experimental work and computations with the following objectives: (1) to build a large scale two-dimensional cascade with a tip gap and a stationary endwall that, as far as possible, simulates the fan tip geometry, (2) to build a moving endwall for use with the large scale cascade, (3) to measure, in detail, the turbulence structure and spectrum generated by the blade wake and tip leakage vortex, for both endwall configurations, (4) to use the CFD to compute the flow and turbulence distributions for both the experimental configurations and the ADP fan, (5) to provide the experimental and CFD results for the cascades and the physical understanding gained from their study as a basis for improving the broadband noise prediction method. In large part these objectives have been achieved. The most important achievements and findings of our experimental and computational efforts are summarized below. The bibliography at the end of this report includes a list of all publications produced to date under this project. Note that this list is necessarily incomplete the task of publication (particularly in journal papers) continues.
Derived from text
Aircraft Engines; Broadband; Bypass Ratio; Computational Fluid Dynamics; Noise Prediction; Turbulent Flow; Fan Blades; Cascade Wind Tunnels

20000040432 NASA Langley Research Center, Hampton, VA USA
Active Structural Acoustic Control of Interior Noise on a Raytheon 1900D
Palumbo, Dan, NASA Langley Research Center, USA; Cabell, Ran, NASA Langley Research Center, USA; Sullivan, Brenda, NASA Langley Research Center, USA; Cline, John, Army Research Lab., USA; March 20000; 80p; In English
Contract(s)/Grant(s): RTOP 538-03-14-01
Report No.(s): NASA/TM-2000-209846; L-17944; NAS1.15:209846; ARL-TR-2205; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

An active structural acoustic control system has been demonstrated on a Raytheon Aircraft Company 1900D turboprop airliner. Both single frequency and multi-frequency control of the blade passage frequency and its harmonics was accomplished. The control algorithm was a variant of the popular filtered-x LMS implemented in the principal component domain. The control system consisted of 21 inertial actuators and 32 microphones. The actuators were mounted to the aircraft's ring frames. The microphones were distributed uniformly throughout the interior at head height, both seated and standing. Actuator locations were selected using a combinatorial search optimization algorithm. The control system achieved a 14 dB noise reduction of the blade passage frequency during single frequency tests. Multi-frequency control of the first 1st, 2nd and 3rd harmonics resulted in 10.2 dB, 3.3 dB and 1.6 dB noise reductions respectively. These results fall short of the predictions which were produced by the optimization algorithm (13.5 dB, 8.6 dB and 6.3 dB). The optimization was based on actuator transfer functions taken on the ground and it is postulated that cabin pressurization at flight altitude was a factor in this discrepancy.
Author
Active Control; Noise (Sound); Structural Stability; Noise Reduction; Optimization; Combinatorial Analysis

72
ATOMIC AND MOLECULAR PHYSICS

Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see 73 Nuclear Physics.

20000038377 Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt, Germany
Initial state dependence of low-energy electron emission in fast ion atom collisions
Moshammer, R.; Schmitt, W.; Kollmus, H.; Ullrich, J.; Fainstein, P. D.; Jun. 30, 1999; 16p; In English
Report No.(s): DE99-768594; GSI-99-20(PREPR.); No Copyright; Avail: Department of Energy Information Bridge

Single and multiple ionization of Neon and Argon atoms by 3.6 MeV/u Au(53+) impact has been explored in kinematically complete experiments. Doubly differential cross sections for low-energy electron emission have been obtained for defined charge state of the recoiling target ion and the receding projectile. Observed target specific structures in the electron continuum are attributable to the nodal structure of the initial bound state momentum distribution. The experimental data are in excellent accord with CDW-EIS single ionization calculations if multiple ionization is considered appropriately.
NTIS
Electron Emission; Atomic Collisions; Ionic Collisions

20000038744 California Inst. of Tech., Submillimeter Observatory, Pasadena, CA USA
Probing the Magnetic Field with Molecular Ion Spectra, 2
Houde, Martin, California Inst. of Tech., USA; Peng, Ruisheng, California Inst. of Tech., USA; Phillips, Thomas G., California Inst. of Tech., USA; Bastien, Pierre, Montreal Univ., Canada; [2000]; 22p; In English; Sponsored in part by FCAR
Contract(s)/Grant(s): NSF AST-96-15025
Report No.(s): Rept-2000-7; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present further observational evidence in support of our earlier proposal for detecting the presence of the magnetic field in molecular clouds by comparing spectra of molecular ions with those of neutral molecules. The ion lines tend to be narrower and do not show the wings due to flows, when the magnetic field is sufficiently strong. We obtained spectra for the optically thin lines of the H-13CN and H-13CO(+) species in a sample of ten molecular clouds and found the results to be in agreement with our previous observations of the main isotopic species, HCN and HCO(+), made in OMC1, OMC2, OMC3 and DR21OH, thus eliminating the possibility of optical depth effects playing a role in the ion line narrowing. HCS(+) was also detected in four of these star forming regions. We also discuss previously published results of N2H(+) detections in a large sample of dark clouds. We show that the similarity in line widths between ion and neutral species in their sample is consistent with the relatively small amount of turbulence and other flows observed in these clouds.
Author
Magnetic Fields; Molecular Ions; Spectra; Molecular Clouds; Detection

20000038885 Naval Postgraduate School, Dept. of Physics, Monterey, CA USA
Quantitative Energy Dispersive X-Ray Spectrometry Using an Emispec Vision System
Kasemodel, Carlos A.; Dec. 1999; 80p; In English
Report No.(s): AD-A374498; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The purpose of this work was to investigate the use of an Emispec Vision system to analyze energy dispersive x-ray spectra (EDS) obtained with the Topcon 002B transmission electron microscope (TEM) in the Materials Science Laboratory at the Naval Postgraduate School. A series of tests performed with a standard NiO sample revealed that the TEM column and EDS detector were operating in a satisfactory fashion. NiO spectra acquired with different sample tilt-angles were used to test the Emispec software. An improved setup configuration, in which accurate quantification is obtained with the sample at zero tilt-angle, was developed. Quantification tests performed with TiO2, Cu-Al2O3 and alumina-YAG (with 2.5% TiO2) samples confirmed the accuracy of the new software setup. Line profiles across the alumina-YAG interfaces were also recorded to verify the performance of the Emispec system for spectrum profile acquisition and to investigate the Ti distribution at the interface of the alumina-YAG heat-treated sample.
DTIC
X Ray Spectroscopy; Quantitative Analysis; Transmission Electron Microscopy; X Ray Spectra; Energy Dissipation

73
NUCLEAR PHYSICS

Includes nuclear particles; and reactor theory. For space radiation see 93 Space Radiation. For atomic and molecular physics see 72 Atomic and Molecular Physics. For elementary particle physics see 77 Physics of Elementary Particles and Fields. For nuclear astrophysics see 90 Astrophysics.

20000038376 Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt, Germany
Direct experimental evidence for strong admixture of different parity states in Li-11
Simon, H.; Aleksandrov, D.; Aumann, T.; Jun. 30, 1999; 5p; In English
Report No.(s): DE99-768596; GSI-99-22(PREPR.); No Copyright; Avail: Department of Energy Information Bridge

Peripheral fragmentation of a 287 MeV/u beam of the halo nucleus Li-11 incident on a carbon target has been studied in a fragment-neutron coincidence experiment. The momentum distribution of the Li-10 fragments gives access to the momentum distribution of the removed neutron in Li-11. From the shape of the distribution, the (1s(sub 1/2))(sup 2) contribution to the mixture of (1s(sub 1/2))(sup 2) and (0p(sub 1/2))(sup 2) components in the ground-state wave function was determined to be 45(+/-)10%. The angular correlation between the knocked out neutron and the one from the decay of Li-10 shows a skew distribution signalling interference of these two different parity states.
NTIS
Admixtures; Parity; Lithium Isotopes; Fragmentation; Nuclear Physics

20000038378 Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt, Germany
Microscopic studies on two-phonon giant resonances
Bertulani, C. A.; Ponomarev, V.; Jun. 30, 1999; 110p; In English
Report No.(s): DE99-768593; GSI-99-19(PREPR.); No Copyright; Avail: Department of Energy Information Bridge

A new class of giant resonances in nuclei, namely double giant resonances, is discussed. Investigation on their properties, together with similar studies on low-lying two-phonon states, should give an answer on how far the harmonic picture of boson-type excitations holds in the finite fermion systems like atomic nuclei. The focus in this review is given to double giant dipole resonances (DGDR) which are observed in relativistic heavy ion collisions with very large cross sections. An experimental and theoretical effort is underway to understand the reaction mechanism which leads to the excitation of these states in nuclei, as well as the better microscopic understanding of their properties. The Coulomb mechanism of the excitation of single and double giant resonances in heavy ion collision at different projectile energies is discussed in details. A contribution of the nuclear excitation to the total cross section of the reaction is also considered. The Coulomb excitation of double resonances is described within both, the second-order perturbation theory approach and in coupled-channels calculation. The properties of single and double resonances are considered within the phenomenologic harmonic vibrator model and microscopic quasiparticle-RPA approach. Finally, we use the quasiparticle-phonon model (QPM) the basic ideas and formalism of which are presented. The QPM predictions of the DGDR properties (energy centroids, widths, strength distributions, anharmonicities and excitation cross sections) are compared to predictions of harmonic vibrator model, results of other microscopic calculations and experimental data available.
NTIS
Phonons; Resonance; Nuclei (Nuclear Physics); Nuclear Physics

20000039473 NASA Marshall Space Flight Center, Huntsville, AL USA
Magnetic Flux Compression Concept for Nuclear Pulse Propulsion and Power
Litchford, Ronald J., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 2nd; Magneto- and Plasma-Aerodynamics for Aerospace Applications, 5-7 Apr. 2000, Moscow, Russia; No Copyright; Avail: Issuing Activity; Abstract Only

The desire for fast, efficient interplanetary transport requires propulsion systems having short acceleration times and very high specific impulse attributes. Unfortunately, most highly efficient propulsion systems which are within the capabilities of present day technologies are either very heavy or yield very low impulse such that the acceleration time to final velocity is too long to be of lasting interest, One exception, the nuclear thermal thruster, could achieve the desired acceleration but it would require inordinately large mass ratios to reach the range of desired final velocities. An alternative approach, among several competing concepts that are beyond our modern technical capabilities, is a pulsed thermonuclear device utilizing microfusion detonations. In this paper, we examine the feasibility of an innovative magnetic flux compression concept for utilizing microfusion detonations, assuming that such low yield nuclear bursts can be realized in practice. In this concept, a magnetic field is compressed between an expanding detonation driven diamagnetic plasma and a stationary structure formed from a high temperature superconductor (HTSC). In general, we are interested in accomplishing two important functions: (1) collimation of a hot diamagnetic plasma for direct thrust production; and (2) pulse power generation for dense plasma ignition. For the purposes of this research, it is assumed that rnicrofusion detonation technology may become available within a few decades, and that this approach could capitalize on recent advances in inertial confinement fusion ICF) technologies including magnetized target concepts and antimatter initiated nuclear detonations. The charged particle expansion velocity in these detonations can be on the order of 10 (exp 6)- 10 (exp 7) meters per second, and, if effectively collimated by a magnetic nozzle, can yield the Isp and the acceleration levels needed for practical interplanetary spaceflight. The ability to ignite pure fusion micro-bursts with reasonable levels of input energy is an equally challenging scientific problem. It remains to be seen, however, whether an effective ignition driver can be developed which meets the requirements for practical spaceflight application (namely high power density, compactness, low weight, and low cost). In this paper, system level performance and design issues are examined including generator performance, magnetic flux compression processes, magnetic diffusion processes, high temperature superconductor (HTSC) material properties, plasmadynamic processes, detonation plasma expansion processes, magnetohydrodynamic instabilities, magnetic nozzle performance, and

thrust production performance. Representative generator performance calculations based on a simplified skin layer formulation are presented as well as the results of exploratory small-scale laboratory experiments on magnetic flux diffusion in HTSC materials. In addition, planned follow-on scientific feasibility experiments are described which utilize high explosive detonations and high energy gas discharges to simulate the plasma conditions associated with thermonuclear micro-detonations.
Author
Magnetic Flux; Nuclear Propulsion; Propulsion System Performance; Plasmas (Physics); Power Efficiency; Compression Loads

20000040462 Caen Univ., UFR de Sciences, France
Statistical and off-equilibrium production of fragments in heavy ion collisions at intermediate energies
Bocage, F.; Dec. 15, 1998; 187p; In French; In English
Report No.(s): DE99-635260; LPCC-T-98-04; No Copyright; Avail: Department of Energy Information Bridge

The study of reaction products, fragments and light charged particles, emitted during heavy-ion collisions at intermediate energies has shown the dominant binary dissipative character of the reaction, which is persisting for almost all impact parameters. However, in comparison with this purely binary process, an excess of nuclear matter is observed in-between the quasi- projectile and the quasi-target. to understand the mechanisms producing such an excess, this work studies more precisely the breakup in two fragments of the quasi-projectile formed in Xe+Sn, from 25 to 50 MeV/u, and Gd+C and Gd+U at 36 MeV/u. The data were obtained during the first INDRA experiment at GANIL. The angular distributions of the two fragments show the competition between statistical fission and non-equilibrated breakup of the quasi-projectile. In the second case, the two fragments are aligned along the separation axis of the two primary partners. The comparison of the fission directions and probabilities with statistical models allows us to measure the fission time, as well as the angular momentum, temperature and size of the fissioning residue. The relative velocities are compatible with Coulomb and thermal effects in the case of statistical fission and are found much higher for the breakup of a non- equilibrated quasi-projectile, which indicates that the projectile was deformed during interaction with the target. Such deformations should be compared with dynamical calculations in order to constrain the viscosity of nuclear matter and the parameters of the nucleon-nucleon interaction,
NTIS
Fission; Ionic Collisions; Heavy Ions; Nuclear Interactions; Statistical Analysis; Temperature Effects; Mathematical Models; Charged Particles

20000040465 Lyon-1 Univ., Villeurbanne, France
Effect of nuclear interactions in neutrino reactions with oxygen targets and its role in atmospheric neutrino anomaly
Marteau Jacques,; Dec. 10, 1998; 151p; In French; In English
Report No.(s): DE99-635264; LYCEN-T-9877; No Copyright; Avail: Department of Energy Information Bridge

Atmospheric neutrinos are produced by interactions of the cosmic rays with the atmosphere’s nuclei. The observed ratio of muonic to electronic neutrinos is smaller than the theoretical one (up to a factor 2), this is the so-called atmospheric anomaly. This anomaly could be linked to that observed in the solar neutrino experiments. The aim of this work is to evaluate the effects of nuclear correlations upon the interaction of the atmospheric neutrinos with the oxygen nuclei of the water Cherenkov detectors. The products of these interactions are detected and identified thanks to the light ring the produce. The events are classified according to the number of produced rings which is computed from the neutrino-oxygen event rates in each exclusive reaction channel. The interpretation of the experimental results has been up to now limited to the quasi-elastic nucleon and (Delta) channels but other reaction channels exist which can lead to identification problems. A special role is played by the non-pionic decay channels of the (Delta) resonance which induce single ring events that have not been considered so far. to calculate them we adopted the nuclear response formalism and started with a semi-classical approximation. This allowed us to take into account the nuclear correlations by solving exactly the RPA equations in the ring approximation. It was found that these correlations strongly modify the inclusive and exclusive neutrino-oxygen cross sections and absolute interaction rates while the ratio of the interaction rates (mu)/e is not very much affected. The analysis in the exclusive channels leads to the result that the number of pions predicted in the simulations is overestimated. In conclusion, this work has shown the importance of the nuclear correlations in the neutrino-oxygen interaction and its impact on the atmospheric neutrino anomaly. It goes beyond the usual quasi- elastic approximations and can be moreover extended to other target nuclei, such as iron, used in earlier experiments. It is an interesting and predictive tool for future neutrino experiments based on different kinds of nuclear targets.
NTIS
Earth Atmosphere; Neutrinos; Nuclear Structure; Oxygen; Nuclear Interactions

20000040467 Clermont-Ferrand Univ., U.F.R. de Recherche Scientifique et Technique, France

Study of flow as a function of centrality in heavy ion collisions at ultrarelativistic energies

Chevrot, I.; Nov. 03, 1998; 178p; In French; In English

Report No.(s): DE99-635270; PCCF-T-9807; No Copyright; Avail: Department of Energy Information Bridge

The goal of the NA50 experiment which continues the NA38 and NA51 experiments, is to put into evidence the quark gluon plasma (QGP) in ultrarelativistic heavy ion collisions. Up to now, the J/(psi) resonance production was used as a probe for the QGP formation. According to strong interaction, quark gluon plasma is supposed to reach a thermal equilibrium, at least locally. An evidence of this thermalization of the matter coming from the collision would appear in the transverse plane as an elliptic flow in the direction of the reaction plane. The analysis developed in this thesis is a study of the elliptic flow in neutral transverse energy as a function centrality in S-S, S-Cu, S-U and Pb-Pb collisions. Flow study is realized using data coming from the electromagnetic calorimeter. An elliptic flow in neutral transverse energy is observed in Pb-Pb interactions. Its maximum value is about 2% for semi-central collisions and it vanishes for central collisions. This is the expected behaviour for a thermalized medium. The same analysis has been done in S-S, S-Cu collisions which provides no evidence for the existence of an elliptic flow. Furthermore, the J/(psi) production as a function of the angle between J/(psi) direction and impact parameter direction could be analyzed. The results seems to show that J/(psi) interaction with produced particles is small.

NTIS

Thermodynamic Equilibrium; Quarks; Ionic Collisions; Beamforming; Charged Particles; Synchrotrons; Radiation Counters

20000040765 Caen Univ., UFR de Sciences, France

Experimental study of the influence of partner structure in the fusion of the almost symmetrical systems

Stodel–Le Lay, C.; Dec. 04, 1998; 137p; In French; In English

Report No.(s): DE99-635261; LPCC-T-98-05; No Copyright; Avail: Department of Energy Information Bridge

The cross-sections for the formation of evaporation residues in Zn70 and Kr86 reactions with Nd150 and Xe130, Xe136 isotopes were measured for excitation energies of the compound nuclei (Th216, Th220, Th222) varied from 7 MeV to 70 MeV, at the linear accelerator UNILAC of the nuclear facility GSI, Darmstadt (Germany). After de-excitation by evaporation (xn,pxn and (alpha)xn), the residual nuclei are separated from the primary beam and from spurious reaction products by the velocity filter SHIP and implanted into a silicon localization detector. Their subsequent decay via alpha particles with characteristic energies allows us to identify them and to deduce their yields. Experimental fusion-evaporation excitation functions are compared with those leading to the same compound nuclei obtained with other projectile and target combinations and with those calculated with a code developed at GSI. This code allows us to evaluate the evolution of the fission probability as a function of the incident energy for each system. The variation of cross- sections and of the fusion probability is studied as a function of the macroscopic and microscopic variables of the partners. For the synthesis of super-heavy elements, these results demonstrate quantitatively the interest in using partners of fusion with closed shell structures and rich in neurons (the fusion cross-section increases by a factor of 9 for a complementary pair of neutrons). On the other hand, closed shell compound nuclei do not influence the fusion cross-section. It will be worth synthesizing isotopes approaching the predicted stability region, nuclei with Z greater than 110 using neutron rich projectiles coming from secondary beams.

NTIS

Cross Sections; Nuclear Structure; Experimentation; Fission; Symmetry; Heavy Ions; Fusion Reactors; Alpha Particles; Reaction Products

20000040768 Pasteur (Louis) Univ., Strasbourg, France

Spectroscopical study of the yrast and yrare structure in far-from- stability nuclei

Hoellinger Fabien,; Jan. 13, 1999; 135p; In French; In English

Report No.(s): DE99-635254; IRES-99-05; No Copyright; Avail: Department of Energy Information Bridge

The nuclear structure study of neutron-rich nuclei was realized with the EUROGAM II array in two different experiments. The first study consisted in the analysis of the product of spontaneous fission of Cm-248. Three neutron-rich cerium isotopes Ce-(147, 149, 151) were analyzed. A level scheme for Ce-151 is presented for the first time. The yrast structure of the three nuclei does not show alternative parity bands as expected in this region of octupole deformations. We studied the rotational structure of the bands and this leads to suggest Nilsson configurations to some of them. The aim of this second experiment was the study of the nuclei Mo-109, Tc-101, Ru-103. The three nuclei are situated on the neutron-rich side of the nuclear chart and are produced as fission fragments of a heavy-ion induced reaction. Some bands are extended to higher spins and some new bands are observed. The structure of the rotational bands is interpreted by means of the Hartree-Fock-Bogolyubov model. A last experiment intended to study the structure of the proton-rich nucleus Pa-223 has been achieved with the JURO+RITU array located at Jyvaeskylae

(Finland). In this proton-rich actinide region, the nuclei develop octupole features around Z(approx-equal)88, N(approx-equal)132. The analysis of this experiment leads to the first assignment of gamma transitions to the Pa-223.
NTIS
Nuclear Structure; Neutron Physics; Nuclei (Nuclear Physics); Fission; Curium Isotopes; Cerium Isotopes

20000040770 Paris II Univ., Inst. de Physique Nucleaire, Orsay, France
Study of very heavy systems by means of INDRA: First evidence for a volume effect in the nuclear multifragmentation process
Frankland, J. D.; Dec. 10, 1998; 190p; In French; In English
Report No.(s): DE99-635251; IPNO-T-98-06; No Copyright; Avail: Department of Energy Information Bridge

We present a study of Gd+U collisions at 36 AMeV measured with the INDRA multidetector, permitting almost complete detection (over 80%) of all the reaction products. We show that events exist which correspond to the multifragmentation of a single system comprising the majority of the nucleons for a cross-section of 2.6 mbarn, by isolating reactions for which the emitted fragments have lost all memory of the entrance channel. Such reactions correspond to neither the most central collisions nor the most isotropic events (in the fragments' momentum space), and therefore cannot be correctly distinguished from the dominant binary deeply-inelastic collisions using these criteria. An initial comparison of the selected data with a statistical code indicates that fragments are formed in a dilute, compact system, undergoing a self-similar expansion corresponding to a collective energy of between 1 and 1.5 MeV. Comparison with the same type of events observed in Xe+Sn collisions at 32 AMeV reveals the existence of a scaling law for the multifragmentation of systems of different mass at the same excitation energy per nucleon: fragment Z distributions are identical while their multiplicity increases proportionally to the mass of the multi-fragmenting system. This observation is interpreted as an experimental signal that this multifragmentation originates in a bulk instability of low-density nuclear matter (spinodal region). A complete semi- classical microscopic calculation for the two reactions, including the formation and multifragmentation by spinodal decomposition of very heavy, low-density systems, reproduces very well not only the experimental fragment multiplicities and Z distributions but also their mean kinetic energies, as well as the size distributions of the largest fragments.
NTIS
Charged Particles; Nucleons; Radiation Counters; Fragmentation

20000040772 Grand Accelerator National d'Ions Lourds, Caen, France
Theoretical description of the towing mode through a time-dependent quantum calculation
Lacroix, D.; Chomaz, P.; Scarpaci, J. A.; Mar. 05, 1999; 13p; In English
Report No.(s): DE99-635227; GANIL-P-99-11; No Copyright; Avail: Department of Energy Information Bridge

The target emission for the reaction of Ni-58 and Ni-58 at 44 MeV/ A is investigated in a time-dependent quantum model. It is shown that, besides the well-known mechanisms of particle emission, a new phenomenon which gives rise to a specific angular and energetic distribution of the particle emission, is also expected. Properties of this mechanism are similar to the so-called 'towing mode', recently observed experimentally in a similar reaction. Characteristics of this new emission type are described.
NTIS
Inelastic Scattering; Quantum Mechanics; Nuclear Scattering; Time Dependence; Quantum Theory

20000040773 Grand Accelerator National d'Ions Lourds, Caen, France
New approach to the nuclear in beam (gamma) spectroscopy of neutron rich nuclei at N=20 using projectile fragmentation
Lopez–Jimenez, M. J.; Saint–Laurent, M. G.; Achouri, L.; Daugas, J. M.; Belleguic, M.; Dec. 31, 1999; 14p; In English
Report No.(s): DE99-635225; GANIL-P-99-08; No Copyright; Avail: Department of Energy Information Bridge

The structure of nuclei far from stability around Mg-32 have been recently investigated by means of a novel method. In-beam (gamma)-decay spectroscopy of a large number of exotic neutron-rich nuclei produced by projectile fragmentation of a S-36 projectile has been performed, using coincidences between the recoil fragments collected at the focal plane of SPEG spectrometer and (gamma)-rays emitted at the target location. Preliminary results on both the population mechanism and the decay of excited states in nuclei around Mg-32 are presented.
NTIS
Spectroscopy; Gamma Ray Spectra; Gamma Ray Beams

20000040774 Grand Accelerator National d'Ions Lourds, Caen, France
Multifragmentation of hot non-spherical nuclei
Le Fevre, A.; Ploszajczak, M.; Toneev, V. D.; Dec. 31, 1999; 15p; In English
Report No.(s): DE99-635224; GANIL-P-99-04; No Copyright; Avail: Department of Energy Information Bridge

Influence of the shape of thermalized source on various characteristics of multifragmentation process as well as its interplay with effects of the angular momentum and the collective expansion are studied for the first time and the most pertinent variables are proposed. The analysis is based on the extension of the statistical microcanonical multifragmentation model.
NTIS
Nuclei (Nuclear Physics); Fragmentation

74
OPTICS

Includes light phenomena and the theory of optical devices. For lasers see 36 Lasers and Masers.

20000038347 NASA Marshall Space Flight Center, Huntsville, AL USA
Poster Presentation: Optical Test of NGST Developmental Mirrors
Hadaway, James B., Alabama Univ., USA; Geary, Joseph, Alabama Univ., USA; Reardon, Patrick, Alabama Univ., USA; Peters, Bruce, Alabama Univ., USA; Keidel, John, NASA Marshall Space Flight Center, USA; Chavers, Greg, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Astronomical Telescopes and Instrumentation Conference, 27-31 Mar. 2000, Munich, Germany; No Copyright; Avail: Issuing Activity; Abstract Only

An Optical Testing System (OTS) has been developed to measure the figure and radius of curvature of NGST developmental mirrors in the vacuum, cryogenic environment of the X-Ray Calibration Facility (XRCF) at Marshall Space Flight Center (MSFC). The OTS consists of a WaveScope Shack-Hartmann sensor from Adaptive Optics Associates as the main instrument, a Point Diffraction Interferometer (PDI), a Point Spread Function (PSF) imager, an alignment system, a Leica Disto Pro distance measurement instrument, and a laser source palette (632.8 nm wavelength) that is fiber-coupled to the sensor instruments. All of the instruments except the laser source palette are located on a single breadboard known as the Wavefront Sensor Pallet (WSP). The WSP is located on top of a 5-DOF motion system located at the center of curvature of the test mirror. Two PC's are used to control the OTS. The error in the figure measurement is dominated by the WaveScope's measurement error. An analysis using the absolute wavefront gradient error of 1/50 wave P-V (at 0.6328 microns) provided by the manufacturer leads to a total surface figure measurement error of approximately 1/100 wave rms. This easily meets the requirement of 1/10 wave P-V. The error in radius of curvature is dominated by the Leica's absolute measurement error of VI.5 mm and the focus setting error of Vi.4 mm, giving an overall error of V2 mm. The OTS is currently being used to test the NGST Mirror System Demonstrators (NMSD's) and the Subscale Beryllium Mirror Demonstrator (SBNM).
Author
Errors; Mirrors; Next Generation Space Telescope Project; Optical Equipment; Test Equipment

20000038388 NASA Marshall Space Flight Center, Huntsville, AL USA
Ion Transmission to the Focal Plane of the Chandra X-Ray Observatory
Kolodziejczak, J. J., NASA Marshall Space Flight Center, USA; Elsner, R. F., NASA Marshall Space Flight Center, USA; Austin, R. A., NASA Marshall Space Flight Center, USA; ODell, S. L., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 45th, 30 Jul. - 4 Aug. 2000, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The severe degradation in spectrometric performance observed by the AXAF CCD Imaging Spectrometer (ACIS) instrument on-board the Chandra X-ray Observatory (CXO) was associated with a sharp increase in charge transfer inefficiency combined with relatively constant dark current. It was also observed that damage occurred only during passage through the earth's radiation belts, and only when ACIS remained in the focal plane during the passage. Subsequent measurements and analyses support the conjecture that the damaging radiation entered through the Observatory's High-Resolution Mirror Assembly (HRMA) aperture. A mechanism whereby low energy magnetospheric protons and/or heavier ions are scattered through the HRMA and reach the focal plane with just enough energy to stop in the CCD's charge transfer region currently provides a reasonably consistent explanation of all observed phenomena. In this paper, we will describe analyses which support this conclusion. Simulations using standard ion transmission codes were used to generate a bi-directional response function (BDRF) for the mirror surfaces and transmission through the various path elements. The BDRF was convolved with the geometry via ray-trace. Damage estimates using measured

proton fluence and ground measurements of ACIS- type CCD damage vs. proton energy will be presented and compared with observed on- orbit damage.
Author
Imaging Spectrometers; Ions; Radiation Damage; X Ray Astrophysics Facility; Bidirectional Reflectance

20000038389 NASA Marshall Space Flight Center, Huntsville, AL USA
MSFC, Research in Lightweight, X-Ray Mirrors for the Constellation-X Mission
Jones, William D., NASA Marshall Space Flight Center, USA; ODell, Stephen L., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; OSA Optical Fabrication and Testing, 18-22 Jun. 2000, Quebec, Canada; No Copyright; Avail: Issuing Activity; Abstract Only

NASA Marshall Space Flight Center is developing enabling technologies for large, lightweight, x-ray optics for the Constellation-x mission. We report on progress in replicating full-shell mirrors with an areal density of 1 kg/m(exp 2).
Author
Mirrors; X Ray Optics; X Ray Telescopes; Spaceborne Telescopes

20000038729 NASA Marshall Space Flight Center, Huntsville, AL USA
Metrology of Optical Beam Expander for Space Readiness Coherent Lidar Experiment (SPARCLE)
Kester, Thomas J., Optical Society of America, USA; Blackwell, Tim, Alabama Univ., USA; Amzajerdian, Farzin, Alabama Univ., USA; [2000]; 1p; In English; Optical Fabrication and Testing, 18-22 Jun. 2000, Quebec, Canada; Sponsored by Optical Society of America, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Stringent requirements of the SPARCLE telescope demanded testing of its individual elements through each step of fabrication, and complete metrology of the integrated telescope both at Helium-Neon and the operational two micron wavelengths.
Author
Fabrication; Metrology; Optical Radar; Light Beams

20000039347 NASA Marshall Space Flight Center, Huntsville, AL USA
HERO: High Energy Replicated Optics for a Hard-X-Ray Balloon Payload
Ramsey, B., NASA Marshall Space Flight Center, USA; Engelhaupt, D., NASA Marshall Space Flight Center, USA; Speegle, C. O., NASA Marshall Space Flight Center, USA; ODell, S. L., NASA Marshall Space Flight Center, USA; Austin, R. A., NASA Marshall Space Flight Center, USA; Elsner, R. F., NASA Marshall Space Flight Center, USA; Kolodziejczak, J. J., NASA Marshall Space Flight Center, USA; Weisskopf, M. C., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 45th, 30 Jul. - 4 Aug. 2000, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We are developing high-energy grazing-incidence replicated optics for a balloon-borne hard-x-ray telescope. When completed, the instrument will have 170 cm2 of effective collecting area at 40 keV and 130 square cm at 60 keV with is less than or equal to 30 arc seconds half power diameter. This payload will offer unprecedented sensitivity in the hard-x-ray region, with around 250 microCrab sensitivity on long-duration flights and 50-100 microCrab on ultra- long-duration balloon missions The payload consists of 16 mirror modules, each with 14 nested mirrors made from a high-strength nickel alloy, and a corresponding array of 16 focal plane detectors. An engineering demonstration flight is scheduled for the Spring of 2000, using just two mirror modules each with 3 shells, above a pair of gas-scintillation-proportional counters. This flight is intended to test a newly designed gondola pointing and aspect system and the stability of the optical bench design. The first scientific flight of the full payload is scheduled for the Fall of 2002. Full details of the payload and its capabilities will be presented together with data from various mirror-module tests. If available data from the first flight will also be presented.
Author
Balloon-Borne Instruments; Grazing Incidence; Optical Equipment; X Ray Telescopes

20000039377 Universities Space Research Association, Huntsville, AL USA
Nonlinear Optical Properties and Applications of Polydiacetylene
Abdeldayem, Hossin, Universities Space Research Association, USA; Paley, Mark S., Universities Space Research Association, USA; Witherow, William K., NASA Marshall Space Flight Center, USA; Frazier, Donald O., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English, 20-23 Jan. 2000, San Jose, CA, USA
Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only

Recently, we have demonstrated a picosecond all-optical switch, which also functions as a partial all-optical NAND logic gate using a novel polydiacetylene that is synthesized in our laboratory. The nonlinear optical properties of the polydiacetylene

material are measured using the Z-scan technique. A theoretical model based on a three level system is investigated and the rate equations of the system are solved. The theoretical calculations are proven to match nicely with the experimental results. The absorption cross-sections for both the first and higher excited states are estimated. The analyses also show that the material suffers a photochemical change beyond a certain level of the laser power and its physical properties suffer radical changes. These changes are the cause for the partial NAND gate function and the switching mechanism.
Author
Laser Outputs; Mathematical Models; Nonlinear Optics; Optical Properties; Optical Switching; Photochemical Reactions

20000039432 Alabama Univ., Huntsville, AL USA
Femtosecond Pulse Characterization as Applied to One-Dimensional Photonic Band Edge Structures ***Final Report, 5 May - 5 Nov. 1999***
Fork, Richard L., Alabama Univ., USA; Gamble, Lisa J., Alabama Univ., USA; Diffey, William M., Alabama Univ., USA; Nov. 05, 1999; 10p; In English
Contract(s)/Grant(s): NAS8-97095; NASA ORder H-31227-D; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The ability to control the group velocity and phase of an optical pulse is important to many current active areas of research. Electronically addressable one-dimensional photonic crystals are an attractive candidate to achieve this control. This report details work done toward the characterization of photonic crystals and improvement of the characterization technique. As part of the work, the spectral dependence of the group delay imparted by a GaAs/AlAs photonic crystal was characterized. Also, a first generation an electrically addressable photonic crystal was tested for the ability to electronically control the group delay. The measurement technique, using 100 femtosecond continuum pulses was improved to yield high spectral resolution (1.7 nanometers) and concurrently with high temporal resolution (tens of femtoseconds). Conclusions and recommendations based upon the work done are also presented.
Author
Group Velocity; Phase Velocity; Photonics; Optical Waveguides; Crystals; Gallium Arsenides; Aluminum Arsenides

20000040168 NASA Marshall Space Flight Center, Huntsville, AL USA
Optical Design of Segmented Hexagon Array Solar Mirror
Huegele, Vince, International Society for Optical Engineering, USA; [2000]; 1p; In English; Optical Science and Technology Symposium, 30 Jul. 2000, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A segmented array of mirrors was designed for a solar concentrator test stand at MSFC for firing solar thermal propulsion engines. The 144 mirrors each have a spherical surface to approximate a parabolic concentrator when combined into the entire 18-foot diameter array. The mirror segments are aluminum hexagons that had the surface diamond turned and quartz coated. The array focuses sunlight reflected from a heliostat to a 4 inch diameter spot containing 10 kw of power at the 15-foot focal point. The derivation of the surface figure for the respective mirror elements is shown. The alignment process of the array is discussed and test results of the system's performance is given.
Author
Design Analysis; Fabrication; Segmented Mirrors; Solar Reflectors; Coatings; Aluminum

20000043536 NASA Goddard Space Flight Center, Greenbelt, MD USA
Simulation of Aluminum Micro-mirrors for Space Applications at Cryogenic Temperatures
Kuhn, J. L., NASA Goddard Space Flight Center, USA; Dutta, S. B., NASA Goddard Space Flight Center, USA; Greenhouse, M. A., NASA Goddard Space Flight Center, USA; Mott, D. B., NASA Goddard Space Flight Center, USA; [2000]; 4p; In English; MSM, 27-29 Mar. 2000, San Diego, CA, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Closed form and finite element models are developed to predict the device response of aluminum electrostatic torsion micro-mirrors fabricated on silicon substrate for space applications at operating temperatures of 30K. Initially, closed form expressions for electrostatic pressure arid mechanical restoring torque are used to predict the pull-in and release voltages at room temperature. Subsequently, a detailed mechanical finite element model is developed to predict stresses and vertical beam deflection induced by the electrostatic and thermal loads. An incremental and iterative solution method is used in conjunction with the nonlinear finite element model and closed form electrostatic equations to solve. the coupled electro-thermo-mechanical problem. The simulation results are compared with experimental measurements at room temperature of fabricated micro-mirror devices.
Author
Electrostatics; Finite Element Method; Mathematical Models; Mirrors; Simulation; Cryogenic Temperature

20000044316 NASA Marshall Space Flight Center, Huntsville, AL USA

Development of Constellation-X Optics Technologies at MSFC

ODell, S. L., NASA Marshall Space Flight Center, USA; Jones, W. D., NASA Marshall Space Flight Center, USA; Smith, W. S., NASA Marshall Space Flight Center, USA; Ramsey, B. D., NASA Marshall Space Flight Center, USA; Engelhaupt, D., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 45th, 30 Jul. - 4 Aug. 2000, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

One of the major technological challenges for the Constellation X-ray Mission is the development of light-weight, high-resolution, grazing-incidence optics. NASA's Marshall Space Flight Center is developing and evaluating candidate technologies, based upon full-shell replication off precision mandrels. Here we report on recent progress in meeting the weight and imaging-performance requirements, using very thin, high-strength electroformed nickel alloys. In addition, we briefly describe MSFC's optics fabrication, metrology, and x-ray test facilities.

Author

Imaging Techniques; Nickel Alloys; Test Facilities; X Ray Astronomy; Grazing Incidence Telescopes; Spatial Resolution

75
PLASMA PHYSICS

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

20000038737 National Inst. for Fusion Science, Toki, Japan

Hydrogen Beam Stopping and Beam Emissions Data for LHD

Summers, H. P., Strathclyde Univ., UK; Anderson, H., Strathclyde Univ., UK; Kato, T., National Inst. for Fusion Science, Japan; Murakami, S., National Inst. for Fusion Science, Japan; Nov. 1999; ISSN 0915-6364; 64p; In English

Report No.(s): NIFS-DATA-55; Copyright; Avail: Issuing Activity

A set of data are presented for estimating neutral hydrogen beam stopping and Balmer alpha beam emission for the fast neutral beams from the H(-) source at the Large Helical Device. The data are presented as economized look-up tables and are suitable for plasmas with arbitrary mixtures of light impurity nuclei up to neon, with impurity species Ar(18+) and Fe(26+) also included. The data stem from very many level collisional-radiative modelling using the most up-to-date fundamental ion and electron impact cross-section information. FORTRAN routines are available for accessing the computer archived data files and assembling the composite coefficients for mixed impurity plasmas.

Author

Hydrogen; Beams (Radiation); Stopping; Emission; Data Acquisition; Ion Impact

20000039378 NASA Marshall Space Flight Center, Huntsville, AL USA

Latitudinal Density Dependence of Magnetic Field Lines Inferred from Polar Plasma Wave Data

Goldstein, J., Dartmouth Coll., USA; Denton, R. E., Dartmouth Coll., USA; Hudson, M. K., Dartmouth Coll., USA; Miftakhova, E. G., Dartmouth Coll., USA; Menietti, J. D., Iowa Univ., USA; Gallagher, D. L., NASA Marshall Space Flight Center, USA; [2000]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Using observations of the electron density, n(sub e), based on measurement of the upper hybrid resonance frequency by the Polar spacecraft Plasma Wave Instrument, we have examined the radial density dependence along field lines in the outer plasmasphere and the near plasmatrough. Sampled L values range from 2.5 to 6.6. Our technique depends on the fact that Polar crosses particular L values at two different points with different radial distance R. In our plasmaspheric data set (n(sub e) is greater than 100/cm3), we find that on average n(sub e) is flat along field lines from the equator up to the latitudes sampled by Polar (R approximately equal to or is greater than 2.0). In the plasmatrough data set (n(sub e) is less than 100/cm-3), there is on average a mild radial dependence n(sub e) varies as R(exp -1.7).

Author

Electron Density (Concentration); Plasmasphere; Magnetic Fields

20000039704 Academy of Sciences (USSR), Inst. for Problems in Mechanics, Moscow, USSR

Overview of Characteristics and Experiments in IPM Plasmatrons

Gordeev, A. N., Academy of Sciences (USSR), USSR; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 1A-1 - 1A-18; In English; See also 20000039703; Copyright Waived; Avail: CASI; A03, Hardcopy

Characteristics of IPG series plasmatrons as well as there application for reentry simulation and testing of thermal protection materials are discussed in the presented paper on the basis of 35 years experience of Plasma Laboratory of IPM RAS. Successful application of plasmatrons for simulation of reentry conditions and testing of thermal protection materials is based on using of plasmatron's advantages such as purity of plasma flow, its high stability, excellent reproducibility as well as wide ranges of realized pressure and heat flux. Using of subsonic regimes together with plasmatron's ability for independent smooth regulation of regime parameters such as pressure and power injected in plasma make a plasmatron the most flexible and powerful instrument for simulation of thermochemical action of shock layer on the surface of descent space vehicle, especially when it is necessary to solve problems concerned radiative & convective heating and/or non-equilibrium heat transfer. to the present day long-term aging tests (up to 100 15-minute testing cycles for one sample) in dissociated gas flow were fulfilled only using plasmatrons. Also there are discussed tests of ablative thermal protection materials, studies of thermo-chemical interaction between dissociated flows and reusable thermal protection materials as well as some "non-space" applications of plasmatron's as deposition of diamond films and testing of industrial materials on heat shock.
Author
Performance Prediction; Plasmatrons; Experimentation; Thermal Protection; Reentry Shielding; Stability; Convective Heat Transfer; Ablative Materials

20000039713 Academy of Sciences (USSR), Inst. for Problems in Mechanics, Moscow, USSR
Combined Measurements and Computations of High Enthalpy and Plasma Flows for Determination of TPM Surface Catalycity
Kolesnikov, A. F., Academy of Sciences (USSR), USSR; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 8A-1 - 8A-16; In English; See also 20000039703; Sponsored in part by RTA
Contract(s)/Grant(s): RTA-4329A; ISTC Proj. 036; Copyright Waived; Avail: CASI; A03, Hardcopy

The paper presents the method for the TPM catalycity prediction on the basis of high enthalpy plasmatron heat transfer tests, performed in subsonic regimes, and appropriate CFD modeling of the whole plasma flow field in the plasma wind tunnel (l), viscous reacting gas flows around a test model (2) a nonequilibrium boundary layer near the stagnation point of a test model (3) and analysis of the the heat transfer for test conditions at the small Reynolds and Mach numbers (4). In general, the methodology was developed during the study of the catalytic efficiencies of the Buran TPM - the black ceramic tile and the C-C material with antioxidation coating - in dissociated nitrogen and air reacting flows. This experimental-theoretical methodology has been modified recently for the determination of TPM catalycity in subsonic carbon dioxide and pure oxygen flows from high enthalpy tests performed by using the 100-kW inductive IPG-4 plasmatron. The interaction between combined ground test measurements and CFD modeling is considered as genesis for catalytic effects duplication, plasma flow field rebuilding and the extraction of the quantitative catalycity parameters from the measured high enthalpy flow parameters, surface temperature and stagnation point heat fluxes.
Author
Computational Fluid Dynamics; Enthalpy; Plasma Flux Measurement; Procedures; Heat Transfer; Surface Temperature; Flow Characteristics; Magnetohydrodynamic Flow

20000039719 Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese, Belgium
The VKI Plasmatron Characteristics and Performance
Bottin, B., Von Karman Inst. for Fluid Dynamics, Belgium; Chazot, O., Von Karman Inst. for Fluid Dynamics, Belgium; Carbonaro, M., Von Karman Inst. for Fluid Dynamics, Belgium; VanDerHaegen, V., Von Karman Inst. for Fluid Dynamics, Belgium; Paris, S., Von Karman Inst. for Fluid Dynamics, Belgium; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 6-1 - 6-26; In English; See also 20000039703; Copyright Waived; Avail: CASI; A03, Hardcopy

The von Karman Institute (VKI) recently completed the commissioning of a new inductively-coupled plasma wind tunnel ("Plasmatron") devoted to the simulation of thermal re-entry conditions as applicable to TPS materials used on real flight trajectories. In the context of the commissioning, two main intrusive measurement techniques, the Pitot tube and the calorimetric heat flux probe, were developed and extensively used to record the performance in order to compare them with the specifications. During the commissioning phase, other techniques were being developed in another VKI facility, the Minitorch, a small inductively-coupled plasma torch used as the instrumental test bench for the Plasmatron. This paper presents the Plasmatron facility to the reader, then describes in detail the probes that were used, the test methodology that was followed, and the results that were obtained during the commissioning phase. The technique of laser Doppler velocimetry (LDV), which is currently developed in the Minitorch and envisaged as one of the standard Plasmatron techniques in the near future, is also described in detail.
Author
Plasmatrons; Performance Tests; Simulation; Reentry; Heat Flux

20000040468 Centre National de la Recherche Scientifique, Lab. de Physique Subatomique et des Technologies Associees, Nantes, France

Instability of the filtering method for Vlasov's equation

Figua, H.; Bouchut, F.; Fijalkow, E.; Feix, M. R.; Dec. 31, 1999; 8p; In English

Report No.(s): DE99-635283; SUBATECH-99-02; No Copyright; Avail: Department of Energy Information Bridge

Klimas has introduced a smoothed Fourier-Fourier method. This method consists in convolving the original distribution function with a Gaussian distribution function, and, next, in solving the new system with a transformed splitting algorithm. Unfortunately, a second-order term appears in the new equation. In this work, it is studied how this term affects the numerical equation. In particular it is proven that instability occurs in the linear version of the Vlasov equation obtained by considering only free non-interacting particles. It is proved that the use of Fourier-Fourier transform is a fundamental requirement to solve this new equation. An important property is pointed out concerning the filtered distribution function in the transformed space.

NTIS

Boltzmann-Vlasov Equation; Distribution Functions; Numerical Analysis; Normal Density Functions

20000042029 Oak Ridge National Lab., TN USA

Toroidal Effects on ICRF Heating and Current Drive

Carlsson, J.; Hedin, J.; Hellsten, T.; Apr. 12, 1999; 4p; In English; 13th; Applications of RF Power to Plasmas, 12-14 Apr. 1999, Annapolis, MD, USA

Report No.(s): DE00-009351; ORNL/CP-103732; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Numerical studies, performed with the Monte-Carlo code FIDO (1), of the evolution of the resonantion distribution function in the presence of ICRH in toroidal geometry are presented. In particular it is pointed out how the absorption of toroidal momentum from a wave field with finite parallel wave numbers causes spatial drift and diffusion, which together with the finite orbit widths of the tail ions is shown to have a large effect on the temperature profile of the resonant ion species and also to cause losses of high-energy ions to the wall (2). Furthermore, it is found that the finite orbit width and the inward drift occuring for negative parallel wave numbers (3) each give rise to a new mechanism of minority-ion cyclotron current drive as compared to earlier models where the drift orbits of the resonant ions are confined to the magnetic flux surfaces. For high levels of coupled power these new mechanisms are found to be the dominating ones (4,5).

NTIS

Ion Cyclotron Radiation; Radio Frequency Heating; Monte Carlo Method; Plasma Heating; Toroidal Plasmas

20000042826 Pulse Sciences, Inc., San Leandro, CA USA

Vacuum Opening Switch Development, *30 Sep. 1993 - 31 Aug. 1997*

Greene, Phil, Pulse Sciences, Inc., USA; Putnam, Sid, Pulse Sciences, Inc., USA; Spence, Phil, Pulse Sciences, Inc., USA; Lidestri, Joe, Pulse Sciences, Inc., USA; Goyer, John, Pulse Sciences, Inc., USA; Nov. 1999; 202p; In English

Contract(s)/Grant(s): DNA001-93-C-0227

Report No.(s): AD-A375676; PSI-FR-2700-01; DSWA-TR-98-7; No Copyright; Avail: CASI; A03, Microfiche; A10, Hardcopy

Results are present from an experimental and theoretical investigation of the operation of the Density Controlled Opening Switch (DCOS), a potential long conduction time opening switch candidate for induction store drivers of advanced high current simulators. The DCOS has two conduction modes of practical interest: a self-opening mode and a mode suitable for control of opening by external gating of the injected ion source. With available experimental hardware these modes were studied with conduction times is less than 2 ms, electron current densities up to 2000 A/cm2 and total currents up to 200 kA. Scaling models for both modes were developed incorporating results of experiments and simulations. The drop of switch impedance observed at later times was identified as due to radial expansion of the current channel rather than gap closure by density electrode plasmas. A second task of the program demonstrated efficient power coupling to a load through an opened low density erosion switch on the DECADE-2 module.

DTIC

Vacuum; Plasmas (Physics); Switches

20000044008 Auburn Univ., Dept. of Physics, AL USA

Development of Novel Spectroscopic Diagnostics for Plasma Radiation Sources, *28 Sep. 1993 - 30 Sep. 1996*

Clothiaux, Eugene J., Auburn Univ., USA; Oks, Eugene, Auburn Univ., USA; Perez, Joseph D., Auburn Univ., USA; Dec. 1999; 158p; In English

Contract(s)/Grant(s): DNA001-93-C-0206

Report No.(s): AD-A375675; DSWA-TR-97-83; No Copyright; Avail: CASI; A02, Microfiche; A08, Hardcopy

This report gives the details of experiments performed to measure the levels and the angular distribution of oscillating electric fields in an aluminum plasma produced by the Phoenix advanced pulsed radiation source. The electric field values were obtained by measuring the L(sub beta), L(sub gamma), L(sub sigma), and L(sub epsilon) line profiles of Al XIII and fitting the profiles to a model for the Phoenix plasma source. The model attempts to take into account all of the mechanisms which lead to broadening of the observed profiles for the conditions present in the Phoenix plasma. The main broadening mechanisms used in the model include Doppler broadening from the bulk motion of the plasma, stark broadening by electrons, ions and oscillating electric fields, and self absorption. In addition to the flat crystal and two curved crystal spectrometers used to measure the lines profiles, a pinhole camera and a four frame camera were used to try and obtain the size of the most dense retions in the plasma. The size of these ”hot spots” were found to be less than 500 microns. From fits of the experimental profiles to the data, the level of anomalous electric fields in the Phoenix plasma source were found to be E(sub o) = 1 - 9 GV/cm, indicative of a strong Langmuir turbulence. The fields were also found to develop anisotropically, primarily along the direction of the discharge.
DTIC
Metallic Plasmas; Plasma Radiation; Pulsed Radiation; Radiation Sources

20000044698 Commissariat a l’Energie Atomique, Dept. de Physique Theorique et Appliquee, Bruyeres-le-Chatel, France
Electromagnetic behaviour of a plasma in fluid and relativistic regimes: simulation code RHEA
Bonnaud, G.; Dussy, S.; Lefebvre, E.; Bouchut, F.; Dec. 31, 1998; 62p; In French; In English
Report No.(s): DE99-627780; CEA-R-5807; No Copyright; Avail: Department of Energy Information Bridge
This report presents a numerical model to simulate the electromagnetic processes involved by electrically-charged relativistic fluids. The physical model is first given. Second, the numerical methods are explained with the various packages of the code RHEA, with indication methods are explained with the various packages of the code RHEA, with indication of its performances, within a 1.5 - dimensional framework. Results from test-simulations are shown to validate the use of the code, for both academic situations and realistic context of laser-plasma interaction, for which the code has been designed: the non-linear phenomena in the context of inertial confinement fusion and the ultra-intense laser pulses.
NTIS
Plasma Physics; Electromagnetic Properties; Cold Plasmas

20000044705 Association Euratom-CEA, Dept. de Recherches sur la Fusion Controlee, Saint Paul-les-Durance, France
Dynamic modelling of tearing mode stabilization by RF current drive
Giruzzi, G.; Zabiego, M.; Gianakon, T. A.; Garbet, X.; Cardinali, A.; Dec. 31, 1998; 58p; In English
Report No.(s): DE99-627797; EUR-CEA-FC-1619; No Copyright; Avail: Department of Energy Information Bridge
The theory of tearing mode stabilization in toroidal plasmas by RF-driven currents that are modulated in phase with the island rotation is investigated. A time scale analysis of the phenomena involved indicates that transient effects, such as finite time response of the driven currents, island rotation during the power pulses, and the inductive response of the plasma, are intrinsically important. A dynamic model of such effects is developed, based on a 3-D Fokker-Planck code coupled to both the electric field diffusion and the island evolution equations. Extensive applications to both Electron Cyclotron and Lower Hybrid current drive in ITER are presented.
NTIS
Plasma Physics; Tearing; Dynamic Models; Modal Response; Dynamic Response

76
SOLID-STATE PHYSICS

Includes condensed matter physics, crystallography, and superconductivity. For related information see also 33 Electronics and Electrical Engineering and 36 Lasers and Masers.

20000038379 International Centre for Theoretical Physics, Trieste, Italy
Analysis of condensed matter physics records in databases: Science and technology indicators in condensed matter physics
Hillebrand, C.; May 31, 1999; 21p; In English
Report No.(s): DE99-636290; IC-99/57; No Copyright; Avail: Department of Energy Information Bridge
An analysis of the literature on Condensed Matter Physics, with particular emphasis on High Temperature Superconductors, was performed on the contents of the bibliographic database International Nuclear Information System (INIS). Quantitative data were obtained on various characteristics of the relevant INIS records such as subject categories, language and country of publica-

tion, publication types, etc. The analysis opens up the possibility for further studies, e.g. on international research cooperation and on publication patterns.
NTIS
Condensed Matter Physics; Research and Development

20000038380 International Centre for Theoretical Physics, Trieste, Italy
Crossover between the dense electron-hole phase and the BCS excitonic phase in quantum dots
Rodriguez, B. A.; Gonzalez, A.; Quiroga, L.; Capote, R.; Rodriguez, F. J.; Sep. 30, 1999; 15p; In English
Report No.(s): DE99-636289; IC-99/120; No Copyright; Avail: Department of Energy Information Bridge

Second order perturbation theory and a Lipkin-Nogami scheme combined with an exact Monte Carlo projection after variation are applied to compute the ground-state energy of 6 (<=) N (<=) 210 electron-hole pairs confined in a parabolic two-dimensional quantum dot. The energy shows nice scaling properties as N or the confinement strength is varied. A crossover from the high-density electron-hole phase to the BCS excitonic phase is found at a density which is roughly four times the close-packing density of excitons.
NTIS
Holes (Electron Deficiencies); Excitons; Quantum Dots; Quantum Mechanics

20000039350 Universities Space Research Association, Huntsville, AL USA
Visualizing the Impurity Depletion Zone Around Holoferritin Crystals Growing in Gel with Ferritin Dimers
Chernov, A. A., Universities Space Research Association, USA; Garcia–Ruiz, J. M., Granada Univ., Spain; Thomas, B. R., Universities Space Research Association, USA; [2000]; 1p; In English; 8th; ICCBM8 Conference, 15 May 2000, SanDestin, FL, USA
Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only

Colorless transparent apoferritin (Mr = 450KDa) crystals have been grown from gel with Cd(2+) as precipitant in the presence of reddish brown-colored ferritin dimers (Mr = 900KDa). In agreement with our previous measurements, showing preferential trapping of dimers (distribution coefficient K = 4), the apoferritin crystals become strongly colored while the gel solution around them became nearly colorless. The depth of the depletion with respect to the colored dimer impurity allowed us to visualize the impurity depletion zone. Depletion with respect to impurity as compared to the crystallizing protein is discussed.
Author
Crystallization; Crystals; Impurities; Protein Crystal Growth

20000039358 NASA Marshall Space Flight Center, Huntsville, AL USA
Fluorescence Studies of Protein Crystal Nucleation
Pusey, Marc, NASA Marshall Space Flight Center, USA; Sumida, John, Universities Space Research Association, USA; [2000]; 1p; In English; 8th; ICCBM, 15 May 2000, SanDestin, FL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We have postulated that, in the case of tetragonal chicken egg white lysozyme, crystal growth occurs by the addition of pre-critical nuclei sized n-mers that form in the bulk solution, and that the n-mer growth units were multiples of the tetrameric 4(sub 3) helical structure. These have the strongest intermolecular bonds in the crystal and are therefore likely to be the first species formed. High resolution AFM studies provide strong supporting evidence for this model, but the data also suggest that the actual species in solution may not be identical in structure to that found in the crystal. We are using fluorescence resonance energy transfer (FRET) to study the initial solution phase self-assembly process, using covalent fluorescent derivatives which crystallize in the characteristic P4(sub 3)2(sub 1)2(sub 1) space group. FRET studies are being carried out between the cascade blue (CB-lys, donor, Ex(sub max) 366 nm, Em 420 nm) and lucifer yellow (LY-lys, acceptor, Ex(sub max) 430 nm, Em 528 nm) asp101 derivatives. The estimated R(sub 0) for this probe pair, the distance where 50% of the donor energy is transferred to the acceptor, is approx. 1.2 nm, compared to 2.2 nm between the side chain carboxyls of adjacent asp101's in the crystalline 4(sub 3) helix. The short donor lifetime of 2.80 ns (chi(sup 2) = 0.644), coupled with the large average distances between the molecules (greater than or equal to 50 nm) in solution, ensure that any energy transfer observed is not due to random diffusive interactions. Lifetime data show that CB-lys has a single lifetime when it is the only species in solution. Similarly, LY-lys also exhibits a single lifetime of 4.63 ns (chi(sup 2) = 0.42) when alone in solution. Addition of LY-lys to CB-lys results in the appearance of a third lifetime component of 0.348ns for the CB-lys. The fractional intensities of the different species present can be used to estimate the distribution of monomer and n-mers in solution. The self-association process is a function of the protein concentration relative to the saturation concentration, and observing it in dilute solution (conc. less than or equal to 10(exp -5)M) requires that the experiments be performed under low solubility conditions, i.e., low temperatures and high salt concentrations. Data from preliminary steady state FRET studies with N-terminal bound pyrene acetic acid (PAA-lys, donor, Ex 340 nm, Em 376 nm) and asp101 LY-lys as an acceptor showed a consistent trend of decreasing donor fluorescence intensity with increasing total protein concentration. The FRET

data have been obtained at pH 4.6, 0.1M NaAC buffer, at 5 and 7% NaCl, 4 C. The corresponding C(sub sat) values are 0.471 and 0.362 mg/ml (approx. 3.3 and approx. 2.5 x 10(exp -5)M respectively). The donor fluorescence decrease is more pronounced at7% NaCl, consistent with the expected increased intermolecular interactions at higher salt concentrations as reflected in the lower solubility. Results from these and other ongoing studies will be discussed in conjunction with an emerging model for how tetragonal lysozyme crystals nucleate and the relevance of that model to other proteins.
Author
Proteins; Research; Fluorescence; Crystals; Nucleation; Chickens; Eggs; Crystal Growth; Lysozyme

20000039359 NASA Marshall Space Flight Center, Huntsville, AL USA
Molecular View of Protein Crystal Growth: Molecular Interactions, Surface Reconstruction and Growth Mechanism
Nadarajah, Arunan, Toledo Univ., USA; Li, Huayu, Toledo Univ., USA; Konnert, John H., Naval Research Lab., USA; Pusey, Marc L., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 8th; ICCBM, 15 May 2000, SanDestin, FL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Studies of the growth and molecular packing of tetragonal lysozyme crystals suggest that there is an underlying molecular growth mechanism, in addition to the classical one involving screw dislocation/2D) nucleation growth. These crystals are constructed by strongly bonded molecular chains forming helices about the 43 axes. The helices are connected to each other by weaker bonds. Crystal growth proceeds by the formation of these 4(sub 3) helices, which would explain some unexpected observations by earlier investigators, such as bimolecular growth steps on the (110) face. Another consequence of these molecular considerations is that only one of two possible packing arrangements could occur on the crystal faces and that their growth unit was at least a tetramer corresponding to the 4(sub 3) helix. Two new high resolution atomic force microscopy (AFM) techniques were developed to directly confirm these predictions on tetragonal lysozyme crystals. Most earlier investigations of protein crystal growth with AFM were in the low resolution mode which is adequate to investigate the classical growth mechanisms, but cannot resolve molecular features and mechanisms. Employing the first of the newly developed techniques, high resolution AFM images of the (110) face were compared with the theoretically constructed images for the two possible packing arrangements on this face. The prediction that the molecular packing arrangement of these faces corresponded to that for complete 4(sub 3) helices was confirmed in this manner. This investigation also showed the occurrence of surface reconstruction on protein crystals. The molecules on the surface of the (110) face were found to pack closer along the 4(sub 3) axes than those in the interior. The second new AFM technique was used to follow the growth process by measuring the dimensions of individual growth units on the (110) face. Linescans across a growth step, performed near the saturation limit of the crystals, allowed the growth unit dimensions to be measured as they were being incorporated into the crystal. These measurements showed that growth on the (110) face proceeded by the formation of new 4(sub 3) helices from the addition of many growth units of at least tetramer size. This is the first time that a time-resolved AFM technique has been used to observe individual molecular events during crystal growth.
Author
Protein Crystal Growth; Molecular Interactions; Crystal Growth; Lysozyme

20000039373 NASA Marshall Space Flight Center, Huntsville, AL USA
The Effects of Thermal History on Nucleation of Tetragonal Lysozyme Crystals, or Hot Protein and Cold Nucleation
Burke, Michael, Alabama Univ., USA; Judge, Russell, Alabama Univ., USA; Pusey, Marc, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 8th; ICCBN 8, 15 May 2000, SanDestin, FL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Chicken egg white lysozyme has a well characterized thermally driven phase transition. Between pH 4.2 and 5.2, the transition temperature, as defined by the point where the tetragonal and orthorhombic solubilities are equal, is a function of the pH, salt (precipitant) type and concentration, and most likely of the buffer concentration as well. This phase transition can be carried out with protein solution alone, prior to addition of precipitant solution. Warming a lysozyme solution above the phase transition point, then cooling it back below this point, has been shown to affect the subsequent nucleation rate, as determined by the numbers and size of crystals formed, but not the growth rate for the tetragonal crystal form . We have now measured the kinetics of this process and investigated its reversibility. The transition effects are progressive with temperature, having a half time of about 1 hour at 37C at pH 4.8. After holding a lysozyme solution at 37C (prior to addition of precipitant) for 16 hours, then cooling it back to 4C no return to the pre-warmed nucleation kinetics are observed after at least 4 weeks. Orthorhombic lysozyme crystals apparently do not undergo the flow-induced growth cessation of tetragonal lysozyme crystals. Putting the protein in the orthorhombic form does not affect the averaged face growth kinetics, only nucleation, for tetragonal crystals. This differential behaviour may be exploited

to elucidate how and where flow affects the lysozyme crystal growth process. The presentation will focus on the results of these and ongoing studies in this area.
Author
Crystal Growth; Lysozyme; Nucleation; Heat Treatment; Temperature Distribution

20000039471 NASA Marshall Space Flight Center, Huntsville, AL USA
The Effect of a Rotating Magnetic Field on Flow Stability During Crystal Growth
Volz, Martin P., NASA Marshall Space Flight Center, USA; Mazuruk, K., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; International Congress of Theoretical and Applied Mechanics, 28 Aug. 2000, Chicago, IL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The effect of a rotating magnetic field on the stability of flow in crystal growth configurations has been experimentally modeled using liquid gallium contained in a finite cylinder and heated from below. Several distinct flow regions were determined as a function of the Rayleigh and Hartmann numbers. At low values of the Rayleigh and Hartmann numbers, a region of stationary flow exists. As the rotating magnetic field is increased, the critical Rayleigh number bounding the stationary flow region can increase by a factor of 10. However, the rotating magnetic field itself induces an instability at a critical value of the Hartmann number independent of the Rayleigh number. In the stationary flow region, the rotating magnetic field can induce fluid motion with velocities several orders of magnitude larger than typical semiconductor crystal growth velocities. Thus, a rotating magnetic field can be used to achieve the benefits of forced convection without triggering deleterious instabilities.
Author
Crystal Growth; Flow Stability; Magnetic Fields; Rotation; Mathematical Models; Magnetic Effects

20000043160 Universities Space Research Association, Huntsville, AL USA
Acetylated Lysozyme as Impurity in Lysozyme Crystals: Constant Distribution Coefficient
Thomas, B. R., Universities Space Research Association, USA; Chernov, A. A., Universities Space Research Association, USA; [2000]; 1p; In English
Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only

Hen egg white lysozyme (HEWL) was acetylated to modify molecular charge keeping the molecular size and weight nearly constant. Two derivatives, A and B, more and less acetylated, respectively, were obtained, separated, purified and added to the solution from which crystals of tetragonal HEWL crystals were grown. Amounts of the A or B impurities added were 0.76, 0.38 and 0.1 milligram per millimeter while HEWL concentration were 20, 30 and 40 milligram per milliliter. The crystals grown in 18 experiments for each impurity were dissolved and quantities of A or B additives in these crystals were analyzed by cation exchange high performance liquid chromatography. All the data for each set of 18 samples with the different impurity and regular HEWL concentrations is well described by one distribution coefficient K = 2.15 plus or minus 0.13 for A and K = 3.42 plus or minus 0.25 for B. The observed independence of the distribution coefficient on both the impurity concentration and supersaturation is explained by the dilution model described in this paper. It shows that impurity adsorption and incorporation rate is proportional to the impurity concentration and that the growth rate is proportional to the crystallizing protein in solution. With the kinetic coefficient for crystallization, beta = 5.10(exp -7) centimeters per second, the frequency at which an impurity molecule near the growing interface irreversibly joins a molecular site on the crystal was found to be 3 1 per second, much higher than the average frequency for crystal molecules. For best quality protein crystals it is better to have low microheterogeneous protein impurity concentration and high supers aturation.
Author
Acetylation; Impurities; Lysozyme; Crystallization; Distribution Functions

20000044315 NASA Marshall Space Flight Center, Huntsville, AL USA
Thermochemical Model and Experimental Studies on Physical Vapor Transport of Lead Telluride-Selenide
Palosz, W., Universities Space Research Association, USA; Alexander, H. A., NASA Glenn Research Center, USA; Grasza, K., Polish Academy of Sciences, Poland; [2000]; 1p; In English
Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only

Mass transport rate and composition of the transported material as a function of different process parameters like temperature, undercooling, inert gas pressure, and the source compactness for different PbTe(1-x)Se(x), compositions were studied. With a proper preparation procedures mass transport rates suitable for growth at the rate of 0.5 - 1 mm/h were obtained. Different composition non-uniformities in the deposited material were observed. Due to deviation of the PbTe-PbSe solid solution from ideality,

congruent mass transport of the material takes place around X = 0.3. For other compositions an improved and even good uniformity can be achieved when a solid, premelted source material is used.
Author
Lead Tellurides; Selenides; Thermochemical Properties; Models

77
PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

Includes quantum mechanics; theoretical physics; and statistical mechanics. For related information see also 72 Atomic and Molecular Physics, 73 Nuclear Physics, and 25 Inorganic, Organic and Physical Chemistry.

20000040460 Savoie Univ., Chambery, France
Correlation functions in finite temperature field theories: formalism and applications to quark-gluon plasma
Gelis, F.; Dec. 31, 1998; 448p; In French; In English
Report No.(s): DE99-635257; LAPP-T-98/07; No Copyright; Avail: Department of Energy Information Bridge

The general framework of this work is thermal field theory, and more precisely the perturbative calculation of thermal Green's functions. In a first part, I consider the problems closely related to the formalism itself. After two introductory chapters devoted to set up the framework and the notations used afterwards, a chapter is dedicated to a clarification of certain aspects of the justification of the Feynman rules of the real time formalism. Then, I consider in the chapter 4 the problem of cutting rules in the real time formalisms. In particular, after solving a controversy on this subject, I generalize these cutting rules to the 'retarded-advanced' version of this formalism. Finally, the last problem considered in this part is that of the pion decay into two photons in a thermal bath. I show that the discrepancies found in the literature are due to peculiarities of the analytical properties of the thermal Green's functions. The second part deals with the calculations of the photons or dilepton (virtual photon) production rate by a quark gluon plasma. The framework of this study is the effective theory based on the resummation of hard thermal loops. The first aspects of this study is related to the production of virtual photons, where we show that important contributions arise at two loops, completing the result already known at one loop. In the case of real photon production, we show that extremely strong collinear singularities make two loop contributions dominant compared to one loop ones. In both cases, the importance of two loop contributions can be interpreted as weaknesses of the hard thermal loop approximation.
NTIS
Temperature Distribution; Correlation; Green'S Functions; Singularity (Mathematics); Real Time Operation

20000040463 Lyon-1 Univ., Villeurbanne, France
Contribution to the study of the few-body systems
Krikeb, A.; Nov. 18, 1998; 164p; In French; In English
Report No.(s): DE99-635262; LYCEN-T-98108; No Copyright; Avail: Department of Energy Information Bridge

This contribution aims to answer questions relating to stability and properties of few-body systems. We make use of a variational method. The trial wave function, the choice of which is crucial, may be expanded on a Gauss or exponential function basis. For higher then three body systems the Gauss function basis states are more desirable since they allow an analytical calculation of all the matrix elements. The accuracy of our method is verified on two-body systems for different potentials, as for instance on (sup 4)He with a nuclear potential and the ground state of the positronium molecule Ps(sub 2). Then, we investigate the stability of a system of three particles of arbitrary mass and charge. Frequently, high accuracy results are required to make evident the stability of these systems. A section of this work is dedicated to the study of lower boundary of the ground state of N body systems decomposed in two- body sub-Hamiltonians. These lower boundaries combined with the variational upper boundaries can give good estimates of the exact result. Finally, we focussed on three and four body systems, for pairwise potential r(sup (beta)), 0(<=)(beta)(<=)2. For (beta)=2 the lower bound is saturated and this is also true for all N-body generalizations. We consider several attractive short range potentials, like Yukawa, Gaussian and exponential potentials, for which we discuss the universality of the borromean binding window which is expected to drop in case of repulsive core potentials such as the Morse interaction.
NTIS
Research; Stability; Four Body Problem; Gauss Equation; Hamiltonian Functions; Nuclear Potential

20000040464 Lyon-1 Univ., Villeurbanne, France
Self-consistent Random Phase Approximation applied to a schematic model of the field theory
Bertrand, T.; Dec. 11, 1998; 170p; In French; In English
Report No.(s): DE99-635263; LYCEN-T-98109; No Copyright; Avail: Department of Energy Information Bridge

The self-consistent Random Phase Approximation (SCRPA) is a method allowing in the mean-field theory inclusion of the correlations in the ground and excited states. It has the advantage of not violating the Pauli principle in contrast to RPA, that is based on the quasi-bosonic approximation; in addition, numerous applications in different domains of physics, show a possible variational character. However, the latter should be formally demonstrated. The first model studied with SCRPA is the anharmonic oscillator in the region where one of its symmetries is spontaneously broken. The ground state energy is reproduced by SCRPA more accurately than RPA, with no violation of the Ritz variational principle, what is not the case for the latter approximation. The success of SCRPA is the the same in case of ground state energy for a model mixing bosons and fermions. At the transition point the SCRPA is correcting RPA drastically, but far from this region the correction becomes negligible, both methods being of similar precision. In the deformed region in the case of RPA a spurious mode occurred due to the microscopical character of the model.. The SCRPA may also reproduce this mode very accurately and actually it coincides with an excitation in the exact spectrum.
NTIS
Bosons; Variational Principles; Harmonic Oscillators; Approximation

20000040466 Clermont-Ferrand Univ., Lab. de Physique Corpusculaire, France
Perturbative QCD study of the polarized structure function g(sub 1) at Next-to-Leading-Order
Incerti, S.; Sabatie, F.; Oct. 31, 1998; 40p; In English
Report No.(s): DE99-635269; PCCF-RI-9901; No Copyright; Avail: Department of Energy Information Bridge
A NLO perturbative study of all available data on polarized structure function g(sub 1)(x,Q(sup 2)) is presented. It is first explained how the Q(sup 2) evolution was performed using the DGLAP equations, which used with the present data, allow to constrain the behaviour of polarized parton distributions. Implications of such a study are discussed and important quantities are derived such as an estimation of the quark and gluon polarizations in the nucleon.
NTIS
Nucleons; Quantum Chromodynamics; Gluons

20000042027 Fermi National Accelerator Lab., Batavia, IL USA
D0 findings on the top quark
Klima, B.; Dec. 31, 1998; 24p; In English
Report No.(s): DE98-053084; FNAL/C-98/137-E; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Recent results on top quark physics with the D0 experiment in pp collisions at radical-s = 1.8 TeV are reported. The direct measurement of the top quark mass uses single lepton and dilepton events, giving the result m(sub top) = 172.1 +/- 7.1 GeV/c(sup 2) . The measurement of the t(anti-t) production cross section includes analyses from 9 top decay channels: dilepton, electron and neutrino, single leptons with and without b tagging, and all-jets (t(anti-t) yield b jets). The authors measured the t(anti t) production cross section to be 5.9 +/- 1.7 pb at m(sub top) = 172.1 GeV/c(sup 2). Preliminary results on a search for charged Higgs production in top events are presented.
NTIS
Particle Production; Particle Decay; Higgs Bosons; Quarks; Weak Interactions (Field Theory); Particle Collisions

80
SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula.

20000039697 North Dakota Univ., Grand Forks, ND USA
Assessing the Environment and Outcomes of Four-Year Aviation Programs: Does Program Quality Make a Difference?
Lindseth, Paul D., North Dakota Univ., USA; Collegiate Aviation Review; October 1999; Volume 17, No. 1, pp. 40-52; In English; See also 20000039693; Copyright; Avail: Issuing Activity
The higher education literature concerning academic program quality offers differing opinions as to which indicators should determine program quality. Recently, greater attention has been focused upon the environment and the outcomes of higher education academic programs. The purpose of this study was to determine to what extent the highest quality U.S. four-year aviation programs follow current literature trends and emphasize environment and outcome indicators of quality. Students (N=447), faculty (N=167), and alumni (N=577) from high, medium, and low quality four-year aviation programs as determined in Lindseth's (1996) study, were surveyed using the Educational Testing Service's Program Self Assessment tool. The instrument measures perceptions of students, faculty, and alumni toward 16 composite characteristics or indicators of academic program quality.

Results showed that except for the indicator internship experiences, the emphasis placed on environment and outcome indicators of academic program quality was not significantly different at the highest quality U.S. four-year aviation programs as compared to intermediate and low quality four-year aviation programs.
Author
Education; Environments; Training Analysis; Assessments

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20000039444 Small Business Administration, Office of Advocacy, Washington, DC USA
A New View of Government, University, and Industry Partnerships
Glover, J.; Feb. 2000; 42p; In English
Report No.(s): PB2000-103405; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A proposal is presented to encourage an improved relationship between the research universities and the small business technology sector for mutual benefit. Data is presented on the contribution of the universities, small businesses, and large businesses to the research agenda of the nation. The Small Business Innovation Research (SBIR) program is discussed including analyses of the program by the General Accounting Office (GAO), and reports by the National Institutes of Health (NIH) and Department of Defense (DOD). University collaborations with large and small businesses leading to the creation of the Route 128 (MIT, Boston MA) area and Silicon Valley (Stanford, Palo Alto, CA) are reviewed, with an update of the impact on creating a new model of cooperation by the leadership at the University of California, San Diego, CA (USCD).
NTIS
Improvement; Universities; Government/Industry Relations

20000039698 Prather (C. Daniel), Tampa, FL USA
Airport Internships: Effectively Structuring a Departmental Rotation Internship
Prather, C. Daniel, Prather (C. Daniel), USA; Collegiate Aviation Review; October 1999; Volume 17, No. 1, pp. 53-73; In English; See also 20000039693; Copyright; Avail: Issuing Activity

This study on the perceptions of airport managers regarding airport internships is one aspect of a paper entitled Airport internships: Combining formal education and practical experience for a successful airport management career, which was prepared as a requirement for the American Association of Airport Executives' (AAAE) Accreditation program. The remaining aspect of the AAAE paper, which was published in the 1998 Collegiate Aviation Review, is a study on the views of airport managers regarding post- secondary aviation education. Findings presented do not necessarily reflect the views of my employer, the Hillsborough County Aviation Authority.
Author
Research; Airports; Management

20000039699 University of Southern Illinois, Carbondale, IL USA
An Evaluation of a Major Airline Flight Internship Program: Participant's Perceptions of Curricular Preparation for, and Components of, the Internship
Ruiz, Jose R., University of Southern Illinois, USA; NewMyer, David A., University of Southern Illinois, USA; Worrells, D. Scott, University of Southern Illinois, USA; Collegiate Aviation Review; October 1999; Volume 17, No. 1, pp. 74-94; In English; See also 20000039693; Copyright; Avail: Issuing Activity

This article presents the results of a follow-up survey administered to 110 former university interns who served a semester-long flight operations internship at United Airlines. The intent of the survey was to obtain the participant's opinions concerning their academic preparation for the internship experience, as well as their overall assessment of the internship experience itself. of the 78 respondents, 75.7% indicated that their university aviation curriculum had prepared them "very well" or "well" for the internship. Further, 80.7% of all respondents indicated that the semester-long internship had a "great impact" or "significant impact" in helping them achieve their career goals. Also, 96.2% of all respondents said that they would recommend a United Airlines internship to students seeking an aviation career.
Author
Education; Surveys; Flight Operations; Commercial Aircraft; Airline Operations

20000040852 National Science and Technology Council, Washington, DC USA
National Science and Technology Council *Annual Report*
2000; 50p; In English
Report No.(s): PB2000-104344; No Copyright; Avail: National Technical Information Service (NTIS)

President Clinton made a commitment to the American people to integrate Federal agency R&D budgets to ensure that the nations S&T investments served broad national goals, as well as agency missions. In 1999, the NSTC undertook activities related to the following broadly stated S&T goals: maintaining world leadership in science, mathematics, and engineering; promoting long-term economic growth; sustaining a healthy, educated citizenry; improving environmental quality; harnessing information technology; and enhancing national security and global stability. Through the NSTC, Federal agencies and departments have identified a set of R&D areas that are important national efforts requiring coordinated investments across several agencies. As with all R&D investments, these interagency priority areas should reflect our objectives of maintaining excellence, maximizing effectiveness, and minimizing costs. This budget guidance, rather than providing an exhaustive list of all Administration R&D priorities, focuses on those activities that require a significant level of interagency coordination.
NTIS
Research and Development; Information Systems; Federal Budgets

20000043658 National Optical Astronomy Observatories, Tucson, AZ USA
NOAO and NASA Work Together
Strom, Steve, National Optical Astronomy Observatories, USA; March 2000, No. 61, pp. 23; In English; No Copyright; Avail: Issuing Activity; Abstract Only

We are pleased to announce a collaboration with two NASA Great Observatories, Chandra and SIRTF, to provide investigators with complementary ground-based observations in support of their programs. Investigators will able to obtain time on NOAO facilities through proposals for SIRTF Legacy programs and through Chandra large programs. The goal of this collaboration is to allow proposers to avoid the double jeopardy inherent in having to pass through two separate TAC processes, and to provide access to facilities essential to obtaining complementary ground-based O/IR data without regard to institutional affiliation.
Author
Space Infrared Telescope Facility; Ground Based Control; Time Sharing

82
DOCUMENTATION AND INFORMATION SCIENCE

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

20000038328 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Interoperability in Geographic Information Systems: Conversion Among Geographic Information Systems Conceptual Models and a Comparison with the Open GIS Standard *Interoperabilidade em Geoprocessamento: Conversao Entre Modelos Conceituais de Sistemas de Informacao Geografica e Comparacao Com o Padrao Open Gis*
Thome, Rogerio, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 206p; In Portuguese
Report No.(s): INPE-7266-TDI/708; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This work discusses the problem of interoperability in Geographic Information Systems (GIS), trying to identify the potential practical barriers which limit the complete interchange of geographical information. The semantic models of three different GIS are described and compared with each other and with the OPEN GIS concepts. These comparisons allow an assessment of the problems and limitations of the semantic translation on the GIS domain. To illustrate the ideas established, a prototype for GIS semantic model conversion has been developed.
Author
Geographic Information Systems; Data Systems; Models

20000038415 Communications Research Lab., Tokyo, Japan
Survey of Image Retrieval Techniques
Kato, Syuko, Communications Research Lab., Japan; Yoshiya, Kiyosumi, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Mar. 1994; ISSN 0914-9274; Volume 40, No. 1, pp. 37-44; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An image retrieval technique is an important part of an image database system, it concerns the interaction between the system and user. The user is able to get various types of information from the contents of an image according to the user's viewpoint and circumstances. A survey of image retrieval techniques based on image content is presented in this paper. First, we assume an information space consisting of three layers, a physical layer, a graphic layer and a semantic layer. to represent various information from the contents of an image. Second, using the information space, we report the survey from four viewpoints: method of inputting the user's intention, forms for representing various information from an image, measures of similarity, and methods of measuring similarity. Finally, we list future study topics for image retrieval techniques.
Author
Images; Data Retrieval; Data Bases; Pattern Recognition

20000038734 Nippon Telegraph and Telephone Public Corp., Service Integrations Labs., Tokyo, Japan
Global Verification Experiments Using GEMnet
Tanaka, Chihaya, Nippon Telegraph and Telephone Public Corp., Japan; Miyaho, Noriharu, Nippon Telegraph and Telephone Public Corp., Japan; Hyuga, Fumiaki, Nippon Telegraph and Telephone Public Corp., Japan; Mizukawa, Makoto, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 2000; ISSN 0915-2334; Volume 12, No. 2, pp. 20-23; In English; Copyright; Avail: Issuing Activity

NTT Laboratories are using the experimental network GEMnet (Global Enhanced Multifunctional Network) to conduct the technology verification that is required in basic development research in an actual network environment. In addition to the technology verification experiments that have been performed up to now by the laboratories, future verification experiments and joint experiments are expected to be done in close cooperation with NTT operation companies. Here, we describe a few of these experiments and discuss how GEMnet will be used in the future.
Author
Technological Forecasting; Proving

20000038735 Nippon Telegraph and Telephone Public Corp., Service Integration Labs., Tokyo, Japan
Functional Enhancement Strategy for GEMnet
Miyaho, Noriharu, Nippon Telegraph and Telephone Public Corp., Japan; Tanaka, Chihaya, Nippon Telegraph and Telephone Public Corp., Japan; Shibata, Nori, Nippon Telegraph and Telephone Public Corp., Japan; Hyuga, Fumiaki, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 2000; ISSN 0915-2334; Volume 12, No. 2, pp. 14-19; In English; Copyright; Avail: Issuing Activity

In order to promote the development of new businesses quickly in the field of information sharing services, it is becoming increasingly important to promote service field tests based on actual network environments efficiently. Global Enhanced Multifunctional Network (GEMnet), the construction of which is being promoted by NTT Laboratories, is a testbed equipped with the newest network environments to facilitate these kinds of field tests. This paper outlines the basic configuration that GEMnet will take on in the future, as well as the functional enhancement strategy for GEMnet, with describing the results of various R&D activities on the next-generation network technologies conducted up to now at NTT Laboratories.
Author
Augmentation; Information Systems; Field Tests

20000039686 Astro Technology, Inc., Houston, TX USA
Database Hazards Analysis Information Compilation and Action Tracking for a Solid Rocket Motor Demilitarization Program
Blake, A. M., Astro Technology, Inc., USA; Losee, L. A., Astro Technology, Inc., USA; 49th JANNAF Propulsion Meeting; December 1999; Volume 1, pp. 123-129; In English; See also 20000039678; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

A Microsoft Access 97 database will be used as part of a solid rocket motor demilitarization program to provide immediate safety information access by hazards analysis team members at different locations. A menu will be displayed when the application is opened and gives users options of opening specific forms or reports or of querying existing data. Many of the objects in the database are being designed as read-only, and the database will be password protected. The database will be a valuable tool to speed up communication and resolution of recommended actions and to enable hazards analysts, engineers, operations personnel, and management to keep up-to-date on safety issues and problem resolution on a daily basis.
Author
Data Bases; Hazards; Safety; Solid Propellant Rocket Engines; Software Engineering

20000040160 RAND Corp., Santa Monica, CA USA

Information and Biological Revolutions: Global Governance Challenges Summary of a Study Group

Fukuyama, Francis; Wagner, Caroline S.; Jan. 2000; 136p; In English

Contract(s)/Grant(s): OPA-9215205

Report No.(s): AD-A374432; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report summarizes the issues that arose and the discussions held during the meetings of a 1998-1999 study group focusing on global governance of information technology and biotechnology. The goal was to bring a policy perspective LONG RANGE(DISTANCE),XTto bear on a discussion of new technological developments through a series of free-flowing and exploratory presentations and discussions. An important part of this effort involved bringing together experts from many different fields-journalists, policymakers, scientists, academics, business people-to discuss developments that will affect all of society. By bringing together such a variety of people, the organizers hoped to see whether people from different professions react differently to emerging technological developments. Each study group meeting featured a presentation by a different invited discussion leader, which either explored some aspect of information technology or biotechnology development or examined the capability of human nature or political structure to deal with new technology, followed by a discussion. This report presents the findings that emerged from these meetings. It addresses a number of issues, with an emphasis on possible U.S. responses on a political or social level to critical technology governance issues. The body of the report summarizes the issues that emerged from the discussion. The appendixes distill the content of the various presentations and discussions.

DTIC

Information Systems; Biotechnology; Conferences

20000040394 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Informasi, Jakarta, Indonesia

A Study of the Literature Needed by LAPAN Researchers ***Kajian Mengenai Pustaka Yang Dibutuhkan Peneliti LAPAN***

Syahbuddin, Basman, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Ritonga, Gemuru, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; April - June 1999; Volume 1, No. 2, pp. 1-5; In Malay-Indonesian; See also 20000040393; Copyright; Avail: Issuing Activity

Researchers need some literatures such as scientific magazines/journals or textbooks as information sources in doing R&D also space application technology. The Center Library of LAPAN serve to prepare all kinds of space information sources faced the limited budget constrain, so that it need the policy which accommodate it. Studying about researchers of LAPAN need on scientific magazines/journals and books has been done by collecting questioner data. Researchers as respondents were classified in S0, SI, S2, S3, graduated and the collected data, then was been analyzed with the Chi Square Test (X2) and alpha = 0,01. The result of the study proved that, there were no differences of the academic rank of researchers need on information sources. The data showed they liked more scientific magazines/journals than books.

Author

Aerospace Engineering; Information Systems; Research and Development; Literature

20000040520 Lunar and Planetary Inst., Center for Advanced Space Studies, Houston, TX USA

Intention and Intension in the Integration of Lunar Data Sets: The Great Instauration

Ryder, G., Lunar and Planetary Inst., USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 53-55; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In formulating a lunar initiative in the integration of diverse datasets, we have tended to concentrate on the advantages of the end product, while glossing over the difficulties inherent in the process. As a rough guide, we can say that our objective is to obtain as full an understanding of the Moon as we can get by using all sources of data about it in combination in addressing key problems. Integration, collaboration, and datasets have become increasingly important concepts over the digital age of the last two decades. Integration to the point of unity of knowledge was an Enlightenment concept, and has its modem counterpart in the metaphysical view of the integration of science, social science, and humanities. The Geological Society of America, The Ecological Society of America, and the U.S. Geological Survey have recognized the importance of understanding integration, beginning to discuss the factors that bring about successful operation of a functional collective across agencies and institutions. But our goal is of a lesser degree than that: integration within a few disciplines of science around the explanation of a common physical object. The technological advances that have made databases common and accessible allow (and produce) a massive sea of data whose archiving and exchange offer unprecedented opportunities. At the same time, there are problems of documentation (metadata) that influence identification, suitability, processing, and analysis. Unfortunately, the words integration and dataset have also become buzzwords that are frequently empty. The meaning of words is important, and although a rose by any other name would smell just as sweet, attempting to invoke the smell of arose in someone else by calling it a rat would fail; calling something a rose when

it smells like a rat would also fail. Defining what a dataset is (and whether it should be one word or two) is neither a trivial nor a meaningless task. Integration even within our initiative has different levels of meaning. The prosthetic extensions of our senses have produced varied kinds and amounts of data about the Moon. The integration of these data into concepts about the Moon is not merely a multidisciplinary approach, but needs to be intellectually immersive and synergistic to be successful. Purely multidisciplinary approaches can probably provide incremental advances on specific problems, but the goal of any significant project (other than engineering or technological projects with clearly defined tasks) is discovery. Most significant questions are epigenetic: We now ask questions about the role of plagioclase elutriation from a magma ocean in influencing subsequent lunar evolution, but no such question existed prior to the Apollo program of investigation that eventually produced such a question. Thus a major intent of the integration initiative should be to derive new questions (or problems) and not just address existing ones. Nonetheless, these existing questions are themselves epigenetic, and remain questions of some importance. We need to see how using data from one discipline can be used in perhaps unexpected ways to address questions typically thought to belong to some other discipline, and not just think traditionally about ”common” problems. One beauty of science is the recognition of the unity of complex phenomena that to direct observation appear to be quite separate things. An example might be magnetic variations in ocean basins, topography of mid-ocean ridges, and chemistry of lavas in orogenic chains, all united by plate tectonics. Geologists in fact do this sort of integration continually, both in the field and out of it, and at varied scales. Continued unification of our lunar understanding is one of our intentions. One problem of integration across disciplines and datasets is communication. Words or terms have both extensions and intensions (in formal logic; note distinction of intension and intention). Using the definition of Dennett, the extension is the thing (or set of things) to which the word or term refers; the intension is the particular way the extension is picked out or determined. (As a simple example, Dennett uses the terms equilateral triangles and equiangular triangles, which pick out the same set of things, and thus have the same extension, but clearly do not mean the same thing. They have different intensions.) Roughly, the intension of a word consists of the properties a thing must have in order to be in the extension of that word. There is no doubt that both the intensions and extensions of particular terms are used differently by members of different disciplines, leading to confusion (identified by Bacon four centuries ago as the direst of errors). This is compounded by the fact that many of our important terms are for abstract and variedly arbitrary concepts. Thus ”anorthositic gabbro” for me denotes a rock containing easily visible grains, mainly plagioclase and clinopyroxene with the former dominant, and of igneous origin (intensional definition). to many remote sensers of the Moon, it merely means something (usually an average soil over a few square kilometers area) with low Fe, whose chemical composition by inference approximates that of an anorthositic gabbro. Anorthositic gabbro in my mind conjures up images of a magma differentiating in a large subterranean chamber over a period of thousands of years, slowly growing crystals and eliminating or trapping liquid in between crystals, and atoms of europium. preferentially being incorporated in the growing plagiocase, and so on. I do not know what image is conjured up in the mind of a remote senser whose main interest is not petrology. This makes it difficult to produce a simple, adequate, all-useful glossary of the terminology used in lunar science. How do I relate the anorthositic gabbro used by remote sensers to the anorthositic gabbro used by me. Additional information contained in original.

Author

Data Management; Moon; Data Integration; Data Bases

20000040858 Japan Nuclear Cycle Development Inst., Tokai, Japan

STAR (structural test and analysis database for reliable design), Version 7.1, User’s manual *STAR*

Hosogai, H.; Kawasaki, N.; Kasahara, N.; Dec. 31, 1998; 106p; In Japanese; In English

Report No.(s): DE99-757524; JNC-TN-9520-99-002; No Copyright; Avail: Department of Energy Information Bridge

The STAR is characterized by having two supporting functions for developing strength evaluation methods in addition to usual data base management system, an automatic damage calculation function with external programs and an analysis system on accuracy of prediction. This report describes the structure and user information for execution of STAR code.

NTIS

Data Base Management Systems; Structural Analysis; Fast Nuclear Reactors; Design Analysis; User Manuals (Computer Programs)

20000040859 Japan Nuclear Cycle Development Inst., Tokai, Japan

STAR (structural test and analysis database for reliable design), Version 7.1, The details of the software

Hosogai, H.; Kawasaki, N.; Kasahara, N.; Dec. 31, 1998; 301p; In Japanese; In English

Report No.(s): DE99-757523; JNC-TN-9520-99-001; No Copyright; Avail: Department of Energy Information Bridge

The structural strength database STAR has been developed to assist improvement of damage evaluation methods for structural materials of fast breeder reactor components. STAR Version 7.1 was upgraded Version 6. In this report, Version 7.1 software is described in detail for facilitation of effective and wide-ranging application of the database.
NTIS
Data Bases; Structural Analysis; Damage Assessment; Fast Nuclear Reactors; Reactor Materials; Design Analysis

83
ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

20000040398 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Propulsi Maju, Jakarta, Indonesia
An Analysis of an Initial Design Economy for a 50,000-Ton Per Year Capacity Polybutadiene Plant in Indonesia ***Analisis Ekonomi Perancangan Awal Pabrik Polibutadien Kapasitas 50.000Ton/Tahun di Indonesia***
Wahyuni, Dwi, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; April - June 1999; Volume 1, No. 2, pp. 23-32; In Malay-Indonesian; See also 20000040393; Copyright; Avail: Issuing Activity

Economical analysis for the preliminary design of 50.000 ton per year polybutadiene industry was the important factor for the feasibility study of this design. This analysis were about the total investment, the investment sources, the profit analysis, the cash flow analysis and the finance analysis. The finance analysis were about Pay Out Time (POT), Return On Investment (ROI), Internal Rate of Return (IRR), Break Even Point (BEP) and sensitivity analysis. From the calculation were found: total investment is Rp. 76.673.662.000,- , the POT is 1,8 year, the ROI is 23,29 %, the IRR is 20,45 % and the BEP is 42,6 %. The profit depends on the material and product prices and it does not depend on the investment change and the life time of the project. We can conclude that the project is feasible to be executed. This industry also has a good social aspects for the neighbor society.
Author
Indonesia; Polybutadiene; Economic Analysis; Design Analysis; Industrial Plants

84
LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes: aviation law; space law and policy; international law; international cooperation; and patent policy

20000038903 Norwegian Defence Research Establishment, Kjeller, Norway
European Security in Times of Changes: An Analysis of the Norwegian Foreign and Security Political Space of Manouvre ***Europeisk Sikkerhet i en Foranderlig Tid: En Analyse av Norges Utenriks- og Sikkerhetspolitiske Handlingsrom***
Knutsen, Bjorn Olav, Norwegian Defence Research Establishment, Norway; Granviken, Alf, Norwegian Defence Research Establishment, Norway; Holte, Mats Ruge, Norwegian Defence Research Establishment, Norway; Kjolberg, Anders, Norwegian Defence Research Establishment, Norway; Aagaard, Finn, Norwegian Defence Research Establishment, Norway; Jan. 10, 2000; 140p; In Norwegian
Contract(s)/Grant(s): FFISYS Proj. 733/161.1
Report No.(s): FFI/RAPPORT-2000/00046; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The aim of this report is to describe and explain Norway's position in the Euro-Atlantic security structure. Huge emphasis is being put on recent developments inside NATO and the EU as regards how security should be handled in a Europe where threats and risks are getting harder to predict. In the report an analysis of NATO's strategic concept from 1999, the new military command structure, NATO's outreach activities during the 1990's are analyzed, as well as the increasing Europeanisation of European security politics due to the EU integration process. Emphasis is also put on the Norwegian foreign policy "culture" where the report describes different aspects like the Norwegian focus up on conscription as the organizing principle behind the Norwegian defence forces, and the Norwegian focus upon territorial defence. This Norwegian "culture" or tradition seems to contradict several developments among other states in the Euro-Atlantic area, like ending conscription and increased priority on international military operations. New security thinking inside NATO and the EU seems in this respect to marginalize Norwegian security interests. In the latter part of the report different strategies are put forward, which Norwegian foreign policy makers could try to pursue to try to reduce the most negative consequences of such a marginalization.
Author
Europe; Foreign Policy; North Atlantic Treaty Organization (NATO); Security; Politics

89
ASTRONOMY

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

20000038401 Vanguard Research, Inc., Fairfax, VA USA
Investigating Galactic Structure with COBE/DIRBE and Simulation
Cohen, Martin, Vanguard Research, Inc., USA; September 1999; 6p; In English
Contract(s)/Grant(s): NAS5-32949
Report No.(s): NASA/CR-1999-209489; NAS 1.26:209489; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In this work I applied the current version of the SKY model of the point source sky to the interpretation of the diffuse all-sky emission observed by COBE/DIRBE (Cosmic Background Explorer Satellite/Diffuse Infrared Background Experiment). The goal was to refine the SKY model using the all-sky DIRBE maps of the Galaxy, in order that a search could be made for an isotropic cosmic background."Faint Source Model" [FSM] was constructed to remove Galactic fore ground stars from the ZSMA products. The FSM mimics SKY version 1 but it was inadequate to seek cosmic background emission because of the sizeable residual emission in the ZSMA products after this starlight subtraction. At this point I can only support that such models are currently inadequate to reveal a cosmic background. Even SKY5 yields the same disappointing result.
Author
Cosmic Background Explorer Satellite; Galactic Structure; Sky Surveys (Astronomy); Infrared Radiation; Diffuse Radiation; Simulation

20000038402 Eureka Scientific, Inc., Oakland, CA USA
The Soft X-Ray Variability and Spectrum of 1H0419-577 from a Long EUVE Observation
Marshall, H. L., Eureka Scientific, Inc., USA; Halpern, J. P., Columbia Univ., USA; Leighly, K., Columbia Univ., USA; June 1999; 14p; In English
Contract(s)/Grant(s): NASA Order S-92511-Z
Report No.(s): NASA/CR-1999-209491; NAS 1.26:209491; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The active galaxy associated with the hard X-ray source 1H0419-577 was observed with EUVE (Extreme Ultraviolet Explorer Satellite) for about 25 days to obtain a long, contiguous light curve and an EUV spectrum. An EUV source was detected which was about as bright as the AGN (Active Galactic Nuclei) and was later identified as an AM Her type system. The AGN showed variations as large as a factor of two over 5-10 day time scales and occasionally varied by 20-30% in less than 0.5day. The spectrum is dominated by a continuum that is poorly fit by a simple power law. There are possible emission lines without positive identifications but the lines are likely to be spurious.
Author
Extreme Ultraviolet Explorer Satellite; X Ray Sources; Space Observations (From Earth); Active Galactic Nuclei; Variability; Ultraviolet Spectra

20000038726 NASA Marshall Space Flight Center, Huntsville, AL USA
The Chandra X-Ray Observatory: First Year of Operation
Weisskopf, M. C., NASA Marshall Space Flight Center, USA; Tananbaum, H., NASA Marshall Space Flight Center, USA; Van-Speybroeck, L., NASA Marshall Space Flight Center, USA; ODell, S. L., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 45th, 30 Jul. - 4 Aug. 2000, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Chandra X-ray Observatory - formerly, the Advanced X-ray Astrophysics Facility (AXAF) - has now joined the Hubble Space Telescope and the Compton Gamma-Ray Observatory, as the third of NASA's "Great Observatories". Chandra provides unprecedented arcsecond imaging and spectrometric imaging and high-resolution dispersive spectroscopy, to address a large range of topics in x-ray astronomy and astrophysics. Here we provide an overview of the Observatory, its operation, and results obtained during its first year of operation.
Author
Astrophysics; Imaging Techniques; X Ray Astronomy; X Ray Astrophysics Facility; High Resolution

20000038730 NASA Marshall Space Flight Center, Huntsville, AL USA
Modeling Chandra Space Environment
Blackwell, W. C., International Society for Optical Engineering, USA; Minow, J. I., International Society for Optical Engineering,

USA; Warren, K., International Society for Optical Engineering, USA; Suggs, R. M., International Society for Optical Engineering, USA; ODell, S. L., International Society for Optical Engineering, USA; Swartz, D. A., International Society for Optical Engineering, USA; Tennant, A. F., International Society for Optical Engineering, USA; Virani, S. N., International Society for Optical Engineering, USA; 20000225; 1p; In English; 45th, 30 Jul. - 4 Aug. 2000, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

This paper describes the development of an environmental risk-mitigation tool for the Chandra X-ray Observatory's Advanced CCD Imaging Spectrometer (ACIS). Because exposure to 100-200 keV protons appears to have degraded the front-illuminated CCD's charge transfer inefficiency (CTI), an accurate tool for predicting encounters with magnetospheric regions rich in these particles is required. We implement standard models to predict bow-shock, magnetopause, and plasma-sheet boundaries. Using these models and solar-wind databases compiled from IMP-8 and ACE measurements, we then calculate the probability that Chandra is located in one of these regions, along with predicted particle flux, to arrive at appropriate safing times for the ACIS detector. Finally, we validate this tool by comparing the model's boundary-crossing and proton flux predictions with measurements from Chandra's on-board particle detector and with data from other spacecraft operating in the Earth's magnetosphere.
Author

Aerospace Environments; Charge Coupled Devices; Charge Transfer; Imaging Spectrometers; Atmospheric Models; X Ray Astrophysics Facility

20000039221 Smithsonian Astrophysical Observatory, Cambridge, MA USA

Orbital Verification of the CXO High-Resolution Mirror Assembly Alignment and Vignetting

Gaetz, T. J., Smithsonian Astrophysical Observatory, USA; Jerius, D., Smithsonian Astrophysical Observatory, USA; Edgar, R. J., Smithsonian Astrophysical Observatory, USA; VanSpeybroeck, L. P., Smithsonian Astrophysical Observatory, USA; Schwartz, D. A., Smithsonian Astrophysical Observatory, USA; Markevitch, M., Smithsonian Astrophysical Observatory, USA; Schulz, N. S., Massachusetts Inst. of Tech., USA; [2000]; 1p; In English; Astronautical Telescopes and Instrumentation 2000 Meeting, 27-31 Mar. 2000, Munich, Germany; Sponsored by International Society for Optical Engineering, USA
Contract(s)/Grant(s): NAS8-39073; No Copyright; Avail: Issuing Activity; Abstract Only

Prior to launch, the High Resolution Mirror Assembly (HRMA) of the Chandra X-ray Observatory underwent extensive ground testing at the X-ray Calibration Facility (XRCF) at the Marshall Space Flight Center in Huntsville. Observations made during the post-launch Orbital Activation and Calibration period, allow the on-orbit condition of the X-ray optics to be assessed. Based on these ground-based and on-orbit data, we examine the alignment of the x-ray optics based on the PSF, and the boresight and alignment of the optical axis alignment relative to the detectors. We examine the vignetting and the single reflection ghost suppression properties of the telescope. Slight imperfections in alignment lead to a small azimuthal dependence of the off-axis area; the morphology of off-axis images also shows an additional small azimuthal dependence varying as 1/2 the off-axis azimuth angle.
Author

Alignment; High Resolution; Mirrors; Vignetting; X Ray Optics

20000039788 Smithsonian Astrophysical Observatory, Cambridge, MA USA

Initial Performance of the Aspect System on the Chandra Observatory: Post-Facto Aspect Reconstruction

Aldcroft, T., Smithsonian Astrophysical Observatory, USA; Karovska, M., Smithsonian Astrophysical Observatory, USA; Cresitello–Dittmar, M., Smithsonian Astrophysical Observatory, USA; Cameron, R., Smithsonian Astrophysical Observatory, USA; [2000]; 1p; In English; Astronomical Telescopes and Instruments 2000 Meeting, 27-31 Mar. 2000, Munich, Germany; Sponsored by International Society for Optical Engineering, USA
Contract(s)/Grant(s): NAS8-39073; No Copyright; Avail: Issuing Activity; Abstract Only

The aspect system of the Chandra Observatory plays a key role in realizing the full potential of Chandra's x-ray optics and detectors. to achieve the highest spatial and spectral resolution (for grating observations), an accurate post-facto time history of the spacecraft attitude and internal alignment is needed. The CXC has developed a suite of tools which process sensor data from the aspect camera assembly and gyroscopes, and produce the spacecraft aspect solution. In this poster, the design of the aspect pipeline software is briefly described, followed by details of aspect system performance during the first eight months of flight. The two key metrics of aspect performance are: image reconstruction accuracy, which measures the x-ray image blurring introduced by aspect; and celestial location, which is the accuracy of detected source positions in absolute sky coordinates.
Author

Blurring; Cameras; Data Processing; Image Reconstruction; Spectral Resolution; X Ray Optics; X Rays

20000040111 NASA Marshall Space Flight Center, Huntsville, AL USA

The Chandra X-Ray Observatory: An Overview

Weisskopf, Martin C., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 33rd; 33rd COSPAR Scientific Assembly, 20 Jul. 2000, Warsaw, Poland; Sponsored by Committee on Space Research, Unknown; No Copyright; Avail: Issuing Activity; Abstract Only

The Chandra X-Ray Observatory was launched early in the morning of July 23, 1999, by the Space Shuttle Columbia. The Shuttle launch was only the first step in placing NASA's latest great observatory into orbit. After release from the cargo bay, the Inertial Upper Stage performed two firings and separated from the observatory as planned. Finally, after five firings of Chandra's own Integral Propulsion System - the last of which took place 15 days after the initial launch - the observatory was placed in its highly elliptical orbit of 140,000 km apogee and 10,000 km perigee. After Observatory activation, the first x-rays focussed by the telescope were observed on 1999, August 12. Beginning with this initial observation one could conclude that the telescope had survived the launch environment and was operating as expected. The month following the opening of the sunshade door was spent adjusting the focus for each set of instrument configurations, determining the optical axis, calibrating the star camera, establishing the relative response functions, determining the energy scale(s), and performing a series of ”publicity” images. Each observation proved to be far more revealing than was expected. Preliminary results will be presented and the status of the instrumentation on the observatory will be discussed.

Author

X Ray Astrophysics Facility; Spaceborne Astronomy; Astronomical Satellites; Calibrating

20000040118 NASA Goddard Space Flight Center, Greenbelt, MD USA

Recent Results for AGN Observed by the Rossi X-Ray Timing Explorer

Madejski, G. M., NASA Goddard Space Flight Center, USA; Done, C., Durham Univ., UK; Zycki, P., Copernicus Center, Poland; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The Rossi X-ray Timing Explorer (RXTE) has produced many excellent observations of active galaxies, providing the best sensitivity in the 10 - 20 keV range so far. This presentation reports selected RTXE data for AGN in the context of the currently popular models. One is the recent result for two Seyfert 1 galaxies, NGC 5548 and IC4329a: both show the ”canonical” Seyfert I X-ray spectra, with an underlying power law, plus Gaussian iron K line and Compton reflection. Interestingly, in both cases, the profile of the Fe K line does not extend as far to the red as seen in the famous NCG-6-30-15, and this indicates that the regions where the Fe K lines originate in AGN are diverse. Independently, in both objects we see a strong spectral variability of the primary continua, which soften as the sources brighten. The second result is for the heavily absorbed Seyfert 2 NGC 4945. The RXTE data confirm the strong absorption corresponding to the optical depth to electron scattering of about 2, but also reveal rapid variability of the hard (8-30 keV) X-ray emission on a time scale of a day or less. This suggests that for NGC 4945, the putative parsec-size molecular torus cannot be both geometrically and optically thick, and implies that the Cosmic X-ray Background is unlikely to be made up primarily of AGN with geometry as inferred for this object.

Author

Data Acquisition; Background Radiation; Electron Scattering; K Lines; Seyfert Galaxies; X Ray Spectra

20000040167 Smithsonian Astrophysical Observatory, Cambridge, MA USA

Orbital Measurement and Verification of the Chandra X-Ray Observatory's PSF

Jerius, D., Smithsonian Astrophysical Observatory, USA; Edgar, R. J., Smithsonian Astrophysical Observatory, USA; Gaetz, T. J., Smithsonian Astrophysical Observatory, USA; McNamara, B. R., Smithsonian Astrophysical Observatory, USA; Schwartz, D. A., Smithsonian Astrophysical Observatory, USA; VanSpeybroeck, L. P., Smithsonian Astrophysical Observatory, USA; [2000]; 1p; In English; Astronomical Telescopes and Instrumentation 2000 Meeting, 27-31 Mar. 2000, Munich, Germany

Contract(s)/Grant(s): NAS8-39073; No Copyright; Avail: Issuing Activity; Abstract Only

The recently launched Chandra x-ray Observatory (CXO) was designed to have the sharpest angular resolution yet of any x-ray telescope. Detailed modeling and metrology of the optics followed by extensive testing at the X-ray Calibration Facility at the Marshall p Space Flight Center in Huntsville, Alabama, indicated that the optics were performing exceedingly well, within our ability to account for distortion of the mirrors due to gravity, and the effects of finite distance and size of the x-ray generator. Thus it was only on-orbit that we expected to directly observe the specified half arcsecond performance. We present here results of the on-orbit calibration of the point spread function (PSF), comparing it with our predictions. We discuss how the PSF varies with source location in the telescope field of view, as well as with the spectral energy distribution of the source.

Author

X Ray Telescopes; Observatories; Metrology; Calibrating; Angular Resolution

20000041138 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Astronomy in Everyday Life, Chapter 1 ***A Astronomia no Dia-a-Dia, Capitulo 1***

deCastroMilone, Andre, Instituto Nacional de Pesquisas Espacias, Brazil; Introduction to Astronomy and Astrophysics; 1999, pp. 1-1 - 1-56; In Portuguese; See also 20000041137; Copyright; Avail: Issuing Activity

It is amazing how fascinated people are with the heavens. Who has never admired a sunset or been amazed at a storm? However, even today, a large part of mankind does not understand the celestial and atmospheric phenomena that are part off our daily lives. These natural phenomena are even the subject of myths. This chapter will serve as an introduction, within certain limits, to educators and university students regarding celestial phenomena that are present in our daily lives even though they go un-noticed by most people. Phenomena which are exclusively part of the atmosphere in our planet will not be discussed. The influence of the Earth's atmosphere in scientific observation of the stars is the focus of Chapter 2.

Author

Students; Education; Earth Atmosphere; Observation

20000042892 National Optical Astronomy Observatories, Tucson, AZ USA

A Shear Way to Find Dark Matter and Transients, Too!

Tyson, Tony, National Solar Observatory, USA; DellAntonio, Ian, National Solar Observatory, USA; March 2000, No. 61, pp. 3-4; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Tony Tyson, David Wittman (Lucent), and Ian Dell'Antonio (NOAO) are leading a team of some twenty Cols worldwide to map the large-scale structure of the mass distribution beyond the local universe, using the Mosaic CCD imagers at the Blanco and Mayall telescopes to conduct an ultra-deep, multi-band optical survey. This "Deep Lens Survey" will run five years to completion and comprises deep multicolor imaging in four bands (B,V,R,z') over seven 2 deg fields. The shear of distant galaxies induced by the mass of foreground structures will be measured. These weak-lensing observations are sensitive to all forms of clumped mass and will yield unbiased mass maps with resolution of 1 min in the plane of the sky (approx. 120/ h kpc at z = 0.2), in multiple redshift ranges. These maps will measure for the first time the change in large-scale structure from z = 1 to the present epoch and test the current theories of structure formation, which predict that mass in the low-redshift universe has a particular filamentary/ sheetlike structure. These observations will constrain the clustering properties of matter, most notably Omega(sub matter) and Omega(sub Lambda) and when compared with the results from microwave background anisotropy missions, will test the basic theory of structure formation via gravitational instability. The deep combined data and catalogs for sub-fields will be released to the community as they are completed.

Derived from text

Dark Matter; Mapping; Galaxies; Gaps (Geology); Mass Distribution; Red Shift; Surveys

20000043525 National Optical Astronomy Observatories, Tucson, AZ USA

WIYN Tip/Tilt Module Moves into Fabrication Phase

Claver, C. F., National Optical Astronomy Observatories, USA; March 2000, No. 61, pp. 46-48; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The 3.5-m WIYN telescope is the facility of choice on Kitt Peak for high-resolution imaging. In an effort to further enhance this capability over a moderate field, a tip/tilt imager is being constructed for WIYN. The WIYN Tip/ Tilt Module (WTTM) is an all-reflecting, visible near-IR re-imaging system that implements fast tip/tilt compensation and includes real-time focus sensing. The project has moved into the fabrication phase, with shared-risk observing projected for 2001 B. The field of view for the WTTM is 4 min. x 4 min. arcminutes with a plate scale of 0.12 sec. per 15 microns pixel. The WTTM will become an integral part of the WIYN Instrument Adapter System and provide a "second" imaging port, in addition to the 10 x 10 arcminute FOV MiniMosaic 4K x 4K imager. Fast change (e.g., less than 5 minutes) between these two imagers to accommodate changing atmospheric conditions is facilitated by moving a single pick-off mirror.

Derived from text

Adapters; Fabrication; Field of View; Imaging Techniques; Real Time Operation; Reflection; Telescopes

20000043526 National Optical Astronomy Observatories, Tucson, AZ USA

Improving Imaging Performance at WIYN

Sawyer, D., National Optical Astronomy Observatories, USA; Corson, C., National Optical Astronomy Observatories, USA; Saha, Abhijit, National Optical Astronomy Observatories, USA; March 2000, No. 61, pp. 44-45; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A combination of recent improvement projects and focused maintenance have more than quadrupled the likelihood of obtaining 0.6 sec. or better images at the WIYN telescope. and the potential exists for yet further improvement. These efforts, coupled

with the implementation of the MiniMosaic imager, which offers improved image sampling (0.14 sec./pixel), are allowing observers to routinely obtain images with what was once remarkable resolution.
Derived from text
Improvement; Imaging Techniques; Maintenance

20000043527 National Optical Astronomy Observatories, Tucson, AZ USA
Significant Improvement in 4-m DIQ
Massey, Phil, National Optical Astronomy Observatories, USA; Abraham, Tony, National Optical Astronomy Observatories, USA; Bohannan, Bruce, National Optical Astronomy Observatories, USA; Claver, Chuck, National Optical Astronomy Observatories, USA; Green, Richard, Kitt Peak National Observatory, USA; Jacoby, George, National Optical Astronomy Observatories, USA; Wolff, Richard, National Optical Astronomy Observatories, USA; March 2000, No. 61, pp. 40-42; In English; No Copyright; Avail: Issuing Activity; Abstract Only

0ver the past few years we have been working hard to improve the delivered image quality (DIQ) at the 4-m, the ”seeing” the astronomer measures. Starting in early 1996, we began nightly seeing measurements using a dedicated CCD camera and PC-based software, implemented by G. Jacoby. We have used these data, along with the recorded temperatures, to determine how to best spend our resources in trying to improve the situation. We were encouraged by the eventual success of similar efforts at the CTIO Blanco 4-m, although conversations with the staff confirmed our own impression-one has to do everything before there’s any noticeable improvement. We appear to have finally made it past that hurdle. The median seeing has dipped below the psychological 1.0” barrier, and we see corresponding gains in both the 25th and 75th percentiles-in other words, the best seeing, the worst seeing, and the average seeing have all gotten better. The significance of this is striking when we compare the data semester by semester.
Author
Image Resolution; CCD Cameras; Improvement

20000043529 National Optical Astronomy Observatories, Tucson, AZ USA
OSIRIS Is the Primary Infrared Instrument at CTIO
Blum, Bob, National Optical Astronomy Observatories, USA; March 2000, No. 61, pp. 30; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The Ohio State InfraRed Imager/Spectrometer (OSIRIS) had its Rockwell HAWAII array replaced in December 1999. New parameters and performance information can be found in the OSIRIS web pages (http://www.ctio.noao.edu/instruments/ir-instruments/osiris). The new array is similar in most respects to the old, but does not exhibit the severe ramping at the quadrant boundaries that the old array did and appears to have a deeper full-well capacity. OSIRIS is now the default IR imager/ spectrometer at CTIO. Its combined imaging and spectroscopic modes allow CTIO to make fewer instrument changes over bright-time runs, an important consideration as we begin to prepare for the additional operational load of SOAR. Observers should propose to use OSIRIS instead of CIRIM or the IRS. The IRS may occasionally be scheduled for very highly rated science proposals that need long wavelength coverage (greater than 2.5 microns) or high resolution (R greater than 5000). CIRIM may be scheduled if it is advantageous to have both IR imagers on two different telescopes at the same time.
Author
Imaging Techniques; Infrared Spectrometers; Arrays

20000043530 National Optical Astronomy Observatories, Tucson, AZ USA
CTIO Instrumentation Update
Walker, Alistair, National Optical Astronomy Observatories, USA; March 2000, No. 61, pp. 29-30; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The CTIO La Serena-based Engineering and Technical Services (ETS) Division has the multiple functions of building new instrumentation, upgrading existing telescopes and their instruments, and providing support to the Tololo-based Telescope Operations Division (Telops). In addition, computer hardware and software support is provided to the systems in both La Serena and on Tololo. Both divisions are expected to provide some support for Gemini South, particularly for NOAO instruments such as Phoenix. The ETS division is managed by Brooke Gregory, while schedules, progress, and priorities are reviewed by a committee of scientists who meet at approximately monthly intervals. The program presently contains 25 projects, large and small; here I concentrate on the major instrumentation projects now underway.
Derived from text
Computer Programs; Subdivisions; Management Systems

20000043531 National Optical Astronomy Observatories, Tucson, AZ USA
Approved 1999 NOAO Survey Programs
Boroson, Todd, National Optical Astronomy Observatories, USA; March 2000, No. 61, pp. 24-25; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Five programs were recommended for approval by the NOAO Survey Panel of the Telescope Allocation Panel and approved by the NOAO Director during the 1999 Survey Proposal round. Each program is to receive an average of about 100 nights total, typically spread over six semesters. Two to four different telescopes are utilized by each program. The successful 1999 NOAO Survey Programs are identified below. Information about these programs, with links to the survey program web sites maintained by the survey groups, may be found at http://www.noao.edu/gateway/surveys/. This programs are: deep imaging survey of nearby star-forming clouds; in search of nearby stars: a parallax program at CTIO; the NOAO deep wide-field survey; deep lens survey; and a fundamental plane peculiar velocity survey of rich clusters within 200/h Mpc.
Author
Imaging Techniques; Parallax; Surveys

20000043532 National Optical Astronomy Observatories, Tucson, AZ USA
Supernova 1987A Dings the Ring
Bohannan, Bruce, National Optical Astronomy Observatories, USA; March 2000, No. 61, pp. 7; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A team of astronomers led by Patrice Boucher (CTIO), which includes Stephen Lawrence, Arlin Crotts, Ben Sugerman, Robert Uglesich (Columbia), and Stephen Heathcote (CTIO), used a new ”tip/tilt” imaging camera at the CTIO 4-m Blanco telescope to discover a new brightening of the circumstellar ring around Supernova 1987A in the Large Magellanic Cloud. This activity indicates that supernova ejecta have finally begun to collide with the shell of gas puffed out by the star earlier in its lifetime-the beginning of a critical phase in the formation of a supernova remnant that has never before been witnessed.
Author
Supernova 1987A; Ejecta; Magellanic Clouds; Stellar Envelopes; Ring Galaxies

20000043533 National Optical Astronomy Observatories, Tucson, AZ USA
The Most Distant Quasar Known
Stern, Daniel, California Univ., USA; March 2000, No. 61, pp. 5-6; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A team of astronomers, led by Daniel Stern (JPL), has recently discovered a quasar at redshift z = 5.50, using the KPNO 4-m, Palomar 5-m, and Keck 10-m telescopes. The quasar, now the most distant known, was picked out as a high-redshift candidate from a deep, multicolor (RIz) imaging survey. The team of astronomers, which also includes Hyron Spinrad (Berkeley), Peter Eisenhardt (JPL) Andrew Bunker (Cambridge), Steve Dawson (Berkeley), Adam Stanford (Davis, IGPP), and Richard Elston (Florida), has begun a deep imaging survey to probe the first Gyr of galaxy formation through rest-frame UV-dropout selection of z approx. 5 galaxies. Broad-band RIz images have been obtained using PFCCD on the KPNO 4-m and the COSMIC camera at the prime focus of the Palomar 5-m telescope. Targets are selected on the basis of the strong signature of the Lyman-alpha forest at z approx. 5, causing objects to disappear in the R-band. For z approx. 5, the Lyman break is inconsequential relative to the thick jungle of the Lyman-alpha forest. The aim of the survey is primarily to study high-redshift galaxies, but it is also sensitive to high-redshift quasars.
Derived from text
Quasars; Galactic Evolution; Lyman Alpha Radiation; Red Shift; Surveys

20000043650 National Optical Astronomy Observatories, Tucson, AZ USA
From the NSO Director’s Office
Keil, Steve, National Optical Astronomy Observatories, USA; March 2000, No. 61, pp. 55-56; In English; No Copyright; Avail: Issuing Activity; Abstract Only

NSO has entered the dawn of the new Millennium by establishing its existence as an independent national center. As noted in the last Newsletter, NSO will continue its close ties with NOAO to support our operations in Tucson and on Kitt Peak, including the sharing of technical support for project development. NSO is in the process of developing its Long Range Plan and, as always, your input is encouraged. The NSO Users’committee met in November and their report appears in this Newsletter. The report includes their reaction to parts of the Long Range Plan and their concerns about establishing an independent budget for NSO.
Author
Project Management; Planning; Fabrication; Solar Instruments

20000043651 National Optical Astronomy Observatories, Tucson, AZ USA

Evolution in the US Gemini Project Office

Schommer, Bob, National Optical Astronomy Observatories, USA; Pilachowski, Caty, National Optical Astronomy Observatories, USA; Boroson, Todd, National Optical Astronomy Observatories, USA; March 2000, No. 61, pp. 52-53; In English; No Copyright; Avail: Issuing Activity; Abstract Only

As the Gemini Observatory evolves from a onstruction project into a working observatory and part of the suite of US facilities, the USGP will be evolving in both structure and personnel. Bob Schommer (based in Chile at CTIO) has become US Gemini Project scientist, as of 1 February, taking on the role that Todd Boroson has fulfilled for the past six years. Cary Pilachowski has become Deputy Project Scientist, coordinating aspects of the US project office in Tucson. Instrument support scientists drawn from both NOAO sites will be supporting US users of the Gemini telescopes, and for this year the principal players include Mike Merrill (for NIRI, the U. Hawaii IR imager and spectrograph), Tod Lauer (for Hokupa'a, the UH AO + IR imager, a "visitor instrument") and Patrice Boucher (for OSCIR, the Florida mid-IR imager and spectrograph, also a "visitor instrument").

Derived from text

Gemini Project; Infrared Radiation; Personnel; Management Planning; Management Methods

20000043652 National Optical Astronomy Observatories, Tucson, AZ USA

CCD Mosaic Imager Status Report

Jacoby, George, National Optical Astronomy Observatories, USA; Armandroff, Taft, National Optical Astronomy Observatories, USA; March 2000, No. 61, pp. 48-50; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The NOAO Mosaic CCD imager covers the sky on a scale previously possible only with photographic plates. This 60 min. x40 min. section of the full 1 deg x l deg field-of-view covers M81 and M82. This R-band image was taken at the KPNO 0.9-m by G. Jacoby and P. Massey. The NOAO CCD Mosaic Imager at KPNO has been operating smoothly with its SITe thinned CCDs since July 1998. No dramatic changes have been made to the system. Several recent upgrades are noteworthy for prospective users.

Derived from text

Field of View; Imaging Spectrometers

20000043653 National Optical Astronomy Observatories, Tucson, AZ USA

The MiniMosaic Imager is On-Line at WIYN

Saha, Abhijit, National Optical Astronomy Observatories, USA; March 2000, No. 61, pp. 43; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The WIYN telescope has a new imager, the MiniMosaic with two SITE 2K x 4K CCDs arranged side by side to provide a 4K x 4K viewing area. At the Nasmyth f/6.3 focus of IWIYN, this imager covers an area that is 9.6 min on the side, with pixels that project to 0. 14 sec. on the sky, thus providing good spatial sampling in even the 0.4 sec. seeing conditions that are increasingly common at the WIYN telescope. The combination of a relatively large field of view with the excellent images across the entire field produced by this camera (less than 10% change in point-spread function even in 0.4 sec. seeing) in excellent, naturally delivered seeing make the images suitable for stellar photometry in large, faint, crowded fields, which is a targeted goal for the \VTYN. Commissioning activities for the MiniMosaic have been completed, and the instrument has become the default imaging instrument at WIYN. The User's Manual for MiniMosaic is available at http://www.noao.edu/kpno/docs.html.

Author

Stellar Spectrophotometry; On-Line Systems; Imaging Techniques; Field of View; Cameras

20000043654 National Optical Astronomy Observatories, Tucson, AZ USA

Synoptic, Target-of-Opportunity, and Exploratory Observations at the WIYN Telescope

Saha, Abhijit, National Optical Astronomy Observatories, USA; Green, Richard, Kitt Peak National Observatory, USA; March 2000, No. 61, pp. 39-40; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The queue observing experiment on the WIYN telescope has been very successful. We have been able to explore techniques of ground-based queue observing well in advance of the advent of Gemini. We have learned important lessons about the impact of tuning the "rules" of executing the queue and the relation of expectations to user satisfaction. We have quantitative information to assess the success rate of executing programs that depend on special conditions. We have the growing body of literature to explore the relative rates of publication for queue vs. classical observing. The success of this experiment was made possible by the extraordinary expertise and care of the queue observers.

Derived from text

Observation; Synoptic Measurement; Telescopes

20000043655 National Optical Astronomy Observatories, Tucson, AZ USA

From the KPNO Director-Evolution of the IR Instrument Complement on Kitt Peak

Green, Richard, Kitt Peak National Observatory, USA; March 2000, No. 61, pp. 35-36; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Gemini North is about to start its scientific operation, KPNO is beginning to deploy a new generation of IR A:instruments that exploit wide field of view. The first is the new incarnation of SQIID, the Simultaneous Quad Infrared Imaging Device, which has now been retrofitted with 4 InSb arrays from the ALADDIN development program. The optics will illuminate the inscribed circles of the 512 square quadrants. SQIID is now upgraded with science-grade arrays and is undergoing lab testing. Telescope testing is scheduled for late February.

Author

Evolution (Development); Infrared Instruments; Field of View

20000043656 National Optical Astronomy Observatories, Tucson, AZ USA

A Tip/Tilt System for the Blanco Telescope

Bouchet, P., National Optical Astronomy Observatories, USA; Lawrence, S., Columbia Univ., USA; Crotts, Columbia Univ., USA; Heathcote, S., National Optical Astronomy Observatories, USA; March 2000, No. 61, pp. 34; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The Tip/Tilt System at the CTIO Blanco 4-m telescope offers first-order wavefront correction for high spatial resolution near-infrared imaging at the f/14 focus. The system is very user friendly, and doesn't require special technical skills from the observer to be operated efficiently. Advance preparation by the astronomer consists of identifying suitable guide stars at V = 8 - 16 magnitude within 2.5 in. radius of the science target. The target itself can be used if it is pointlike and sufficiently bright at visible wavelengths. At the telescope, initial acquisition and setup is performed by the operator. The observer can interact with the guider and telescope to move the science FOV while guiding, disable guiding to go off to sky, move the guider to reacquire a guide star, etc. The Tip/Tilt System is used in conjunction with CTIO's infrared instruments: CIRIM, OSIRIS, and IRS. It couples an optical sensor and active secondary to the instrument; a guider box ahead of the instrument provides guiding signals to the telescope at a slow rate (once every few seconds) and to the steerable f/ 14 secondary at a high rate (10-100 Hz). The system can in principle operate under very poor seeing conditions; the maximum amplitude and frequency of the system are 3 in. at 230 Hz. However, rarely are these limits pushed: typical displacements are less than 1 in. at lower frequencies (the system is not designed for "chopping," or oscillations with amplitudes of many arcseconds). The optical quality of the mirror surfaces is the ultimate limit on system performance-this is currently being evaluated by wavefront curvature and Hartmann tests.

Derived from text

Telescopes; Adaptive Optics; High Resolution; Imaging Techniques; Infrared Radiation; Optical Measuring Instruments

20000043657 National Optical Astronomy Observatories, Tucson, AZ USA

The First Semester of the NOAO MOSAIC II Camera at CTIO

Schommer, R. A., National Optical Astronomy Observatories, USA; Smith, R. C., National Optical Astronomy Observatories, USA; Walker, A., National Optical Astronomy Observatories, USA; Olsen, K., National Optical Astronomy Observatories, USA; March 2000, No. 61, pp. 31-32; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The Mosaic II camera was successfully commissioned at CTIO in July 1999. Shared-risk observing starting in August produced useful images from the first night, and observers have taken home some excellent data over the past five months. Guided images in red bandpasses have been obtained with FWHMis less than 0.7 sec over is greater than 600 sec.

Author

Imaging Spectrometers; Data Acquisition

20000043659 National Optical Astronomy Observatories, Tucson, AZ USA

Partnering Opportunities Sought for Wide-Field Infrared Imaging Capability

Probst, Ron, National Optical Astronomy Observatories, USA; Green, Richard, National Optical Astronomy Observatories, USA; March 2000, No. 61, pp. 13; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Wide-field, moderate-resolution infrared imaging on 2-4 in class telescopes has been identified as a crucial need for the US community of Gemini users. Such a capability is also a natural extension of both advances in IR sensor technology and current research programs involving moderately deep survey-mode imaging. NOAO is enthusiastic about offering this capability to the US community. We have developed an instrument concept that provides one-quarter square degree of mosaiced field of view, at 1-2.4 microns, on the 4-m Mayall telescope (http://www.noao.edu/ets/newfirm). We are now seeking interested partners to bring this, or some similar concept, to reality. We wish to put new instrumentation into the communities hands rapidly and have several

candidates for development over the next few years. to achieve this goal with solely in-house technical resources would require that we focus on only one of these candidates. We also wish to develop major capabilities through community-based partnerships, a goal encouraged by the NOAO Users Committee. There appears to be real promise in the development of wide-field IR imaging through partnering because of demonstrated community expertise as well as shared scientific goals.
Derived from text
Infrared Imagery; Infrared Detectors; Field of View; Image Resolution

20000043660 National Optical Astronomy Observatories, Tucson, AZ USA
Observing Time on the Gemini Telescopes
Wolff, Sidney C., National Optical Astronomy Observatories, USA; March 2000, No. 61, pp. 11-12; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The first deadline for proposals for the Gemini telescopes is likely to be 31 March 2000 (see article elsewhere in this Newsletter). It is therefore appropriate to announce now that we plan to implement the same policies for allocation of time on these telescopes as are used for allocating time on Kitt Peak and Cerro Tololo telescopes. Specifically, you will be able to use the same observing forms and procedures with which you are already familiar, and the TACs will operate in exactly the same manner. If current experience at CTIO and KPNO is a guide, we can expect that 80-90 percent of the US share of the observing time on the Gemini telescopes will go to astronomers outside NOAO. NOAO is responsible for providing support to the US users of the Gemini telescopes, except when the observers are actually at the observatories in Hawaii or Chile. NOAO staff will be the first point of contact for questions about planning observing programs at Gemini, optimizing observing strategies, and reducing data-just as they now are for CTIO and KPNO telescopes. Therefore, NOAO staff will have to become knowledgeable about the Gemini instruments and their quirks and capabilities.
Author
Observation; Policies; Telescopes; Time Lag

20000043994 Smithsonian Astrophysical Observatory, Cambridge, MA USA
Chandra X-Ray Observatory's Radiation Environment and the AP-8/AE-8 Model
Virani, S. N., Smithsonian Astrophysical Observatory, USA; Plucinsky, P. P., Smithsonian Astrophysical Observatory, USA; Butt, Y. M., Smithsonian Astrophysical Observatory, USA; Mueller–Mellin, R., Keil Univ., Germany; [2000]; 1p; In English; Astronomical Telescopes and Instrumentation 2000 Meeting, 27-31 Mar. 2000, Munich, Germany; Sponsored by International Society for Optical Engineering, USA
Contract(s)/Grant(s): NAS8-39073; No Copyright; Avail: Issuing Activity; Abstract Only

The Chandra X-ray Observatory (CXO) was launched on July 23, 1999 and reached its final orbit on August 7, 1999. The CXO is in a highly elliptical orbit, approximately 140,000 km x 10,000 km, and has a period of roughly 63.5 hours (approx. 2.6 days). It transits the Earth's Van Allen belts once per orbit during which no science observations can be performed due to the high radiation environment. The Chandra X-ray Observatory Center (CXC) currently uses the National Space Science Data Center's "near Earth" AP-8/AE-8 radiation belt model to predict the start and end times of passage through the radiation belts. However, our scheduling software only uses a simple dipole model of the Earth's magnetic field. The resulting B, L magnet coordinates, do not always give sufficiently accurate predictions of the start and end times of transit of the Van Allen belts. We show this by comparing to the data from Chandra's on-board radiation monitor, the EPHIN (Electron, Proton, Helium Instrument particle detector) instrument. We present evidence that demonstrates this mis- of the radiation belts as well as data that also demonstrate the significant variability of one radiation belt transit to the next as experienced by the CXO. We present an explanation for why the dipole implementation of the AP-8/AE-8 gives inaccurate results. We are also investigating use of the Magnetospheric Specification and Forecast Model (MSM) - a model that also accounts for radiation belt variability and geometry.
Author
X Ray Astrophysics Facility; Radiation Measurement; Geomagnetism; Radiation Counters; Radiation Belts

20000044317 NASA Marshall Space Flight Center, Huntsville, AL USA
Measurements with the Chandra Flight Contamination Monitor
Elsner, R. E., NASA Marshall Space Flight Center, USA; Kolodziejczak, J. J., NASA Marshall Space Flight Center, USA; ODell, S. L., NASA Marshall Space Flight Center, USA; Swartz, D. A., NASA Marshall Space Flight Center, USA; Tennant, A. F., NASA Marshall Space Flight Center, USA; Weisskopf, M. C., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 45th, 30 Jul. - 4 Aug. 2000, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

NASA's Chandra X-ray Observatory includes a Flight Contamination Monitor (FCM), a system of 16 radioactive calibration sources mounted to the inside of the Observatory's forward contamination cover. The purpose of the FCM is to verify the ground-to-orbit transfer of the Chandra flux scale, through comparison of data acquired during the ground calibration with those obtained in orbit, immediately prior to opening the Observatory's sun-shade door. Here we report results of these measurements, which place limits on the change in mirror-detector system response and, hence, on any accumulation of molecular contamination on the mirrors' iridium-coated surfaces.
Author
X Ray Astrophysics Facility; Radioactive Contaminants; Radioactivity; Calibrating; Monitors

20000044320 NASA Marshall Space Flight Center, Huntsville, AL USA
Finite Element Modeling of a Semi-Rigid Hybrid Mirror and a Highly Actuated Membrane Mirror as Candidates for the Next Generation Space Telescope
Craig, Larry, NASA Marshall Space Flight Center, USA; Jacobson, Dave, NASA Marshall Space Flight Center, USA; Mosier, Gary, NASA Goddard Space Flight Center, USA; Nein, Max, NASA Marshall Space Flight Center, USA; Page, Timothy, NASA Marshall Space Flight Center, USA; Redding, Dave, Jet Propulsion Lab., California Inst. of Tech., USA; Sutherlin, Steve, NASA Marshall Space Flight Center, USA; Wilkerson, Gary, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; International Symposium Astronomical Telescopes and Instrumentation 2000, 27-31 Mar. 2000, Munich, Germany; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Advanced space telescopes, which will eventually replace the Hubble Space Telescope (HTS), will have apertures of 8 - 20 n. Primary mirrors of these dimensions will have to be foldable to fit into the space launcher. by necessity these mirrors will be extremely light weight and flexible and the historical approaches to mirror designs, where the mirror is made as rigid as possible to maintain figure and to serve as the anchor for the entire telescope, cannot be applied any longer. New design concepts and verifications will depend entirely on analytical methods to predict optical performance. Finite element modeling of the structural and thermal behavior of such mirrors is becoming the tool for advanced space mirror designs. This paper discusses some of the preliminary tasks and study results, which are currently the basis for the design studies of the Next Generation Space Telescope.
Author
Finite Element Method; Mathematical Models; Mirrors; Next Generation Space Telescope Project; Spaceborne Telescopes

20000044322 Smithsonian Astrophysical Observatory, Cambridge, MA USA
Absolute Effective Area of the Chandra High-Resolution Mirror Assembly
Schwartz, D. A., Smithsonian Astrophysical Observatory, USA; David, L. P., Smithsonian Astrophysical Observatory, USA; Donnelly, R. H., Smithsonian Astrophysical Observatory, USA; Edgar, R. J., Smithsonian Astrophysical Observatory, USA; Gaetz, T. J., Smithsonian Astrophysical Observatory, USA; Jerius, D., Smithsonian Astrophysical Observatory, USA; Juda, M., Smithsonian Astrophysical Observatory, USA; Kellogg, E. M., Smithsonian Astrophysical Observatory, USA; McNamara, B. R., Smithsonian Astrophysical Observatory, USA; Dewey, D., Massachusetts Inst. of Tech., USA; [2000]; 1p; In English; Astronomical Telescopes and Instrumentation 2000 Meeting, 27-31 Mar. 2000, Munich, Germany; Sponsored by International Society for Optical Engineering, USA
Contract(s)/Grant(s): NAS8-39073; No Copyright; Avail: Issuing Activity; Abstract Only

The Chandra X-ray Observatory was launched in July 1999, and is returning exquisite sub-arcsecond x-ray images of star groups, supernova remnants, galaxies, quasars, and clusters of galaxies. In addition to being the premier X-ray observatory in terms of angular and spectral resolution, Chandra is the best calibrated X-ray facility ever flown. We discuss here the calibration of the effective area of the High Resolution Mirror Assembly. Because we do not know the absolute X-ray flux density of any celestial source, this must be based primarily on ground measurements and on modeling. In particular, we must remove the calibrated modeled responses of the detectors and gratings to obtain the mirror area. For celestial sources which may be assumed to have smoothly varying spectra, such as the Crab Nebula, we may verify the continuity of the area calibration as a function of energy. This is of significance in energy regions such as the Ir M-edges, or near the critical grazing angle cutoff of the various mirror shells.
Author
Angular Resolution; X Rays; Observatories; Image Analysis; Stars; Mirrors

20000044325 Smithsonian Institution, Cambridge, MA USA

Observed On-Orbit Background of the ACIS Detector on the Chandra X-Ray Observatory

Plucinsky, P. P., Smithsonian Institution, USA; Virani, S. N., Smithsonian Institution, USA; [2000]; 1p; In English; Astronomical Telescopes and Instrumentation 2000 Meeting, 27-31 Mar. 2000, Munich, Germany; Sponsored by International Society for Optical Engineering, USA

Contract(s)/Grant(s): NAS8-39073; No Copyright; Avail: Issuing Activity; Abstract Only

We have analyzed calibration data acquired during the Orbital Activation and Checkout (OAC) phase of the Chandra X-ray Observatory (CXO) mission in order to characterize the background of the Advanced CCD Imaging Spectrometer (ACIS) produced by charged particles and non-cosmic X-rays. The ACIS instrument contains 8 Front-Illuminated (FI) CCDs and 2 Back-Illuminated (BI) CCDs. The FI and BI CCD)s exhibit dramatically different responses to enhancements in the particle flux. The F1 CCDs show relatively little increase in the overall count rate, typical increases are 1 - 3 counts/s; the BI CCDs show large excursions to as high as 100 counts/s. The duration of these intervals of enhanced background are highly variable ranging from 100 s to 5000 s. The spatial distribution of these background events is relatively flat across the power-law. The events produce morphologies which are similar to cosmic X-ray events, so that morphology alone cannot be used as a rejection criterion. We explore the correlation of these times of high background with the data from Chandra's on-board radiation monitor, the EPHIN (Electron, Proton, Helium Instrument particle detector) instrument and archival data from the Advanced Composition Explorer (ACE) satellite. We discuss strategies for observers to identify and exclude times of high background and to model and subtract the background events from their data.

Author

Data Acquisition; Data Processing; Calibrating; Imaging Spectrometers; Charge Coupled Devices; X Rays; Radiation Counters

20000044326 Smithsonian Astrophysical Observatory, Cambridge, MA USA

The Low Energy Effective Area of the Chandra Low Energy Transmission Grating Spectrograph

Pease, D., Smithsonian Institution, USA; Drake, J. J., Smithsonian Institution, USA; Johnson, C. O., Smithsonian Institution, USA; Kashya, V., Smithsonian Institution, USA; Ratzlaff, P. W., Smithsonian Institution, USA; Wargelin, B. J., Smithsonian Institution, USA; Brinkman, A. C., Space Research Organisation, Netherlands; Kaastra, J. S., Space Research Organisation, Netherlands; vanderMeer, R., Space Research Organisation, Netherlands; Paerels, F. B., Space Research Organisation, Netherlands; [2000]; 1p; In English; Astronomical Telescopes and Instrumentation 2000 Meeting, 27-31 Mar. 2000, Munich, Germany; Sponsored by International Society for Optical Engineering, USA

Contract(s)/Grant(s): NAS8-39073; No Copyright; Avail: Issuing Activity; Abstract Only

The Chandra X-ray Observatory was successfully launched on July 23, 1999, and subsequently began an intensive calibration phase. We present the preliminary results from the in-flight calibration of the low energy response of the High Resolution Camera spectroscopic readout (HRC-S) combined with the Low Energy Transmission Grating (LETG) aboard Chandra. These instruments comprise the Low Energy Transmission Grating Spectrograph (LETGS). For this calibration study, we employ a pure hydrogen non-LTE white dwarf emission model (T = 25000 K and log g = 9.0) for comparison with the Chandra observations of Sirius B. The pre-flight calibration of the LETGS effective area only covered wavelengths shortward of 44 A (E less than 277 eV). Our Sirius B analysis shows that the HRC-S quantum efficiency (QE) model assumed for longer wavelengths leads to an overestimate of the effective area by an average factor of about 1.6. We derive a correction to the low energy HRC-S QE model to match the predicted and observed Sirius B spectra over the wavelength range of 44-185 A. We make an independent test of our results by the comparison of a Chandra LETGS observation of HZ 43 with pure hydrogen model atmosphere predictions and find good agreement.

Author

Spectrographs; Calibrating; Data Acquisition; High Resolution; Readout

20000044329 NASA Marshall Space Flight Center, Huntsville, AL USA

Radiation Environment of the Chandra X-Ray Observatory

ODell, S. L., NASA Marshall Space Flight Center, USA; Bautz, M., NASA Marshall Space Flight Center, USA; Blackwell, W. C., NASA Marshall Space Flight Center, USA; Butt, Y. M., NASA Marshall Space Flight Center, USA; Cameron, R., NASA Marshall Space Flight Center, USA; Elsner, R. F., NASA Marshall Space Flight Center, USA; Gussenhoven, S., NASA Marshall Space Flight Center, USA; Kolodziejczak, J. J., NASA Marshall Space Flight Center, USA; Minow, J. I., NASA Marshall Space Flight Center, USA; Swartz, D. A., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 45th, 30 Jul. - 4 Aug. 2000, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Chandra X-ray Observatory lies in a highly elliptical orbit which dips into the outer radiation belt. During the initial stages of orbital operations, Chandra's front-illuminated CCD's (but not the back-illuminated ones) experienced an unanticipated degradation of the charge-transfer efficiency. The subsequent anomaly investigation determined that moderately low-energy protons (or other ions) propagated through the mirror assembly, causing the observed damage. This paper summarizes the effort to determine the radiation environment at the Chandra focal plane and the steps taken to prevent further performance degradation by magnetospheric and solar-wind protons and other ions.
Author
Charge Transfer; Elliptical Orbits; Charge Coupled Devices; X Ray Astrophysics Facility; Prevention

90
ASTROPHYSICS

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

20000038343 NASA Marshall Space Flight Center, Huntsville, AL USA
Dusty Plasma Experiments Using an Electrodynamic Balance
Spann, J. F., NASA Marshall Space Flight Center, USA; Abbas, M. M., NASA Marshall Space Flight Center, USA; Suess, S. T., NASA Marshall Space Flight Center, USA; Venturini, C. C., Alabama Univ., USA; Comfort, R. H., Alabama Univ., USA; [2000]; 1p; In English; International Topical Conference on Plasma Physics: Colloidal Plasma Science, 3-7 Jul. 2000, Trieste, Italy; No Copyright; Avail: Issuing Activity; Abstract Only

Knowledge of the formation, distribution, physical, chemical and optical characteristics of interstellar, interplanetary, and planetary dust grains provide valuable information about many issues dealing with the origin and formation of the solar system bodies, interplanetary and interstellar environments as well as various industrial processes. Understanding the microphysics of individual grains and their interaction with the surrounding environment is key to properly model various conditions and interpret existing data. The theory and models of individual dust grains are well developed for environments that vary from dense planetary atmospheres to dusty plasmas to diffuse environments such is interplanetary space. However, experimental investigations of individual dust grains in equilibrium are less common, perhaps due to the difficult of these experiments. Laboratory measurements of dust grains have primarily measured ensemble properties or transient properties of single grains. A technique developed in the 1950's for ion spectroscopy, known as a quadrupole trap or 'Paul Trap', has recently been used to investigate single micron-sized dust grains. This scaled ion trap called an electrodynamic balance has been used for atmospheric aerosol research. A description of this technique is provided. Recent results from experiments to investigate the equilibrium potential of dust grains exposed to far ultraviolet light or to -,in electron or ion beam are presented. This laboratory technique]ends itself to many applications that relate to planetary atmospheres, heliospheric environments, pre-stellar and pre-planetary conditions, and industrial settings. Several planned experimental approaches are presented. Potential experiments to investigate the interaction of multiple dust grains using an electrodynamic balance are proposed.
Author
Interstellar Matter; Cosmic Dust

20000038345 NASA Marshall Space Flight Center, Huntsville, AL USA
Photoemission of Single Dust Grains for Heliospheric Conditions
Spann, James F., Jr., NASA Marshall Space Flight Center, USA; Venturini, Catherine C., NASA Marshall Space Flight Center, USA; Abbas, Mian M., NASA Marshall Space Flight Center, USA; Comfort, Richard H., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English, 30 May - 3 Jun. 2000, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Initial results of an experiment to measure the photoemission of single dust grains as a function of far ultraviolet wavelengths are presented. Coulombic forces dominate the interaction of the dust grains in the heliosphere. Knowledge of the charge state of dust grains, whether in a dusty plasma (Debye length is less than intergrain distance) or in the diffuse interplanetary region, is key to understanding their interaction with the solar wind and other solar system constituents. The charge state of heliospheric grains is primarily determined by primary electron and ion collisions, secondary electron emission and photoemission due to ultraviolet sunlight. We have established a unique experimental technique to measure the photoemission of individual micron-sized dust grains in vacuum. This technique resolves difficulties associated with statistical measurements of dust grain ensembles and non-

static dust beams. The photoemission yield of Aluminum Oxide 3-micron grains For wavelengths from 120-300 nm with a spectral resolution of 1 nm FWHM is reported. Results are compared to interplanetary conditions.
Author
Aluminum Oxides; Dust; Heliosphere; Photoelectric Emission

20000038359 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
A Study of Geoeffective Magnetic Clouds in the Interplanetary Medium ***Estudo de Nuvens Magneticas Geoefetivas no Meio Interplanetario***
Lago, Alisson Dal, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 120p; In Portuguese; Original contains color illustrations
Report No.(s): INPE-7263-TDI/705; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Magnetic clouds are interplanetary structures whose origins are related to Coronal Mass Ejections (CUE). Their features are: strong magnetic field intensity (typically is greater than 10nT (nano Tesla)), a large rotation in the magnetic field angle as the cloud crosses the spacecraft, low proton temperature and Beta (thermal pressure/magnetic pressure) values (approximately 0.1). For a set of previously published magnetic cloud events and another set of clouds identified in the whole year of 1979 we present a study of plasma and magnetic field parameters. We have shown the existence of a relationship between the peak magnetic field strength and peak velocity value of the cloud, with a tendency that clouds which move at higher speeds also possess higher core magnetic field strengths. There is also an indication that this relationship is peculiar to magnetic clouds, whereas other types of non-cloud driver gas, or ICME , events do not seam to show a similar relationship. Both parameters, velocity and magnetic field strength, are related to Magnetic Storms. It is also addressed the interaction between magnetic clouds and other features in the interplanetary medium by calculating the Total Static Pressure, Magnetic plus Thermal, and the Dynamic Pressure relative to other structures surrounding the cloud, investigating their possible relation to magnetic cloud field enhancement. This work contributes to: (1) Space Weather Forecasting, through the calculation of the magnetic cloud field strengths by knowing their velocities (the latter can be remotely measured by sequences of coronograph images); (2) the study of the relation between magnetic clouds and magnetic storms; and (3) the study of the interaction between magnetic clouds and other interplanetary structures surrounding it.
Author
Magnetic Clouds; Interplanetary Medium; Stellar Mass Ejection; Interplanetary Magnetic Fields; Magnetic Field Configurations; Magnetic Field Reconnection; Magnetic Flux

20000038371 Hertfordshire Univ., Dept. of Physical Sciences, Hatfield, UK
Polarization Models of Young Stellar Objects, 2, Linear and Circular Polarimetry of R Corona Australis
Clark, Stuart, Hertfordshire Univ., UK; McCall, Alan, Hertfordshire Univ., UK; Chrysostomou, Antonio, Hertfordshire Univ., UK; Gledhill, Tim, Hertfordshire Univ., UK; Yates, Jeremy, Hertfordshire Univ., UK; Hough, James, Hertfordshire Univ., UK; Feb. 22, 2000; 16p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present near infrared linear imaging polarimetry of the young stellar objects R CrA and T CrA in the J, H and Kn bands and circular imaging polarimetry in the H band. The data is modelled with the Clark and McCall scattering model(1997, 1998). The R CrA and T CrA system is shown to be a particularly complex scattering environment. In the case of R CrA there is evidence that the wavelength dependence of polarization changes across the nebula. MRN dust grain models do not explain this behaviour. Depolarization by line emission is considered as an alternative explanation. The dust grain properties could also be changing across the nebula. Although surrounded by reflection nebulosity, there is a region of particularly low polarization surrounding R CrA that is best modeled by the canonical bipolar outflow being truncated by an evacuated spherical cavity surrounding the star. The nebula's symmetry axis appears inclined by 50 deg to the plane of the sky. The H band circular polarimetry of R CrA clearly shows a quadrupolar structure of positive and negative degrees of circular polarization that reach peak magnitudes of approx. 5% within our limited map. It is shown that spherical MRN grains are incapable of producing this circular polarization given the observed linear polarization of the R CrA system. Instead we propose scattering from aligned non-spherical grains as the operating mechanism. T CrA is a more archetypical bipolar reflection nebula and we model this object as a canonical parabolic reflection nebula that lies in the plane of the sky. The wavelength independence of linear polarization in the T CrA reflection nebula suggests that the scattering particles are Rayleigh sized. We model this with the MRN interstellar grain size distribution.
Author
Polarization Characteristics; Stellar Models; Polarimetry; Circular Polarization; Imaging Techniques; Infrared Imagery

20000038743 California Inst. of Tech., Submillimeter Observatory, Pasadena, CA USA

Vertical Distributions of PH3 in Saturn from Observations of Its 1-0 and 3-2 Rotational Lines

Orton, G. S., Jet Propulsion Lab., California Inst. of Tech., USA; Serabyn, E., Jet Propulsion Lab., California Inst. of Tech., USA; Lee, Y. T., California Inst. of Tech., USA; [2000]; 42p; In Other

Report No.(s): Rept-2000-8; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Far-infrared Fourier-transform spectrometer measurements of the 1-0 and 3-2 PH3 transitions in Saturn's disk near 267 and 800 GHz (8.9 and 26.7/cm), respectively, were analyzed simultaneously to derive a global mean profile for the PH3 vertical mixing ratio between 100 and 600 mbar total pressure. The far-infrared spectrum is relatively free from spectral interlopers, suffers minimal absorption or scattering by atmospheric particulates, and contains intrinsically weak PH3 lines that are sensitive to a range of atmospheric depths. The combined spectra are inconsistent with a uniform tropospheric mixing ratio, even with a stratospheric cut-off. They are consistent with a volume mixing ratio of PH3 that drops from 1.2 x 10(exp -5) at 645 mbar pressure to a value of 4.1 x 10(exp -7) at 150 mbar pressure, a decrease that is linear is log abundance vs log pressure. The mixing ratio could drop even more quickly at atmospheric pressures below 150 mbar and still be consistent with the data. The mixing ratio may well remain constant with depth for pressures above 630 mbar. The maximum PH3 mixing ratio in this model is consistent with a [P]/[H] ratio in the deep atmosphere that is about a factor of 10 higher than solar composition. Such a model is consistent with rapid mixing up to the radiative-convective boundary and transport by, for example, vertical waves just above this boundary. In the best fitting model, the eddy diffusion coefficient is approximately 10(exp 4) sq cm near 630 mbar, and it must increase with altitude. The predominant PH3 loss mechanisms are direct photolysis by UV radiation and scavenging by H atoms produced by the photolysis. Author

Far Infrared Radiation; Fourier Transformation; Phosphines

20000039362 NASA Goddard Space Flight Center, Greenbelt, MD USA

HST Studies of the Chromospheres, Wind, and Mass-Loss Rates of Cool Giant and Supergiant Stars

Carpenter, Kenneth G., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English, 2 Mar. 2000, Palo Alto, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

UV spectra of K-M giant and supergiant stars and of carbon stars have been acquired with the Goddard High Resolution Spectrograph (GHRS) on the Hubble Space Telescope (HST). These spectra have been used to measure chromospheric flow and turbulent velocities, study the acceleration of their stellar winds, acquire constraints on their outer atmospheric structure, and enable estimates of their mass-loss rates. Results from our observations of the giant stars Gamma Dra (K5 III hybrid), Alpha Tau (K5 III), Gamma Cru (M3.4 III), Mu Gem (M3 IIIab), and 30 Her (MG III), the supergiants Alpha Ori (M2 Iab) and Lambda Vel (K5 Ib), and the carbon stars TX Psc (NO; C6,2) and TW Hor (NO; C7,2) will be summarized and compared. The high resolution and wavelength accuracy of these data have allowed the direct measurement of the acceleration of the stellar winds in the chromospheres of several of these stars (from initial velocities of 3-9 km/s to upper velocities of 15-25 km/s) and of the chromospheric macroturbulence (-25-35 km/s). The high signal-to-noise and large dynamic range of these spectra have allowed the detection and identification of numerous new emission features, including weak C IV emission indicative of hot transition-region plasma in the non-coronal giant Alpha Tau, many new fluorescent lines of Fe II, and the first detection of fluorescent molecular hydrogen emission and of Ca II recombination lines in the UV spectrum of a giant star. The UV spectrum of two carbon stars have been studied with unprecedented resolution and reveal extraordinarily complicated Mg II lines nearly smothered by circumstellar absorptions. Finally, comparison of synthetic UV emission line profiles computed with the Lamers et al. (1987) Sobolev with Exact Integration (SEI) code with observations of chromospheric emission lines overlain with wind absorption features provides estimates of the mass-loss rates for four of these stars.

Author

Chromosphere; Giant Stars; Hubble Space Telescope; Stellar Winds; Supergiant Stars; Ultraviolet Radiation; Mass Flow Rate

20000039374 Smithsonian Astrophysical Observatory, Cambridge, MA USA

MBM12: A Close, Younger Version of the TW Hydrae Association

Wolk, S. J., Smithsonian Astrophysical Observatory, USA; Hearty, T., Smithsonian Astrophysical Observatory, USA; Jayawardhana, R., Smithsonian Astrophysical Observatory, USA; [2000]; 1p; In English; From Darkness to Light: Origins and Early Evolution of Young Stellar Clusters, 31 Mar. - 9 Apr. 2000, Corsica, France

Contract(s)/Grant(s): NAS8-39073; No Copyright; Avail: Issuing Activity; Abstract Only

MBM 12 is a dark cloud located about 65 pc from the sun. During the late 1980's and early 1990's, five Classical T Tauri stars were discovered associated with the cloud. The co-existence of the cloud and several stars with disks implies a very young association, very close to the earth. Such an association would be in a league with TWA and Eta Cham. However, at an estimated age of about 1 Myrs. Brown dwarfs/Jupiters would be brighter and disk should be more numerous. Deep ROSAT images and fol-

low up spectroscopic observations raised the cluster membership to 8. We have expanded on this study with deep groundbased imaging, followup spectroscopy and infrared data. We discuss our current data base of U through I observations (complete to V=20) J through K observations (complete to K=14) and spectra of most stars above V magnitude 15. We will present a mass function for the about 40 stars now identified with the association and discuss disk, binary and brown dwarf candidates.
Author
Brown Dwarf Stars; T Tauri Stars; Star Formation; Molecular Clouds; Stellar Evolution; Binary Stars; Infrared Astronomy

20000040171 Smithsonian Astrophysical Observatory, Cambridge, MA USA
Atomic Data in X-Ray Astrophysics
Brickhouse, N. S., Smithsonian Astrophysical Observatory, USA; [2000]; 1p; In English; ICAMDATA, 26-30 Mar. 2000, Oxford, UK
Contract(s)/Grant(s): NAS8-39073; No Copyright; Avail: Issuing Activity; Abstract Only

With the launches of the Chandra X-ray Observatory (CXO) and the X-ray Multimirror Mission (XMM) and the upcoming launch of the Japanese mission ASTRO-E, high resolution X-ray spectroscopy of cosmic sources has begun. Early, deep observations of three stellar coronal sources will provide not only invaluable calibration data, but will also give us benchmarks for the atomic data under collisional equilibrium conditions. Analysis of the Chandra X-ray Observatory data, and data from other telescopes taken simultaneously, for these stars is ongoing as part of the Emission Line Project. Goals of the Emission Line Project are: (1) to determine and verify accurate and robust diagnostics and (2) to identify and prioritize issues in fundamental spectroscopy which will require further theoretical and/or laboratory work. The Astrophysical Plasma Emission Database will be described in some detail, as it is introducing standardization and flexibility into X-ray spectral modeling. Spectral models of X-ray astrophysical plasmas can be generally classified as dominated by either collisional ionization or by X-ray photoionization. While the atomic data needs for spectral models under these two types of ionization are significantly different, there axe overlapping data needs, as I will describe. Early results from the Emission Line Project benchmarks are providing an invaluable starting place, but continuing work to improve the accuracy and completeness of atomic data is needed. Additionally, we consider the possibility that some sources will require that both collisional ionization and photoionization be taken into account, or that time-dependent ionization be considered. Thus plasma spectral models of general use need to be computed over a wide range of physical conditions.
Author
Atoms; Data Acquisition; X Rays; X Ray Spectroscopy; Ionization; Emission Spectra; Data Bases; Cosmic Rays

20000040457 NASA Goddard Space Flight Center, Greenbelt, MD USA
Metastable Eutectic Equilibrium in Natural Environments: Recent Developments and Research Opportunities
Rietmeijer, Fans J. M., New Mexico Univ., USA; Nuth, Joseph A., II, NASA Goddard Space Flight Center, USA; Jablonska, Mariola, Silesia Univ., Poland; Karner, James M., New Mexico Univ., USA; Jan. 15, 2000; 45p; In English
Contract(s)/Grant(s): NAG5-4441; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Chemical ordering at metastable eutectics was recognized in non-equilibrium gas-to- solid condensation experiments to constrain 'silicate' dust formation in O-rich circumstellar environments. The predictable metastable eutectic behavior successfully predicted the observed ferromagnesiosilica, compositions of circumstellar dust, presolar and solar nebula grains in the matrix of the collected aggregate IDPs. Many of the experimentally determined metastable eutectic solids match the fundamental building blocks of common rock-forming layer silicates: this could have implications for the origin of Life. The physical conditions conducive to metastable eutectic behavior, i.e. high temperature and (ultra)fast quenching, lead to unique amorphous, typically nano- to micrometer-sized, materials. The new paradigm of metastable eutectic behavior opens the door to new and exciting research opportunities in uncovering the many implications of these unique amorphous and typically nano- to micrometer-sized, metastable eutectic materials.
Author
Amorphous Materials; Eutectics; Metastable State; Stellar Envelopes

20000040793 NASA Johnson Space Center, Houston, TX USA
Antarctic Meteorite Newsletter
Lindstrom, Marilyn, NASA Johnson Space Center, USA; February 2000; Volume 23, No. 1, pp. 1-23; In English
Contract(s)/Grant(s): RTOP 344-31-00-05; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This newsletter contains something for everyone! It lists classifications of about 440 meteorites mostly from the 1997 and 1998 ANSMET (Antarctic Search for Meteorites) seasons. It also gives descriptions of about 45 meteorites of special petrologic

type. These include 1 iron, 17 chondrites (7 CC, 1 EC, 9 OC) and 27 achondrites (25 HED, UR). Most notable are an acapoloite (GRA98028) and an olivine diogenite (GRA98108).
Derived from text
Antarctic Regions; Meteorites; Meteoritic Composition; Classifications

20000041137 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Introduction to Astronomy and Astrophysics ***Introducao a Astronomia e Astrofisica***
1999; 262p; In Portuguese; See also 20000041138 through 20000041143
Report No.(s): INPE-7177-PUD/38; Copyright; Avail: Issuing Activity

Since the beginning of civilization, human nature has been facinated with the mysteries of the universe. While admiring its extent and beauty, we feel the challenge to know it and the desire to discover its connection with us. When we investigate the cosmos we are also inquiring about our own origin. Man probably peered into the sky with wonder before looking over the land, seas and rivers that were much closer. The cycle of seasons, the sun's light and heat during the day and the moon and stars at night, the need to orient ourselves in travels from one place to another and to establish a chronology for events, were reason enough for man to try and find his place in the universe. At first the known universe was restricted to the sun, moon and some planets. But as our ideas evolved and astronomical tools were improved, human knowledge expanded, reviling the Cosmos in a surprising and amazing manner.
Author
Universe; Astronomy; Astrophysics; Chronology; Research

20000041139 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Observational Astrophysics, Chapter 2 ***Astrofisica Observacional, Capitulo 2***
Jablonski, Francisco Jose, Instituto Nacional de Pesquisas Espacias, Brazil; Introduction to Astronomy and Astrophysics; 1999, pp. 2-1 - 2-21; In Portuguese; See also 20000041137; Copyright; Avail: Issuing Activity

Hamlet is the name of a very famous play written by William Shakespeare. The opening scene is p impressive: the guards of a castle in Denmark see the specter of king Hamlet wandering the parapet at night. The explanation for the ghost's appearance is central to the drama, which contains seven deaths by sword blows, poisonings, drowning, real and simulated madness, adultery, the skull of a happy jester exhumed at an opportune moment and, of course, a phantasmagoric vpecter. In a recent film version, Mel Gibson plays the role of Hamlet. The opening scene has the specter of the old king appear in a phosphorescent and transparent form.
Author
Electromagnetic Spectra; Phosphorescence; Transparence

20000041140 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Stars, Chapter 4 ***Estrelas, Capitulo 4***
Capelato, Hugo Vicente, Instituto Nacional de Pesquisas Espacias, Brazil; Introduction to Astronomy and Astrophysics; 1999, pp. 4-1 - 4-35; In Portuguese; See also 20000041137; Copyright; Avail: Issuing Activity

We will begin our study with a more or less superficial inspection of the "forest" of stars that we see in the skies. The first thing we notice is that, as sources of light, they are much weaker than the Sun. Second, their apparent colors vary; from a bluish-white in most of them to a reddish-yellow, which is rarer. There is also a third aspect, though it is not very obvious to the naked eye: most of the stars group themselves in small families of two, three or more members. A good example is the Alpha Centauri, the closest star to us, which, in fact, is a triple system of stars. Another is the group of 7 stars that make up the Pleiades, which will be discussed later on. In fact, almost half of the stars are double systems with only two members, called binary stars. Most of these double stars, though together, are separated by several astronomical units (one astronomical unit, AU, is the distance from Earth to the sun: see Chapter 1), and revolve around each other over periods of several years. and yet the revolutions of some binary stars, separated by much smaller distances, occur in only a few hours! These stars are so close to each other that they can share enveloping material. Often this exchange occurs in a somewhat violent manner. Local explosions may occur, expelling matter away from the system. In other binary systems, where one of the components is a very compact, dense star, companion material flows more calmly, making up a light disk around the compact star.
Author
Research; A Stars; Inspection; Distance; Color

20000041141 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Cosmology, Chapter 5 ***Cosmologia, Capitulo 5***

Wuensche, Carlos Alexandre, Instituto Nacional de Pesquisas Espacias, Brazil; Introduction to Astronomy and Astrophysics; 1999, pp. 5-1 - 5-73; In Portuguese; See also 20000041137; Copyright; Avail: Issuing Activity

In recent decades, we have seen a rapid increase in knowledge about our cosmic neighborhood. As more and more distant objects have been observed, the edge of the universe seems to have been pushed to the limits of time. We are the first generation of human beings able to view the major details of cosmic history, from the origins of the universe to the parade of galaxies through the skies. We are part of the universe, and our understanding of it will shape our future. In this chapter, we will briefly summarize the history of astronomy/cosmology, components of the universe on a scale larger than we have seen up to now (the solar system), ideas concerning their origin and evolution, the large-scale phenomena we observe in the universe, a description of the standard cosmological model, and a small experiment regarding the future of the universe.

Author

Cosmology; Solar System; Astronomical Models

20000041142 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Astrophysics Research at the National Institute for Space Research, Chapter 6 ***Pesquisas em Astrofisica no INPE, Capitulo 6***

Neto, Thyrso Villela, Instituto Nacional de Pesquisas Espacias, Brazil; Introduction to Astronomy and Astrophysics; 1999, pp. 6-1 - 6-20; In Portuguese; See also 20000041137; Copyright; Avail: Issuing Activity

Astrophysics is the activity of the National Institute for Space Research - INPE - and that term could more directly characterize the Institute. After all, its object of study is space, comprising the most distant borders that can be glimpsed by human beings, in either time or space. Historically, the origin of astrophysics research at the INPE is linked to the development of space science at the Institute. Space science was the area of research from which the INPE originated. Initially, the objective was to study the Earth's neighbors in space. Later on, this field of study was broadened to include outer space. For that reason, there was a need to develop tools that would make observations in space by means of balloons, rockets and satellites, since Earth's atmosphere absorbs a large part of the signals that come from space.

Author

Astrophysics; Research; Earth Atmosphere

20000041143 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

The Solar System, Chapter 3 ***O Sistema Solar, Capitulo 3***

Rodrigues, Claudia Vilega, Instituto Nacional de Pesquisas Espacias, Brazil; Introduction to Astronomy and Astrophysics; 1999, pp. 3-1 - 3-46; In Portuguese; See also 20000041137; Copyright; Avail: Issuing Activity

In this chapter we will understand the solar system better. It is comprised of the sun, planets (including the Earth), other smaller bodies (which include comets and asteroids) as well as the interplanetary medium. What are these stars? How are they different? How big are they? How do they move? What are they made of? What is their origin? At the present time, man can answer some of these questions with a degree of certainty. In the next sections we will present a little of what is known about the solar system.

Author

Solar System; Mass; Kinematics; Comets; Stars

20000042293 NASA Johnson Space Center, Houston, TX USA

The Leonid Meteors and Space Shuttle Risk Assessment

Pawlowski, James F., NASA Johnson Space Center, USA; Hebert, Thomas, Houston Univ., USA; 2000; 1p; In English; Leonid MAC, 16-19 Apr. 2000, Tel-Aviv, Israel; Sponsored by Tel-Aviv Univ., Ramat-Aviv, Israel

Contract(s)/Grant(s): RTOP 478-21-01; No Copyright; Avail: Issuing Activity; Abstract Only

The November 1999 Leonid meteor shower was videotaped on the grounds of the NASA Johnson Space Center (JSC) and at the JSC Observatory in Cloudcroft, New Mexico. The videotapes were analyzed using a meteor analysis system developed at JSC. The results of the analysis were compared to the Leonid Meteors Mass Distribution Model derived at JSC and used for micro-meteoroid and orbital debris risk assessment performed before each Space Shuttle mission. The observed data compared favorably to the model in the .001 to 0.2 gram range but diverged from the model for the smaller masses. We attribute the divergence to optical equipment limitations. These 1999 results will be compared with the 1998 results which were presented at the April 1999 Leonid Multi-Instrument Aircraft Campaign (MAC) Workshop.

Author

Meteoroid Showers; Risk; Space Missions; Space Shuttles; Leonid Meteoroids

20000043528 National Optical Astronomy Observatories, Tucson, AZ USA

"Stars, Gas, and Dust" Coming to La Serena

Olsen, Knut, National Optical Astronomy Observatories, USA; March 2000, No. 61, pp. 33; In English; No Copyright; Avail: Issuing Activity; Abstract Only

From March 15-18, more than 100 astronomers will meet in La Serena to attend the workshop "Stars, Gas, and Dust in Galaxies: Exploring the Links," organized jointly by CTIO, the European Southern Observatory, and the Las Campanas Observatory. For several years, the three observatories have held joint conferences roughly biannually. The last was held in 1997 and commemorated the 10th anniversary of the discovery of supernova 1987A in the Large Magellanic Cloud. This year's workshop seeks to develop a global view of the physics of galaxies. The workshop will open with a treatment of the interstellar medium in galaxies, starting with an inventory of its phases, with later discussion of the physics of interaction between the phases. Focus will then move to the stellar populations and their feedback to the ISM, first discussing single stars and their effect on their surroundings. Next, the star formation and chemical evolution histories of entire galaxies, including the important techniques used to derive these, will be discussed. Finally, the workshop will treat galaxy physics operating at large scales, including galaxy interactions and large-scale gas flows. The astronomers will be working hard; however, registrants have been asked to provide and to come prepared to discuss one "burning" question that they would like addressed during the workshop. The last day will be devoted to discussions in small working groups, with programs previously prepared by appointed working group leaders. Hopefully there will be pictures!

Author

Star Formation; Gas Flow; Dust; Astronomical Observatories; Chemical Evolution; Conferences; Galactic Evolution

91
LUNAR AND PLANETARY SCIENCE AND EXPLORATION

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

20000038751 Hertfordshire Univ., Dept. of Physical Sciences, Hatfield, UK

A Population of Very Young Brown Dwarfs and Free-Floating Planets in Orion

Lucas, P. W., Hertfordshire Univ., UK; Roche, P. F., Oxford Univ., UK; [2000]; 14p; In English; Copyright; Avail: Issuing Activity

We describe the results of a very deep imaging, survey of the Trapezium Cluster in the IJH bands, using the UKIRT high resolution camera UFTL. Approximately 32% of the 515 point sources detected are brown dwarf candidates, including several free floating objects with masses below the Deuterium burning (planetary) threshold at 0.013 solar masses, which are detectable because of their extreme youth. We have confidence that almost all the sources detected are cluster members, since foreground contamination is minimal in the 33 arcmin(sup 2) area surveyed and the dense backdrop of OMC-1 obscures all background stars at these wavelengths. Extinction is calculated from the (J-H) colors, permitting accurate luminosity estimates and temperatures are derived from the dereddened (I-J) colors. There is some evidence for a cut-off In the luminosity function below the level corresponding to several Jupiter masses, which may represent the bottom end of the IMF Since star formation is complete in the Trapezium this limit could have Wide Significance, if confirmed. However, it could well be an effect of the dispersal of the molecular cloud by the central O-type stars, a process whose timescale will vary between star formation regions.

Author

Populations; Brown Dwarf Stars; Early Stars; Star Formation; O Stars; Pre-Main Sequence Stars; Stellar Envelopes; Point Sources

20000040479 Lunar and Planetary Inst., Houston, TX USA

Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets

1999; 82p; In English; 2nd; New Views of the Moon: Understanding the Moon Through the Integration of Diverse Datasets, 22-24 Sep. 1999, Flagstaff, AZ, USA; Sponsored by Lunar and Planetary Inst., USA; See also 20000040480 through 20000040534

Contract(s)/Grant(s): NASW-4574

Report No.(s): LPI-Contrib-980; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This volume contains abstracts that have been accepted for presentation at the Workshop on New Views of the Moon II: Understanding the Moon Through the Integration of Diverse Datasets, September 22-24, 1999, in Flagstaff, Arizona. The workshop conveners are Lisa Gaddis (U.S. Geological Survey, Flagstaff and Charles K. Shearer (University of New Mexico). Color

versions of some of the images contained in this volume are available on the meeting Web site (http://cass.jsc.nasa.gov/meetings/moon99/pdf/program.pdf).
Author
Moon; Lunar Geology; Conferences; Data Processing; Data Integration

20000040481 Geological Survey, Flagstaff, AZ USA
Photometric Imaging of the Moon from the Robotic Lunar Observatory
Anderson, J. M., Geological Survey, USA; Kieffer, H. H., Geological Survey, USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 2-3; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

As part of the calibration program for the NASA Earth Observing System (part of NASA's Earth Science Enterprise), the U.S. Geological Survey operates the Robotic Lunar Observatory (ROLO). The ROLO project is designed to produce a photometric model of the nearside lunar surface for all phase and libration angles visible from Flagstaff [2]. Goals for this photometric model are 2.5 % absolute and 1.0% relative uncertainty. Although the model is principally intended to produce radiance images of the Moon for use in calibration of Earth-orbiting spacecraft, the ROLO data and model will also provide important information for studies of the lunar soil. Instrumentation: An astronomical observatory dedicated to the radiometry of the Moon has been constructed on the campus of the U.S. Geological Survey Flagstaff Field Station in Arizona. Two separate camera systems are attached to a single telescope mount and boresighted to the same pointing direction. The visible/near infrared (VNIR) camera uses a 512 x 512 pixel CCD and 23 intermediate width interference filters for wavelength selection. The shortwave infrared (SWIR) camera uses a 256 x 256 pixel cooled-HgCdTe infrared array and nine intermediate-width interference filters. Table I and Fig. I provide information on the instrumental passbands. Separate 20-cm-diameter Ritchey-Cretien telescopes are provided for the two cameras. The optics are designed to image the entire Moon within each camera's field of view, resulting in instrument pixel scales of 4 and 8 arcsec /pixel (about 7.4 and 15 km/pixel for the sub-Earth point on the Moon) for VNIR and SWIR respectively. Detailed information on the instrumentation can be found in Anderson et al. Observations: Routine imaging has been in progress since late 1995 for VNIR and late 1997 for SWIR, and is expected to continue through at least 2002. ROLO observes the Moon every clear night between the first and last quarter phases of the moon. On such nights, the Moon is imaged through all 32 filters at half-hour intervals during the time that the Moon is above the 60 deg. zenith angle. Observations of standard stars to measure atmospheric extinction and detector responsivity drifts occupy the remainder of the nighttime. Measurements of the dark current and detector bias levels are made during the dusk and dawn periods for VNIR and throughout the night for SWIR. Flat field corrections and absolute radiance calibrations are provided through observations of a Spectralon plate illuminated by a NIST-traceable 1000 W FEL lamp. Raw data are converted to ISIS cubes and stored on CD-ROM. Detailed information on the observing procedure is also found. As the development of data-reduction software for the ROLO project progresses and additional data are accumulated, the raw data are repeatedly processed into a calibrated form. Corrections for instrument response characteristics, photon scattering processes, and atmospheric extinction are applied to the raw lunar images to produce exoatmospheric radiance images of the Moon. These images are then transformed to a fixed selenographic-grid projection designed to accommodate all of the possible viewing geometries of the ROLO telescope. A preliminary discussion of results for the total irradiance of the Moon derived from ROLO VNIR images acquired through April 1998 was published by Kieffer and Anderson. At that time, difficulties in adequately determining the atmospheric extinction limited the accuracy of the derived lunar irradiance values. Significant improvements in the reduction software have been developed since that time and measurement scatter is expected to be reduced to approximately = or is less than 2% for the data-processing run planned for the summer of 1999. As of June 1999 , ROLO has acquired over 2200 cubes of raw Moon images with VNIR and over 1200 cubes with SWIR. by 2002, ROLO expects to have acquired roughly 3500 images of the Moon through each VNIR filter and nearly 3000 images through each SWIR filter, or more than 100,000 absolutely calibrated images of the Moon. These data are used to create photometric models of the lunar surface that are position, phase, and wavelength dependent. Kieffer and Anderson and Grant et al. provide examples of calibrating spacecraft instruments with existing ROLO data. The dataset will also provide a wealth of information about the geological properties of the lunar surface. The photometric function of many thousands of points on the Moon will be measured for phase angles between 2 and 90 deg for wavelengths within 0.35-2.4 micron. Absolute and normalized color ratios and their phase-angle dependence will enable detailed studies of the mineral abundances of the Lunar soil. Information on the photometric function dependence on phase and wavelength will aid investigations of the surface particulate structure of the soil. Additional information contained in original.
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Imaging Techniques; Lunar Observatories; Lunar Soil; Lunar Surface; Moon; Photometry

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The Lunar Crustal Thickness from Analysis of the Lunar Prospector Gravity and Clementine Topography Datasets

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The Lunar Prospector spacecraft has mapped the gravity field of the Moon to a level of resolution never achieved before, and a spherical harmonic representation to degree and order 100 is available. When combined with the topography dataset produced by the Clementine mission, the resulting Bouguer anomaly map is interpreted to model the thickness of the lunar crust. Such models are crucial to understanding the lunar thermal history and the formation of geological features such as mascon basins, several more of which have been newly discovered from this dataset. A two-layer planetary model was used to compute the variations of the depth to the lunar Moho. The thickness values ranged from near 0 to 120 km. There is significant agreement with previous work using the Clementine gravitational field data with differences in specific locations such as South Pole-Aitken Basin, for example.

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Gravitation; Gravitational Fields; Lunar Crust; Moon; Thickness

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Three Paradigms of Lunar Regolith Evolution

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Integration of diverse datasets on the Moon may render some paradigms of lunar science either better-defended or vulnerable. We will consider three paradigms commonly used for understanding the processes of lunar regolith evolution in light of new and accumulated data. Our premise is that all data-sets should converge to a single interpretation if a concept or model is to be accepted as a paradigm. If a convergence is lacking, the paradigm needs fresh scrutiny. SteadyState: Lunar regolith evolution is currently understood in terms of comminution, agglutination, and replenishment as described by McKay and coworkers). Briefly, the model envisages continued micrometeoritic bombardment to comminute exposed soil particles to finer sizes while continued agglutination consumes finer sizes to produce larger constructional particles. Eventually, a balance between these two opposing processes achieves a steady state; soils at steady state maintain their mean grain size (M(sub z)). Episodic higher-energy impacts excavate fresh coarse material from below the soil cover, disturb the steady state, and restart the process to achieve a new steady state. It follows that the thickness of the regolith at any site would control the frequency of replenishment; indeed, the thickness of the regolith at Apollo landing sites was predicted by McKay et al. from the average M(sub z) of local soils. However, replenishment may come also from disintegrating boulders and cobbles at the lunar surface, and rates of comminution and agglutination may depend on the properties of target material. Regression between M(sub z) and I(sub s)/Fe(sup 0) (a measure of maturity or total surface exposure) of Apollo soils at different sites shows the following relations and estimated M(sub z) at a high maturity of I(sub s)/Fe(sup 0)= 100. It is possible that Apollo 12 and 15 sites have the thickest regolith and the Apollo 16 site has the thinnest. It is also possible that Apollo 12 and 15 basalts are comminuted faster than Apollo 16 highland rocks and Apollo 14 and 17 soils are products of mixed parentage. If a soil becomes continually finer as it matures until agglutination catches up, and if comminution is differential-dependent on the physical properties of the constituents, then the composition of the bulk soil has to match the composition of some ”fulcrum” grain size fraction, say X Grain size fractions is greater than X and <Xwillcomplementeachother;heir mass balance is the bulk soil. It appears that the 10-20-micron size fraction may be the fulcrum. In general, trace-element chemistry and IR reflectance spectra of this size fraction are closest to that of the bulk soil, regardless of maturity that is surprising. Disaggregated products of regolith breccias may also show similar relationships. If the 10-20 gm is the fulcrum (i.e., X as above) for many soil properties (e.g., major element composition, FMR, solar-wind-implanted elements), then this may be the ultimate mean grain size of lunar soils at steady state. However, different properties of soils may find steady states at different grain size fractions. The steady state of solar-wind-implanted elements, on the other hand, will climb up the grain-size scale as agglutinates transfer surface-correlated components into volume correlated components until a saturation level is reached or the rates of replenishment and implantation become equal. The same will be the case with vapor-deposited reduced metals as they too are incorporated inside constructional particles. Properties that are directly affected by soil-maturation processes will thus have different pathways of achieving steady states. Maturity, i.e., cumulative surface exposure, of lunar soils is best quantified by the amount of nanophase superparamagnetic Fe(sup 0) (np-Fe(sup 0)) normalized to Fe content (=I(sub s)/Fe(sup 0). The majority consensus (paradigm?) for the production of np-Fe(sup 0) is associated with the production of agglutinates. Because large

doses of solar-wind H are implanted in all lunar soils upon exposure, any melting (e.g., during agglutinate production) triggers a chemical reduction of Fe-bearing minerals resulting in np-Fe(sup 0) production. The quantity of np-Fe(sup 0) is thus dependent on melting events, (i.e., exposure), and limited by the Fe content of the soil. All freshly produced np-Fe(sup 0) resides in agglutinitic glass, as new TEM images show. Apparently, the correction procedure developed by Lucey et al. to estimate the Fe content of the lunar surface from IR-reflectance spectra depends on accepting the above. However, the process of producing np-Fe(sup 0) may be physical rather than chemical. All np-Fe(sup 0) could be deposits from a vapor produced by micrometeoritic impact on lunar soils. If metal-O bonds in target phases are broken, O being "most volatile" will escape leaving an O-deficient vapor to facilitate the production of np-Fe(sup 0). If so, the quantity of np-Fe(sup 0) is dependent on the vaporizing events, (i.e., exposure), and limited by the efficiency of breaking metal-O bonds and the escape of 0. to the extent that strengths of metal-O bonds are dependent on the local crystal field, production of np-Fe(sup 0) may be limited by the mineral composition of target soils and not by their total Fe content. According to this model, vapor-deposited np-Fe(sup 0) should be found at any retentive sites on lunar soil grains. Indeed, TEM images show np-Fe(sup 0) on plagioclase and ilmenite. Incorporation of such pre-irradiated np-Fe(sup 0)-bearing grains into agglutinates may account for eventual increased emplacement of np-Fe(sup 0) in agglutinates. Such a paradigm shift in understanding the origin of np-Fe(sup 0) will raise questions ranging from the unquestionable use of Is/FeO as the universal maturity parameter of lunar soils to global elemental maps of the Moon from remote-sensing data. Additional information is contained in the original.

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Agglutination; Breccia; Comminution; Lunar Rocks; Lunar Soil; Lunar Surface; Moon; Regolith; Lunar Evolution

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Lunar Global Petrologic Variations

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An initial attempt at producing petrologic province maps of the lunar highlands combined orbital and sample geochemical data in variation diagrams.Three different variation diagrams were produced: Mg* (= 100 Mg/Mg+Fe) vs. [(Th/Ti)(sub c), Al vs. Mg*/(Th/Ti)(sub c), and Fe vs. (Th/Ti)(sub c). ([Th/Ti](sub c) is the ratio of Th to Ti, normalized to the chrondritic ratio for these elements.] Later work applied a ternary diagram approach to look at global lunar petrologic variations. This work used the Fe-(Th/Ti)(sub c) technique as this had the most spatial coverage with the available data and also appeared to be adequate at distinguishing between different rock types. In the ternary diagram, the apexes were assigned the average Fe and (Th/Ti), values of ferroan anorthosite, mare basalt, and KREEP rocks. Each apex was assigned a primary color while the center of the triangle was represented by gray. Each point on the lunar surface, covered by the Apollo geochemical instruments, was then assigned a color depending on where in the ternary their composition placed them. The resultant petrologic classification map shows how the petrologic units vary spatially. The main results from this work were as follows: (1) The highlands contain large areas of relatively pure ferroan anorthosite; (2) KREEP/Mg suite rocks represent a small percentage of the upper lunar crust; (3) farside outcrops of KREEP/ Mg suite rocks are associated with areas of crustal thinning, particularly on the floor of South Pole Aitken Basin; (4) the average composition of the highlands is richer in Fe than ferroan anorthosite, which supports the magma ocean hypothesis of crystal formation; and (5) regions of the eastern limb and farside highlands are relatively more mafic than average highlands. These areas have a high density of dark halo craters, supporting the idea that mare volcanism occurred in this region before the end of the heavy bombardment. This earlier work utilized the Apollo gamma and X-ray orbital datasets. These data provided limited coverage of the lunar surface (mostly confined to the equatorial latitudes). The gamma ray instrument covered approximately 19% of the lunar surface while the X-ray only covered 9%. With the Clementine and Lunar Prospector datasets, we now have global maps of Fe, Ti, and Th. Apart from global coverage, another important advantage of the new datasets is higher spatial resolution. The resolution of the Apollo instruments was 15 km for the X-ray and 100 km for the gamma ray. The Fe and Ti maps are derived from the full-resolution Clementine UV-VIS data, i.e., about 250 m/pixel. The resolution of the Th data, obtained by Lunar Prospector's neutron spectrometer, is currently about 150 km, but will be available in the future with a spatial resolution of 60 km. The other improvement provided by the recent lunar missions is the error associated with the data. The errors associated with the Fe, Ti, and Th values obtained by Apollo were 10-25 wt%. The error of the Clementine-derived Fe and Ti values is about 1% while the Th data have an error of about 1 ppm. We intend to investigate the petrologic variations on the Moon at a global scale using the new Clementine and Lunar Prospector elemental maps for Fe, Ti, and Th. We shall use the technique described in Davis and Spudis. An initial study has been undertaken that looks at some regions that were covered by the Apollo geochemistry data. Two mare regions, one in Imbrium and the other in Procellarum, match well with the results using the Apollo data. The highland terrain appears problematic. The calibration of the Th data is based on the assumption of a constant background. This is a valid assumption

where Th counts are well above background limits, but as count rates decrease variations in Th concentration are more sensitive to background fluctuations. Eventually we will circumvent this problem by using the lower-altitude (i.e., higher resolution) Prospector data and a calibration derived from deconvolution of the gamma ray spectra with proper attention to background variations. The Th/Ti vs. Fe technique provides more geologic information than can be extracted from solely using the elemental data because it quantitatively determines each pixel's composition in terms of the end-member compositions: ferroan anorthosite, mare basalt, and KREEP rocks. Moreover, the digital map illustrates the extent and lateral transition of one rock-type to another, thus allowing the sample data to be placed in a regional and global context. Initial examination confirms earlier conclusions that the Mg suite is not a major contributor to at least the upper lunar crust. We summarize elsewhere in this volume evidence that Mg-suite rocks maybe a significant contributor to the composition of the lowercrust. Work continues on the problem of the crustal fraction of the Mg suite, needed to determine the Mg# of the bulk crust, an important constraint on lunar origin. Original contains additional information.

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Geochemistry; Kreep; Lunar Crust; Lunar Maria; Lunar Surface; Mineralogy; Moon; Lunar Geology

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Integration of the Ultraviolet-Visible Spectral Clementine Data and the Gamma-Ray Lunar Prospector Data: Preliminary Results Concerning FeO, TiO2, and Th Abundances of the Lunar Surface at Global Scale

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The Clementine mission (CLM) produced global multispectral data that resulted in a map of FeO and Ti02 concentrations of the lunar surface. The recent Lunar Prospector (LP) mission returned the first global data for the distribution of surface abundances of key elements in lunar rocks, using a gamma-ray spectrometer (GRS) and neutron spectrometer(NS). Integrating CLM mineralogical spectral reflectance and LP chemical data is important to enhance our view of lunar crust origin and evolution, lunar volcanism, and surface processes. Iron, Ti, and Th having relatively large compositional variation over the lunar surface, as well as strong isolated peaks in the GRS spectra, information concerning the distribution and concentration of these elements has been derived from maps of corrected (cosmic ray, nonsymmetric response of the instrument) counting rates only, without converting them into absolute abundances. Maps produced contain count rates in equal-area projection averaged into 5 x 5 degrees latitude/longitude bins, from -90 to +90 degrees latitude and -180 to +180 degrees longitude. In this work, we have used the CLM global FeO and Ti02 abundances (wt%) maps converted at the LP spatial resolution (about 150 km/pixel) to produce FeO and TiO2 GRS abundance maps, through a linear regression based on the analysis of the scatter distribution of both datasets. The regression coefficients have been determined from the data taken between -60 and +60 degrees latitude to avoid uncertainties in the CLM spectral data due to nonnominal conditions of observation at high latitudes. After a critical assessment of the validity of these coefficients for every class of absolute abundance, the LP data have been transformed into absolute abundances for the whole Moon. The Th LP data have been converted into abundances (ppm) using Th concentrations in average soils from the Apollo and Luna sites given. Values of Th abundances for these samples range between 0.5 and 13 ppm. A nonlinear regression has been applied to the LP data, except for low count rate values (corresponding to Th abundances below 1.27 ppm) for which a first-order linear regression has been applied. Statistical tests demonstrate that the Lunar Prospector FeO, TiO2, and Th abundances estimates we have produced through the regressions are reliable. For the LP maps, the uncertainty of absolute FeO and Ti02 estimates is on the same order as that for CLM, i.e., 2 and 1.5 wt% respectively. For the Th, abundance estimates, the uncertainty is about 1-2 ppm. At first order, our global FeO and Ti02 abundances maps from LP are in very good agreement with those obtained from CLM. The Th abundance map is also in good agreement with a recent global Th abundance map, although concentrations have a higher range (0-20 ppm) in our case, and may be slightly overestimated. However, a more detailed comparison between CLM and LP abundance maps of FeO and Ti02 reveals regional differences. Differences between the two datasets are expected because of instrumental and observational causes (spatial resolution, depth of observation), but also because they are sensitive to different types of information (mineralogy vs. chemistry). Maps of differences in abundances between LP and CLM data have been produced for both FeO and Ti02. In relation to the precision of the LP and CLM data, we consider that differences between the two datasets exceeding 2 wt% are significant. Concerning FeO contents, differences up to 4-5 wt% are observed in the South Pole Aitken Basin, and generally at high latitude (up to 70 degrees) in the southern hemisphere, as well as in the northern border (Iridum-Gruithuisen domes region) and the southern border (Sinus Aestum) of the Imbrium Basin. Most important differences, up to 6-7 wt%, are found in Mare Serenitatis, Crisium, and Fecunditatis. Concerning Ti02, most important differences (4-5 wt%) between LP and CLM abundances are located within Mare Tranquillitatis. Differences (about 2-3 wt%) also occur in the northern border of the Imbrium Basin (Ir-

Gruithuisen domes region) and in the western part of Oceanus Procellarum (from southwest of Kepler, up to the Aristarchus Plateau). Regions for which differences in FeO and/or Ti02 content may arise from the presence of heterogeneous terrains due to geological transitions at the scale of observation of LP have been identified on the basis of the spatially degraded FeO and Ti02 CLM maps. These regions correspond to Mare Crisium, the western part of Procellarum, and Mare Humorum. The surface heterogeneity effect cannot be invoked in the case of the South Pole Aitken (SPA) Basin interior and its immediate vicinity. However, LP indicates a lower content in FeO than CLM (8-11 wt% vs. 11-13 wt% respectively). This observation suggests that the SPA materials may contain a lower proportion of Fe than was previously thought. This may imply a smaller proportion of mantle materials excavated during the impact event than predicted in and give some constraints to the models of large basin formation, Some regions such as Mare Serenitatis, Tranquillitatis, Fecunditatis, and Crisium do present significant differences in FeO and Ti02 abundances, the LP estimates being lower than the CLM ones. This might be ascribed to a different perception of the influence of the mare regolith reworking by the LP geochemical observation, sensitive to the subsurface regolith, and the CLM reflectance spectroscopy observation, sensitive to the surface mineralogy. Original document contains more information.
Author
Iron Oxides; Lunar Crust; Lunar Maria; Lunar Surface; Mineralogy; Regolith; Titanium Oxides; Thorium

20000040486 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Distribution of Titanium in Lunar Soils on the Basis of Sensor and In Situ Data Fusion
Clark, P. E., NASA Goddard Space Flight Center, USA; Evans, L., NASA Goddard Space Flight Center, USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 7-8; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A variety of remote-sensing measurements have been used to map the distribution of elements on the Moon as a means of providing constraints on the processes from which its crust and major terranes originated. Discussed here is Ti, which is incorporated into refractory minerals such as ilmenite during the latter stages of differentiation, and is thus a most useful element for understanding mare basalt petrogenesis. One of the earliest Ti maps showed Ti variations in nearside maria on the basis of groundbased spectral reflectance measurements. A map of Ti derived from gamma-ray measurements on Apollo 15 and 16 was produced at about the same time, and was improved upon considerably by Davis and coworkers, who effectively removed sources of spurious variation from Fe and Al or REE (e.g., Th) interference, and calibrated Ti on the bases of landing-site soil averages. In recent years, spectral reflectance measurements from Clementine have been used by Lucey and coworkers to produce global Ti distribution maps as well. As we indicated previously, the Lucey and Davis maps agree to first order. Meanwhile, we are using the concept of sensor data fusion to combine measurements from the AGR (Apollo gamma-ray) and CSR (Clementine Spectral Reflectance) techniques with ground truth from lunar soils to utilize the differences between the two maps to understand the distribution of Ti within lunar soil components, as we have done with Fe. This technique should be verified and applied on Lunar Prospector gamma-ray measurements of Ti, as the calibrated data become available within the next couple of years. Lunar Ti is found principally in the mineral ilmenite, and is associated with certain components of lunar soil: crystalline Ilmenite mineral fragments and high Ti-bearing glass. All data indicate that Ti is associated with maria and mafic minerals. In AGR and CSR datasets, Ti is highest on the nearside and in the maria, particularly in southern Serenitatis/northern Tranquillitatis and northwestern Procellarum. Unlike CSR-derived values, AGR Ti values show modest increase (up to 0.7%) on the northern farside. Both techniques show a primarily unimodal distribution with a shoulder in the high Ti direction and a primary mode at approximately 0.2% (0.15% for CSR and 0.25% for AGR data), but the AGR Ti data have more structure in the shoulder, including an apparent minor mode at 1.2% Ti, representing non-highland areas. Recalibrating the two datasets on the basis of matching the peaks and range on the histograms would not account for this additional structure in the AGR data. Low Ti areas, which occur predominantly on the farside, are not represented well in the lunar sample collection, although several meteorites thought to be of lunar highland origin show Ti abundances averaging about 0.2%. (Error bars on AGR Ti values are about 0.5%.) Gamma-ray measurements reflect intrinsic Ti surface composition, regardless of the physical or chemical state of Ti. Lucey and coworkers have attempted to produce an equivalent bulk Ti map by normalizing the spectral feature at 415 nm to remove the effects of physical variations from soil to soil. The normalization is based on laboratory measurements of available samples, primarily nearside maria, and is undoubtedly optimized for the proportions in which Ti- components are found in these soils. In particular, mare soils tend to have a much higher proportion of opaque mineral grains, which appears to be well correlated with Ti abundance. The relationship between Ti abundance and proportion of Ti-bearing glass (weighted for Ti abundance) is not as direct. Also shows the relationship between landing site soil average, AGR, and CSR Ti abundances (with CSR filtered to match resolution and field of view of AGR data). AGR Ti values show the best agreement with Ti soil averages, CSR Ti values being somewhat higher in high-Ti soils, and lower in low-Ti soils. These results would tend to support the argument that the technique for deriving Ti from the CSR measurements is optimized for one of the primary Ti-bearing components, most likely opaque mineral grains, and is thus over-compensating and reporting higher

Ti values in mare areas, and underreporting Ti in highland areas with much lower proportions of opaque mineral grains. More information is contained in original.
Author
Multisensor Fusion; Data Integration; Lunar Maria; Lunar Rocks; Lunar Soil; Mineralogy; Moon; Titanium; Selenology; Lunar Composition; Lunar Geology

20000040487 National Air and Space Museum, Center for Earth and Planetary Studies, Washington, DC USA
Digital Elevation Models of the Lunar Surface
Cook, A. C., National Air and Space Museum, USA; Robinson, M. S., Northwestern Univ., USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 8-10; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Several digital elevation models (DEMs) have been produced at a scale of 1km/pixel and covering approximately one-fifth of the lunar surface. These were produced mostly by semiautomatically matching the stereo available between Clementine UV/VIS images, although some localized DEMs have been produced by applying this technique to Apollo Metric stereo pairs, or by digitizing an existing Apollo Metric contour map. The DEMS that result from Clementine UV/VIS images, although of Poorer height accuracy (1300-600 in for a single matched point) than the Clementine laser altimeter point measurements (is less than +/-100 m), do provide considerably higher spatial resolution (e.g., every kilometer vs. every tens of kilometers) and allow topography in the polar regions to be determined. Nadir-pointing Clementine UV-VIS stereo pairs are automatically stereo matched using a patch-based matcher and fed through A stereo intersection camera model to yield a digital terrain model (DTM) of longitude, latitude, and height points. The DTM for each stereo pair is then replotted and interpolated to form map-projected DEM tiles. The DEM files can then be fitted to absolute height laser altimeter points, or iteratively to each other, to form a DEM mosaic. Uncertainties in UV-VIS camera pointing and the need to accumulate a sufficiently good topographic S/N ratio necessitates the use of 1 km pixels for the UV-VIS derived DEMs. For Apollo Metric stereo, an internal camera geometry correction and a full photogrammetric block adjustment must be performed using ground- control points to derive a DEM. The image scale of Apollo Metric, as well as the stereo angle, allow for a DEM with 100 m pixels and a height accuracy of +/- 25m. Apollo Metric imagery had previously been used to derive contour maps for much of the lunar equatorial regions; however, to recover this information in digital form these maps must be digitized. Most of the mare areas mapped contain noticeable topographic noise. This results from the stereo matcher failing in regions of low texture and contrast. Below is a summary of the regions for which DEMs have been generated, and some of the features visible in each (heights are referenced to a 1738km radius sphere): Apollo 15 landing site (1E-7E,20N-30N). Features include Hadley Rille (just visible) and several mountains. Apollo 17 landing site (30.0E-31.5E, 19.5N-21.0N). This DEM was derived by digitizing contours from a map. Alpine Valley (2W-8E, 47N-51N), The valley and Trouvelot crater are visible. Topography ranges from 1 km to -4 km. The valley walls are is less than 1 km high. Aristarchus (60W-40W,20N-30N). Features visible include Aristarchus craters, Vallis Schroteri, and the craters Herodotus, Schiaparelli, and Prinz. Copernicus Crater (30W-10W, 0N-20N). Features visible include Montes Carpatus and the craters Copernicus, Eratosthenes, Reinhold, and Tobias Mayer. Giordano Bruno Crater (101 E-106E, 33N-38N). This DEM reveals about 60% of the crater interior. Kepler Crater (38W, 8N). Using this DEM a perspective view of this crater has been produced with a USGS color-ratio map overlaid. Korolev Basin (I 75W-160W, 10S-20N). Seventy-five percent of the Korolev basin is present in this DEM together with a pre-Nectarian basin the size of Korololev just to the north. The topography in this DEM ranges from 0 km to 9.6 km. Named craters visible include Mach, McMath, Icarus, and Tsander. Luna 9/13 landing site (70W-60W, 0N-30N). The topographic range is from about 0 km to about 4.5 km, the latter being on the floor of Hevelius A crater. Mare Crisium (50E-70E, 0N-20N). This DEM covers the lower half of the basin and surrounding highlands. The topographic range is from +3 km to -5 km. Several protruding floor crater rims are visible on the basin floor (e.g., Picard, Yerkes, and Lick). Mare Orientate (120W-75W, 40S-0N). This area was covered well in stereo, and a regional north-south slope is detectable across the basin. The topography varies from +6 km on the western rim to -5 km on the bottom of Maunder crater. Three rings of the basin are clearly visible in the topography. Mare Serenitatis (1OE-40E,1ON-40N). Highland areas are well depicted in the DEM, as are craters Bessel, Dawes, Le Monier, Menelaus, Plinius, Posidonius, and Ross. North polar region (60deg -90 deg). An analysis of this DEM revealed the newly discovered Sylvester-Nansen pre-Nectarian impact basin (300-400 km diameter, centered on 45E, 83N). The Schwarzchild and Be'lkovich basins are clearly visible, as is the northern extent of the Imbrium basin. Several secondary ejecta scour marks are present in the topography and spread out radially from Mare Imbrium. The crater Hayn contains a north-south running graben which bisects its central peaks. Saha crater area (90E-105E, 5S-5N). Stereo imagery is missing in the center of this region. Schickard (60W-50W, 50S-40S). The floor interior craterlets and surrounding highlands are clearly visible. Sinus Iridum (40W-30W, 30N-50N). South polar region (90S-60S). An analysis of this DEM has revealed two newly discovered pre-Nectarian impact basins (Schrodinger-Zeeman, 250 km in diameter, centered on 165W, 81S, and 330 km diameter Bailly-Newton, centered on 57W, 73S). Several other prominent basins are visible, including the southern half of the South Pole Aitken (SPA) Basin, Bailly, Schro-

dinger, part of Clavius, and the Amundsen-Ganswindt Basin. The topographic range in this DEM is considerably greater than the north polar DEM due to the presence of the SPA topgraphy. Tsiolkovsky(124E,19S). In this DEM the western flanks of Tsiolkovsky are shown in great detail. Tycho (20W-0W, 50S-40S). This DEM shows Tycho crater and its surroundings as well as the northern interior of Maginus Crater. Original document contains additional information
Author
Craters; Imagery; Lunar Maria; Lunar Surface; Lunar Topography; Meteorite Craters; Relief Maps; Topography; Lunar Geology; Selenology; Selenography; Lunar Maps; Moon

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Simulating the Formation of Lunar Floor-Fracture Craters Using Elastoviscoplastic Relaxation
Dombard, A. J., Washington Univ., USA; Gillis, J. J., Washington Univ., USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 10-11; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Lunar floor-fracture craters formed during the height of mare basalt emplacement. Due to a general temporal and spatial relation with the maria, these craters, numbering some 200, may be diagnostic of the thermal structure of the crust during this time. As the name suggests, these craters exhibit brittle failure, generally limited to the central floor region. That, and a shallower depth than fresh lunar craters, has led to two main theories as to their formation: laccolith emplacement under the crater and viscous relaxation. The implications of each model for the state of the Moon's crust during this time are quite different, so the viability of each model must be checked. Laccolith emplacement has been treated elsewhere. However, previous attempts to study the relaxation of the craters have assumed only a uniform, Newtonian viscous response of the near surface to the topographic driving forces, and simply postulated that the fractures resulted from tensile stresses associated with floor uplift. Here, we use a more sophisticated rheological model that includes not only non-Newtonian viscous behavior (i.e., the viscosity is stress-dependent), but also incorporates elastic behavior and a plastic component to the rheology to directly simulate the formation of the floor fractures. The results of our simulations show that while elastoviscoplastic relaxation is potentially viable for larger floor-fracture craters, it is not viable for craters with diameters is less than or = 60 km, the size of the majority of floor-fracture craters. We employ the finite element method, a numerical technique well suited for boundary-value problems, via the commercially available MARC software package. to test the viability of topographic relaxation, our goal is to prepare the simulations as to maximize the amount of relaxation. We take advantage of the natural axisymmetry of craters, simulating one radial plane. Initial shapes are based on data for fresh craters from Pike. To simplify implementation, a fourth order polynomial is used for the basin, while a third order inverse function is used for the rim. This form closely approximates the long-wavelength behavior of complex craters, while ignoring higher-frequency topography, save the rim. This approximation is appropriate because crater relaxation is strongly controlled by long-wavelength topography. Loading is accomplished assuming a uniform gravity field (1.62 m/s-square) and a uniform density of 2900 kg/cubic m. The initial stress state is set to be hydrostatic, with an additional pressure term to account for any overlying topography. This additional pressure term is tapered exponentially with depth. While the simulations quickly settle on a preferred stress state, and while the final solution is fairly insensitive to the choice of the e-folding depth of the taper, selecting an e-folding depth close to the diameter of the crater sets the initial stress state near the preferred state. We assume a diuranally averaged surface temperature of -20 C, and allow temperature to increase with depth at a rate of 50 K//km. Assuming a thermal conductivity of 2 W/in/K, this gradient translates to a heat flow of 100mW/square m, an extremely high value for the Moon. Temperature, of course, will not increase without bound. to maximize relaxation, we allow our temperature profile to increase linearly until it reaches the solidus (assumed to be 1200C) at a depth of 24.4 km, at which point it is kept constant. The presence of melt will drop the bulk viscosity; however, we have no rheological control for partial melts. Therefore, we make no attempt to simulate this situation. Elastoviscoplastic rheological model. In general, geologic materials can behave in three main ways: elastically, viscously (via solid-state creep), and brittly (plasticity is a continuum approach to simulate this phenomenon). We combine these three deformation mechanisms in an extended Maxwell solid, where the total strain can be broken down into a simple summation of the elastic, creep, and plastic strains. In relaxation phenomena in general, the system takes advantage of any means possible to eliminate deviatoric stresses by relaxing away the topography. Previous analyses have only modeled the viscous response. Comparatively, the elastic response in our model can augment the relaxation, to a point. This effect decreases as the elastic response becomes stiffer; indeed, in the limit of infinite elastic Young's modulus (and with no plasticity), the solution converges on the purely viscous solution. Igneous rocks common to the lunar near-surface have Young's modulii in the range of 10-100 GPa. to maximize relaxation, we use a Young's modulus of 10 GPa. (There is negligible sensitivity to the other elastic modulus, the Poisson's ratio; we use 0.25.) For the viscous response, we use a flow law for steady-state creep in thoroughly dried Columbia diabase, because the high plagioclase (about 70 vol%) and orthopyroxene (about 17 vol%) content is similar to the composition of the lunar highland crust as described by remote sensing and sample studies: noritic anorthosite. This flow law is highly non-Newtonian, i.e., the viscosity is highly stress dependent. That, and the variability with temperature, stands in strong contrast to previous examinations

of lunar floor-fracture crater relaxation. to model discrete, brittle faulting, we assume ”Byerlee’s rule,” a standard geodynamical technique. We implement this ”rule” with an-angle of internal friction of about 40 deg, and a higher-than-normal cohesion of about 3.2 MPa (to approximate the breaking of unfractured rock). The actual behavior of geologic materials is more complex than in our rheological model, so the uncertainties in the plasticity do not represent the state-of-the-art error. Additional information is contained in the original.

Author

Craters; Finite Element Method; Fracturing; Lunar Craters; Lunar Crust; Maria; Moon; Rheology; Temperature Profiles; Topography; Viscosity; Elastoplasticity; Viscoplasticity

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Sample Return Mission to the South Pole Aitken Basin

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The South Pole Aitken Basin (SPA) is the largest and oldest observed feature on the Moon. Compositional and topographic data from Galileo, Clementine, and Lunar Prospector have demonstrated that SPA represents a distinctive major lunar terrane, which has not been sampled either by sample return missions (Apollo, Luna) or by lunar meteorites. The floor of SPA is characterized by mafic compositions enriched in Fe, Ti, and Th in comparison to its surroundings. This composition may represent melt rocks from the SPA event, which would be mixtures of the preexisting crust and mantle rocks. However, the Fe content is higher than expected, and the large Apollo basin, within SPA, exposes deeper material with lower iron content. Some of the Fe enrichment may represent mare and cryptomare deposits. No model adequately accounts for all of the characteristics of the SPA and disagreements are fundamental. Is mantle material exposed or contained as fragments in melt rock and breccias? If impact melt is present, did the vast sheet differentiate? Was the initial mantle and crust compositionally different from other regions of the Moon? Was the impact event somehow peculiar, (e.g., a low-velocity impact)? The precise time of formation of the SPA is unknown, being limited only by the initial differentiation of the Moon and the age of the Imbrium event, believed to be 3.9 b.y. The questions raised by the SPA can be addressed only with detailed sample analysis. Analysis of the melt rocks, fragments in breccias, and basalts of SPA can address several highly significant problems for the Moon and the history of the solar system. The time of formation of SPA, based on analysis of melt rocks formed in the event. would put limits on the period of intense bombardment of the Moon, which has been inferred by some to include a ”terminal cataclysm.” If close to 3.9 Ga, the presumed age of the Imbrium Basin, the SPA date would confirm the lunar cataclysm. This episode, if it occurred, would have affected all of the planets of the inner solar system, and in particular, could have been critical to the history of life on Earth. If the SPA is significantly older, a more orderly cratering history may be inferred. Secondly, melt-rock compositions and clasts in melt rocks or breccias may yield evidence of the composition of the lunar mantle, which could have been penetrated by the impact or exposed by the rebound process that occurred after the impact. Thirdly, study of mare and cryptomare basalts could yield further constraints on the age of SPA and the thermal history of the crust and mantle in that region. The integration of these data may allow inferences to be made on the nature of the impacting body. Secondary science objectives in samples from the SPA could include analysis of the regolith for the latitudinal effects of solar wind irradiation, which should be reduced from its equatorial values; possible remnant magnetization of very old basalts; and evidence for Imbrium Basin ejecta and KREEP materials. If a sampling site is chosen close enough to the poles, it is possible that indirect evidence of polar-ice deposits may be found in the form of oxidized or hydrated regolith constituents. A sample return mission to the Moon may be possible within the constraints of NASA’s Discovery Program. Recent progress in the development of sample return canisters for Genesis, Stardust, and Mars Sample Return missions suggests that a small capsule can be returned directly to the ground without a parachute, thus reducing its mass and complexity. Return of a 1-kg sample from the lunar surface would appear to be compatible with a Delta 11 class launch from Earth, or possibly with a piggyback opportunity on a commercial launch to GEO. A total mission price tag on the order of $100 million would be a goal. Target date would be late 2002. Samples would be returned to the curatorial facility at the Johnson Space Center for description and allocation for investigations. Concentration of milligram-to gram-sized rocklets is a very effective strategy for sample studies of the lunar regolith. A rake accomplished this type of sampling in the Apollo missions. For the SPA sample return mission, either a small rover or an arm on a lander would deliver regolith to a sieving mechanism that retains fragments in the 1-10 mm size range. Approximately 10% of the mass of Apollo 16 regolith samples, which were from possibly similar highland terrain, consisted of fragments in the size range. to return 1 kg of rock fragments, about 5 x 10(exp 3) cubic cm of regolith would have to be sampled. Warren et al. suggested 7-10 mm as the optimum size for individual samples, which would require more regolith to be sieved. This mission would represent the first lander mission to the lunar farside and, as such, would require that a communication link

be established with the Earth. A growing number of assets at the Sun-Earth L-1 libration point may provide access to a viable communication link, avoiding the need for a communications orbiter. The mission need only be designed to last through a single lunar day, which could make it relatively straightforward; if a rover is chosen as the implementation for sampling, it may be possible to keep the rover alive for longer. This would be a cost/benefit tradeoff to be determined as part of the mission analysis. Issues on which the lunar sample community should make input include: identification of additional scientific problems that can be addressed by samples from SPA; choice of landing site to maximize the probability of addressing the first-order problems; sample size and the distribution between regolith and rocklet samples; details of sample collection (range from lander, depth, avoidance of contamination from lander); and environmental control constraints on samples (maximum temperatures, acceptable leak rates on Earth). Additional information is contained in the original
Author
Lunar Geology; Lunar Mantle; Lunar Maria; Lunar Rocks; Lunar Soil; Lunar Surface; Moon; Regolith; Lunar Craters; Lunar Exploration; Lunar Far Side

20000040490 Space Science Inst., Boulder, CO USA
Subpixel Detection of Pyroclastic Materials in Clementine Ultra Violet-Visible Data
Farrand, W. H., Space Science Inst., USA; Gaddis, L. R., Geological Survey, USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 12-14; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Lunar pyroclastic deposits represent a style of volcanism different from that responsible for the flood basalts that fill the mare basins. As volatile-coated, primitive materials originating deep (about 400 km) within the Moon, these products of explosive volcanic eruptions are also important as probes of mantle composition and as a potential resource for future settlers. While many of the lunar pyroclastic deposits are spatially restricted and relatively small in size, they are easily resolvable at the spatial scale (about 100 m/pixel) of the Clementine UV-VIS camera. Recent studies confirm previous results indicating that these deposits are not compositionally uniform, and suggest that further analyses can help to identify possible genetic relationships among lunar pyroclastic deposits, characterize their juvenile components, and clarify their relationships to nearby maria. Among the juvenile materials from sampled lunar pyroclastic deposits are the orange glass and devitrified black beads found in the Taurus-Littrow Valley and the green glass found by Apollo 15. Recent studies suggest that deposits dominated by materials such as these may represent end members in the observed compositional variations among the lunar pyroclastic deposits. Here we present preliminary results of analyses focused on the use of the Clementine UV-VIS data for characterizing the composition and distribution of juvenile pyroclastic materials. Our test case for detailed mapping of a lunar pyroclastic deposit is that of the Apollo 17 landing site in the Taurus-Littrow (TL) Valley. Although black beads dominate the observed spectral reflectance at this site, sample data show that the pyroclastic eruption changed character, producing first orange glass and then black beads. to assess the compositional variability of this deposit, especially our ability to distinguish the orange glasses, we apply techniques based on spectral mixture analysis to detect materials at subpixel scales. The low albedo and subdued absorption features of the Taurus-Littrow deposit make this a challenging task. In recent years, several subpixel detection techniques have been developed for use with terrestrial airborne imaging spectrometer data. A technique that is functionally equivalent to spectral mixture analysis, the orthogonal subspace projection (OSP) technique is used for the simulations presented here. In OSP, a target spectrum is projected onto a subspace that is orthogonal to a set of background spectra. In this process, the response from the background spectra are nulled and that of the target is maximized. For the TL site, the spectra used for the simulation included three laboratory-measured sample spectra convolved to the five UV/VIS bandpasses, and two spectra extracted from UV-VIS data over the TL Valley. The target spectrum was the orange soil sample 74220 from the Shorty Crater rim. ”Background” spectra were from samples 74221 (a gray soil found near the orange soil) and 75111 (a dark mare soil). From the UV/VIS data, additional background spectra were obtained at the mare/highland interface and from the ”crater cluster” area in the TL Valley. In the simulation, the background spectra were randomly mixed in each of 100 samples with 0.1% Gaussian noise added. For samples 20,40, 60, and 80, the orange soil target was added in abundances of 90, 80, 60, and 40%. The 100-sample set was then reduced via OSP. For this example, the orange soil was detectable only at the 90 and 80% abundance levels. It was found that the addition of higher noise levels (about 1%), made the orange glass undetectable even at the 90% level. However, using background materials more representative of the highlands made the orange soil detectable at lower abundances. These results suggest that we should be able to map the distribution of juvenile pyroclastic materials, such as the orange glasses, using the Clementine UV-VIS data and subpixel analysis techniques such as spectral mixture analysis and foreground background analysis. Given the low albedo of these materials, a high fill factor will be required on a per pixel basis in order to achieve that mapping; however, observations made by others, including orbital observations by the Apollo 17 astronauts, have indicated that these abundances are met for several pyroclastic deposits. The production of such

maps will help to constrain the dynamics of pyroclastic eruptions on the Moon by providing information on die type, relative quantity, and distribution of juvenile volcanic materials. (Additional information is contained in original.)
Author
Abundance; Deposits; Moon; Volcanology; Lunar Composition; Lunar Crust; Lunar Geology; Lunar Soil

20000040491 Los Alamos National Lab., NM USA
Enhanced Hydrogen Abundances Near Both Lunar Poles
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Chemical analyses of all samples of the Moon returned to Earth show that the lunar surface is highly depleted in volatiles. Specifically, the H content of lunar soils averages only 50 ppm, which can be explained in terms of surface implantation of solar-wind H. We note that all returned samples come from near-equatorial latitudes where daytime temperatures are sufficiently high that water is not stable to evaporation, photo dissociation, ionization, and eventual loss to space through pickup by the solar wind. However, it has long been postulated that a significant fraction of water delivered to the Moon by comets, meteoroids, and interplanetary dust can be stably trapped within the permanently shaded floors of polar craters where temperatures are sufficiently low so that sublimation times can be longer than several billion years. Recent results from analysis of the high-altitude (100 +/- 20 km) portion of the Lunar Prospector Neutron Spectrometer (LPNS) dataset have revealed that H abundances near both lunar poles are enhanced relative to that which exist at equatorial latitudes. Because this average enhancement is not much larger than the near-equatorial average of 50 ppm, it is reasonable to ask how much of the polar-H enhancement comes from the solar wind and how much comes from lunar impacts by solid interplanetary materials. Perhaps the low temperatures at polar latitudes could reduce loss rates of solar-wind-implanted H sufficiently to account for the inferred difference between average polar and equatorial H abundances. Although the foregoing suggestion is plausible, neither laboratory simulations on returned soil samples nor numerical simulations of H loss rates from the radiation-damaged surfaces of soil grains have been performed to prove its feasibility. We try to address this question by analyzing the low-altitude (30 +/- 15 km) portion of LPNS data to search for relatively small spatial-scale enhancements in H data to search for relatively small spatial-scale enhancements in H abundances at both lunar poles. Maps were constructed of epithermal-neutrons corrected for elemental abundance variations by subtracting 7% of measured thermal-neutron counting rates. Although the spatial resolution of the LPNS at 30-km altitude is about 55 km FWHM, we binned all the data in 0.5 deg x 0.5 deg spatial pixels and then applied a 30-km FWHM Gaussian smoothing algorithm. Resultant polar maps of corrected epithermal counting rates are shown. Inspection reveals discrete depressions in counting rates that are superimposed on more generally distributed depressions that surround both poles. Comparison with the radar-measured polar topography shows that the areas of most depressed epithermal counts rates in the south overlie craters that have floors in permanent shade. Furthermore, these depressions are neither cylindrically symmetric about either pole nor do they minimize at the poles. Similar maps of fast neutrons (not shown here) reveal a single, statistically significant depression centered on the maximum depression of the epithermal neutrons at about 88 S, 20 E. Comparison between high-altitude and low-altitude epithermal maps reveals a larger depression at low altitudes in the south but the same magnitude of depression in the north. Hydrogen enhancements in the south must therefore have spatial scales comparable to the spatial resolution of LPNS, 55-km FWHM, yet consist of smaller clumps more uniformly distributed over the LPNS field of view in the north. A quantitative comparison between measured epithermal counting rates and numerical simulations using the measured polar topography yields the following: (1) H abundances within the permanently shaded craters near the south pole are equivalent to a water-ice mass fraction of 1.5 +/- 0.8%, (2) the enhanced H within these craters must not be buried beneath the surface by more than -log /square cm (5 cm at a density of 2g / cubic centimeter (3) the H abundance near both poles averages 100 ppm above that known from near-equatorial returned soil samples (50 ppm,), and (4) the total mass content of H poleward of about 75 deg is about 200 x 10(exp 6) t, and that poleward of +75deg is about 150 x 106 t. If the enhanced H within all regions of permanent shade near both poles is in the form of water ice, use of the area estimates given by Margot et al yields estimates of 135 (240) x 10(exp 6) t in the 2250 (4000) square km of shaded areas poleward of -87.5 deg, and 62 x 10 (exp 6) t in the 1030 square km of shaded areas poleward of +87.5 deg. We note, however, that neutron observations by themselves cannot uniquely identify the chemical form of H in lunar regolith. That is, LPNS data cannot discriminate solar-wind-implanted H from OH, H20, etc. In the absence of a temperature map of the lunar poles and a knowledge of the retentivity of H by lunar soil grains as a function of temperature, sufficient information is not yet available to uniquely identify water-ice deposits at the lunar poles. Nevertheless, the floors of permanently shaded polar craters are predicted to have temperatures sufficiently low that water ice should be stable for billions of years, yet uncratered surfaces near the polar cap are too high in tempera-

ture to retain water ice. This suggests that at least some of the enhanced deposits of H identified by LPNS are in the form of water ice. (Additional information contained in the original)
Author
Hydrogen; Ice; Lunar Surface; Polar Caps; Moon; Water; Lunar Craters; Lunar Composition; Selenology

20000040492 Manchester Univ., Dept. of Earth Sciences, UK
Laser Argon-40-Argon-39 Age Studies of Dar Al Gani 262 Lunar Meteorite
Fernandes, V. A., Manchester Univ., UK; Burgess, R., Manchester Univ., UK; Turner, G., Manchester Univ., UK; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 15-16; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The lunar meteorite Dar al Gani 262 (DAG 262) was found in the Sahara Desert in Libya on March 23,1997. This was the first lunar meteorite found in a desert and is the thirteenth lunar meteorite discovered. DAG 262 is a polymict anorthositic lunar highland breccia. The Ar-40-Ar-39 dating technique has been applied to DAG 262 in an attempt to determine the crystallization age and shock events experienced by this meteorite. Previous studies have indicated that this meteorite may have suffered up to four shock events. Due to the brecciated nature of the rock and the likelihood of multiple shock events, a laser-probe technique has been used to analyze individual components (minerals and clasts) of the meteorite. The sample supplied to us (about 1.5 g) shows two distinct clast types (1) feldspathic and (2) basaltic, the latter not having been previously described. Plagioclases show fractures and undulatory extinction as the result of shock events. The feldspathic clast has small, round low-Ca pyroxenes distributed within it. Electron-microprobe analyses of feldspar and pyroxene are given. The bulk composition as determined by suggests that the source of this clast is the ferroan-anorthositic suite. The basaltic clast shows a very fine intergranular texture with some larger plagioclase grains. The two clasts are separated by a melt-glass matrix that contains plagioclase with the same chemical composition as those plagioclases within the feldspathic clast. A devitrified mafic-glass spherule of - 150 mm diameter was identified within the matrix as well as other small fragments of possible glass spheres. Some dendritic veins can be observed on the outer part of the section, which formed after breccia lithification. Two laser Ar-40-Ar-39 experiments are being carried out: (1) infrared laser-stepped heating of feldspathic fragments that have been separated from the meteorite; and (2) ultraviolet laser spot fusion (50 micron) of a slice of meteorite (about 1.0 x 0.5 cm) showing both clast types. Preliminary results from experiments (1) have been obtained so far. Three feldspathic fragments (DAG 1-3, each weighing about 1 mg) have been heated using between 20-30 steps, of increasing laser output power, each of 1 min duration. A plot of Ar-36/Ar-40 VS. Ar-39/Ar-40 for 20 extractions obtained from DAG3. Overall, the data show increasing Ar-36/Ar-40 and decreasing Ar-39/Ar-40 as heating proceeds. In detail the release is more complex; the plot shows a significant decrease in Ar-39/Ar-40 corresponding to an increase in apparent age from 1.3 to 5.1 Ga. This variation may be attributed to the combined effects of terrestrial alteration that result in loss of radiogenic Ar-40 and implantation of lunar Ar-40 in grain boundaries that lead to an increase in apparent age. Points 5-20 define a linear correlation interpreted to represent mixing between radiogenic Ar-40, released at intermediate temperature, and trapped Ar that dominates the high temperature release. The intercept of the correlation on the Ar-39/Ar-40 axis corresponds to an age of 1.95 Ga. This age is low compared with other lunar meteorites and is most likely related to a shock event. The trapped component released at high-temperature has Ar-36/Ar-40 of about 2.8, which is close to the value of about 2.5 reported previously for the bulk meteorite. The increasing proportion of trapped Ar released at high temperature is contrary to the usual release pattern obtained for lunar soils. Two possible explanations are given: (1) Ar loss from grain boundaries occurred at depth within the lunar regolith, while preserving trapped Ar with higher Ar-36/Ar-40 in the center of grains; or (2) release of trapped Ar from a low-K-bearing mineral present in feldspathic fragments. Anomalously high apparent ages (>4.5 Ga) obtained at low temperature from steps 3 and 4 indicate that DAG3 contains implanted lunar atmosphere Ar-40 presumably acquired near the surface of the lunar regolith. This is inconsistent with the explanation (1) that loss occurred at depth. Fine-grained pyroxene is a common component in the matrix of DAG 262 [21, has low K content, and will retain Ar to a higher temperature than plagioclase making explanation (2) the most likely. Release of Ar from fragment DAG1 was similar to that of DAG3 giving an indistinguishable intercept age of 2.0 Ga. However, DAG2 contained much lower levels of trapped Ar and 19% of the total 39Ar released at high temperature gave an age of 3.05 Ga. This age is slightly below previously inferred total gas ages for lunar meteorites and may be related to the crystallization event. These are based on plots of 37Ar/36Ar VS Ar-38/Ar-36 and give ages of 185 Ma, 252 Ma and 122 Ma for DAG1, DAG2 and DAG3 respectively. The cosmic-ray exposure ages indicate the components of DAG 262 had different exposure histories, an expected result given that this meteorite is a breccia. The K/Ca weight ratio calculated from Ar-39/Ar-37 of 3.6 x 10 (exp -3) is similar to the bulk ratio obtained of 3.8 x 10(exp -3). A much lower K/Ca of 0.6 x 10(exp -3) obtained from feldspar by electron microprobe is evidence for the impurity of the feldspar separates analyzed for the age study. The low K/Ca ratio of the feldspar compared to the bulk indicates that there is an additional K-bearing phase in DAG 262 that remains to be identified. Current investigations are

aimed at using the UV laser to determine Ar-40/Ar-39 ages from individual minerals within DAG 262. (Additional information contained in original.)
Author
Argon Isotopes; Chemical Composition; Feldspars; Lunar Rocks; Meteorites; Meteoritic Composition; Moon

20000040493 Geological Survey, Astrogeology Team, Flagstaff, AZ USA
Progress Toward Characterization of Juvenile Materials in Lunar Pyroclatic Deposits
Gaddis, L. R., Geological Survey, USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 16-17; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In recent analyses, the 5-band Clementine UV-VIS data have been used to examine the compositions of lunar pyroclastic deposits. A primary goal of these analyses has been the characterization of the primary volcanic or juvenile components of these deposits. The compositions, physical and morphological characteristics, and spatial distributions of juvenile volcanic materials provide information on the distribution of primary mafic materials on the Moon, conditions required for their eruption at the surface, and the behavior of lunar volcanic processes over time. Using current analytical techniques with the new Clementine UV-VIS global mosaic, and data from the GLGM2 geophysical models, to supplement ongoing work with Earth-based spectral reflectance analyses and laboratory investigations, we have adopted a three-pronged approach to these issues involving: (1) compositional analyses of lunar pyroclastic deposits; (2) characterization of the relations between effusive and explosive lunar volcanism; and (3) examination of the global occurrence and distribution of lunar pyroclastic deposits. This report and related work describe progress toward remote characterization of the compositions of juvenile materials in the pyroclastic deposits located at Taurus-Littrow and J. Herschel. These studies have implications for characterization of the relations between the products of effusive and explosive volcanism on the Moon. Analyses of lunar pyroclastic materials, primarily the juvenile picritic glasses, provide unique information on the composition of the mantle and on the nature and origin of associated volatile elements in an otherwise volatile-depleted environment. Possible fundamental differences between picritic glasses and mare basalts, (e.g., lesser fractional crystallization and greater depth of origin for glasses) support their identification as the best examples of primitive materials on the Moon, and attest to their importance in characterizing the lunar interior and as a starting place for understanding the origin and evolution of basaltic magmatism on the Moon. Remote-sensing analyses of these deposits have helped us to identify the characteristic components of some of these deposits, to begin to constrain the distribution of lunar volcanic deposits, and to understand the styles of eruption and emplacement of basalts on the Moon. to fully appreciate the role of pyroclastic volcanism on the Moon, we must understand the ranges of composition, spatial and temporal distribution, relationship to effusive volcanic deposits, and modes of occurrence and formation of pyroclastic deposits. Until additional samples are available, remote analyses of lunar pyroclastic deposits are a primary means of fully characterizing these deposits. More than 100 pyroclastic deposits are identified on the Moon. Their characteristics, summarized here briefly, are described in detail elsewhere. Lunar pyroclastic deposits are dark and smooth surfaced, and they are observed in association with sinuous rilles, irregular depressions, or endogenic craters within highlands and/or on the floors of old impact craters situated along the margins of many mare-filled basins on the lunar nearside and farside. Lunar pyroclastic deposits are divided into two classes on the basis of size, morphology, and occurrence. The about 12 large deposits are of regional extent (up to several tens of thousands sq. km), while small deposits (about 90 in number) are more localized, typically only several hundred sq.km. Large deposits were probably emplaced via Strombolian-style or continuous fire-fountain eruptions, with wide dispersion of wellsorted pyroclasts. A significant component of Fe+2-bearing volcanic glass beads was identified in many of the regional pyroclastic deposits. At Taurus-Littrow, black beads (the crystallized equivalent of Fe+2-bearing orange glasses) are the characteristic ingredient of the regional pyroclastic deposit. Both orange and black beads were recognized as pyroclastic, with variations in cooling time in a fire fountain producing quenched, crystallized, and/or composite droplets. Small pyroclastic deposits were formed via Vulcanian-style or intermittent eruptions, with explosive decompression removing a plug of lava or caprock within a conduit and forming a vent depression. Small pyroclastic deposits were divided into three classes on the basis of their ”1-mm” or mafic absorption bands. Most Group 1 deposits are mixtures of highlands-rich country rock and glassy juvenile material with small amounts of basaltic caprock material. Group 2 deposits consist largely of fragmented basaltic material, with insignificant amounts of highland and glassy materials. Group 3 deposits are dominated by olivine, and orthopyroxene; the olivine is almost certainly associated with juvenile material, and the orthopyroxene is likely to have been emplaced as a result of erosion and entrainment of the wall rock. Although differing origins have been proposed for the large and small pyroclastic deposits, comparison of Clementine UV-VIS spectral reflectance data for these deposits shows a linear trend, suggesting some compositional relationship between the two types of deposits. Weitz et al in studying (Taurus-Littrow, Sulpicius Gallus, Mare Vaponim, Rima Bode, Sinus Aestuum, Aristarchus Plateau, and Orientale), proposed that this linear trend represents a ”mixing line” between those large deposits with about 100% crystallized beads and those with about 100% glass beads. A Sinus Aestuum dark spot is the crystallized end member, and Aristarchus is the glass end member. However, the overlap between the

small and large deposits and between the pyroclastic deposits and nearby mare and highlands units suggests that (1) the juvenile pyroclastic materials are not glasses in all cases and (2) substantial spectral contribution from highland and mare units maybe observed for large and small deposits.(Additional information is contained in the original)
Author
Crystallization; Glass; Igneous Rocks; Lunar Maria; Lunar Rocks; Volcanoes; Volcanology; Moon; Lunar Geology; Selenography

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Lateral and Vertical Heterogeneity of Thorium in the Procellarum KREEP Terrane: As Reflected in the Ejecta Deposits of Post-Imbrium Craters
Gillis, J. J., Washington Univ., USA; Jolliff, B. L., Washington Univ., USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 18-19; In English; See also 20000040479
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The Procellarum KREEP Terrane displays the highest concentrations of Th on the Moon. However, locations of elevated Th in this region appear to be random. As observed in the 5 deg per pixel equal-area Th data, and made more evident in the preliminary 2 deg data, Th is enhanced around the craters Aristillus, Aristarchus, Kepler, Mairan, the Apennine Bench formation, and the Fra Mauro region, while noticeably and unexpectedly lower in other locations (e.g., Archimedes, Copernicus, Eratosthenes, and Plato). We have examined the composition of the materials present in these regions with the goal of understanding the patchy nature to the distribution of Th and ultimately to decipher the geologic processes that have concentrated the Th. At present time, the published resolution of the Lunar Prospector Th gamma-ray data is low (5 deg per pixel), but this will soon be superceded by significantly higher-resolution data (2 deg per pixel). Even at this improved resolution, however, it is difficult to resolve the units that are the major source of Th. In an attempt to circumvent this problem, we employ the higher-resolution Clementine multispectral data for those regions mentioned above. We use the UV-VIS-derived compositional information and the spectral properties of craters, and their ejecta as drill holes through the mare-basalt surface to investigate the thickness and composition of underlying material. With this information we attempt to piece together the stratigraphy and geologic history of the Imbrium-Procellanim region. We processed the five-band multispectral data from the Clementine Mission (415, 750,900,950, and 1000nm) using ISIS software and calibration parameters developed by the USGS, Flagstaff, Arizona. Final image mosaics are in equal-area sinusoidal projection, and have a resolution of 250 m/pixel. Using the method of we produced maps of FeO and Ti02 composition. Here we examine the Th, FeO, and Ti02 composition and spectral properties of the craters discussed above and their ejecta, with the goal of describing the materials they excavate. One interpretation for the origin of the high-Th material is that subsurface KREEPy materials have been excavated by impact craters. The material excavated may be either volcanic KREEP (e,g., Apennine Bench Formation), KREEPy impact-melt breccia formed by the Imbrium impact (e.g., Fra Mauro Formation), or other KREEP-rich crustal material. Determining which type of material is responsible for the elevated Th and its extent is important to understanding the premare and possibly the prebasin stratigraphy of the Imbrium-Procellarum Region. Merging the 5 deg. Th data with the shaded relief map, we observe that the highest Th concentrations are not related to pre-Imbrium upper crustal materials. The Apennines, Alpes, and Caucasus Mountains represent the pre-Imbrian highlands material and do not express concentrations of Th, FeO, and TiO2 as high as the most Th-fich materials exposed within the Procellarum KREEP Terrane. We observe that, in general, these massifs contain 10-14 wt% FeO and 4-7 ppm Th. Determining whether the Th signal is from KREEP basalts or KREEPy impact-melt breccias cannot be done with the Clementine data because the two rock types are compositionally and mineralogically too similar (e.g., the Th-rich, mafic impact-melt breccias in the Apollo sample collection are dominated by a KREEP-basalt like component. Mapping-the distribution and sizes of craters and whether they display elevated Th concentrations or not, should reveal the depth and thickness of the KREEP-rich materials, and whether they are ubiquitous (i.e., impact-melt breccia) or more randomly distributed; this might be taken as an indicator of localized KREEP-basalt flows. Within the southeastern region of the Imbrium basin, there are two Th hot spots. The first is associated with the crater Aristillus, and the latter with the Apennine Bench Formation. Adjacent to these two hot spots are craters with a lower Th signature: Archimedes and Autolycus. We observe in the ejecta of Aristillus, a region of significantly lower FeO (10-14 wt%) relative to the surrounding mare basalt. The crater Autolycus, 50 km to the south, did not excavate similar low-FeO material. We suggest that the lower-FeO material in the ejecta of Aristillus corresponds to Th-rich material; the FeO content observed in Aristillus ejecta is comparable to that of KREEP basalt or mafic impact melt breccia (10-12 wt% FeO). We determine that this low FeO, Th-rich material is volcanic KREEP, as opposed to Imbrium impact melt, on the basis that the low-Fe material is exposed more prominently in ejecta in the northern portion of Aristillus. Our assumption is that if the layer underlying Aristillus was continuous, a more widespread and uniform low-Fe signature wouldbe observed in the ejecta deposit. Archimedes, 110 km southwest of Aristillus, impacted the northern portion of the Apennine Bench prior to the eruption of KREEP basalt. Archimedes rim material is not as enriched in Th as the Apennine Bench, and

there are differences between the two in FeO concentration and in their continuum slope. Archimedes exhibits a much steeperor ”redder” continuum slope than the Apennine Bench. This steepslope suggests the presence of glassy material. The glassy material is concentrated around an unnamed crater on the southern rim of Archimedes (4.5W, 28.2N) and along the northern rim of Archimedes. We suggest two possibilities, or a combination of the two, to explain the low-Th signal from Archimedes: (1) The Apennine Bench prior to KREEP basalt eruption was lower in Th (4-7 ppm, e.g., similar to the Apennine massifs) and KREEP basalts are absent in the rim of Archimedes; or (2) the glassy (possibly pyroclastic) material layering the rim of the Archimedes, dilutes any high-Th material present with low-Th material. (Additional information is contained in the original)
Author
Breccia; Kreep; Lunar Maria; Moon; Thorium; Volcanoes; Volcanology; Lunar Soil; Lunar Craters; Lunar Composition; Lunar Geology; Selenology

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The Opitical Maturity of Ejecta from Large Rayed Craters: Preliminary Results and Implications
Grier, J. A., Arizona Univ., USA; McEwen, A. S., Arizona Univ., USA; Lucey, P. G., Hawaii Univ., USA; Milazzo, M., Arizona Univ., USA; Strom, R. G., Arizona Univ., USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 19-21; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Shoemaker argued that several lines of evidence suggest a significant increase in the production of large craters on the Earth late in geological time (about 200-300 Ma). We have conducted a preliminary test of this hypothesis via a study of large recent craters on the Moon, and have concluded that the lunar record does not support this idea. The relatively recent (is less than 1 Ga) flux of asteroids and comets forming craters on the Earth and Moon may be accurately recorded by lunar craters whose ejecta are optically immature, and therefore distinguishable from the overall mature background soils. Lucey et al. have developed a methodology for extracting an optical maturity (OMAT) parameter from multispectral images. We have generated a preliminary dataset of average radial profiles of OMAT values around large craters (about 20 km diameter) that have been suggested or suspected of belonging to the Copernican timestratigraphic system. Our survey covers the Moon from +/- 60 deg latitude. The average OMAT profile for each large crater is generated from nearside and farside OMAT mosaics. The profiles clearly fall into three bins based on their relative age. Young craters’ profiles are characterized by high OMAT values near the rim and very steep dropoffs in OMAT value over a long distance away from the crater. Old craters whose profiles over their ejecta are essentially flat sloped and indistinguishable from background; their OMAT values at the rim are very low. Intermediate craters in this bin are between young and old; they have moderate OMAT values at the rim, and their profiles, while somewhat flat, are distinguishable from background some distance away from the crater rim. Profiles for a sample of large craters show a range of possible values and slopes; clearly the trend is a continuum. These suggested bins are based on the absolute ages of a few lunar craters, such as Tycho and Copernicus. Tycho and Copernicus are approximately the same size, but their OMAT profiles are quite different. Tycho is clearly young, with a high OMAT value at the crater rim and a steep dropoff in OMAT values as one follows the ejecta away from the crater. Copernican ejecta appears to be almost entirely mature, but there may be some suggestion of more immature ejecta within 2 crater diameters of the rim. Copernicus is therefore either old, or is on the old side of intermediate. Copernicus has been radiometrically dated at about 810 Ma, so the upper limit of this technique to identify and relatively date large craters must fall at less than about 800 Ma. Tycho is about 100 Ma. Craters with ejecta both much less and more mature than these craters have been identified. The density of large craters classified as younger than Copernicus is at least 40% less than the density of farside craters with bright rays, which was suggested to represent a population of craters younger than Copernicus. Furthermore, these craters have a ”flatter” size-frequency distribution (relatively more large craters) than do the farside rayed craters or other lunar craters younger than 3.2 Ga. We suspect that there is an age-size bias to our classification, such that the OMAT profiles of smaller craters look like that of larger but older craters. Nevertheless, two large nearside craters previously mapped as Copernican, Eudoxus (67 km), and Aristillus (55 km), which are close in size to our ”calibration” craters (Copernicus 92 km and Tycho - 86 km), are now known to have optically mature ejecta. Thus it is likely that the density of large craters younger than Copernicus must be reduced from the estimates in, and the case for a modest increase in the cratering rate (in the past 800 m.y. versus the previous 2.4 b.y.) has been weakened. However, if Copernican ejecta are completely mature, then there may well be additional large craters younger than 800 Ma, and the cratering rate over the past 800 m.y. may have increased. Our preliminary investigation also shows no evidence for a change in the cratering rate since Tycho (about 109Ma) compared with the cratering rate since Copernicus (about 810 Ma). There are two additional results from this preliminary study that are relevant to lunar stratigraphy based on our analyses of Aristillus, Autolycus and Lichtenberg Craters. We find optically mature ejecta around the crater Lichtenberg (20-km diameter). Marc lavas are emplaced over the bright ejecta and rays of Lichtenberg; this has been cited as evidence for Copernican-age mare volcanism. Our data indicate that this superposition does not require an unusually young age for the mare lavas, based on the relative age of the crater. Both Aristillus and Autolycus have been morphologically classified as rayed, due to the nature of their ejecta; Autolycus

has been radiometrically dated at about 2 Ga and Aristillus at 1.3 Ga . These ages seemed in possible contradiction with the supposition that rayed craters are all relatively recent. The OMAT profiles for both of these craters, though, are otherwise indistinguishable from OMAT background values and are very flat. The profiles indicate that the maturity of the ejecta from these craters is much greater than the ejecta of Copernicus, which is consistent with their radiometric ages. It is therefore clear that the presence of rays alone do not imply that a large crater is near or younger than the age of Copernicus. Since these craters possess mature ejecta, and are classified as old, this does not support the suggestion by that the cratering rate during the Copernican was about 2x lower than that during the Eratosthenian.
Author
Cratering; Ejecta; Geochronology; Lunar Craters; Lunar Maria; Selenology; Moon; Lunar Geology

20000040496 National Space Development Agency, Advanced Mission Research Center, Tsukuba, Japan
The Lunar Imager/Spectrometer for the SELENE Mission
Haruyama, J., National Space Development Agency, Japan; Otake, H., National Space Development Agency, Japan; Matsunaga, T., Tokyo Inst. of Tech., Japan; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 21-22; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Moon is the nearest celestial body to the Earth. The investigation of the Moon gives clues as to the origin and evolution of not only the Moon itself, but also the Earth. ISAS (Institute of Space and Astronautical Science) and NASDA (National Space Development Agency of Japan) are cooperatively planning to launch a Moon explorer named SELENE (Selenological and Engineering Explorer) in 2003. Phase C study has been started since last April 1999. SELENE will load 14 mission instruments to obtain scientific data of the Moon. The scientific data will be also used for investigating the possibility of future utilization of the Moon. SELENE will carry out the orbiter mission for one year and subsequently separate the propulsion module that will be a lander and send the radio signal for the differential VLBI for two months. The orbiter will end its role when the propulsion module is separated. Imagery and spectral profiling are most useful techniques for understanding the structure and materials of a planetary surface. From the SELENE mission, we will obtain data with high spatial and spectral resolution by LISM (Lunar Imager/SpectroMeter). LISM consists of three sensors: a terrain camera (TC), a multiband imager (MI), and a spectral profiler (SP). We introduce LISM in this paper. LISM will obtain digitized global imaging and spectral profiling data of the Moon with high-quality spatial resolution, wavelength resolution, and signal-to-noise ratio. Data of LISM will be also combined and analyzed with the data of other mission instruments of SELENE. The LISM group consists of about 20 researchers, who have responsibility on LISM development including science requirement decision, instrumentation, software development, and operation. The current status of LISM development is in phase C, or PM (preflight model) designing and making phase. From the next year, we will start designing FM (flight model). The main purpose of TC is global stereo mapping with high spatial resolutions. to investigate subkilometer size morphology for all over the Moon in detail, we used images with spatial resolution of 10 m and height resolution of 20-30 m. TC consists of two slant telescopes, each of which has a linear CCD detector, and takes images by pushbroom scanning. The swath of TC is 35 km. when the altitude of SELENE orbiter is 100 km, so that images taken at serial paths are overlapped for across-track direction. DCT lossy compression method has been adopted to reduce the tremendous data. The data will be nominally compressed to 30% or less. The main purpose of MI is global multiband mapping of spatial resolution of 20 m for visible range, and 60m for near-infrared range. MI consists of two telescopes, each of which has a two-dimensional detector with band-path filters. Data of several lines of the detectors, each of which correspond to band assignments, are read out. MI takes images by pushbroom scanning. The swath of MI is 20 km when the altitude of SELENE orbiter is 100 km. We adopt a DPCM loss-less compression method to avoid irreparable loss of information about subtle difference of reflectance. The main purpose of SP is to obtain detailed continuous spectral data of the Moon in the 500-2600-nm range to understand distribution and chemical composition of minerals on the surface. SP has one set of optics with three detectors for three ranges (VIS: 500-1000 nm NIRI: 900-1700 nm, and NIR2: 1700-2600 nm. NIR2 is cooled to 220 K by a peltier cooler. The spatial resolution is 500 m for across-track and along track directions. Since we require high accuracy to analyze SAM data, we execute on-board calibration with using halogen lamps. The spectral profiler will be operated in all daytime. The total amount of data of TC and MI is so large that TC and MI are not operated at the same time. Still, operations of TC and Mi should be carried out in limited daytime. to identify where SP is observing, however, highly compressed TC images or one-band images of MI are planned to be taken simultaneously with SP data.
Author
Imaging Techniques; Moon; Spatial Resolution; Spectral Resolution; Spectrometers; Very Long Base Interferometry; Lunar Composition; Lunar Geology; Cameras

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The Composition and Origin of Selected Lunar Crater Rays

Hawke, B. R., Hawaii Univ., USA; Blewett, D. T., Hawaii Univ., USA; Lucey, P. G., Hawaii Univ., USA; Peterson, C. A., Hawaii Univ., USA; Bell, J. F., III, Cornell Univ., USA; Campbell, B. A., National Air and Space Museum, USA; Robinson, M. S., Northwestern Univ., USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 22-23; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The nature and origin of lunar crater rays has long been a source of major controversy. Some lunar scientists have proposed that rays are dominated by primary crater ejecta, while others have emphasized the role of secondary craters in producing rays. Pieters et al. presented the results of a remote sensing study of a portion of the ray system north of Copernicus. They provided evidence that the present brightness of the Copernicus rays in this sector is due largely to the presence of a component of highland ejecta intimately mixed with local mare basalt, and that an increasing component of local material is observed in the rays at progressively greater radial distances from the parent crater. These results have been questioned, and the origin of lunar rays is still uncertain In an effort to better understand the processes responsible for the formation of lunar rays, we have utilized a variety of remote-sensing data to study selected rays associated with Olbers A, Lichtenberg, the Messier Crater Complex, and Tycho. The data include near-IR reflectance spectra (0.6-2.5 micron) and 3.8-cm and 70-cm radar maps. In addition, Clementine UV-VIS images were used to produce high-resolution FeO, TiO, and maturity maps for the various rays using the methods presented by Lucey and et al. Messier (14 km in long dimension) and Messier A (diameter = 11 km) are located near 2S, 47E in Mare Fecunditatis. Major rays from these craters occur to the south and west of the parent craters. Spectra were obtained for portions of the rays west and south of the crater complex, as well as for Messier A and nearby mature mare regions.The spectrum of Messier A exhibits an extremely deep (29%) ferrous iron absorption band centered at 0.98 micron, and a fresh mare composition is indicated. Both the near-IR spectrum and the FeO image clearly demonstrate that Messier A did not penetrate the Fecunditatis mare fill. In addition, Messier A crater exhibits strong returns on both the 3.8-cm and 70-cm depolarized radar images . The spectrum collected for the ray west of Messier A has a 15% absorption feature centered at 0.99 micron. The ray has slightly enhanced values in the depolarized 3.8-cm radar image, but no enhancement is apparent in the 70-cm dataset. 'Me mature mare unit adjacent to this ray has a spectrum with a shallower band depth (12%) and a similar band center. The FeO image indicates that the west ray exhibits FeO values similar to adjacent mare deposits. The brightness of the ray west of Messier A is due to the presence of large amounts of fresh mare basalt. Near-IR spectra as well as the FeO and maturity maps indicate that the ray south of the Messier complex is also dominated by fresh mare material. A major ray from Tycho Crater crosses much of Mare Nectaris. The 80-km long ray segment northeast of Rosse Crater (17.9N, 35E) has a somewhat conical shape, ranging in width from 8 km near Rosse to 16 km northwest of Bohnenberger Crater. Spectra were obtained for Rosse Crater (diameter = 12 km), mature mare units, and two small areas on the Tycho ray northeast of Rosse. Both of the spots on the ray are located near a Tycho secondary crater cluster - 1400 km from the center of the parent crater. The spectrum collected for a mature mare area east of Rosse exhibits an 8.5% absorption feature centered at 0.98 micron. Both ray spectra have 11.6% bands centered at about 0.99 micron. It appears that the ray in the areas for which spectra were collected are dominated by fresh mare debris. These results are in agreement with those presented by Campbell et al. These workers noted that the Tycho secondary craters in the cluster are easily seen in high-resolution 3.0 cm. radar images, and a radar-bright area extends 10-15 km downrange of Tycho from the approximate center of the cluster. In addition, they noted that the radar-bright region exhibited a deeper "1-micron" feature in multispectral ratio images and suggested that fragmental material was emplaced well downrange of the visible secondaries, perhaps by a secondary debris surge. The FeO and maturity images support this interpretation. In summary, analyses of near-IR reflectance spectra, multispectral imagery, and a variety of radar data suggest that Tycho ray in Mare Nectaris is dominated by fresh local material excavated and emplaced by secondary craters. While some highlands material from Tycho is undoubtedly present in the ray, the major factor that produces the brightness of the ray is the immature mare basalt. Olbers A Ray. This Copernican-aged impact crater (diameter 43 km) located in the highlands on the Moon's western limb (8.1N, 77.6W) exhibits an extensive ray system. Eight near-IR reflectance spectra were obtained for a prominent ray that extends northeast of Olbers A across Oceanus Procellarum. Three of these spectra were for small (3-6 km in diameter) areas near the intersection of two major ray elements about 385 km northeast of Olbers A. Three spectra were collected for a portion of the ray immediately northeast of Seleucus Crater. This ray segment is about 550 km from the rim of the parent crater. Two spectra were obtained for diffuse ray elements in the same general area. Spectra were also obtained for Olbers A Crater as well as both mature mare and fresh craters near the ray. All spectra were analyzed and spectral mixing model studies were conducted using the techniques described by Blewett et al. Three component mixing studies were performed using mature mare, fresh mare, and either fresh or mature highland material as end members. The spectra obtained for areas near the ray intersection are dominated by mare material. However, highland debris is quite abundant (contributing 30-50% of the flux

to the spectra). Perhaps these high values are due to the fact that two rays cross in the area for which the spectra were collected. Additional information contained in original
Author
Ejecta; Lunar Craters; Lunar Maria; Lunar Rays; Selenography; Meteorite Craters

20000040498 Brown Univ., Dept. of Geological Sciences, Providence, RI USA
Lunar Gruithuisen and Mairan Domes: Rheology and Mode of Emplacement
Head, J. W., Brown Univ., USA; Wilson, L., Lancaster Univ., UK; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 23-24; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The lunar steep-sided Gruithuisen and Mairan domes are morphologically and spectrally distinctive structures that appear similar to terrestrial features characterized by viscous magma. We use the basic morphologic and morphometric characteristics of the domes to estimate their yield strength (about 10(exp 5) Pa), plastic viscosity (about 10(exp 9) Pa s), and effusion rates (about 50 cubic m/s). These values are similar to terrestrial rhyolites, dacites, and basaltic andesites and support the hypothesis that these domes are an unusual variation of typical highlands and mare compositions. Typical dike geometries are predicted to have widths about 50 m and lengths about 15 km. The magma rise speed implied by this geometry is very low, about 7 x 10(exp -5) m/s, and the Reynolds number of the motion is about 2 x 10(exp -8), implying a completely laminar flow regime. Introduction: The Gruithuisen and Mairan domes represent examples of topographically, morphologically, and spectrally distinctive structures on the Moon that appear to be candidates for very viscous magma. In this analysis, we use the basic morphologic and morphometric characteristics of the domes as a bases for estimating their yield strength, plastic viscosity, eruption rates, and dike feeder geometry (e.g., dike width and length). We begin by assuming that each dome is a single structure emplaced on a flat plain and use Blake's treatment of domes modeled as Bingham plastics to establish the order of magnitude of the yield strength, (t), and plastic viscosity (h). Inferred values of t are about 3 x 10(exp 5) Pa for the Gruithuisen domes and 1.0 x 10(exp 5) Pa for Mairan features. Next we use an empirical formula given by Moore and Ackerman to relate the plastic viscosity, to the yield strength. The most likely value of h for the Gruithuisen domes is about 1 x 10(exp 10) Pa s and for the Mairan domes is perhaps within a factor of two of 5 x 10(exp 8) Pa s. As a specific example, we treat the Gruithuisen Gamma dome as an underlying symmetric dome of radius = 10 km and unknown thickness on which are superimposed three flow lobes; we assume that these merge toward the summit, where they have a common thickness. The values (t = 7.7 x 10(exp 4) Pa; h = 3.2 x 10(exp 8) Pa s) are, as expected, significantly less than the first approximations, which ignored the detailed morphology of the dome. Given the resolution of the images used and the consequent difficulties in mapping and measuring features, it might be argued that measurements for t and h represent a single Bingham plastic magma for which t = (10 +/- 3) x 10(exp 4) Pa and h = (6+/- 4) x 10(exp 8) Pa s. Alternatively, we could separate the two groups of domes and characterize the Gruithuisen dome magma by t = (12+/-3) x 10(exp 4) Pa, h = (l0 +/- 5) x 10(exp 8) Pa s and the Mairan dome magma by the slightly smaller values t = (8 +/- 4) x 10(exp 4) Pa, h=(5 +/- 4) x 10)(exp8) Pa s. We now turn to the estimation of the eruption rates of the magmas forming the various dome units. to do this we assume that the advance of the flow front of each flow unit or dome-forming episode was limited by cooling. Pinkerton and Wilson show that a variety of types of lava flow cease to move when the Gratz number, a dimensionless measure of the depth of penetration into the flow of the cooled boundary layer, has decreased from its initially very high value to a critical value of -300. Blake's model of Bingham plastic domes shows the way in which the radius of the dome grows as a function of time. The assumption that flow lobes are cooling-limited always leads to effusion-rate estimates of lower bounds. This is because any flow unit assumed to be cooling limited may in fact have been volume-limited (i.e., ceased to flow simply because the magma supply was exhausted), implying that it had the potential to travel further than the observed distance and therefore had a higher effusion rate than that deduced. For each of the Gruithuisen domes we have either a second smaller dome or a flow lobe superimposed on a larger, earlier dome. It is very tempting to assume that the second unit in each case is a breakout at the vent caused by the magma supply continuing after the first unit has reached its cooling-limited length. This automatically implies that the effusion rates deduced from the large dome geometries (about 48,24, and 119 cubic M/S for Gruithuisen Delta, Northwest, and Gamma, respectively) are the realistic estimates and that the rates found from the smaller units are underestimates. For the Mairan domes we are not able to resolve multiple lobe structures and must regard the effusion rates of about 50 m/s as lower limits on the true rates. (Additional information is contained in the original)
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Lava; Magma; Moon; Rock Intrusions; Lunar Craters; Lunar Maria; Rheology; Lunar Topography; Volcanoes

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A Multispectral Analysis of the Flamsteed Region of Oceanus Procellarum

Heather, D. J., University Coll., UK; Dunkin, S. K., University Coll., UK; Spudis, P. D., Lunar and Planetary Inst., USA; Bussey, D. B. J., European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 24-26; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Flamsteed area of Oceanus Procellarum is representative of basalts that have yet to be sampled. They studied the area in detail using telescopic data to identify seven distinct mare flows. This diversity makes the Flamsteed region an ideal candidate for Clementine multispectral studies. The region studied here is far smaller than that covered, but the higher spatial resolution of the Clementine data will allow us to make a fresh interpretation of the nature of our restricted area before expanding to encompass the surrounding regions. The primary aim of this work is to use Clementine UV-VIS data to analyze flows on a smaller scale and determine the stratigraphy of the mare, using impact craters as probes to measure the thickness of mare lavas wherever possible. We used the Clementine UV-VIS data to produce a multispectral image of the Flamsteed area from 0.60N to 16.06S and 308.34E to 317.12E. The data were processed at a resolution of 200 m/pixel using the ISIS software program (available through the USGS), and the photometric coefficients tabulated. In addition to the multispectral image, a ”true color” image, FeO map using the algorithms, and a Ti02 map using the algorithms were generated. In conjunction with a 750-nm Clementine mosaic and Lunar Orbiter photographs, these images formed the dataset used for this analysis. For more details on the data-reduction procedure used, please contact the authors. The area studied here lies in the southeastern portion of Oceanus Procellarum, and covers approximately 134,500 square km, extending from the mare-highland boundary (to the south) up to and including the Flamsteed P ring. The number of spectrally distinct flows in the area is striking in the Clementine mosaics, ranging from high-Ti flows in and around Flamsteed P to low-Ti flows at the edges of the mare-highland boundaries. From a preliminary analysis, we have identified at least five flows in the multispectral image alone. Sunshine and Pieters found three distinct flows within the Flamsteed P ring using high resolution CCD images from a groundbased telescope. We find evidence for only two: a younger high-Ti flow overlying an older lower-Ti flow. However, we have not yet reduced the data for the most eastern part of the ring, and it is possible that further flow(s) could be found in our missing section. The low-Ti flows at some of the mare highland contacts to the south are exceptionally bright in the 750/415 nm channel of the multispectral image. These areas correlate with intermediate FeO and Ti02 content, and seem to be the oldest flows visible on the surface, probably extending over a large area beneath the later flows. Boundaries were defined according to multispectral and albedo properties. Detailed studies of the Ti02 map and maturity data (taken through observations of crater densities from the Orbiter frames and an optical maturity image produced using the algorithm of Lucey et al., will improve this map. Work is continuing in an attempt to delineate clearer flow boundaries. The primary aim of this work is to determine the thickness of the mare flows as one moves out from the highland boundary into Oceanus Procellarum. First-order indications of thickness can be obtained by searching for highland outcrops within the maria. The Flamsteed area shows many such outcrops, and the lavas must be quite thin close to these. A more absolute idea of basalt thickness can be obtained by calculating the depths of craters that have dug through the lavas to expose highland material below. These craters can be identified from multispectral images and 5-point spectra. Previous work has suggested that a cyan color in the multispectral frame represents highland material, and that yellows and greens are freshly excavated basalts. However, we have recently found that a cyan color can also result from a freshly excavated high-Ti basalt. In order to differentiate between the high-Ti and highland signature, it is necessary to look at the FeO and Ti02 frames and plot 5-point spectra to look for the absorption at 0.95 mm that is characteristic of pyroxenes in the basalts. These observations have shown there to be candidate craters in the Flamsteed region which have excavated highland material. The example crater displays a basaltic signature with a clear O.95 micron absorption in its south wall and ejecta, while the absorption in the north wall and ejecta is far weaker. The northern deposits are also relatively low in Ti02 and FeO, and probably represent a mix of basaltic and highland material. The crater is 8 km in diameter, so will have excavated to a depth of about 800mm (using the depth:diameter ratio of 1:10 given by Croft); this is therefore an upper limit to the thickness of the basalts at the crater’s northern edge. In addition, there are several areas where craters close together excavate spectrally distinct materials. These may indicate boundaries of subsurface mare flows, and will allow for a more detailed stratigraphic picture to be constructed. We intend to map the lava flow and crater distribution across the Flamsteed region, using craters to deduce depths to the highland-mare contact where possible. Flamsteed will then be combined with adjoining areas of Oceanus Procellarum, gradually developing a complete picture of the stratigraphy and basalt thickness across the basin. This work will form part of a continuing project in which we aim to study maria across the whole Moon, providing a global perspective of lunar volcanic history. Additional information is contained in the original.

Author

Ejecta; Lava; Lunar Maria; Moon; Volcanoes; Lunar Craters; Lunar Topography; Volcanology

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Petrogenesis of Magnesian-Suite Troctolites and Norites

Hess, P. C., Brown Univ., USA; Parmentier, E. M., Brown Univ., USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 26-27; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Models for the petrogenesis of magnesian-suite troctolites and norites are severely constrained by a number of important geochemical features. I. Most troctolites have olivines with Mg* values that range from 84 to 92. Rare spinel troctolites have extremely primitive olivines with Mg* 95-96. Hess showed that a peridotite source with Mg*>91 was required to produce the most magnesian troctolite parent liquids known at that time. But these parent liquids were strongly undersaturated with respect to plagioclase at the low pressures expected of the lunar anorthosite crust. Such liquids must crystallize significant quantities of olivine in order to bring plagioclase onto the liquidus; the fractionation of olivine must reduce the Mg* value of the plagioclase-saturated liquids. It follows that troctolites with Mg* of 90-92 cannot be produced in this way. The problem is far worse for the spinel troctolite with Mg*96. II. The crystallization sequence of magnesian suite magmas is non-tholeiitic; i.e., the crystallization of low-CaO pyroxene precedes high-CaO pyroxene. Indeed, troctolites and norites are nearly free of discrete CaO-rich pyroxene, a feature implying a melt and a source with low normative diopside, certainly much lower than in typical terrestrial lherzolite. III. The parent magmas for magnesian norites and troctolite have calculated REE contents typically between 1 and 2x high-K KREEP or about 300-600x chondrite! IV. The parent magmas to the most primitive troctolite are hot and have temperatures that exceed 12700C at 1 bar. V. Radiogenic isotope ages for magnesian norites imply that magma generation was long lived, contemporary with the formation of ferroan anorthosite and extending to (and possibly beyond) 4.2 AE. Three models of petrogenesis are tested against the petrochemical features listed above. These models include (1) impact melting, (2) cumulate remelting, and (3) assimilation of cumulates by late-stage liquids of the magma ocean. A. In this model, the parent magmas to the magnesian-suite troctolite are impact melts formed by melting the ferroan anorthosite crust and the early-most cumulates of the magma ocean. The mafic cumulates exist below the crust through the agency of cumulate overturn as the original cumulate pile establishes gravitational equilibrium. A magma ocean with Mg* 84-88 is required to produce olivines with Mg* 92-95. Such high Mg* values require that the magma ocean experienced fractional rather than equilibrium crystallization even at the earliest periods of crystallization. The high and variable REE content is explained by melting of variable amounts of the KREEP layer that survived the overturn. The mafic cumulate cannot be solely of olivine, however, since the magnesian norites require an orthopyroxene-bearing source. An orthopyroxene-bearing dunite or even an olivine-rich harzburgite is required. This would imply that the magma ocean was less olivine normative than typical terrestrial mantle. The impact model nicely reconciles constraints I to IV, whereas V simply requires multiple impacts. Indeed, since magnesian-suite rocks were collected from Apollo 11, 12, 14, 15, 16, and 17, impact melting in this model was a common and widespread event. If this model is correct, why are the ferroan anorthosite and magnesian suite plutonic trends so distinct? Why isn't there a continuum of compositions? It is also noteworthy that upper mantle samples are rare to nonexistent in the lunar collection. In fact, neither ferroan anorthosites or cumulate mantle samples are typically found within the ejecta deposits that include magnesian-suite samples. B. In the cumulate remelting model, the high Mg* values of the magnesian troctolite are contributed also by a source dominated by early olivine cumulates of the magma ocean. The normative plagioclase and orthopyroxene components are supplied by sinking parcels of quenched crust of the convecting magma ocean or perhaps by interaction with partial melts generated by melting the primitive interior of the Moon, if indeed such an interior exists. In either case, the mafic cumulates of olivine, perhaps with small amounts of orthopyroxene (see earlier discussion), must dominate the source. Pressure-release melting associated with the cumulate overturn creates the parent magmas for the magnesian suite. Sufficient melting is required to leave only orthopyroxene and olivine in the source to maintain low normative diopside contents. This model satisfies constraints I, II, and IV but has difficulty with III, the high KREEP contents of the Mg-suite parent liquids. Possibly the high KREEP contents are the result of assimilation of high level KREEP deposits. However, if KREEP is akin to ferroan basalt then the assimilation of this mass would lower Mg* values. If KREEP is quartz normative and granitic, assimilation would compromise the olivine-normative character of the parent liquids; KREEP-rich troctolite parent liquids would evolve to norite parent liquids. This latter viewpoint is probably the more acceptable one. If this model is correct, then convective overturn and pressure release melting must not only begin promptly to create old Magnesian-suite rocks but must also continue for 200-300 more m.y. to account for the youngest members of the Magnesian-suite. The rapid formation of the cumulate pile is consistent with the 182W-isotopic anomalies that require that heterogeneous and discrete source regions must be established in the first 50 m.y. of the origin of the Moon. Perhaps thermal rather then chemically driven convection is needed to explain the origin of young Magnesian norites. Additional information is contained in original document.

Author

Geochemistry; Kreep; Lunar Crust; Magma; Mineralogy; Petrogenesis; Pyroxenes; Lunar Geology; Petrography; Lunar Maria

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Ages of Oceanus Procellarum Basalts and other Nearside Mare Basalts

Hiesinger, H., Brown Univ., USA; Head, J. W., III, Brown Univ., USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 27-28; In English; See also 20000040479; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In a previous paper we reported on crater size frequency distribution data for 139 spectrally and morphologically defined basalt units in six nearside impact basins (Australe, Tranquillitatis, Humboldtianum, Humorum, Serenitatis, and Imbrium). We also presented results on the relationship between Ti concentration and age of a basalt unit, the influence of crustal thickness on the eruption of a basalt onto the lunar surface, and the flux of lunar mare volcanism. In this paper we expand our study to Oceanus Procellarum in order to include the largest mare basalt covered area into our investigation.
Author

Basalt; Craters; Geochemistry; Lunar Crust; Lunar Maria; Lunar Surface; Volcanology; Geochronology; Selenology

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High-Resolution Mapping of Lunar Crustal Magnetic Fields: Correlations with Albedo Markings of the Reiner Gamma Class

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During the last eight months of the Lunar Prospector mission (December 1999-July 1999), the spacecraft was placed in a relatively low-altitude (15-30-km perapsis), near-polar orbit that allowed high-resolution mapping of crustal magnetic fields. We report here initial studies of the correlation of locally strong magnetic anomalies with unusual, swirl-like albedo markings of the Reiner Gamma class. Based on this correlation, which is known from earlier studies of Apollo subsatellite magnetometer data, it has been proposed that the swirls represent regions whose higher albedos have been preserved via deflection of the solar-wind ion bombardment by strong crustal fields. This model in turn depends on the hypothesis that solar-wind implanted H is at least one component of the process that optically matures exposed silicate surfaces in the inner solar system . Specifically, it is hypothesized that implanted H acts as an effective reducing agent to enhance the rate of production of nanophase metallic Fe particles from preexisting silicates during micrometeoroid impacts. According to the model, the curvilinear shapes of these albedo markings are caused, at least in part, by the geometry of ion deflections in a magnetic field. The improved resolution and coverage of the Prospector data allow more detailed mapping of the fields, especially on the lunar farside. This permits a more quantitative test of whether all albedo markings of this class are associated with strong local magnetic fields.Only if the latter condition is met can the solar-wind deflection hypothesis he valid. The basic procedure for mapping crustal magnetic fields using Lunar Prospector magnetometer data follows that developed for analysis of Apollo subsatellite magnetometer data. The specific mapping steps are (1) selection of mission time intervals suitable for mapping crustal fields; these are limited essentially either to times when the Moon is in a lobe of the geomagnetic tail or to times when the Moon is in the solar wind but the spacecraft is in the lunar wake; the data are transformed to a radial, east, and north coordinate system with measurements given as a function of spacecraft latitude, longitude, and altitude; (2) visual editing of individual orbit segments selected for minimal external field disturbances; (3) minimization of remaining low-frequency external fields for individual orbit data segments by quadratic detrending; and (4) two-dimensional filtering of individual orbit segments to produce a vector field map along the slightly curved surface defined by the spacecraft altitude; maps of the three field components (radial, east, and north), the field magnitude, and the spacecraft altitude are constructed. For data obtained at low to middle latitudes, the horizontal resolution of the field maps is limited by the orbit-track separation (about 30 km at the equator). Maps of the field magnitude have been constructed within limited selenographic regions based mainly on data acquired in March, April, and May of 1999. This was a time period when the orbit plane was nearly aligned with the Sun-Moon line so that field mapping was possible at times when the Moon was in the solar wind as well as when the Moon was in the geomagnetic tail. Most of the coverage is across the lunar farside. However, a shows an example of a field map produced from solar-wind wake data for a region including Reiner Gamm on western Oceanus Procellarum (location: 58.5W, 7.5N). The contour interval is 3 nT and the mean spacecraft altitude is 18 km to within the accuracy allowed by the resolution of the map (30 km or about 1 deg.); strong magnetic anomalies correlate closely with swirl locations. Individual orbit profiles (whose resolution along the orbit track is comparable to the spacecraft altitude of 18 km) also demonstrate a good correlation of field magnitude with surface albedo. In order to investigate the correlation of magnetic fields with the location of swirl features, we have reexamined available lunar imagery (Lunar Orbiter, Apollo, and Clementine) to identify and map swirl locations within regions where swirls have previously been mapped. In these images, swirls were distinguished from other high-albedo features such as crater rays by their curvilinear shapes and increased visibility in forward-scattered light. Digital maps of swirls identified by all available

imagery were then superposed on maps of the field magnitude at the spacecraft altitude. Based upon analysis of these composite magnetic/geologic maps, we draw the preliminary conclusion that swirl features are associated with magnetic anomalies revealed by Lunar Prospector. Detailed maps of these swirl features are currently being constructed for the magnetically strong regions antipodal to the Imbrium, Serenitatis, and Crisium Basins. Additional information contained in the original,
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Geomagnetism; Lunar Magnetic Fields; Lunar Maps; Magnetic Anomalies; Moon; Solar Wind; Selenology; Selenography

20000040503 Geological Survey, Branch of Astrogeology, Flagstaff, AZ USA
Solar-Wind-Implanted Volatiles in the Lunar Regolith
Johnson, J. R., Geological Survey, USA; Swindle, T. D., Arizona Univ., USA; Lucey, P. G., Hawaii Univ., USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 29-31; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The epithermal neutron distribution from Lunar Prospector (LP) and the H abundance and maturity of returned lunar soils are being used synergistically to estimate global H distribution. The ability to determine lunar H abundance using a combination of remote sensing and laboratory analyses broadens our understanding of the retentivity of volatiles in the lunar regolith and the nature of the sources from which the volatiles arrived (i.e., solar wind, cometary impacts). This is relevant to the search for water ice at the lunar poles as well as other potential resources such as H-3. Knowledge of these possible resource-rich regions will be important for future mission planning, instrument selection, and landing-site analyses. The Level I calibrated epithermal neutron distribution maps (initially calibrated to remove major instrumental effects by the LP team) have been used for first-order calibration to H abundance. The equation of Feldman et al. i.e., (epithermal* = epithermal - (0.068 * thermal) was used to minimize the effects of compositional variations between mare and highlands (likely due to major-element concentrations such as Ti, Fe) on the epithermal neutron counting rates. Comparison of the average H abundances for the Apollo landing site soils with the epithermal* neutron counts for the landing sites from results in the rather poor correlation shown. Neglecting the Apollo 11 sample, the sense of the correlation is correct (fewer epithermal* neutrons implies greater H abundance), but the correlation is still mediocre (r=-0.574). This may result from using the average values for the landing sites as opposed to the individual soil sample values. It can be seen in the epithermal* map that the highest counting rates (likely the lowest H abundances) correspond well to regions of fresh, Copernican-age impacts (e.g., Tycho, Hayn, Jackson, possibly Stevinus). This implies a dearth of solar-wind-implanted gases, which could be explained by the immaturity of the regolith in these regions. But there are also mare regions near the limbs (Orientale, Crisium) with high values that require other explanations. Further, while the darker regions in the polar areas have been interpreted as water-ice-bearing regions, the low-valued highland terrain west of Sinus Iridium requires further study. Overall, the solar-wind fluence model's predictions of highest volatile abundances on the central farside and lowest values on the central nearside are not immediately apparent in the epithermal* map. However, if the lower counting rates (higher H abundances) at longitudes 75-180E are real, it would be consistent with the solar wind model (at least for that portion of the eastern limb and farside). Hydrogen contents of 54 Apollo bulk lunar soils will be compared to the epithermal neutron counts for the landing sites to determine mare precisely an average correlation. This will be applied to the LP data to estimate H content on the lunar surface. Because exposure age affects retained solar-wind-implanted volatile abundances, incorporation of soil maturity using the I(sub s)/FeO parameter (reduced:total Fe ratio) and/or spectrally-derived maturity data from lunar soils will also be used in conjunction with H abundances to refine the correlation. Once a H map is constructed, it will be used to test a solar-wind fluence model for the Moon developed previously that represents relative solar-wind-implanted elemental abundances (assuming minimal variations in impact history and chemical composition of the soils, as well as minimal saturation of soils with volatiles). Deviations of the H distribution from the idealized solar fluence model will be investigated by incorporating the effects of local magnetic fields, composition (e.g., Ti, Fe), and soil maturity. further, previous work by the authors has shown that abundances of H-3 (a potential lunar resource relevant as a fuel for future nuclear fusion power) in the lunar regolith can be estimated using the fluence model in combination with surface maturity and Ti maps constructed using Clementine multispectral data. The modeled solar-wind fluence distribution map will be updated based on observations of the epithermal neutron-derived H maps, and the Clementine and LP Ti-abundance maps will be incorporated with Clementine surface maturity maps to construct revised estimates of H-3 abundance. The calibration of the LP neutron spectrometer data to provide maps of H abundance will be important in understanding the nature of the solar-wind-implanted volatiles in the lunar regolith, particularly the distribution, migration, and retentivity of H relevant to understanding the possible presence of water ice at the lunar poles. Hydrogen maps will be useful in separating the near surface geologic history (e.g., solar-wind implantation and micrometeorite bombardment history related to surface maturity) from the underlying crustal evolution, the knowledge of which is a required component of our total understanding of the planetary history of the Moon. The preliminary observations made here regarding correlations of epithermal* neutron counts with geologic features are intriguing and will require further study. Potential improvements to models of solar-wind fluence will assist

in mapping other volatiles in the regolith, particularly H-3, which along with H and water ice are some of the most promising potential lunar resources available on the Moon. Additional information contained in the original
Author
Chemical Composition; Lunar Maria; Lunar Resources; Lunar Rocks; Lunar Soil; Lunar Surface; Moon; Neutrons; Solar Wind

20000040504 Washington Univ., Dept. of Earth and Planetary Sciences, Saint Louis, MO USA
Thorium Enrichment within the Procellarum KREEP Terrane: The Record in Surface Deposits and Significance for Thermal Evolution
Jolliff, B. L., Washington Univ., USA; Gillis, J. J., Washington Univ., USA; Haskin, L. A., Washington Univ., USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 31-32; In English; See also 20000040479
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The nearside-farside structural and compositional asymmetry of the Moon was recognized during the early days of Apollo and the suggestion was made that the migration of mantle melts to the nearside would have been favored by early Earth-Moon orbital dynamics and nonuniform planetesimal bombardment. Recent global geochemical mapping by Lunar Prospector has provided additional data, particularly in the Th distribution, that strongly supports the notion of global, preferential melt migration, which led in part to the development of the Procellarum KREEP Terrane (PKT) [2-5]. The surface distribution of Th was then reshaped by basin-forming impacts into the PKT, especially the Imbrium impact, which was the last and largest to strike in that region. The Imbrium event probably excavated material from a partially molten zone deep in the crust and delivered Th-rich ejecta Moon-wide. A fundamentally important but poorly understood aspect of the global Th distribution is the concentration of Th in the subsurface rocks of the PKT crustal section. For example, depending on what assumptions are made, the PKT crustal section, which is about 12% of the crust and only about 1.2% of the whole Moon, may contain as much as 40% of the Moon's entire Th budget. Such a distribution of Th and related heat-producing elements would have had a profound effect on melting, mixing, and the thermal evolution of the PKT and the underlying mantle. In this abstract, we examine the compositions of terra formations within the PKT and relate them to some of the Th-bearing rock types known from the Apollo samples. It appears that the existence of the PKT may be a unifying concept for a number of petrologic and geochemical observations. From the initial Lunar Prospector gamma-ray spectrometer data(-about 5 deg. resolution) and from the preliminary low-orbit data, there appears to be a number of relatively hotter "spots" within the PKT in terms of Th concentration. Some of the hotter spots correspond to intermediate-sized craters that penetrated volcanic flows and excavated Th-rich, submare material, such as Aristarchus, Aristillus, and Kepler. Other spots, however, correspond to surficial formations that constitute mainly rough topography associated with Imbrium ejecta or circum-Imbrium ring mountains and do not necessarily imply the presence of exposed KREEP basalts. The Fra Mauro Formation south of Copernicus toward the Apollo 14 site and regions of the Alpes Formation southwest of Copernicus in the vicinity of Reinhold lie within the most prominent hotspot; here them concentration is consistent with that found in the Apollo 14 soils (about 12-13 ppm) when the proportions of Fra Mauro Formation and mare basalt are considered. The area between Copernicus and Kepler and northwest of Copernicus in terra extending to the Carpathians is similarly enriched in Th. The Apennines from Eratosthenes toward the Apollo 15 site contain elevated Th concentrations, as does the northwestern quadrant of circum-Imbrium terra, especially between (but not including) La Condamine and Plato, and in the region northwest of the Jura mountains extending southward past Mairan to the Gruithuisen-Domes region. Within the main topographic rim of Imbrium, the Apennine Bench formation south of Archimedes appears to have relatively elevated Th concentration. Comparing the map of Th distribution to a digital-elevation map derived from Clementine altimetry, it appears that most of the areas richest in Th occur where the surface is elevated relative to the majority of PKT volcanic plains. Not all rough topography within the PKT has such elevated Th, however. Based on an analysis of the 5 deg. data, and using the calibration of, the mean Th concentrations for mainly volcanic-resurfaced terrain and rugged terrain are similar (about 5.5 ppm). This occurs in part because craters that penetrated mare basalt excavated Th-rich material. Even so, there appear to be extensive areas of volcanic resurfacing that have no obvious extrinsic source of Th-rich material, suggesting that the basalts, themselves, may contain as much as 5-6 ppm Th. High-FeO concentrations (18 to is greater than 20 wt%) indicate that these are not KREEP basalts but mare basalts. If so, this is surprising because most of the Apollo-sampled mare basalts have very low-Th (typically is less than 2 ppm). A variety of Th-rich materials occur in the sample collection, particularly in the samples from the Apollo 12,14, and 15 sites. The most abundant Th-rich rock types are the mafic impact-melt breccias, which although found at all sites, are most abundant at Apollo 14, where they dominate the rock samples and make up some 40% of the rock particles in the soil. These have Th concentrations ranging up to about 30 ppm and averaging about 18 ppm. The Apollo 14 soils contain about 13 ppm Th, reflecting the high abundance of this melt-breccia component. At the nearby Apollo 12 site, the rocks consist mainly of mare basalts, and these have low-Th concentrations, mostly is less than 1 ppm. Among the nonmare rocks, however, a few such as complex breccia 12013 contain a variety of evolved lithologies and represent potential sources of

Th-rich components ranging from 17 to 50 ppm. A single fragment of KREEP basalt from the Apollo 12 soil contains about 50 ppm Th. Despite the identification of highly Th-enriched lithologic components at the Apollo 12 site, the soils there vary linearly in composition so as to extrapolate to a moderate Th KREEP-basalt component or a composition like that of the Fra Mauro formation as reflected by Apollo 14 soil (14 ppm Th at 10 wt% FeO). The nearby Lansberg Crater (39-km diameter) is a likely candidate to have delivered submare material such as buried Fra Mauro or Alpes material to the Apollo 12 site. Additional information contained in the original.

Author

Geochemistry; Kreep; Lunar Maria; Lunar Surface; Thorium; Volcanoes; Thermodynamic Properties; Lunar Soil

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Space Weathering in the Fine Size Fractions of Lunar Soils: Soil Maturity Effects

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The effects of space weathering on the optical properties of lunar materials have been well documented. These effects include a reddened continuum slope, lowered albedo, and attenuated absorption features in reflectance spectra of lunar soils as compared to finely comminuted rocks from the same Apollo sites. However, the regolith processes that cause these effects are not well known, nor is the petrographic setting of the products of these processes fully understood. A Lunar Soil Characterization Consortium has been formed with the purpose of systematically integrating chemical and mineralogical data with the optical properties of lunar soils. Understanding space-weathering effects is critical in order to fully integrate the lunar sample collection with remotely-sensed data from recent robotic missions (e.g., Lunar Prospector, Clementine, and Galileo) We have shown that depositional processes (condensation of impact-derived vapors, sputter deposits, accreted impact material, e.g., splash glass, spherules, etc.) are a major factor in the modification of the optical surfaces of lunar regolith materials. In mature soils, it is the size and distribution of the nanophase metal in the soil grains that has the major effect on optical properties. In this report, we compare and contrast the space-weathering effects in an immature and a mature soil with similar elemental compositions. For this study, we analyzed is less than 10 micron sieve fractions of two Apollo 17 soils, 79221 (mature, Is/FeO = 81) and 71061 (immature, Is/FeO = 14). Details of the sieving procedures and allocation scheme are given else where. The results of other detailed chemical, mineralogical, and spectroscopic analyses of these soil samples are reported elsewhere. A representative sample of each soil was embedded in low-viscosity epoxy, and thin sections (about 70nm thick) were obtained through ultra microtomy. The thin sections used for these analyses typically contained cross sections of up to 500 individual grains. The thin sections were studied using a JEOL 2010 transmission electron microscope (TEM) equipped with a thin window energy-dispersive X-ray (EDX) spectrometer. An individual thin section was selected from each soil, and for each grain in the section we determined (1) the elemental composition by EDX; (2) whether the grain was crystalline or glassy using electron diffraction and darkfield imaging; (3) the presence or absence of rims and accreted material; and (4) the distribution of nanophase Fe where present. Most of the categories are self-evident; however, we divide the agglutinate derived material into agglutinitic glass (glass with approximately the same composition as the bulk soil that contains nanophase Fe with or without vesicles) and agglutinate fragments, which are composed of crystalline grains and agglutinitic glass. Lithic fragments are defined as polymineralic grains with no glass. Pyroxene grains have been divided into high- and low-Ca groups. As expected, there are a number of differences in the petrography of the is less than 10-microns fractions of 79221 and 71061 given the great difference in their respective maturities, but we focus here on two major distinctions: agglutinate content and the number of grains with micropatina. Slightly over 50% of the particles in 79221 consist of agglutinitic glass and agglutinate fragments, while the remainder are predominantly crystalline mineral grains. The agglutinic glass particles contain abundant nanophase Fe and vesicles. Angular particles are rare, with most showing smooth, rounded exteriors, of the mineral grains analyzed thus far, over 90% of the grains have amorphous rims that contain nanophase Fe (these rims are believed to have formed by vapor deposition and irradiation effects). The nanophase Fe in these rims probably accounts for a significant fraction of the increase in Is/FeO measured in these size fractions. In addition to the rims, the majority of particles also show abundant accreted material in the form of glass splashes and spherules that also contain nanophase Fe. In stark contrast, the surfaces of the mineral grains in the 71061 sample are relatively prisitine, as only about 14% of the mineral grains in the sample exhibited amorphous rims. Furthermore, the mineral particles are more angular and show greater surface roughness than in the mature sample. Accreted material on particle surfaces is rare. Agglutinitic material is a major component of the 71061 sample; however, nanophase Fe and vesicles are not as well developed as in the 79221 sample. It is now recognized that nanophase Fe is probably the main agent in modifying the optical properties of lunar soil grains. The most important result of this study is the observation that

in the fine size fractions of mature soils, nearly every grain has nanophase Fe within 100 run of the particle surface. (Additional Information contained in original)
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Agglutination; Chemical Composition; Lunar Rocks; Lunar Soil; Regolith; Weathering; Selenology

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The Deepest Lunar SPA Basin and its Unusual Infilling: Constraints Imposed by Angular Momentum Considerations
Kochemasov, G. G., Academy of Sciences (USSR), USSR; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 34; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Successful applications of planetary wave tectonics for predicting the shapes of small celestial bodies (asteroids, satellites), Phobos' rippling, the dumbbell shape of martian spheres, and fractionated martian crust, allow us to extend this method to lunar tectonics and related it to the chemistry of the enigmatic South Pole Aitken Basin. The accepted origin by many (but not all) planetologists is an impact hypothesis of the SPA basin; we alternatively, consider it as a part of a global lunar sectoral structure centered in the Mare Orientale. Sectoral structures of celestial bodies are a result of interference of standing inertia-gravity waves proceeding in four directions (ortho- and diagonal). These warping planetary waves arise in them as a result of their movements in elliptical orbits with periodically changing curvatures and cosmic accelerations. Fundamental waves of long 2-pi-R (R = body radius) produce tectonic dichotomy; waves of long pi-R (the first obertone) produce sectoring; and smaller waves length of which is proportional to orbital periods produce tectonic granulation. Segments, sectors, and granulas. of differing radius-vectors (risen + and fallen - tectonic domains) tend to equalize their angular momenta by density of infilling matter. That is why oceanic and mare basins normally are filled with denser material (basalts) than lighter highlands. On Earth one observes six antipodal centers of pi-R-structures (three pairs: (1) Equatorial Atlantic; (2) New Guinea; (3) The Pamirs-Hindukush; (4) Easter Island; (5) Bering Strait; and (6) Bouvet Island.) that regularly converge by common algorithm fallen normally oceanic and risen normally continental blocks. Around the Pamirs-Hindukush center, for example, are placed two differently risen sectors (African + +, Asian +) separated by 2 differently subsided ones (Eurasian -, Indoceanic - -). The six centers form vertices of an octahedron inscribed in the terrestrial sphere. The first antipodal pair lies in the equatorial zone, the second in tropics, and the third in the polar ring zones stressing profound connection between cosmic position of a body and its internal structure. On the Moon we now know four antipodal centers of pi-R-structures: (1) Mare Orientale; (2) Joliot-Maxwell-Giordano Bruno area; (3) Daedalus-Heaviside; and (4) Ptolemaeus-Flammarion. Around the Mare Orientale, like on Earth, are two opposite differently subsided sectors (Procellarum Ocean -, SPA basin --) separated by two differently uplifted ones (+ +, +), one of which (+ +) is the highest lunar highland region. Observing the angular momentum preservation law, the highest sector is composed of anorthosites, and even of the less dense Na-rich varieties of this rock. The deepest SPA basin sector with an abrupt northern boundary separating it from the highest sector (like the Indoceanic sector contacts with the highest African one) must be filled with denser rocks than the shallower Procellarum ocean sector filled-with basalts and Ti basalts. The Clementine spectral data show a presence of orthopyroxene and an absence of plagioclase, favoring some dense ultrabasic rock. The obvious tendency to approach this type of rock would be to observe it in the Luna 24 samples from also very deep Mare Crisium. In fragments there prevail pyroxene and VLT-ferrobasalts (Mg-poor). Unusual melt matrix breccia with globules and crystals of Fe metal were also found. In SPA basin fill some admixture of Fe metal and troilite could be also predicted. With this rock in mind we can construct a ladder of ascending UB-basic rock densities against descending topography: KREEP basalts, low-Ti basalts, high-Ti basalts, VLT-Mg-poor ferrobasalts, and pyroxene (with metal) rich rocks. On Earth, the density of basalt floods (their Fe/Mg ratio) also increases in the same direction. The lunar and terrestrial sectoral structures as well as tectonic dichotomies were formed in the very beginning of their geological histories.
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Angular Momentum; Basalt; Lunar Craters; Lunar Maria; Tectonics; Selenology; Lunar Rocks

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North-Polar Lunar Light Plains: Ages and Compositional Observations
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Varying surface ages of lunar light plains in northern-nearside latitudes indicate an origin of these smooth terrae units not exclusively related to Imbrium and/or Orientale impact ejecta. and subsequent processes. Multispectral data seem to support a more diversified history for many of these plains. The nature, ages, stratigraphic position, composition, and mode of emplacement of lunar light plains have been discussed with controversy for more than three decades. Covering about 5% of the lunar terra sur-

face, the relatively low albedo plains are the most distinctive terra landforms after the more crater-like ejecta of the fresh basins. Morphological properties, like their smoothness, lower crater densities, their superposition on the "Imbrian Sculpture," and frequent occurence as crater fill, are mare-like. Other features, such as relative (compared to mare basalts) high-albedo and geological/stratigraphical setting, are more highland-like. Not surprisingly, light plains were seen as both volcanic and impact related deposits. The Cayley Plains, a type locality in the central-nearside highlands, has been chosen as the landing site of the Apollo XVI mission partly to help resolve these interpretations. The astronauts collected samples - highly brecciated rocks - and concluded that the Cayley was indeed of impact origin. These findings have been extrapolated to stratigraphically similar plains units on the nearside, focusing on the Imbrium and Orientale impacts as responsible events for resurfacing terrae environment to form light plains. In addition, theoretical modeling mechanisms have been provided that could explain how basin and crater ejecta were able to make up for the smoothness of light plains by stirring up local material through secondary-impact related processes, or mega impact induced seismic shaking. However, subsequent age determinations showed that some light plains cannot be correlated to the Imbrium or Orientale event, the last two basin-forming impacts to occur on the Moon that had the ability to resurface areas thousands of kilometers away from their target site. An unknown form of highland volcanism was proposed as a contributing process in light-plains formation. The question remained unanswered whether processes other than impact-related processes were responsible for the formation of these enigmatic geological units, and how these processes might have worked. Focusing on light plains in the northern-nearside highlands, a chronological approach has been chosen to address these questions, and compositional information from multispectral data has been included to support our investigations. Mapping the northern-nearside light plains, earlier workers have recognized the stratigraphically and morphologically obvious bimodal distribution of smooth terrae units north and northeast of Mare Frigoris. The older of these plains (IP-1; based on stratigraphic relations and surface-crater densities) show gradual transition into (Imbrium-impact) Fra Mauro Formation units, whereas the younger unit (IP-2) cannot be related to this relatively nearby impact event. Instead, it was proposed that the impact of Orientale, despite the fact it is several thousand kilometers away, could have smoothed these terrae units with its ejecta stirring up local highland material, an interpretation that seems to be not very compelling, as these younger plains show quite homogeneous surfaces over extended areas. Determining precise surface ages of smooth surface units should help with getting a chronology of plains emplacement in these latitudes. Based on the principle of crater-frequency distribution measurements and adjusting the cumulative crater-frequency distributions to a lunar standard distribution, and "fixing" the Orientale and Imbrium event with the absolute ages obtained by radiometric measurements of Apollo samples to this distribution, one is able to determine reliable absolute-age data for surfaces after measuring the crater-frequency distribution on it. As the decline in impact frequency is rather steep during the first billion years in lunar history, the discrimination between surfaces of different age can be determined to a relatively high degree of reliability. Forty-five smooth plains areas north and northeast of Mare Frigoris have been mapped for crater frequency. Some light plains have been disturbed by secondary cratering impact to a degree that made deduction of reliable age data impossible, so only 27 crater counts yielded useful absolute ages. A histogram of how these plains ages are distributed is shown. For reference, the Imbrium and Orientale events are marked at their respective time of impact at 3.90 Ga, and 3.84 Ga respectively. There are several observations that can be made in this distribution: (1) the ages do not cluster around one or two peaks; instead, the majority of light plains formed in a rather broad time span between 4.0 Ga and 3.65 Ga; (2) there are some light plains that seemed to have formed before the Imbrium impact event; (3) light plains formation peaked at the time of, or shortly after, the Orientale impact event; (4) light plains formation continued a significant time span after the Orientale basin impact; (5) there are light plains ages that are remarkably younger than the age of the Orientale basin, exposing surface ages that are only slightly older than the mare-basalt ages of their neighboring units at the eastern margin of Mare Frigoris; and (6) the time span of light-plains surface formation seems to extend from around 3.95-4.0 Ga to 3.60-3.65 Ga. (Additional information contained in original)

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Composition (Property); Craters; Ejecta; Landforms; Lunar Maria; Lunar Surface; Lunar Topography; Selenology; Geochronology

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Lunar Meteorites and Implications for Compositional Remote Sensing of the Lunar Surface

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Lunar meteorites (LMs) are rocks found on Earth that were ejected from the Moon by impact of an asteroidal meteoroid. Three factors make the LMs important to remote-sensing studies: (1) Most are breccias composed of regolith or fragmental material; (2) all are rocks that resided (or breccias composed of material that resided) in the upper few meters of the Moon prior to launch and (3) most apparently come from areas distant from the Apollo sites. How Many Lunar Locations? At this writing (June 1999), there are 18 known lunar meteorite specimens. When unambiguous cases of terrestrial pairing are considered, the number of actual

LMs reduces to 13. (Terrestrial pairing is when a single piece of lunar rock entered Earth's atmosphere, but multiple fragments were produced because the meteoroid broke apart on entry, upon hitting the ground or ice, or while being transported through the ice.) We have no reason to believe that LMs preferentially derive from any specific region(s) of the Moon; i.e., we believe that they are samples from random locations. However, we do not know how many different locations are represented by the LMs; mathematically, it could be as few as 1 or as many as 13. The actual maximum is is less than 13 because in some cases a single impact appears to have yielded more than one LM. Yamato 793169 and Asuka 881757 are considered "source-crater paired" or "launch paired" because they are compositionally and petrographically similar to each other and distinct from the others, and both have similar cosmic-ray exposure (CRE) histories. The same can be said of QUE 94281 and Y 793274. Thus the 13 meteorites probably represent a maximum of 11 locations on the Moon. The minimum number of likely source craters is debated and in flux as new data for different isotopic systems are obtained. Conservatively, considering CRE data only, a minimum of about 5 impacts is required. Compositional and petrographic data offer only probabilistic constraints. An extreme, but not unreasonable viewpoint, is that such data offer no constraint. For example, if one were to cut up the Apollo 17 landing site (which was selected for its diversity) into softball-sized pieces, some of those pieces (e.g., sample 70135) would be crystalline mare basalts like Y 793169 whereas others (e.g., sample 73131 would be feldspathic regolith breccias like MAC 88104/ 88105. However, nature is not so devious. Warren argues that LMs come from craters of only a few kilometers in diameter. If so, even though CRE data allow, for example, that ALHA 81005 and Y 791197) were launched simultaneously from the same crater, the probability is nevertheless low because the two meteorites are compositionally and mineralogically distinct. Thus, within the allowed range (5-11) for the number of locations represented by the LMs, values at the high end of the range are probably more likely. Mare Meteorites: Three LMs consist almost entirely of mare basalt. Two, Y 793169 and Asuka 881757, are unbrecciated, low-Ti, crystalline rocks that are compositionally and mineralogically similar (but not identical) to each other; they probably derive from a single lunar-mare location. The third, EET 87521/96008, is a fragmental breccia consisting predominantly of VLT mare basalt. Thus, these LMs probably represent only two lunar mare locations. The basaltic LMs have mineral and bulk compositions distinct from Apollo mare basalts. The petrography of Calcalong Creek has not been described in detail, but compositionally it is unique in that it corresponds to a mixture (breccia) of about one-half feldspathic material (i.e., the mean composition of the feldspathic lunar meteorites, below), one-fourth KREEP norite, one-fourth VLT mare basalt (like EET 87521), and 1% CI chondrite. With 4 micro g/g Th and correspondingly high concentrations of other incompatible elements, it is the only lunar meteorite that is likely to have come from within the Procellarum KREEP Terrane (PKT). Yamato 793274 and QUE 94281 are together distinct in being fragmental breccias containing subequal parts of feldspathic highland material and VLT mare basalt. Jolliff et al. estimate a mare to highland ratio of 54:46 for QUE 94281 and 62:38 for Y 793274; this difference is well within the range observed for soils collected only centimeters apart (in cores) at interface site like Apollo 15 and 17 [11]. Although the two meteorites were found on opposite sides of Antarctica, they are probably launch-paired. The strongest evidence is that the pyroclastic glass spherules that occur in both are of two compositional groups and the two groups are essentially the same in both meteorites. Yamato 791197 is nominally a feldspathic lunar meteorite (below), but among FLMs, it probably contains the highest abundance of clasts and glasses of mare derivation. As a consequence, its composition is at the high-Fe, low-Mg end of the range for FLMs and is not included in the FLM average of Table 1. Its composition is consistent with about 10% mare-derived material. Similarly, the two small (Y 82) pieces of Y 82192/82193186032 are more mafic than the large (Y 86) piece, probably as a result of about 7% mare-derived material. All Apollo missions went to areas in or near the PKT, and, consequently, all Apollo regolith samples are contaminated with Th-rich material from the PKT. At the nominally "typical" highland site, Apollo 16, about 30% of the regolith (is less than 1-mm fines) is Th-rich ejecta from the Imbrium impact and about 6% is mare material probably derived from mare basins. Thus Apollo 16 regolith is not typical of the highlands. Among Apollo rocks, the compositions of the FLMs correspond most closely to the feldspathic granulitic breccias of Apollo 16 and 17. (Additional information is contained in original)

Author

Ejecta; Lunar Maria; Lunar Rocks; Lunar Surface; Meteorites; Moon; Regolith; Meteoritic Composition; Lunar Composition

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Iron Abundances on the Moon as Seen by the Lunar Prospector Gamma-Ray Spectrometer

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Measurements of global-Fe abundances on the Moon are important because Fe is a key element that is used in models of lunar formation and evolution. Previous measurements of lunar Fe abundances have been made by the Apollo Gamma-Ray (AGR) experiment and Clementine spectral reflectance (CSR) experiment. The AGR experiment made direct elemental measurements

for about 20% of the Moon. However, these measurements had large uncertainties due mostly to low statistics and an absence of thermal neutron data (see below). The CSR-derived Fe data has much better coverage (100% coverage equatorward of +/-70 deg. latitude) and spatial resolution (about 100-m surface resolution vs. about 150-km surface resolution for the AGR data), but there have been questions regarding the accuracy of these data far from the Apollo landing sites. Here we present preliminary estimates of the relative Fe abundances using the Lunar Prospector (LP) gamma-ray spectrometer (GRS). While these data are important and useful by themselves, the ultimate goal of this study is to combine the LP Fe data with the CSR data to obtain a better calibrated and more accurate picture of the Fe abundances on the Moon. to derive Fe abundances, we are using two gamma ray lines near 7.6 MeV. These gamma-rays are produced by thermal neutron capture. Here, Fe nuclei absorb thermal neutrons, become energetically excited, and then de-excite with the production of gamma-rays. Because this process depends upon thermal neutrons, the measured flux of 7.6 MeV gamma-rays is proportional not only to the Fe abundances, but also to the thermal neutron number density. Here, we use measurements from the LP neutron spectrometer (NS) to correct for this thermal neutron effect. As seen elsewhere, this correction is quite large as the thermal neutron count rate varies over the Moon by a factor of 3. Many considerations need to be taken into account to make sure an appropriate correction is applied. These include (1) converting the measured thermal neutron flux into a true thermal neutron number density; (2) accounting for composition effects such as thermal neutron absorption due to Gd and Sm; and (3) equating the instrument surface resolution for the GRS and NS. to take care of most of these considerations, detailed calculations need to be carried out. Yet with some assumptions, a preliminary estimate of the thermal neutron correction can be obtained. to relate the measured thermal neutron flux to the thermal neutron number density, we assume that the thermal neutron energy distribution is Maxwellian and independent of soil composition. With this assumption, the measured neutron flux, F, is proportional to both the neutron number density, n, and the square root of the mean lunar surface temperature, T: F varies as n(square root of T). Here, the measured neutron flux also includes epithermal neutrons that contribute to the overall neutron number density. to obtain a global surface temperature, we have used a mean equatorial surface temperature of 250 K and scaled it as cos(latitude)((exp 1/4). Because this scaling results in very low temperatures at the poles, a low temperature cutoff has been set at 130 K. For this study, we have used the high-altitude GRS data to obtain the relative Fe abundances. We correct for the thermal neutron effect using the low-altitude summed thermal and epithermal neutron data smoothed to the footprint of the high-altitude GRS data set. The resulting relative Fe abundance map is shown. A comparison between this map and the published CSR Fe map shows a good correspondence. This correspondence is shown more quantitatively in a scatter plot between the two datasets. Here, the CSR data has. been smoothed to the footprint of the GRS data. As seen, for most of the Moon, there is a good correlation between the datasets with a correlation coefficient of 0.93. One region of some disagreement is in the South Pole Aitken (SPA) Basin (red points), where the CSR measurements correspond to a about 20% higher count rate than is observed with the GRS data. In contrast to the corrected GRS data, the blue points show the GRS data before the thermal neutron correction is applied. The correlation coefficient between the uncorrected GRS data and the CSR data is poorer at 0.73. In addition, the spread of the GRS data at a given CSR abundance (about 5 channels) is almost as large as the entire dynamic range of the uncorrected count rate (about 6 channels), which implies that there are large uncertainties in the uncorrected data. Because there are many assumptions leading to the results portrayed in Fig. 1, the uncertainties of these data are not yet known. For example, it is not clear if the discrepancy seen in SPA is real or is some effect of the simplified data-reduction technique. Even so, we are demonstrating the ability to compare LP and CSR Fe datasets and show that they may indeed agree quite well. Additional information is contained in the original

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Abundance; Data Reduction; Iron; Moon; Lunar Composition; Lunar Crust; Selenology

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Discrimination Between Maturity and Composition from Integrated Clementine UltraViolet-Visible and Near-Infrared Data

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The Clementine UV-VIS dataset has greatly improved our understanding of the Moon. The UV-VIS camera was limited to five spectral channels from 415 to 1000 nm. The Clementine near-infrared (NIR) camera was designed to complement this spectral coverage. The NIR filter at 2000 run allows the discrimination between olivine and pyroxene within identified mare basalts. In addition, we will show that the integration of Clementine UV-VIS and NIR datasets allows a better evaluation of the ferrous 1-micron absorption band depth and gives access to the slope of the continuum. The discrimination between maturity and FeO composition can be achieved by a principal component analysis performed on spectral parameters. We selected 952 Clementine

UV-VIS and NIR images to compute a multispectral cube covering the Aristarchus Plateau. Aristarchus Plateau is one of the most heterogeneous areas on the Moon. Highland-type materials, mare basalts, and dark mantle deposits have previously been mentioned. The mosaic represents a set of about 500 x 600 nine-channel spectra. UV-VIS filters at 415, 750, 900, 950, and 1000 run were calibrated using the ISIS software. We applied the reduction method described elsewhere to reduce the NIR filters at 1100, 1250, 1500 and 2000 nm. Absolute gain and offset values were refined for the NIR images by using eight telescopic spectra acquired as references. With this calibration test, we were able to reproduce the eight telescopic spectra with a maximum error of 1.8%. The integration of UV-VIS and NIR spectral channels allows the visualization of complete low-resolution spectra. In order to investigate the spectral effects of the space-weathering processes, we focused our analysis on a small mare crater and its immediate surroundings. According to the small size of the crater (about 2-km) and its location on an homogeneous mare area, we can reasonably assume that the content in FeO is homogeneous. The impact event has induced a variation of the maturity of the soil by excavating fresh material. Graphs displays five absolute reflectance spectra extracted from this area. One graph displays the same spectra divided by a continuum, which is considered to be a right line fitting the spectra at 0.75 and 1.5 micron. Spectrum 1 is extracted from the brightest part of the crater interior, and spectrum 5 is extracted from the surrounding mare material. Spectra 2, 3, and 4 are extracted from intermediate distances between the two areas. The 1-and-2 micron absorption band depths and the overall reflectance increase from spectrum 5 (corresponding to a mature area) to spectrum 1 (the most immature area). Conversely, the continuum slope decreases from spectrum 5 to spectrum 1. These three spectral effects of maturity have also been identified on laboratory spectra of lunar samples. Most of the lunar soils exhibit a signature near 1 micron. This absorption band is due to the presence of Fe2+ in mafic minerals such as orthopyroxene, clinopyroxene, and olivine. In the case of Clementine UV-VIS data alone, the depth of the 1-micron feature is evaluated by the 950/750-nm reflectance ratio. This ratio combined to the reflectance at 750nm has been used to evaluate the global content in FeO of the lunar surface. Near-infrared data makes a more precise evaluation of the 1 micron band depth possible by providing the right side of the band. The continuum in the vicinity of the band can be evaluated by an arithmetic mean or a geometric interpolation of both sides of the band, which are taken at 750 and 1500nm. The geometric interpolation is less sensitive to residual calibration uncertainties. With this method, the 1-micron absorption band depth for the Aristarchus; Plateau can be refined by as much as 10%. The difference is maximum on Fe-poor, highland-type materials. Similarly, the NIR data provide the possibility to investigate the continuum slope of the spectra. The continuum slope is a key parameter in any spectral analysis. The continuum slope variations seem to be mainly dominated by maturity effects, as suggested by the high correlation with the independent evaluation of maturity (OMAT parameter). We have also found a good correlation between the continuum slope and the OMAT parameter on laboratory spectra of lunar samples of the J. B. Adams collection. The discrimination between maturity effects and composition effects can be achieved by using a principal component analysis (PCA) on three spectral parameters, which are the reflectance at 0.75 micron the depth of the 1-micron feature, and the continuum slope. These parameters are mostly affected by maturity and FeO content. The effects of various glass content are assimilated to maturity. The aim of the PCA is to decorrelate the FeO content and maturity effects in the three input parameters. The integration of UV-VIS and NIR datasets allows for a better understanding of the spectral properties of the lunar surface by giving access to key parameters such as the 1 and 2-micron band depths and the continuum slope. The continuum slope can be combined with the depth of the mafic 1-micron absorption feature and the reflectance at 750 nm to discriminate between maturity and composition. NIR images of the sample return stations will be very interesting to refine absolute FeO content and maturity evaluations. Additional information is available in original.

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Iron Oxides; Lunar Geology; Lunar Rocks; Lunar Soil; Lunar Surface; Maria

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Topographic-Compositional Relationships within the South Pole Aitken Basin

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The South Pole Aitken (SPA) Basin is an immense structure that dominates the geology of much of the farside of the Moon. Its floor is composed mostly of impact deposits, though it also has numerous relatively small regions of mare basalt. The basin floor exhibits a lower albedo and higher mafic mineral abundance than the surrounding highlands [I]. The origin of this mafic anomaly is a major question in lunar geology. Hypotheses for the presence of the mafic anomaly were briefly reviewed in [2] and include mare deposits mixed and obscured by basin or crater ejecta (cryptomaria), a large impact melt sheet that may have differentiated, exposed lower crustal material, and a significant component of excavated mantle. A study of mineralogy as revealed in Clementine UV-VIS imagery for limited portions of the basin found a predominantly low-Capyroxene (noritic) character [2], ruling out cryptomaria as an important contributor to the mafic enhancement. A few small cryptomaria, revealed by dark-halo impact

craters and light plains units with high-FeO contents, have been found in SPA; however, it appears that extensive cryptomaria are lacking in this basin. The uniformly noritic lithology within SPA led to favor exposed lower crust or a homogenized melt sheet as the explanation for the mafic anomaly. Models of basin formation predict that a basin the size of SPA should have excavated through the entire lunar crust (assuming nonoblique impact), potentially exposing or mixing a large component of material from the mantle. Comparison of SPA floor FeO and Ti02 (derived from Clementine UV-VIS observations) and also Th (from Lunar Prospector) with model-mantle chemistries appears to be consistent with a mixture of approximately equal proportions of lower-crust and mantle material. In the present study, we examine the relationship between the basin's topography and composition in order to provide further insight on the origin of the basin floor material. Data: Clementine UV-VIS data at 1-km/pixel spatial resolution were placed in an orthographic projection centered on the basin (55S, 180E). Maps of Fe and Ti abundance were produced using the spectral algorithms. A map of topography derived from Clementine laser altimeter measurements was retrieved from the Planetary Data System Web site [61 and reprojected to match the UV-VIS image and elemental maps. Findings and Discussion: We find an inverse correlation between topography and FeO content for the basin interior. The correlation coefficient between elevation and [1/(FeO)] is aboutO.7. A typical east-west compositional profile across the basin is shown compared to a model profile generated by a linear fit to the data. The occurrence of greater FeO contents at greater depths could be explained in several ways. The magma ocean model for the formation of the lunar crust predicts a crust that becomes more Fe rich with depth, so in SPA we may be seeing an exposed crustal column. An undifferentiated melt sheet composed of such a stratified crustal material is lower in FeO. The excavation of the SPA cavity would have been a massive unroofing event that could have triggered significant mafic igneous activity through pressure-release melting. The melts that were generated would tend to erupt and or collect in the low-elevation central portion of the basin. At higher elevations, progressively smaller quantities of magma and greater impact dilution with underlying more-felspathic rocks might lead to the observed correlation between elevation and Fe content. It is interesting to note that KREEP basalts, which may have originated in a similar manner in the Imbrium Basin, possess FeO of roughly 12 wt%, comparable to much of the floor of SPA.
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Iron Oxides; Lunar Geology; Lunar Maria; Lunar Topography; Lunar Composition; Structural Basins

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The Interior of the Moon, Core Formation, and the Lunar Hotspot: What Samples Tell Us
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Remotely-gathered Lunar Prospector data have demonstrated the existence of a lunar "hotspot" on the near side of the Moon. This hotspot contains relatively high abundances of KREEPy incompatible trace elements (i.e., Th). It is generally accepted that primordial KREEP or urKREEP represents the residual liquid after the crystallization of a lunar magma ocean (LMO). The crystalline products from the LMO formed the source regions for the mare basalts. Lunar volcanic glasses cannot be genetically related to the crystalline mare basalts, and experimental petrology indicates they are derived from greater (> 400 km) depths than the mare basalts. Questions to be addressed include: (1) What was the extent of LMO melting? (2) What is the composition of the core? (3) Are there distinct geochemical reservoirs in the Moon? (4) Is there evidence of garnet in the lunar interior? (5) What caused the formation of the lunar hotspot? The scale of the LMO has been suggested to be whole Moon melting or only the outer about 400 km. If whole Moon melting is invoked, then differentiation of the Moon into a flotation plagioclase-rich crust, a mafic mineral cumulate mantle, and a Fe-rich core is more easily facilitated. However, as pointed out, if the material that formed the Moon came primarily from the already-differentiated Earth mantle, there may not be enough Fe to form a metallic Fe core on the Moon. Authors have suggested that the lunar core is made up of dense, ilmenite-rich, late-stage cumulates from the LMO. This can be tested by examining the Zr/Hf ratios of mare basalts and, where possible, the volcanic glasses. Partition coefficients for Zr and Hf in ilmenite are 0.29-0.32 and 0.4-0.43, respectively, with Zr being less compatible. Therefore, extraction of an "ilmenite" core would have a profound effect on the Zr/Hf ratio of urKREEP as ilmenite is a late-stage fractionating LMO phase. Assuming either a "primitive mantle" or chondritic starting material with a Zr/Hf ratio of 36-37, ilmenite extraction will increase this ratio in the residual liquid. Conversely, derivation of a melt from a source rich in ilmenite will produce a melt of lower Zr/ Hf ratio. Hughes and Schmitt defined a mean Zr/Hf for KREEP of 41.0 +/- 0.4, about 39 for Apollo 15 basalts, and 30-32 for Apollo 11, 12, and 17 basalts, with the decreases in Zr/Hf broadly correlating with La/Yb. However, literature data for Apollo 15 KREEP basalts and the KREEP-rich Apollo 14 mare basalts exhibit little variation in Zr/Hf from 36, indicating the KREEP component did not result from a major fractionation of ilmenite and suggesting that the lunar core is probably metallic in overall composition. With volcanic glasses being unrelated to the mare basalts and derived from greater depths, compositional comparisons allow their source regions to be compared. Highly siderophile elements Au and Ir are more abundant in the glasses relative to the basalts. As these elements are generally incompatible in silicate minerals, crystal fractionation experienced by the basalts will tend to

increase the Au and It abundances. Therefore, the glasses may be derived from a source enriched in highly siderophile elements such as the platinum-group elements (PGEs) represented by Ir, relative to the source of the basalts. This observation can be accommodated with the basalts being derived from the LMO cumulates and the glasses derived from a source that represents ”primitive Moon” that did not melt and, therefore, did not have its budget of PGEs and Au reduced through core formation. This can be tested by analyzing mare basalts and glasses for the PGEs. Although analytically challenging, the first PGE patterns in lunar samples were demonstrated that the source regions for the different Apollo 12 basalts could not be differentiated on the basis of PGE budgets, although the profiles are typical of silicate melts. Analysis of other trace-element data indicate that the high-field-strength elements can be used to differentiate between high- and low-Ti basalts. Also, the volcanic glasses were derived from a source with a higher Zr/Y ratio relative to the basalts, consistent with retention of garnet in the residue. If the glasses were derived from is greater than 400 km, garnet could be stable. It is concluded that the volcanic glasses were derived from a source that contained garnet, but escaped the melting that formed the LMO. The mare basalts were derived from the LMO cumulate pile. Basaltic samples from Apollo 14 exhibit a range in ITE. They also exhibit a range of ages from 4.33 Ga to 3.96 Ga with the older basalts being KREEP-poor and the younger being KREEP-rich. Prospector mapping has identified relatively high Th abundances in this area, suggesting a large KREEP component is present at or near the surface. LMO ”layer cake models” have residual urKREEP sandwiched between the mafic cumulate mantle and the plagioclase flotation cumulate crust. However, late-stage cumulates and the residual liquid will be more dense that the early mafic cumulates resulting in gravitational instabilities and overturn of the cumulate pile. This could transport urKREEP to the base of the LMO cumulate pile, but above the glass source region. The effect of Earth on the symmetry of the Moon has displaced the low-density crust, producing a thicker crust on the farside. This has produced an offset of the center of mass for the Moon toward Earth. It is suggested that the gravitational forces of the Earth pooled the urKREEP beneath at the base of the LMO on the lunar nearside. Heating through radioactive decay produced thermal instabilities, resulting in a plume of hot, KREEPy material rising adiabatically beneath the Apollo 14 site. The oldest Apollo basalts contain no evidence of a KREEPy component, suggesting diapiric rise of the KREEPy plume had not occurred at this time. Additional information contained in original.

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Kreep; Lunar Core; Lunar Geology; Moon; Volcanoes; Lunar Maria; Lunar Composition; Lunar Rocks; Lunar Evolution

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The Distribution of Anorthosite on the Lunar Farside

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There is much evidence to support the hypothesis that a giant impact on early Earth created the Moon and that a magma ocean was present on the young Moon. As the magma cooled and crystallized, plagioclase flotation could have produced the upper part of the Moon’s original crust. But how much of this original crust has survived to the present? Has it been entirely disrupted, or do portions remain relatively unchanged? Remote sensing studies of the lunar highlands, combined with analysis of lunar materials returned from known locations on the surface of the Moon, have allowed the determination of the lithologies present in many locations on the Moon. Our study of the distribution of the various lunar-highland rock types has revealed large-scale patterns that suggest the broad outlines of the evolution of portions of the lunar crust. Our previous efforts have used Earth-based spectra and Galileo SSI to study the lunar nearside. We have used Clementine UV-VIS data to extend our studies of the lunar highlands to the farside. Calibration of the Clementine UV-VIS data is essentially complete, and FeO and Ti02 values derived from the Clementine data have been derived from this well-calibrated data. In addition, Lunar Prospector data are now available in preliminary form and can add to our understanding of the composition of highlands units on the farside. We can use this combined dataset to (1) study the composition of farside highlands units; (2) identify and determine the distribution of anorthosite on the lunar farside; and (3) investigate the stratigraphy of the farside crust. The great majority of the Moon’s highlands surface is composed of only a few minerals, and these are easily distinguishable using reflection spectroscopy at wavelengths from the UV through visible light and into the near infrared. The mafic minerals pyroxene and olivine contain Fe that causes the minerals to absorb light with a wavelength near 1 micron In contrast, plagioclase feldspar does not absorb light near 1 micron, although plagioclase can show absorption of light near 1.25 micron if it has not been highly shocked by impacts. Through the use of Earth-based telescopic reflectance spectra, it is possible to determine the lithologies present in the area observed, typically from 2 to 6 km in diameter. The Galileo and Clementine spacecraft returned multispectral images of the Moon that, while of lower spectral resolution than Earth-based spot ’spectra, covered large areas of the Moon and used filters at wavelengths useful for determining the lithologies present. These spacecraft data have also been used to determine the abundance of FeO and Ti02 present in lunar surface materials. Other products, such as band-ratio maps, have been produced, and spectra have been extracted from coregistered image cubes. Lunar

Prospector has collected a large quantity of gamma-ray and neutron spectrometer data. While much of the data will require further processing before reliable quantitative interpretations can be made, some data from that mission have already been made available. In particular, the gamma-ray spectrometer counting data for Th, K, and Fe can be used to confirm and extend our knowledge of the composition of the lunar farside crust. A preliminary Th distribution map has been produced from the raw data by utilizing ground truth from the lunar landing sites. Noritic anorthosite and anorthositic norite are the predominant rock types at the surface of the nearside lunar highlands. Lesser amounts of anorthosite, norite, troctolite, and gabbroic rocks are also present. Studies of Earth-based reflectance spectra initially revealed the presence of anorthosite in isolated outcrops extending in a narrow band from the Inner Rook mountains in the west to the crater Petavius in the east. More recently, additional outcrops of anorthosite have been identified in the central peaks of some craters, such as Aristarchus, and in the northern and northeastern nearside . In most cases, these anorthosite deposits have been exposed by impacts that removed a more mafic overburden and raised them to the surface from deeper in the crust, for example in the peak rings of the Orientale, Humorurn, and Grimaldi Basins. Much of the nearside lunar highlands likely shares this stratigraphic sequence: a layer of pure anorthosite overlies a more mafic lower crust and is in turn overlain by a somewhat more mafic layer. Much anorthosite likely remains hidden by this surface layer on the nearside today. On the lunar farside, the giant South Pole Aitken (SPA) Basin shows a mafic anomaly that is the dominant compositional feature on the farside. At 2500 km in diameter, SPA (centered at 55S, 180E) is the largest unambiguously identified impact basin in the solar system. It is also the oldest identified lunar basin except possibly for Procellarum. There is a 13-km difference in elevation from the interior of the basin to the surrounding highlands. The interior exhibits a 7-10% FeO enrichment relative to the surrounding highlands, and portions of the interior exhibit enhanced Ti02 values [131. Portions of the interior also display elevated Th and K abundances. The high-FeO values found inside SPA drop off with increasing distance to the north of the basin. The region between 100E and 100W and between40N and 70N exhibits very low values of FeO and Ti02. The new Lunar Prospector data show very low-Th and-K abundances there as well. FeO maps produced from high spatial resolution Clementine data reveal extremely low FeO values near the crater Fowler (43N, 145W) in the vicinity of the Coulomb-Sarton Basin. We interpret these data as indicating a region in which pure anorthosite is dominant. Many areas in this region appear to contain nothing but anorthosite. Between SPA and the far north, the data generally indicate intermediate FeO values and low Th values. Additional information is contained in original.

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Anorthosite; Iron Oxides; Lunar Crust; Lunar Maria; Lunar Rocks; Lunar Soil; Mineralogy; Moon; Lunar Evolution; Selenology

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The Moon as a Spectral Calibration Standard Enabled by Lunar Samples: The Clementine Example

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Special calibration of Clementine data relies on the Apollo 16 site and laboratory measurements of mature soil 62231.The process produces calibrated spectra reflectance factors. What color is the Moon? A reflectance spectrum is essentially a measure of how much radiation incident on a surface (solar radiation) is reflected and how much is absorbed at each wavelength. to the eye the Moon is gray-white, but to photoelectric instruments it is various shades of red - that is, it exhibits an increase in brightness with wavelength. In the near-infrared there are absorptions diagnostic of minerals superimposed on the Moon's redness. For the Moon and other rocky bodies such as asteroids, most of the detectable absorptions arise from ferrous iron in various crystallographic sites. The wavelength, shape, and strength of these absorptions identify the minerals present, and allow their abundances to be estimated. Accurately measuring these diagnostic mineral absorptions with remote detectors requires not only a quality instrument, but also excellent electronic calibration and either direct measurement of the light source (the Sun) or a proxy, or a well-known reference standard illuminated by the same light source. In the laboratory a white reference such as halon (or commercial Spectralon), is used which in turn has been extensively calibrated relative to a known radiance. In space, or at the telescope, a separate reference must be found to mimic solar radiation and to eliminate instrumental and atmospheric effects. Radiation from stars to a first order follows a black body spectral curve with multiple emission and absorption lines superimposed. Because stellar lines vary with spectral type, and very few stars are really solar-like, it is actually quite difficult to use stars as spectral standards. The Moon is a nearby atmosphereless body that reflects solar radiation. Because the Moon's surface itself does not change with time (at least within our lifetimes), it provides an excellent reference standard. The calibration challenge then reduces to identifying an area on the Moon whose measurable properties are exceptionally well known. The return of lunar samples allows their properties to be measured accurately in Earth-based laboratories. Since the samples were collected from known areas on the surface of the Moon, carefully selected samples can be used to represent the properties of that area. For Clementine data, the Apollo 16 site was chosen as a calibration target because it is a relatively homogeneous area with no nearby units of a significantly differ-

ent material. Since all remote data are acquired as bidirectional reflectance, we use i = 30 deg., e = 0 deg as the standard geometry. The calibration steps used and the assumptions made are discussed briefly below. Additional information is contained in original. Author

Calibrating; Lunar Soil; Moon; Spectra; Reflectance

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Regional Dark Mantle Deposits on the Moon: Rima Bode and Sinus Aestuum Analysis

Pinori, S., Consiglio Nazionale delle Ricerche, Italy; Bellucci, G., Consiglio Nazionale delle Ricerche, Italy; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 49-50; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Regional pyroclastic deposits on the Moon usually are located on mare basins borders, blanketing adjacent highlands. We present the study of two Dark Mantle Deposits (DMD): Rima Bode and Sinus Aestuum. The statistical approach allows us to identify not only the dark mantle terrain, but also some areas spectrally different from the DMD that we have interpreted as a mixing of DMD and the neighboring soils. The data have been obtained at the 1.5-m telescope of Sierra Nevada Observatory (Granada, Spain) using an imaging spectrometer working in the 0.4-1.0-micron spectral range, corresponding to 96 spectral bands. The spectra have been normalized to Mare Serenitatis (MS2) average spectrum. Two different statistical procedures have been employed to analyze the two regions and to discriminate between the different geologic units, the Pixel Purity Index (PPI) and the Spectral Angle Mapper (SAM). The PPI is a method of finding the most ”spectrally pure,” or extreme, spectra in multispectral images. The PPI is computed by repeatedly projecting n-dimensional scatter plot onto a random unit vector. The extreme pixels in each projection are recorded and the total number of times each pixel is marked as extreme is noted. In this way it is possible to create a PPI image in which the DN of each pixel corresponds to the number of times that pixel has been recorded as extreme. The SAM is a method for comparing the image spectra to a set of spectra chosen as a priori end members. The algorithm determines the similarity between two spectra by calculating the ”spectral angle” between them, treating them as vectors in a space with dimensionality equal to the number of bands. For each reference spectrum chosen, the spectral angle is determined for each pixel and the final classification image shows a map where pixels of the same color represent regions of similar composition. The DMD borders, obtained from the 0.7-micron albedo image, are overlapped on the maps. Our analysis is devoted to the study of the relationship between the DMD and the adjacent terrain in order to better understand the spectral properties of the different terrain present in the area. The PPI procedures point up the spectral variability of the region and the DMD are clearly identified as ”pure” or more extreme spectra. Both the DMI)s present the highest values of the images (white and violet areas ranging from 200 to 400 DN) while the adjacent zones present intermediate values (red areas ranging from 100 to 200 DN). The maria and highlands present in the images have been classified as green areas (ranging from 0 to 100 DN). Rima Bode deposit presents a narrow and long shape and an extensive red area, while the Sinus Aestuum dark mantle deposit is heart shaped and shows a not vast red area. Rima Bode deposit is more homogeneous than Sinus Aestuum, where some patches (white areas) corresponding to the more extreme spectra are present. Using the analysis the PPI image, we have chosen five different end members for each region to apply the SAM procedure. On the basis of the spectra and of the position we identify the red class as highland, the blue class as mare, the yellow class as pure DMD, and the cyan class as crater ejecta. The last two classes, the green and the sea-green, have been interpreted as mixing soils of pyroclastic products and highland, the green one, and DMD and mare the sea-green. Sinus Aestuum mean DMD spectrum shows a deep absorption band with the minimum at 0.7 micron in the visible range and symmetrical wings at the extremes. Rima Bode DMD spectrum presents less absorption in the visible and a lower NIR-VIS value. The difference suggests an effective distinct mineralogical composition: The Sinus Aestuum deposit could be dominated by crystallized beads, while Rima Bode could be a mixing of volcanic glasses and black beads. We expect that DMDs mixed with the highland soils show a decrease in the UV-VIS slope. This effect is visible in both the spectra corresponding to the green areas. The analysis points up the presence of another mixing area in the Rima Bode region between DMD and the mare. The mean spectrum of this class shows a negative slope. Conclusions: The new statistical techniques allow us to identify some mixing areas with mare or highland soils. These regions are spectrally distinct from the DMDs and can help us to better understand the possible evolution of the eruptions that led to the deposits emplacement. Additional information contained in original.

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Lunar Maria; Moon; Terrain; Lunar Mantle; Selenology

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Lunar Elemental Abundances from Gamma-Ray and Neutron Measurements

Reedy, R. C., Los Alamos National Lab., USA; Vaniman, D. T., Los Alamos National Lab., USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 50-52; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The determination of elemental abundances is one of the highest science objectives of most lunar missions. Such multi-element abundances, ratios, or maps should include results for elements that are diagnostic or important in lunar processes, including heat-producing elements (such as K and Th), important incompatible elements (Th and rare earth elements), H (for polar deposits and regolith maturity), and key variable elements in major lunar provinces (such as Fe and Ti in the maria). Both neutron and gamma-ray spectroscopy can be used to infer elemental abundances; the two complement each other. These elemental abundances need to be determined with high accuracy and precision from measurements such as those made by the gamma-ray spectrometer (GRS) and neutron spectrometers (NS) on Lunar Prospector. As presented here, a series of steps, computer codes, and nuclear databases are needed to properly convert the raw gamma-ray and neutron measurements into good elemental abundances, ratios, and/or maps. Lunar Prospector (LP) is the first planetary mission that has measured neutrons escaping from a planet other than the Earth. The neutron spectrometers on Lunar Prospector measured a wide range of neutron energies. The ability to measure neutrons with thermal (E is less than 0.1 eV), epithermal (E about equal 0.1 - 1000 eV), and fast (E about 0.1-10 MeV) energies maximizes the scientific return, being especially sensitive to both H (using epithermal neutrons) and thermal-neutron-absorbing elements. Neutrons are made in the lunar surface by the interaction of galactic-cosmic-ray (GCR) particles with the atomic nuclei in the surface. Most neutrons are produced with energies above about 0.1 MeV. The flux of fast neutrons in and escaping from the Moon depends on es the intensity of the cosmic rays (which vary with solar activity) and the elemental composition of the surface. Variations in the elemental composition of the lunar surface can affect the flux of fast neutrons by about 25% , with Ti and Fe emitting more fast neutrons than light elements like O and Si. Most elements moderate neutrons to thermal energies at similar rates. The main exception is when neutrons scatter from H, in which case neutrons can be rapidly thermalized. The cross sections for the absorption of thermal neutrons can vary widely among elements, with major elements like Ti and Fe having high-capture cross sections. Some trace elements, such as Sm and Gd, have such large neutron-absorption cross sections that, despite their low abundances, can absorb significant amounts of thermal neutrons in the Moon. Because the processes affecting neutrons are complicated, good modeling is needed to properly extract elemental information from measured neutron fluxes. The LAHET Code System (LCS) can be use to calculate neutron fluxes from GCR interactions in the Moon. Lunar Gamma-Ray Spectroscopy: The main sources of planetary gamma-rays are the decay of the naturally occurring radioactive isotopes of K, Th, and U and the interactions of GCRs with atomic nuclei in the planet's surface. Most "cosmogenic" gamma-rays are produced by fast and thermal neutrons made in the planet's surface by GCRs, and their production rates can vary with time. Over 300 gamma-ray lines have been identified that can be emitted from planetary surfaces by a variety of production mechanisms. There exist nuclear databases that can be used to identify and quantify other gamma-ray lines. Use will be made of gamma-rays from major elements, particularly those from Si and O, that have not been routinely used in the past. The fluxes of gamma-rays from a given element can vary depending on many factors besides the concentration of that element. For example, the fluxes of neutron-capture gamma-rays in the planetary region of interest depend on (1) the total cross section for elements to absorb thermalized neutrons and (2) the H content of the top meter of the surface. The fluxes of the fast neutrons that induce inelastic-scattering and other nonelastic-scattering reactions can vary with the composition of the surface There are several key steps in preparing gamma-ray data into a form from which accurate elemental abundances can be determined. One needs to identify, quantify, and remove or correct for all backgrounds in the gamma-ray spectra. Among the more important of these backgrounds are features made by the decay of radioactivities made in the GRS by cosmic-ray particles and the prompt and decay gamma-rays emitted from the material surrounding the active elements of the LPGRS and from the LP spacecraft. Gamma-ray spectra obtained during the cruise to the Moon or those measured while LP was at various distances from the Moon can be used to distinguish features in the gamma-ray spectra that are from the Moon and those that are made on the LP spacecraft. Each background-corrected spectrum will be analyzed with existing gamma-ray spectral-unfolding codes to identify the energies and intensities of all peaks. These peaks will be examined when there are potential interferences in the analysis of a given gamma-ray line. Such interferences could be a problem for determining Mg and Al using some of their inelastic-scattering gamma-rays such as the 1.369-MeV gamma-ray from Mg that is also readily made from Al and Si. The key data needed to get elemental abundances from the fluxes of gamma-rays in the processed spectra are good values for the fluxes of gamma-rays that should be emitted from a given region for known or nominal elemental abundances. Such flux determinations were done for analysis of the Apollo gamma-ray data. The codes to do such calculations and the nuclear data used in such calculations have been improved much since then. Additional information contained in original.
Author

Abundance; Chemical Composition; Fast Neutrons; Moon; Lunar Composition; Lunar Environment; Lunar Geology

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Lunar South Pole Topography Derived from Clementine Imagery

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During the Clementine Mission both oblique and vertical multispectral images were collected. The oblique and vertical images from a single spectral band collected during the same orbit form a stereo pair that can be used to derive the topography. These stereo pairs are being used to derive the topography of an area (90 deg S to 650S latitude) surrounding the lunar south pole. Work on the lunar north pole topography will start after completion of the south pole topography. This report provides an update on the initial results for the lunar south pole topography. In 1994, the Clementine spacecraft acquired digital images of the Moon at visible and near-infrared wavelengths. Onboard there were four camera systems and a laser altimeter. During the first pass, periapsis was at 30S and the highest resolution images were obtained in the southern hemisphere. Over the northern polar area, a series of oblique and vertical images were obtained with the ultraviolet-visible (UV-VIS) camera on each orbit. During the second pass, periapsis was at 30N and the image acquisition strategy was reversed. The UV-VIS camera image size was 384 x 288 pixels with five spectral bands and one broad band. The 750-nm-band stereo pairs are the primary image source for this study. The ground sample distances (GSD) for oblique images range from 300 to 400m. The GSD for the vertical images, acquired at the end of an orbit, are slightly larger and range from 325 to 450 m. Using the formula for stereo-height accuracy, an estimate of height accuracy is 180m. This formula is IFOV(sub MAX)/(K*B/H) with IFOV(sub MAX) defined as Maximum Instantaneous Field of View; B/H is the base-to-height ratio and K is an estimate of pixel measurement accuracy on the imagery. The Clementine laser altimeter (LIDAR) data were used previously to produce a global topographic model of the Moon . The model has a vertical accuracy of about 100 m and a spatial resolution of 2.5 deg. Altimetry data were collected between 79S and 810N. These data were filtered and then interpolated to fill in the polar regions where the altimeter did not collect data. A global topography model was then derived based on spherical harmonic expansion. Image mosaic. A global image mosaic of the Moon was produced from the 750-nm. Clementine data . The mosaic includes high-resolution, oblique, and vertical images. Match points were picked to tie the imagery together, and the camera pointing angles were adjusted to align the imagery. This adjustment used a spherical surface, and the elevation of all points was held to a constant value, 1737.4 km. This produced a seamless image mosaic with latitude and longitude information but no information on the elevation. The imagery and support information were downloaded to our digital photogrammetric workstation from the Integrated Software for Imagers and Spectrometers (ISIS) system. The support data included the camera location and pointing angles. Match points used to, produce the image mosaic were also downloaded. The camera angles were adjusted to account for the elevation of the match points. This was accomplished with the Multi Sensor Triangulation (MST) software from LH Systems SOCET Set software package. The revised camera angles allowed for the derivation of a digital elevation model (DEM) from the stereo pairs. The match-point latitude and longitude from the global image mosaic are accurate and used for an initial estimate of the horizontal position. The elevations of the match points were estimated from the altimetry data. The camera angles used in the altimetry processing and in the creation of the image mosaic were adjusted independently. Hence, the horizontal position of the altimetry data and the image mosaic are not aligned correctly. Clementine was designed so the altimeter shared the optical system of the HIRES camera system. The HIRES and UV-VIS camera systems were aligned so the HIRES image was centered in the UV-VIS image. We therefore made an adjustment so that the altimetry points would fall near the centerline of the UV-VIS imagery. A DEM was created from the altimetry data using the adjusted position and the match-point elevations were estimated from the adjusted DEM. These points were used in the HATS software, which allows for the use of weights on the estimated position based on the accuracy of the point. The horizontal positions were given a weight of 1 km, and the vertical estimates were given a weight of 5 km. In forming the Clementine Mosaic, over 3600 images and 29,000 match points were used in the southern polar region, an area defined as 64S or less. Different techniques were tried in adjusting the images and match points. Limitations of computer memory required breaking the data into blocks that would be solved separately and then brought back together. Initial results had large elevation errors in the DEMs derived from different stereo pairs. This was most likely caused by the fact that although the stereo models overlapped, they did not share similar match points. One solution for this problem would require transferring all 29,000 match points to all the images they fall on within the set of 36M images. This would be a tremendous amount of work. The solution used was to thin the images to just the stereo pairs (983 images) and to thin the match points to cover the area (973 points.) The MST software was then used to add match points with the criteria that each image should have nine match points distributed throughout the image. This process added 1181 points. During editing and checking the match points, 45 more match points were added. The number of match points within an image ranges from 3 to 30 points, with 96% of the images having nine or more points and the average image having 16 points. Additional information contained in original.

Author

Elevation; Imagery; Lunar Topography; Selenology; Selenography; Moon; Lunar Geology; Lunar Maps; Lunar Surface

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Naming Lunar Mare Basalts: Quo Vadimus Redux

Ryder, G., Lunar and Planetary Inst., USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 55-56; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Nearly a decade ago, I noted that the nomenclature of lunar mare basalts was inconsistent, complicated, and arcane. I suggested that this reflected both the limitations of our understanding of the basalts, and the piecemeal progression made in lunar science by the nature of the Apollo missions. Although the word ”classification” is commonly attached to various schemes of mare basalt nomenclature, there is still no classification of mare basalts that has any fundamental grounding. We remain basically at a classification of the first kind in the terms of Shand; that is, things have names. Quoting John Stuart Mill, Shand discussed classification of the second kind: ”The ends of scientific classification are best answered when the objects are formed into groups respecting which a greater number of propositions can be made, and those propositions more important than could be made respecting any other groups into which the same things could be distributed.” Here I repeat some of the main contents of my discussion from a decade ago, and add a further discussion based on events of the last decade. A necessary first step of sample studies that aims to understand lunar mare basalt processes is to associate samples with one another as members of the same igneous event, such as a single eruption lava flow, or differentiation event. This has been fairly successful, and discrete suites have been identified at all mare sites, members that are eruptively related to each other but not to members of other suites. These eruptive members have been given site-specific labels, e.g., Luna24 VLT, Apollo 11 hi-K, A12 olivine basalts, and Apollo 15 Green Glass C. This is classification of the first kind, but is not a useful classification of any other kind. At a minimum, a classification is inclusive (all objects have a place) and exclusive (all objects have only one place). The answer to ”How should rocks be classified?” is far from trivial, for it demands a fundamental choice about nature and ordering. Classification functions as a primary tool of perception, opening up ways of seeing things and sealing off others. Lacking a classification, mare-basalt petrology appears immature with little consensual perception of the qualities and signifigances of the basalts. The appearance may or may not be the reality, but it demonstrates a need for a functioning, communicatory classification, in particular for the dissemination of ideas and the furtherance of studies. Names are inconsistent both among lunar rocks and between lunar and terrestrial rocks. Samples are labeled by elements, chemistry with tags, chemistry cast into mineralogy, or a mineralogical attribute (respective examples A 14 VHK A 17 high-Ti Group B 1, A 15 quartz-normative, A-12 pigeonite). Such inconsistency is bound to lead to confusion. Chemical descriptions mean different things in mildly different contexts: A low-K Fra Mauro basalt (not a basalt!) contains slightly more K than an Apollo 11 high-K basalt. High-alumina means more than about 11% Al2O3 for mare basalts, but 21% for highlands ”basalts.” Volcanic KREEP basalts, about 18% Al2O3, are not (usually) qualified with ”high-alumina.” Yet for terrestrial basalts, high-alumina means more than about 17% Al2O3, Further, even very-low-Ti mare basalts have Ti abundances (about 0.5-1.5% Ti02) as great as typical terrestrial basalts. Thus, parallels between lunar and terrestrial nomenclatures are nonexistent (reinforced by the fact that a mare-basalt composition found on Earth would be too ultramafic to name basalt at all). A separate type of name exists for mare-basalt glasses, which are identified by site, color, and a letter for any subsequent distinctions, e.g., A15 Green Glass C. While the inconsistencies cited above by themselves make nomenclature arcane, a greater source of difficulty is the common use of acronyms such as VHK and VLT. Most of these are partly chemical acronyms, but degrading the symbol Ti to T (for instance) makes them unintelligible and devoid of information even to the intelligent, educated non-expert. Classifications have functions. A major one must be communication; i.e., a name for a mare basalt provides a common understanding of what the basalt is. For the small number of suites currently available, the present labels (though inefficient and insufficient) may work; with continued recognition of more basalts, Antarctic meteorite samples, orbiter data, sample returns, and lunar base studies, labels will become increasingly inefficient. Clementine and Prospector data have made mapping of mare basalts a much more visible activity than it was, and increasingly common ground among sample petrologists and remote sensers has emerged. to establish a usable classification, there must be some criteria for relationships. Petrologists need to decide what the most significant characters are, and how these can be translated into a classification. The common distinction on the basis of Ti (the major element with the greatest variation) may or may not be appropriate. It remains to be established whether the use of Ti is of fundamental value both in relating basalts to each other and in communication, or merely an historical accident or response to its variance. Additional information contained in original

Author

Classifications; Lunar Rocks; Maria; Naming; Nomenclatures; Petrology

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Origin and Evolution of the Moon: Apollo 2000 Model

Schmitt, H. H., Wisconsin Univ., USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 56-58; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A descriptive formulation of the stages of lunar evolution as an augmentation of the traditional time-stratigraphic approach [21 enables broadened multidisciplinary discussions of issues related to the Moon and planets. An update of this descriptive for-

mulation [3], integrating Apollo and subsequently acquired data, provides additional perspectives on many of the outstanding issues in lunar science. (Stage 1): Beginning (Pre-Nectarian) - 4.57 Ga; (Stage 2): Magma Ocean (Pre-Nectarian) - 4.57-4.2(?) Ga; (Stage 3:) Cratered Highlands (Pre-Nectarian) - 4.4(?) 4.2(?) Ga (Stage 4:) Large Basins - (Pre-Nectarian - Upper Imbrium) 4.3(?)-3.8 Ga; (Stage 4A:) Old Large Basins and Crustal Strengthening (Pre Nectarian) - 4.3(?)-3.92 Ga; (Stage 4B): Young Large Basins (Nectarian - Lower Imbrium) 3.92-3.80 Ga; (Stage 5): Basaltic Maria (Upper Imbrium) - 4.3(?)- 1.0(?) Ga; (Stage 6): Mature Surface (Copernican and Eratosthenian) - 3.80 Ga to Present. Increasingly strong indications of a largely undifferentiated lower lunar mantle and increasingly constrained initial conditions for models of an Earth-impact origin for the Moon suggest that lunar origin by capture of an independently evolved planet should be investigated more vigorously. Capture appears to better explain the geochemical and geophysical details related to the lower mantle of the Moon and to the distribution of elements and their isotopes. For example, the source of the volatile components of the Apollo 17 orange glass apparently would have lain below the degassed and differentiated magma ocean (3) in a relatively undifferentiated primordial lower mantle. Also, a density reversal from 3.7 gm/cubic cm to approximately 3.3 gm/cubic cm is required at the base of the upper mantle to be consistent with the overall density of the Moon. Finally, Hf/W systematics allow only a very narrow window, if any at all for a giant impact to form the Moon. Continued accretionary impact activity during the crystallization of the magma ocean would result in the ”splash intrusion” of residual liquids into the lower crust of the Moon as soon as the crust was coherent enough to resist re-incorporation into the magma ocean. For Mg-suite rocks with crystallization ages greater than about 4.4 Ga, impact-dominated dynamics of crustal formation resulted in the injection of liquids from the magma ocean into the crust. Such a process probably helps to account for the apparent increasingly mafic character of the crust with depth. Creation of a mega-regolith during the cratered highland stage constituted a necessary prerequisite for the later remelting of magma ocean cumulates to produce mare basalt magmas. The increasingly insulating character of the pulverized upper crust would slow the cooling of the residual magma ocean. It also would have allowed the gradual accumulation of radiogenic heat necessary to eventually partially remelt the source regions in the upper mantle that produced the mare basalts and related pyroclastic volcanic eruptions. The reverse wave of heating would proceed downward into the upper mantle from the still molten and significantly radio-isotopic urKREEP residual liquid zone at the base of the crust. The potential effects of a giant, Procellarum basin-forming event ca. 4.3 Ga and of a geographically coincident Imbrium event ca. 3.87 Ga can explain the surface concentration of KREEP-related materials in the Procellarum region of the Moon. Lunar Prospector gamma ray spectrometer data indicate that the Procellarum event excavated only relatively small amounts of material related to KREEP. This strongly suggests that urKREEP magmas had yet to move into the Moon’s lower crust. The extensive movement of such liquids across and possibly along the crust-mantle boundary region to beneath Procellarum, however, may well have occurred in response to the regional reduction in lithostactic pressure. The coincidental formation of another large basin, the 1160-km diameter Imbrium basin, near the center of Procellarum resulted in the redistribution of KREEP-related materials roughly radial to the younger basin. This scenario may make unnecessary recent proposals of a chemically asymmetric Moon to account for the surface concentration of KREEP-related material around Imbrium. The timing of the giant, South Pole Aitken Basin-forming event at the end of the cratered highland stage (about 4.2 Ga.) can account for the lack of both extensive KREEP-related material and basaltic maria associated with South Pole Aitken. The absence of an Imbrium-size event in South Pole Aitken would have kept hidden any KREEP-rich crustal province. As would be expected with the removal of most of the insulating upper crust, relatively little mare basalt has erupted in South Pole Aitken, except possibly in its northern portions. After the cratered highlands stage and before the basaltic maria stage, objects from a discrete source region formed about 50 large basins on the Moon over -400 m.y. Four possibilities for sources of the impactors of the large basin stage appear plausible at this time. of these possibilities, the initial breakup of the original Main Belt planetesimal would appear to be the best present choice as a discrete impactor source. The striking differences between young, mascon basins (about 3.92-3.80 Ga) and old, nonmascon basins (about 4.2-3.92 Ga) indicate that the older, isostaticly compensated basins triggered the regional intrusion, extrusion, and solidification of mobile urKREEP-related magmas prior to the formation of the younger, uncompensated basins. This suggests that the fracturing of the lunar crust by the older basin-forming events permitted urKREEP liquids to migrate into the crust, removing the potential for rapid, post-basin isostatic adjustment by urKREEP magma movement at the crust-mantle boundary. Additional information contained in original.

Author

Kreep; Lunar Crust; Lunar Evolution; Lunar Mantle; Lunar Maria; Magma; Moon; Selenology; Pre-Imbrian Period

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Magmatism of the Lunar Highlands and the Early Paleoproterozoic Magmatism of the Earth: Similarities and Distinctions

Sharkov, E. V., Academy of Sciences (USSR), USSR; Bogatilkov, O. A., Academy of Sciences (USSR), USSR; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 58-59; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Important feature of tectonic-magmatic activity on the Moon is it closeness to the Earth's early Paleoproterozoic stage of evolution. The most ancient magmatism of the Moon was begun at highlands from low-Ti melts of the magnesian suite, which were rather close in composition of rocks, their mineralogy and geochemistry to the early Palaeoproterozoic terrestrial magmatism of the siliceous high-Mg (boninite-like) series (SHMS). Around 3.8 Ga, it was changed by basaltic magmatism of maria, where high-Ti varieties were common. This type of magmatism is resembled the oceanic-type magmatism of the Earth (including Fe-Ti basalts of oceanic islands), which firstly appeared in the late Palaeoproterozoic: ca. 2 Ga. On the Moon are lacking both analogs of the Archean type of activity of the Earth, when formation of granite-greenstone terranes occurred, and the Phanerozoic subduction-related magmatism. On Earth, the SHMS rocks of 2.5-2.1 Ga formed large igneous provinces within the Archean granite-greenstone cratons. For example, on the Baltic Shield such province evolved on territory measuring about 1 million square-km and represented by different volcanics (low-Ti picrites, Mg basalts, high-Al basalts, andesites, dacites, and rhyolites, where basalts predominated) in riftlike structures, gabbronorite dyke swarms, and large layered intrusions. The latter consist of dunites, harzburgites, pyroxenites, norites and gabbronorites, including pigeonite varieties, gabbro-anorthosites, Mgt gabbronorites, and diorites. The SHMS rocks on their major, rare, and rare earth elements contents were rather close to the Phanerozoic calc-alkaline series related to subduction zones, but on its geological position they had within-plate tectonic settings and look like the continental flood basalt province. The Epsilon-Nd(T) value of -1 to -2 is characteristic for the studied SHMS-rocks, indicating that the origin of such melts was linked with large-scale assimilation of crustal rocks by high-temperature, mantle-derived magmas during their ascending to the surface. Potassic granites and monzodiorites and K-enriched volcanics, varied from low-Ti picrites and trachybasalts to alkaline andesites and dacites, are not uncommonly associated with the SHMS rocks. According to isotopic data, these rocks also had mixed mantle-crustal origin. Around 2.2-2.0 Ga, practically on the whole Earth simultaneously, the Fe-Ti picrites and basalts of different alkalinity, similar to the Phanerozoic within-plate rocks were appeared, and substituted the SHMS rocks as a main type of within-plate magmatic activity. The lunar magmatism of the highlands was rather close to the early Paleoproterozoic magmatism of the Earth. The earliest (4.45-4.25 Ga) magnesian-suite magmatism, which intruded the primary anorthositic crust, was represented by volcanics and intrusive rocks. Pristine intrusive rocks of this suite are represented by dunites, harzburgites, troctolites, norites, gabbronorites, and anorthosites (ANT-series). Important role in these rocks play orthopyroxene and pigeonite; Cr spine], orthoclase, quartz, apatite, and Ti phases occur in many varieties. On their composition these intrusive rocks rather close to the rocks of the early Paleoproterozoic layered intrusions. As a whole, all these rocks on their major, rare and rare earth elements pattern are rather close to the terrestrial early Palaeoproterozoic SHMS. What is more, the Epsilon-Nd(T) value in the rocks of the lunar magnesian suite is about -1, which correlates with data for the terrestrial SHMS rocks (from -1 to -2). The main difference between these lunar rocks from terrestrial rocks is a lower alkali content and very subordinate role of acid and intermediate melts. According to Snyder et al., the origin of these rocks was linked with contamination of high-temperature mantle-derived magmas by lunar crustal material during their ascension to the surface. Rocks of the 4.3-4.0 Ga KREEP series are the second type of magmatism of the highlands, where they are associated with the rocks of the magnesian suite. They are characterized by elevated K content, REE and P alkalinity, and are represented by volcanics (mainly basalts) and their intrusive analogs "alkaline series" "alkaline" anorthosites, gabbro and gabbronorites, monzodiorites and potassium granites could be finite members of the series. The rocks of these composition and tectonic settings closely resemble the enriched K in the early Paleoproterozoic terrestrial rocks of cratons. Thus, the lunar magmatism is close to only one (the Palaeoproterozoic), stage of terrestrial magmatism evolution. The cause of this could be both in some different primordial composition of the silicate mantles of these planetary bodies, and the different degree of their differentiation during solidification of their planetary magma oceans: it suggests that the depth of the latter in the case of the Moon was about 200-300 km, whereas in the Earth it was about 700 km.
Author
Geology; Igneous Rocks; Lunar Rocks; Mineralogy; Moon; Tectonics; Volcanology; Lunar Evolution; Selenology; Magma

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Mare Magmatism of the Moon and Oceanic Magmatism of the Earth: Similarities and Distinctions
Sharkov, E. V., Academy of Sciences (USSR), USSR; Bogatikov, O. A., Academy of Sciences (USSR), USSR; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 59; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

(1) Maria with mafic basaltic floors are the second major type of morphostructures of the Moon, which were formed in the late stages of its evolution from 3.8 to 3.2 Ga. They form large rounded depressions (10-km depths) in the lunar relief. On their structure (presence of mid-maria moundlike rises and local rises), and on basaltic rocks composition they resemble oceanic segments of the Earth with its mid-oceanic ridges and within-plate oceanic islands. These types of the Earth's structures also began to form later than continental segments of the lithosphere, from ca. Ga. (2) Like on the Earth, two types of basalts are typical for the lunar maria: low-Ti and high-Ti, which could be correlated with the midoceanic ridge basalts (MORB) and oceanic island Fe-Ti basalts (0113) consequently. This type of tectonic-magmatic activity survived until now on the Earth; its petrogenesis associated

with ascending of the mantle plumes that originated on the core-mantle boundary (CMB), in the layer D". For the terrestrial plumes it is characteristically a presence of specific fluid components, enriched in Fe, Ti, alkalies, -, - -, Zr, - - -, etc. Concentration of the fluid components is low in MORB and the highest in the within-plate Fe-Ti basalts. (3) Ocean-island basalt magmatism has a limited range in the Earth's oceans and is often localized on the mid-oceanic ridge slopes or far from them. With distance from the ridges axes composition of melts became more alkaline and titaniferous. The same picture is common for the continental traps provinces, whose origin is linked with superplume ascension; close to the MORB tholeiitic basalts are predominate, and alkaline Fe-Ti basalts present in a limited range. Traps appearance often preceded oceans opening and in this sense they could be defined as the first stage of the ocean development. (4) by analogy of the Earth, it is suggested that petrogenesis of the mare basalts could be also linked with plume activity, which were ascended from the lunar CMB of that time. Instead of the Earth, the lunar outer (liquid) core did not survive until present, but had to be active during the maria formation. The main difference of a fluid components of these plumes from the Earth's analog was the practical absence of H20 in them; this indicates a mineral composition of the mare basalts, where important role-play mineral phases formed under reduce conditions. (5) Another important difference is linked with the lunar high-Ti basalts, which are characterized by a strong negative Eu anomaly;however, such an anomaly has not been found in the very low-Ti (VLT) varieties. Traditionally, the presence of such an anomaly is associated with fractionation of plagioclase in magmatic processes. However, we suggest that in this particular case this phenomenon is more likely linked with reduced character of the Moon interior, because in magmatic systems a value of EU2,/EU3+ ratio depends on f(O2), and in reducing systems all Eu is represented by EU2+, which accumulated in the basic plagioclase. In contrast to the terrestrial basalts, where both Eu isotopes occur and removing one of them smoothed off through accumulation of the second, here only EU2+ occurred and so its fractionation led to strong depletion of the residual melt in Eu. Consequently, appearance of the Eu anomaly could be linked with fractionation of plagioclase in transitional magmatic chambers (intrusions) in the form of different gabbroids. Because Eu content in basalts quickly rises under growth of Ti, this process is most effective in the case of the high-Ti melts. (6) Beneath the lunar maria excess of masses (mascones) occurs and the lunar crust becomes thinner above them. In general, such a situation resembles a character of distribution of Earth's crust above continental rifts. Probably, the mascones are solidified mantle-plume head, which are known on the Earth as large lens like bodies of anomalous mantle beneath mid-oceanic ridges and continental rift zones. (7) So, there are essential similarities in structure and origin of the lunar maria and terrestrial oceans. However, instead of the Earth, the ancient lunar crust did not disrupt with formation of the lithosphere of oceanic type and further development according to a plate-tectonics model. The process ended on the first stage, analogous to the terrestrial continental traps formation. Author

Core-Mantle Boundary; Igneous Rocks; Lunar Maria; Basalt; Lunar Geology; Earth Crust

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Mare Basaltic Magmatism: A View from the Sample Suite With and Without a Remote-Sensing Prospective

Shearer, C. K., New Mexico Univ., USA; Papike, J. J., New Mexico Univ., USA; Gaddis, L. R., Geological Survey, USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 59-61; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

It has long been recognized that the lunar-sample suite returned by the Apollo and Luna missions is biased with regard to its representation of lunar mare basalts. This sampling bias is reflected in both an incorrect portrayal of the volume of mare basalt types and the absence of many basalt groups known to exist from spectral data. This bias obviously affects models for the petrogenesis of mare basalts and the interior of the Moon. Here, we explore the implications of this bias and compare models for lunar magmatism that are derived solely from samples with potential models derived from combined sample and remote-sensing data. We focus on the implications of these contrasts in several areas: volume, distribution, and age of mare basalts, KREEP enrichment on the nearside of the Moon, heat sources for melting, and depth of mare basalt source regions. The mare basalt sample suite indicates that the TiO2 distribution of crystalline mare basalt samples is bimodal, with a majority of the mare basalts occurring in the range of 1.5-5.5 and 10-13 wt% TiO2. A compositional gap appears to exist between 6 and 9 wt% TiO2. Although the population of picritic mare glasses also exhibits a bimodal distribution with regard to Ti02, it is dominated by very low-Ti glasses (is less than 1 wt% TiO2) and high-Ti glasses (8-16 wt% TiO2) and exhibits a very broad compositional gap between 1 and 8 wt% Ti02. The simplest interpretation of the bimodal Ti distribution is that two distinct sources were melted to produce the mare basalts: late, rather shallow, Ti-rich lunar magma ocean (LMO) cumulates and early, rather deep, Ti-poor LMO cumulates. More recently, on the basis of Galileo SSI and Clementine UV-VIS data, global TiO2 distribution has been interpreted to be continuous in the maria with no hint of biomodality and an abundance peak between I and 3.5 wt% TiO2. These new observations indicate a mare source model in which a small volume of late, ilmenite-bearing LMO cumulates mixed with a large volume of early LMO cumulates in which ilmenite was absent. These differences in models have implications for heat sources for generating mare basalts, the relative depth of various mare basalt sources, and the early dynamics of the lunar mantle. Although remote optical and spectral observations of the lunar surface document the concentration of mare basalts on the nearside of the Moon our limited sampling

of basalts does not define the overall distribution of mare basalt compositions. The relative distribution of high-Ti basalts should shed light on the asymmetry of LMO cumulates and refine or refute mare basalt models that require recycling of late, high-Ti cumulates into the deep lunar mantle. Lunar pyroclastic glasses have been identified at all of the Apollo sites, Based on samples, the compositional variation of these glasses is bimodal and their overall abundance is unknown. Understanding both their compositional diversity and distribution is critical to deciphering how these near-primary magmas were transported to the lunar surface from great depths and how they are related to crystalline mare basalts. Based on Clementine data and previous work, more than 100 lunar pyroclastic deposits have been proposed and potentially a large number consist of high-Ti glass beads. The existence of so many deposits that could consist of near-primary basaltic magmas implies that mechanisms for their transport to the surface are not extraordinary and that density contrasts between melts and surrounding mantle do not significantly impede their source segregation and movement, at high pressure, to the lunar surface. Age of mare basalt groups. While radiometric age dating of lunar mare basalts provides a precise means of dating individual samples, when it is combined with relative age relationships determined by remote sensing (e.g., crater counts) it becomes a method for reconstructing magmatism on a planetary scale. Two examples where this approach has provided useful information and will continue to bear fruit are the duration and early history of lunar volcanism and the relationship between mare basalt composition and eruptive history. Although the petrologic record has been obscured by the early catastrophic impact history of the Moon, there is abundant evidence of pre-3.9 Ga nonmare basaltic volcanism [e.g., 7-8]. Most of this record is retained in small clasts from highland soils and breccias or has been identified through remote sensing. The relationship between the samples and units identified through remote sensing is speculative. Further identification and delineation of older episodes of volcanism and their relationship to episodes of crustal plutonism (Mg and alkali suites) is critical to our interpretation of mantle evolution following magma ocean crystallization and prior to the onset of mare volcanism. Combined sample and remote sensing data sets will allow us to better distinguish among the wide range of models that have been proposed for these early periods of lunar magmatism (Mg suite, alkali suite, KREEP basalts). These models include (1) impact origin; (2) magma ocean crystallization; (3) melting and remobilization of late magma ocean cumulates and/or KREEP infiltrated lower crust; (4) melting of the lower portions of the cumulate pile followed by assimilation of KREEP or anorthositic crust; and (5) melting of deep, hybrid mixed cumulate sources. Additional information is contained in the original.

Author

Basalt; Breccia; Crusts; Lunar Geology; Lunar Maria; Lunar Rocks; Lunar Surface; Magma; Titanium Oxides; Volcanology; Lunar Crust

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Structure and Composition of the Lunar Crust

Spudis, P. D., Lunar and Planetary Inst., USA; Bussey, D. B. J., European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; Hawke, B. R., Hawaii Univ., USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 61-62; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Since the first return of lunar samples indicated that global differentiation of the Moon had occurred, numerous models of crustal structure have been proposed. With the completion of the first global reconnaissance mapping by Clementine and Lunar Prospector, we are now in position to re-evaluate crustal structure and composition at a global scale. Although this is a difficult and complex task, and one requiring significant study, some first-order results are apparent now and are quite telling. We here summarize our current view of crustal structure and identify some required knowledge to better understand the origin and evolution of the lunar crust. Wood et al. attempted to estimate the amount of plagioclase in the crust, based on the average elevation difference between mare and highlands and some simple assumptions about anorthosite and basalt as responsible for the principal lunar rock types. Later, more complex models emerged, involving layered crusts of feldspathic material over more basaltic material or a laterally variable crust, with Mg-suite plutons intruding a grossly anorthositic crust. Later models attempted to reconcile these contrasting styles by incorporating both features. In part, crustal structure was inferred by the envisioned mode of crustal formation. A decade-long debate on the reality of the lunar ”magma ocean,” stimulated by the provocative notion of Walker that the Moon never had a magma ocean, and the recognition that the anorthosites and Mg suite probably recorded different and unrelated magmatic events. Such a scenario leaves much about crustal structure an open question, but allows for both lateral and vertical heterogeneity, thus accommodating both principal crustal models. Global maps of Fe , Ti, and Th both confirm old ideas and create new problems. It is clear that vast areas of the lunar highlands are extremely low in Fe, consistent with a significant amount of anorthosite. Such a distribution supports the magma ocean. However, the average lunar highlands composition is, as long suspected, that of ”anorthositic norite”, a mixed rock type, somewhat similar to many of the lunar meteorites (e.g,., ALHA 81005 and more mafic than pure ferroan anorthosite. Anorthosite proper does occur on the Moon; it is found almost exclusively within the inner rings of multiring basins. These basins span a range of ages and distributions. Mafic provinces occur in the central Procellarum region of the front side and on the floor of the South Pole Aitken Basin. In these areas, the lunar surface is ”highland basaltic”

composition (FeO about 9-10 wt%). Additional highland basaltic areas occur in the vicinity of nearside basins, such as Serenitatis. The major lunar ”hot spot” of high Th concentration (about 10 ppm) occurs within a broad, oval depression approximately coincident with Oceanus Procellarum. Slightly less elevated amounts (about ppm) are associated with the basaltic floor of SPA Basin on the farside. Aside from this, Th highs are isolated and minor. On the basis of the new global data, as well as from our continuing study of the composition of basin ejecta to probe the deep crust, we have modified slightly our existing crustal model to accommodate the new findings. We propose a three-layer model of crustal configuration. The uppermost zone, down to depths of about 15-20 km, consists of mega breccia of mostly anorthositic norite composition (FeO about 4-6 wt%; Al2O3 about 26 wt%). This zone is neither laterally or vertically uniform, displaying anomalous compositional zones at scales of tens to hundreds of kilometers, but is remarkably homogeneous at planetwide scales. In bulk composition, it resembles the ”ferroan anorthositic norite” suite of mixed rocks described by Lindstorm et al. and many of the highlands regolith breccias found as lunar meteorites. It is also similar to the average crustal composition inferred by Taylor , on the basis of Apollo granulitic breccias and limited orbital chemical data. Although some areas on the northern farside appear very anorthositic, most areas of the upper highlands different from this composition are more mafic, not more feldspathic, showing affinities to highland basalt, with or without KREEP. The next zone of the crust is found at depths between 15 and about 35 km. It appears to consist largely of nearly pure, ferroan anorthosite (FeO is less than 2 wt%; Al2O3 is greater than 33 wt%). Outcrops of pure anorthosite principally occur on the Moon in the inner rings of multiring basins, which are structurally uplifted blocks from midcrustal levels, or rarely, as central peaks in some selected craters (Alphonsus, Aristarchus). The anorthosite is apparently confined to middle levels in the crust; moreover, it appears to be at least partly of global extent, as basin rings of anorthosite are found in basins spanning the globe, from Orientale to Humboldtianum. Because anorthosite is most likely to represent the primordial crust , we interpret this global ”layer” of anorthosite as the remnant of the original crust of the Moon. The petrological nature of the roughly half of the crust below the anorthosite zone (depths of 35-65 km) remains obscure, but several observations may be made about the likely nature of rocks tobe found there. First, where most of the upper crust has been removed by large, basin-forming impact (such as the floors of the SPA and Imbrium Basins), the crustal composition appears to be that of highland basalt (FeO 9-12 wt%; Al2O3 18-20 wt%). Second, a plot of the total Fe content of basin ejecta (determined from orbital measurements;) against basin size shows that larger basins excavate more mafic (Fe-rich) material. This relation suggests that the lower levels of the crust are more ”basaltic” than middle or upper levels. Additional information contained in original.

Author

Craters; Igneous Rocks; Lunar Composition; Lunar Crust; Lunar Geology; Lunar Maria; Lunar Rocks; Lunar Soil; Lunar Surface; Moon

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The Mineralogy of the Youngest Lunar Basalts

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The last stage of lunar volcanism produced spectrally distinct basalts on the western nearside of the Moon, which remain unsampled by landing missions. The spectral properties of these late-stage basalts are examined using high-spatial-resolution Clementine images to constrain their mineralogic composition. The young high-Ti basalts in the western Procellarum and Imbrium Basins display a significantly stronger ferrous absorption than earlier mare basalts, suggesting that they may be the most Fe-rich deposits on the Moon. The distinct long-wavelength shape of this ferrous absorption is found to be similar for surface soils and materials excavated from depth. The pervasive character of this absorption feature supports the interpretation of abundant olivine within these late-stage lunar deposits. Important distinctions exist between the early-stage eastern maria and the late-stage western basalts, even though both appear to be Ti-rich. For example, the western maria are more radiogenic than eastern deposits. Telescopic spectra of the high-Ti western maria also exhibit a unique combination of a strong 1 micron feature and a relatively weak or attenuated 2-micron absorption. Pieters et al. concluded that the unusual strength and shape of the 1-micron absorption in western basalts results from an additional absorption from abundant olivine and/or Fe-bearing glass. Either mineralogy could produce the strong long wavelength 1-micron band, but a glassy Fe-rich surface could only form by rapid cooling along the exterior surfaces of flows. Clementine UV-VIS data of late-stage basalts are examined for regions in Oceanus Procellarum and Mare Imbrium. The spectral properties of western regions are compared to the sampled Apollo 11 basalts in Mare Tranquillitatis, which contain similar albedos and UV-VIS spectral properties. For reference, the western basalts are also compared to the low-Ti and Fe-rich basalts in Mare Serenitatis (mISP). Serenitatis basalts have the strongest mafic absorption of any eastern nearside maria in Clementine imagery. Unlike previous Earth-based and Galileo imagery, Clementine data resolve the spectral properties of immature crater deposits small enough to sample individual volcanic flows. A strategy has been developed to reevaluate lunar basalt types using Clementine imagery of such fresh mare craters and their associated soils. to allow direct comparisons between regions, scat-

ter plots of useful spectral parameters were constructed by sampling a fixed number of evenly spaced pixels from each mare region. Scatter plots comparing the mare study areas are shown. Since mature soils dominate the surfaces exposed, the density distribution of each data cloud has been presented after a root stretch to enhance the visibility of the less-abundant immature materials. Five-color spectra were also collected for all fresh craters within each mare region and grouped according to size. The UV-VIS ratio has been used extensively to estimate Ti in mature soils and plots of this parameter against 0.75-micron reflectance are included for each mare region. The UV-VIS ratio coupled with the 0.75-micron parameter has been applied more recently to estimate Ti content across many lunar materials. High-Ti basalts plot in the upper left portion because of their low-albedo and high-UV-VIS ratio values. Clementine UV-VIS ratio values for the Procellarum HDSA unit are similar to, but slightly lower than, HDWA Apollo 11 basalts. These values are consistent with previous evaluations of the western high Ti basalts using telescopic and Apollo gamma-ray data, which suggest only a minor difference in TiO, contents between these mare deposits. The Imbrium hDSA and Serenitatis mISP basalts are seen to be progressively less dark and blue, consistent with the previously noted decreasing amount of weight percent TiO2. The scatter plot captures the micron absorption strength and albedo of large areas for each study region over a range of optical maturities. This scatter plot allows trends related to maturity to be evaluated. Materials whose soil surfaces have not achieved optical maturity are slightly brighter and display a stronger ferrous band. For each basalt type, the result is a roughly parallel range of values for these spectral parameters forming a distinct ”weathering cloud” of data. The western HDSA and hDSA basalts, show a much stronger mafic ratio than the Tranquillitatis basalts for both mature soils and immature crater materials. Despite a higher abundance of opaques (which should subdue absorption features) the western HDSA and hDSA mare units also exhibit a stronger mafic ratio than the Fe-rich Serenitatis basalts. These combined properties indicate an exceptionally high abundance of mafic minerals and suggest that the Eratosthenian deposits within Procellarum may be the most Fe-rich basalts extruded on the surface of the Moon. It is difficult to estimate the FeO content of these young basalts since returned samples demonstrate that all lunar soils contain a fraction of foreign materials and mare soils have a lower weight percent FeO than their associated basalts. We are in the process of considering such sample information and mixing issues in order to estimate the actual FeO abundances of the mafic-rich western basalts. Regions that represent the most immature materials within each mare area were selected by identifying pixels that correspond to the lower-right limit of each mare unit’s 1 micron vs. 0.75 micron scatter plot cloud. These spectra, shown, allow comparisons of the strong ferrous absorption for the most crystalline materials within each basalt type. The shape of the 1 micron feature is much flatter and centered at a longer wavelength in the spectra of the western Procellarum basalts compared to the eastern Serenitatis and Tranquillitatis basalts. Additional information contained in original.
Author
Basalt; Lunar Maria; Lunar Rocks; Lunar Soil; Mineralogy; Minerals; Moon; Olivine; Titanium Oxides

20000040528 NASA Johnson Space Center, Houston, TX USA
Apollo 17 Soil Characterization for Reflectance Spectroscopy
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It is the fine fractions that dominate the observed spectral signatures of bulk lunar soil, and the next to the smallest size fractions are the most similar to the overall properties of the bulk soil. Thus, our Lunar Soil Characterization Consortium has concentrated on understanding the inter-relations of compositional, mineralogical, and optical properties of the is less than 45-micron size fraction and its component sizes (20-44 micron, 10-20 micron, and is less than 10 micron size fractions). to be able to generalize our results beyond the particular sample set studied, it is necessary to quantitatively identify the observed effects of space weathering and evaluate the processes involved. For this, it is necessary to know the chemistry of each size fraction, modal abundances of each phase, average compositions of the minerals and glasses, I(sub s)/FeO values, reflectance spectra, and the physical makeup of the individual particles and their patinas. This characterization includes the important dissection of the pyroxene minerals into four separate populations, with data on both modes and average chemical compositions. Armed with such data, it should be possible to effectively isolate spectral effects of space weathering from spectral properties related to mineral and glass chemistry. Four mare soils from the Apollo 17 site were selected for characterization based upon similarities in bulk composition and their contrasting maturities, ranging from immature to submature to mature. The methodology of our characterization has been discussed previously. Results of the Apollo 17 mare soils, outlined herein, are being prepared for publication in MAPS. As shown, with decreasing grain size, the agglutinitic (impact) glass content profoundly increases. This is the most impressive change for the mare soils. In several soils we have examined, there is an over two-fold increase in the agglutinitic glass contents between the 90-150- micron and the 10-20-micron size fractions. Accompanying this increase in agglutinitic glass is a definite decrease in pyroxenes and to lesser extents, the oxides (ilmenite), volcanic glass, and olivine. Unexpectedly, however, the absolute plagioclase

abundances stay relatively constant throughout the different grain sizes, although the abundance of plagioclase relative to the mafic minerals increases with decreasing particle size. These soils were chosen for study based upon their similarities in FeO and Ti02 content, allowing for direct comparisons between evolutions of chemistry between size fractions and among different maturities of soils. The bulk chemistry of these fractions was determined by EMP analyses of fused glass beads. In contrast to the systematic variations in bulk chemistry discussed below, the relatively uniform composition of agglutinitic glass with grain size and soil maturity is illustrated. The composition of the bulk fraction of each size fraction becomes more feldspathic with increasing maturity, with the effect being most pronounced for the finest fractions. The composition of the agglutinitic glass, however, is relatively invariant and more feldspathic (i.e., rich in Al2O3) than even the is less than 10-micron fraction. This relation not only strengthens the ”fusion of the finest fraction” (F(sup 3)) hypothesis, but also highlights the important role of plagioclase in the formation of agglutinitic glass. With decreasing grain size, FeO, MgO, and TiO2 contents decrease, whereas CaO, Na2O, and Al2O3 (plag components) increase for all soils. These chemical variations would appear to be coupled with the significant increase in agglutinitic glass and decrease in oxide (ilmenite),pyroxene, and volcanic glass. These changes in chemistry do not appear to be due to distinct changes in the compositions of individual phases but to their abundances. Values of I(sub s)/FeO increase with decreasing grain size, even though the bulk FeO contents decrease. That is, the percentage of the total Fe that is present as nanophase Fe(sup O) has increased substantially in the smaller size fraction. Note that the increase in nanophase FeO in smaller size fractions is significantly greater than the increase in agglutinitic glass content, with its single-domain FeO component. This would seem to indicate that at least some of the FeO is surface correlated. to illustrate this effect, if it is assumed that the nanophase FeO is entirely surface correlated, then equal masses of 15-micron and 6-micron spheres should have about 3x as much FeO in the finer fraction. The recent findings of Kelleret al. of the major role of vapor-deposited, nanophase FeO-containing patinas on most soil particles is a major breakthrough in our understanding of the distribution of FeO within agglutinitic glass and upon grain surfaces. Bidirectional reflectance spectra for a representative Apollo 17 soil (70181) are shown. The size separates all have similar albedo in the blue and follow a regular sequence in which the continuum slope increases, ferrous bands weaken, and albedo, increases with decreasing particle size. The bulk is less than 45-micron soil is typically close to the 10-20 micron spectrum. It is important to note that although the finest fraction (is less than 10 micron) is close in composition to the abundant agglutinitic glass in each size fraction, this size fraction is relatively featureless and does not dominate the spectrum of the bulk is less than 45-micron soil. It has long been suspected that agglutinitic glass, to a large extent, is the product of melting of the finest fraction of the soils, with a dominance of plagioclase. Given the low abundance of pyroxene in the finest fractions of each soil the source of the FeO in these Apollo 17 agglutinitic glasses is not fully identified. We suspect the abundant volcanic glass in these samples may be a significant contributor and this hypothesis will be tested with the suite under study from other Apollo sites.
Author
Iron Oxides; Lunar Soil; Mineralogy; Optical Properties; Reflectance; Spectral Signatures; Spectroscopy

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The Lunar Atmosphere and its Intimate Connection to the Lunar Surface: A Review
Stern, S. A., Southwest Research Inst., USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 64; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Due to the lack of optical phenomena associated with the lunar atmosphere, it is usually stated that the Moon has no atmosphere. This is not correct. In fact, the Moon is surrounded by a tenuous envelope with a surface number density and pressure not unlike that of a cometary coma. However, the analogy ends there: The lunar atmosphere is essentially everywhere collisionless, unlike a cometary coma, its composition is quite different from that of any comet, and the extant lunar species do not create optically bright emissions. Since the lunar atmosphere is in fact an exosphere, one can think of its various compositional components as ”independent atmospheres” occupying the same space. Upper limits derived by Apollo-based instruments indicate that the entire native envelope weighs only about 100 t. However, the complexity and scientific value of this atmosphere are not commensurate with its low mass. The lunar atmosphere contains vital information about the location of near-surface volatiles, including water; it also acts as a reservoir of gases released from the interior and may even mirror the composition of certain surface-lying mineralogical units. Furthermore, the lunar atmosphere is the most accessible of the solar system’s SBEs, and offers a rich variety of physical processes to study as analogs to other SBEs across the solar system. An important advantage of the Moon for such studies is that we enjoy abundant surface samples and orbital geochemical data that provide key ”boundary conditions” to the physics and chemistry at work, unlike any other similarly exposed planetary surface. In this review I will summarize the present state of knowledge about the lunar atmosphere, describe the important physical processes taking place within it, and provide a

comparison of the lunar atmosphere to other tenuous atmospheres in the solar system. Particular emphasis will be placed on the intimate connection between the lunar atmosphere and its source. the lunar regolith.
Author
Lunar Atmosphere; Lunar Rocks; Moon; Lunar Composition; Selenology

20000040530 Los Alamos National Lab., NM USA
Global Geochemical Variation on the Lunar Surface: A Three-Element Approach
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We present a method for displaying the relative abundances of three important elements (Th, Fe, and Ti) on the same map projection of the lunar surface. Using Th-, Fe-, and Ti-elemental abundances from orbital geochemical data and assigning each element a primary color, a false-color map of the lunar surface was created. This approach is similar to the ternary diagram approach presented by Davis and Spudis with some important differences, discussed later. For the present maps, Th abundances were measured by the Lunar Prospector (LP) Gamma-Ray Spectrometer(GRS).The new LPGRS low-altitude dataset was used in this analysis. Iron and Ti weight percentages were based on Clementine spectral reflectance data smoothed to the LP low altitude footprint. This method of presentation was designed to aid in the location and recognition of three principal lunar compositions: ferroan anorthosite (FAN), mare basalts (MB), and the Mg suite/ KREEP-rich rocks on the lunar surface, with special emphasis on the highlands and specific impact basins. In addition to the recognition of these endmember rock compositions, this method is an attempt to examine the relationship between elemental compositions that do not conform readily to previously accepted or observed endmember rocks in various specific regions of interest, including eastern highlands regions centered on 150 deg longitude, and a northern highlands Th-rich region observed. The LP low-altitude data has full width at half-maximum spatial resolution of about 40 km. The Clementine spectral reflectance datasets were adapted using an equal-area, gaussian smoothing routine to this footprint. In addition, these datasets, reported in weight percent of FeO and of Ti02, were adjusted to Fe and Ti weight percentages. Each dataset was then assigned one of the three primary colors: blue for Th, red for Fe, and green for Ti. For each element, the data range was normalized to represent the ratio of each point to the maximum in the dataset. (To view the color table, go to http://cass.jsc.nasa.gov/meetings/moon99/pdf/8033.pdf.) The full range of lunar longitudes is represented, but due to the lack of coverage of the Clementine data for latitudes is greater than 70 deg and <#0106>70 deg, the data for these regions is excluded. The differences between this approach and the ternary diagram approach of Davis and Spudis eliminate some of the uncertainty and ambiguity of the ternary diagram approach. Rather than using a ratio of Th to Ti normalized to CI chondritic ratios, and a ternary diagram with ternary apexes located at specific endmember compositional values, elemental compositions were used independently, eliminating the errors resulting from dividing numbers that can have high uncertainties, especially at low concentration. The three elements used in this method of presentation were chosen for several reasons. One reason for the inclusion of Th in this study is that it is an accurate indicator of KREEP. Iron and Ti concentrations are both low in highland regolith, causing any small fluctuations in Th to stand out very well. In addition, Fe and Ti are good compositional indicators of different mare basalts. Mixed with red for Fe, the green for Ti produces a yellow signal in high-Ti basalts. While universally high in Fe relative to the surrounding highlands, mare basalts have a diverse range of Ti values, making Ti concentration a valuable asset to the classification and identification of different basalt types. Finally, an important constraint in element selection is the availability of the global data, both from LP and Clementine results. Data for Th, Fe, and Ti are among the highest quality of existing lunar remote-sensing data. In addition, LP data for Fe and Ti will become available, enabling these data to be incorporated into the analysis. Using upper-limit values for end member rock compositions calculated from Korotev et al., attempts were made to locate the different endmember compositions of terranes on this diagram. Most strikingly, ferroan anorthosite (Th is less than and = 0.37 micro g/g; Fe (wt%)is less than and =2.29; Ti (wt%) is less than and = 0.22), which should appear as an almost black, reddish color, does not appear on the diagram at any noticeable frequency. Based on this analysis, the suggestion of extensive FAN regions on the lunar surface is not strong, especially at the presently accepted values for Fe and Th. However, to make sure this effect is not due to systematic errors, a thorough investigation of the precision, accuracy, and uncertainties of the Fe, Ti, and Th abundances needs to be carried out, especially at low concentrations. A particular region of interest is an area of high Th concentrations relative to Fe and Ti content north and east of Humboldtianum Crater. First observed by Lawrence et al., this region does not coincide with any visible impact structure and comprises one of the closest approximations to pure blue (high Th, very low Ti and Fe) on the lunar surface. Such an elemental composition does not lend itself readily to classification, and presents something of an anomaly. More detailed analysis of this region is needed to understand its structure and origin. There seems to be a longitudinal asymmetry

in the Th concentrations of the highlands regolith. High-Th, low-Ti, and Fe regions are located between 135 deg and 180 deg longitude and between -30 deg and +30 deg latitude. While the Th levels are not high enough to attract attention in a single elemental display, the variation in the abundance of Th relative to Fe and Ti abundances can be clearly seen. The composition that these data suggest is not well represented in the sample return suite. In addition, these regions were largely missed by the Apollo orbital ground tracks, which only covered the outer edge of the areas of interest. The LP orbital Th data represent the first information about the Th concentrations in these regions of the highlands. Additional information contained in original.
Author
Chemical Composition; Lunar Surface; Selenology; Lunar Composition; Lunar Maria; Lunar Rocks

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Siderophile Element Systematics and the Moon's Core-Mantle Differentiation History
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The most highly siderophile elements (HSEs), i.e., the most sensitive indicators of planetary metal-silicate differentiation, are the heavier platinum-group elements: Os, Ir, and Pt, and their periodic-table neighbors Re and Au. The HSE that has been determined most often and most successfully in lunar rocks is Ir. Even so, previous estimates of the concentration of Ir in the lunar mantle indicate great uncertainty, as they range from 0.01 to 4 ng/g, or 0.00002 to 0.009 x CI chondrites. This uncertainty stems from several factors, including the "nugget effect" and other analytical difficulties. The lunar HSE database is scattered amidst many papers, and in most cases analyses for Ir (and other HSE) did not simultaneously determine compatible-lithophile elements. Previous interpretations of these data in terms of mantle concentrations have involved little more than comparison between mean concentrations in lunar vs. terrestrial basalts. Such interpretations are inadequate, because basalts; are diverse. Even the most extremely siderophile elements exhibit compatible behavior under metal-absent conditions. I have compiled a database that is a comprehensive blend of siderophile data with compatible-lithophile data for identical basaltic samples. Over 50% of the HSE data are from the compilation of Wolf et al.; many of the other data are from past publications from my UCLA lab. This database manifests correlations between siderophile elements and several compatible elements that imply relatively tight constraints on the lunar mantle siderophile composition. The notion that FeNi metal may have been a residual mantle phase that determined the HSE compositions of lunar basalts is precluded by a correlation between W (which would be markedly siderophile in the presence of metal) and U. Conceivably residual sulfides controlled the HSE. But textural-mineralogical observations preclude S saturation in the low-Ti basalts, and experimental data indicate that even the most S-rich high-Ti types erupted about 50% undersaturated in S. Nickel, although not quite a HSE like Ir, is a strongly siderophile element with a very extensive database. A plot of MgO vs. Ni manifests clearly significant, albeit nonlinear, correlation trends. The lunar trend parallels that for Earth basalts and komatiites (and a similar trend for martian rocks), but is displaced to lower Ni. The Mg0 contents of the two mantles differ slightly, but mostly this offset reflects an about 5x lower (Ni) in the lunar mantle vs. its terrestrial counterpart. The terrestrial trend passes through the MgO content of Earth's mantle at Ni approximately equals 2200 micro g/g. The implied Ni content of the lunar mantle is about 400 micro g/g. The hypothesis that (Ni) is the same in the lunar and terrestrial mantles is clearly untenable. Ni shows similarly strong correlations vs. Cr and V (except among terrestrial rocks, where V is generally incompatible with olivine). A plot of MgO vs. Ir shows greater scatter, but the same basic relationships. Again, the lunar data form a trend that parallels the Earth trend, but at a displacement indicating about 6x lower Ir) in the lunar mantle vs its terrestrial counterpart. This same inference extends at least to Os, which shows an excellent correlation vs. Ir, at chondritic Os/Ir, among lunar basalts. The lunar mantle ReAr (and Re/Os) is also at least nearly chondritic; Au/Ir, however, gives some indication of being as much as 3x greater than chondritic. The inferred composition implies that Ni/Ir is enhanced in the lunar mantle by nearly the same factor, about 30x Cl chondrites, as in Earth's mantle. In a sense, it is remarkable that the lunar mantle siderophile depletions are not much greater. In the case of the Earth and Mars, the hypothesis that siderophiles were added as a veneer after differentiation of the core remains controversial. In the case of Earth, high-pressure dampening of metal/silicate partitioning behavior may have played a more important role. Recent Lunar Prospector results indicate that the Moon possesses a core amounting to 1-2 wt% of its bulk mass. The depletion factor delta implied by an equilibrium between the silicate portion of the planet and its core can be calculated from the simple mass balance Delta = 1/(Dc+[1-c]) where c is the weight fraction of the core and D is the core/silicate (metal/silicate?) distribution coefficient. With a low-pressure metal/ silicate D of the order 5 x 10(exp 5) and perhaps much higher, Ir should have been depleted in the lunar mantle to about 0.0002x the bulk-Moon concentration (which in any event is presumably not chondritic for siderophile elements, given the Moon's gross depletion in Fe metal). For Ni, the metal/silicate D is roughly 25x lower, so core-mantle equilibration for Ni should have resulted in Delta= 0.005 and Ni/Ir = 25x the bulk-Moon ratio (and the implication regarding Ni/Ir is approximately the same for all finite values of c). by many models, the Moon formed largely from, and thus inherited its bulk composition largely from, Earth's mantle. If a core subsequently formed within the Moon, the Moon-mantle Ir/Ni should have

been depleted by an additional factor of 25 vs. the Earth-mantle value. Thus, it is remarkable that Ir/Ni is so nearly identical in the two mantles. A gross disequilibrium between the mantle and core, i.e., accretion of a ”late veneer,” is most unambiguously implied for the Moon, even though the proportion of the veneer (0.1 wt% of CL-like material, based on Ir) is much less for the Moon’s mantle than often suggested (about 0.7 wt%) for the Earth’s mantle. Additional information contained in original. Author

Lunar Mantle; Lunar Rocks; Lunar Core; Lunar Evolution; Lunar Composition; Selenology; Core-Mantle Boundary; Earth Core; Earth Mantle

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The Transport of Magma from the Mare Source to the Surface

Wieczorek, M. A., Washington Univ., USA; Phillips, R. J., Washington Univ., USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 69-71; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Although it has been known from the beginnings of the space age that the lunar mare basalts are primarily located on the nearside of the Moon, the definitive cause of this phenomenon has remained a mystery. One popular explanation is that the hydrostatic pressure of the mare source controls the eruption of mare basalts. In this scenario, the depth of the mare source controls the maximum height that magma can rise in the crust. If the maximum depth of the mare source was globally uniform, then mare basalts would only be able to erupt at the surface below a critical elevation. Following the discovery of the Moon’s 2-km center-of-mass/center-of-figure offset, many have suggested that the higher elevations of the lunar farside could have prevented farside magmas from reaching the surface due to their lack of the necessary pressure in their source. Recent data obtained from the Clementine and Lunar Prospector missions suggest that this scenario may be a bit simplistic. Using Clementine altimetry data, the full topographic extent of the South Pole Aitken Basin has been determined. Even though the lowest elevations of the Moon were found to occur within this basin’s floor, mare flows in this basins are volumetrically insignificant when compared to the nearside basins and Oceanus Procellarum. If elevation was the only factor controlling the eruption of basalts, then this basin should surely have been completely flooded . Gamma-ray data from the Lunar Prospector mission also suggest that elevation is not the only factor that controls the eruption of mare basalts to the surface. Based on the surface distribution of KREEP, as well as results from previous studies, it has recently been argued that the Procellarum and Imbrium region of the Moon is a unique geochemical crustal province enriched in incompatible and heat-producing elements (named the ”Procellarum KREEP terrane,” or PKT). Wieczorek and Phillips have noted that more than 60% of the Moon’s mare basalts reside within this province, and have argued for a genetic relationship between the two. Specifically, by placing a layer of KREEP basalt in this province, their thermal models predict that the lunar mantle should have partially melted only beneath this province. The eruption of mare basalts thus may be primarily controlled by the distribution of heat sources in the Moon. A figure shows the elevation of the lunar mare referenced to the geoid. We reference the mare elevations to the geoid for two reasons. First, magma on the surface of the Moon would flow down the geopotential gradient (i.e., downhill). Secondly, for a given hydrostatic pressure in the mare source, the maximum height a column of magma can extend is a function of elevation referenced to the geoid. We plotted histograms of elevation referenced to the geoid for the entire Moon, the mare within the confines of the Procellarum KREEP terrane, and the remainder of the mare outside this terrane. From this plot it is found that the eruption of mare basalts does indeed appear to be limited by elevation. In particular, no mare flows occur above an elevation of 2.6 km, and the vast majority of flows occur below about 0.5 km. This is true for both mare basalts that erupted inside and outside the confines of the PKT. This result is consistent with the hypothesis that hydrostatic forces in the mare source control the eruption of basaltic magmas, if the maximum depth of the mare source is globally uniform. The maximum elevation of mare basalts can be used to determine the maximum depth of the mare source by performing a simple force balance. For mechanical equilibrium, the pressure at the base of a column of magma must be balanced by the Moon’s reference hydrostatic pressure at this depth. We have attempted to maximize the depth of the mare source in this calculation by taking extreme values of the density and bulk modulus of the mare basaltic magmas. These values were computed at the material’s liquidus temperature using the technique of Delano and the data of others for the mare basaltic reference suite. The variation in density of this magma with depth was determined using the second-order Birch-Murnagban equation of state, and gravity was computed as a function of depth. If mare basalts only erupt below an elevation of 2.6km, then from the above considerations, a column of magma in hydrostatic equilibrium, at this elevation would extend to a depth of 135 km below the surface. If this column of magma were to extend deeper into the lunar mantle, then it would have been possible for mare basalts to erupt at elevations higher than are observed. It is natural to interpret this depth as the maximum depth of the mare source, and as a working hypothesis we assume this to be the case. We note, however, that this interpretation appears to be inconsistent with the petrologically constrained depth of the mare source. Assuming that the picritic glasses were multiply saturated in olivine and pyroxene in their source, the mare basalts (which are likely derived from these magmas) should have all been derived from depths between 360 and 500 km. In addition, if the magmas parental to the picritic glasses fractionated olivine before erupting, then these depths should be interpreted

as a lower limit. In the following sections, we briefly discuss three possible scenarios that may rectify the disparity between the depth of the mare source based on hydrostatic and petrologic arguments. If the density of mare basaltic magmas was less than that of the surrounding crust, then these melts would have been able to rise to the surface based on buoyancy forces alone. Though the upper anorthositic crust of the Moon is certainly less dense than most mare basaltic magmas, many have argued that the lunar crust becomes progressively mafic with increasing depth below the surface. Additional information contained in original.
Author
Basalt; Elevation; Lunar Crust; Lunar Mantle; Lunar Maria; Magma; Moon; Topography; Volcanology; Selenology

20000040533 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
A View of the Lunar Interior Through Lunar Laser Range Analysis
Williams, J. G., Jet Propulsion Lab., California Inst. of Tech., USA; Boggs, D. H., Jet Propulsion Lab., California Inst. of Tech., USA; Ratcliff, J. T., Jet Propulsion Lab., California Inst. of Tech., USA; Yoder, C. F., Jet Propulsion Lab., California Inst. of Tech., USA; Dickey, J. O., Jet Propulsion Lab., California Inst. of Tech., USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 71-72; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Laser ranges between observatories on the Earth and retroreflectors on the Moon started in 1969 and continue to the present. Recent range accuracies are 2 cm while earliest ranges are an C, order of magnitude less certain. Four retroreflectors are ranged: three located at the Apollo 11, 14, and 15 sites and one on the Lunakhod 2 rover. Accurate analysis of the range data determines a number of lunar science parameters. The lunar interior variables include a fluid core parameter. The Lunar Laser Ranging effort is reviewed elsewhere. Many parameters are detected through their influence on rotation. Also detected are solid-body tides and accurate selenocentric reflector locations. Determined through the rotation are moment-of-inertia differences, gravitational harmonics, potential Love number, and dissipation effects due to tides and molten core. The rotation of the Moon is not at its minimum energy state; some recently active process has caused free librations. The moment differences contributed to the recent improvement of the Moon's moment of inertia from the Lunar Prospector gravity field. The Love numbers provide bulk elastic properties. Future possibilities for measurement include oblateness of the core-mantle boundary and core moment. A study of dissipation signatures in the rotation determines tidal Q vs. frequency and concludes that the Moon has a molten core. At 1 month the tidal Q is 37 and at 1 yr it is 60. The core radius is is less than or = 352 km for Fe and is less than or = 374 km for the Fe-FeS eutectic. The core detection exceeds 3x its uncertainty. The spin of the core is not aligned with the spin of the mantle and torque arises from the velocity difference at the boundary. Yoder's turbulent boundary layer theory is used to compute the radii. The present heat generation from tides and core interaction is minor compared to radiogenic heating. The heating for ancient times is more interesting. Peale and Cassen investigated lunar tidal heating while the lunar orbit expanded due to tides on Earth. Their calculations predate the measurement of Q and should be multiplied by 3.45 to match the lunar-laser-determined Love number and monthly Q. Tidal-heating computations depend on how fast the lunar orbit evolved and whether the tidal dissipation is localized. Neither is known, but plausible assumptions lead to early central region temperature increases of several hundred degrees. Most of the energy is deposited early in the Moon's history. The turbulent boundary layer theory allows a prediction of energy dissipated at the core-mantle boundary during orbit evolution. Under the assumption that the properties of the early core are the same as at present, the energy dissipated by core-mantle interaction is about the same as for tidal dissipation, but it is deposited in a smaller volume. This source of energy is capable of promoting convection in an early fluid core and driving a dynamo. This is a transient phase with a duration depending on the rate of orbit evolution. Plausible assumptions lead to a duration of a few hundred million years. Thus, the remnant magnetization of many lunar rocks is compatible with a brief global magnetic field powered by dynamical energy dissipation. Analysis of the lunar laser ranges is providing information on lunar geophysics. Future data will improve accuracies of present solution parameters, and several more interior effects should be detectable.
Author
Core-Mantle Boundary; Elastic Properties; Lunar Mantle; Selenology; Lunar Core; Lunar Tides; Lunar Geology

20000040534 Wisconsin Univ., Fusion Technology Inst., Madison, WI USA
A Study of an Unmanned Lunar Mission for the Assay of Volatile Gases from the Soil
Wittenberg, L. J., Wisconsin Univ., USA; Sviatoslavsky, I. N., Wisconsin Univ., USA; Kulcinski, G. L., Wisconsin Univ., USA; Mogahed, E. A., Wisconsin Univ., USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 72; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The success of a manned lunar outpost may require that indigenous resources be utilized in order to reduce the requirements for the periodic resupply from Earth for the human inhabitants. Some indigenous lunar resources do exist. For instance, studies of the lunar regoliths, acquired by the Apollo and Luna missions from several maria, indicate that upon heating in a vacuum, these

soils evolve the volatile gases: helium (He), hydrogen (H2), carbon dioxide (CO2), carbon monoxide (CO), nitrogen (N2), and sulfur dioxide (SO2). The He, H, C, and N were originally implanted by solar wind These gases would be valuable to supply life-support systems. For instance, the H2 could be used as a rocket fuel, or alternatively, reacted with the mineral ilmenite (FeTiO3), indigenous to the lunar soil, to yield water (H2O). In an enclosed structure irradiated by solar energy, the H2O, N2, and CO2 could be utilized to grow edible plants for lunar inhabitants. Alternatively, the H2O could be electrolyzed, using photovoltaic cells, yielding breathable O. The inert gas He, would be useful for filling inflatable structures. In addition, the lunar He contains a high abundance of the rare isotopic He-3, which has been identified as a potentially valuable fuel for nuclear-fusion space power systems. In order to determine the economic potential of these lunar volatiles, we need information to assess the in situ quantities of these gases and identify the most abundant sites. In order to acquire such information, a large number of soil samples must be acquired and analyzed because it is not known if these volatile gases in the soil vary widely over the distance of a few meters or several kilometers. In addition, all of the lunar soil samples were analyzed on Earth, after being contaminated by terrestrial air and water. For these reasons, therefore, a mobile, robotic vehicle has been proposed that would be landed-on a lunar maria and assay the volatiles evolved by heating the indigenous lunar regolith. A lunar rover platform with the sample equipment attached has been designed. This science platform was conceptionally designed to fit on a small Marsokhod Rover (75 kg) with a 100-km range. The proposed sampling protocol would be to collect two samples, nearly adjacent. If the results agreed within the experimental deviation, the rover would proceed 0.5 km along the planned route and select two new samples. The progress of the rover and the results of the analyses would be continuously monitored from Earth so that the sampling protocol could be revised as needed. The scientific equipment would accomplish the assay of the regolith samples in the following sequence: (1) retrieve a sample of regolith from the lunar surface by use of a scoop mounted on the platform; (2) reduce the sample to about 1 g of particles is less than 200 pm; (3) weigh the sample; (4) characterize the mineral content (TiO2); (5) heat the sample to 1200C in a vacuum furnace; (6) collect the volatiles; (7) characterize the volatile products; and (8) transmit the data. The components of the scientific package were conceptually designed and are briefly described: (1) The heater unit. A 1 g sample of the surface regolith would be placed in a ferritic steel crucible 0.8 cm OD x 1.57 cm high. This container would be placed in a coiled electrical heater inside an evacuated 1-L container. Heat transfer calculations indicate that the sample would attain 1200C in 14 min with a 25-W heater. For a high-Ti maria regolith sufficient gases are released to create a pressure of 70 Pa at 30C, which is a sufficient sample for the mass spectrometer. (2) Determination of metallic elements. Before the sample is heated, a laser beam delivers 0.45-2.0 Joules per pulse at a wave length of 1 micron to the surface of the sample. The absorption of the laser energy vaporizes some of the minerals in the soils. The vaporized ions are quantitatively determined by the mass spectrometer. (3) Mass spectrometer. This instrument must be utilized to characterize the mineral content of the soil and the volatile gases, essentially from 1 to 72 AMU range. A Fourier Transform Mass Spectrometer (FTMS) may be particularly useful for this analysis, but requires testing. (4) Powersupply. The initial power subsystem assumed the availability of a general purpose heat source, or a Radioisotope Thermoelectric Generator. If the launch of an RTG is forbidden for safety reasons, alternative power supplies would be considered such as solar-electric or beamed microwave sources.

Author

Lunar Resources; Lunar Roving Vehicles; Lunar Laboratories; Lunar Environment; Mission Planning

20000041375 NASA Johnson Space Center, Houston, TX USA

The Geologic History of Mars: An Astrobiology Perspective

Gibson, Everett K., NASA Johnson Space Center, USA; Westall, Frances, NASA Johnson Space Center, USA; McKay, David S., NASA Johnson Space Center, USA; Thomas–Keprta, Kathie, Lockheed Martin Corp., USA; Socki, Richard A., Lockheed Martin Corp., USA; 2000; 1p; In English; 1st; Astrobiology Science, 3-5 Apr. 2000, Mountain View, CA, USA; Sponsored by NASA Ames Research Center, USA

Contract(s)/Grant(s): RTOP 344-50-92; No Copyright; Avail: Issuing Activity; Abstract Only

Fourteen SNC meteorites contain information which must be incorporated with recent spaceflight data for developing Mars' geologic history. SNCs have crystallization ages of 4500 to 160 m.y. Tle oldest meteorite ALH84001 contains information on the Noachian period of Mars' history. There are no meteorites from the Hesperian period and the remaining 13 meteorites fall into two age groups within the Amazonian: The nakhlites around 1300 m.y. and the shergottites between 800-160 m.y. Oxygen isotopic analysis of Martian samples shows two distinct O2 reservoirs throughout Martian history indicating late additions of volatiles and a lack of plate tectonics prior to 3.9 Gy. Evidence for percolation of aqueous brines through impact-produced fractures in the rocky surface is contained in the 3.9 Gy-old ALH84001 carbonate deposits. These carbonates precipitated at approx. 100 C. At this time life had already evolved on Earth. Early Mars could have hosted life similar to the bacteria that inhabited early Earth. Potential microorganisms could have been transported into fractures by carbonate-bearing waters and their remains could have become incorporated into the precipitated carbonate. Since Mars had a weak magnetic field at this time, it can be hypothesized that some of the Martian microorganisms may have been similar to terrestrial magnetotactic bacteria. Over geologic time episodic cratering,

and tectonic events have occurred on Mars along with the periodic release of subsurface waters which may have produced clays within SNC meteorites. The geochemical data contained within SNC meteorites complements previous observational data and the recent Mars Global Surveyor data to provide a geological and environmental history which spans almost the entire lifespan on Mars. One of the outstanding features of this model is the possible creation of an early (about 4 Gy) volatile reservoir distinct from the outgassed Mars volatiles, and the persistence of this reservoir throughout most, if not all of subsequent Mars' history. Within the framework of this history a potential scenario for a possible record of living organisms is provided by suggestive structures and organic signatures trapped within secondary mineral deposits and alteration features of some SNC meteorites. Tracing the differences in oxygen isotopic compositions within Martian components allows us to gain insight in the history of Mars.
Author
Exobiology; Geochemistry; Mars (Planet); Histories; Planetary Geology

20000043648 National Optical Astronomy Observatories, Tucson, AZ USA
Rapid Changes in Mercury's Sodium Exosphere
Potter, Drew, NASA Johnson Space Center, USA; March 2000, No. 61, pp. 61-62; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Sodium in the atmosphere of Mercury can be detected by sunlight scattered in the D1 and D2 resonance lines. Images of the sodium emission show that the sodium density changes from day to day and is often concentrated in regions at high or mid latitudes. Drew Potter (NASA/JSC) and Tom Morgan (SWRI) suggested that sputtering by magnetospheric particles was the origin of the sodium. A problem with this is that the magnetic field of Mercury is strong enough that it is believed to shield the surface from solar particles much of the time, although particle precipitation at the magnetospheric cusps could deposit particles to the surface at high latitudes. Ann Sprague (UA/LPL) noted that the "spots" of sodium emission tended to coincide with major geologic features, such as the Caloris Basin. She proposed that the sodium is released from sodiumrich surface rocks that are associated with these features; however, some spots have appeared where there are no obvious geologic features. Some of the difficulty in ascribing a source for the sodium arises from the effect of terrestrial atmospheric blurring of the image. It is hard to tell exactly where the sodium emission originates after the atmosphere has blurred the image. Potter, Killen (SWRI), and Morgan recently developed a technique for correcting sodium images for atmospheric blurring, using images made with a large-area image slicer. They applied this technique to a series of Mercury sodium observations made in November, 1997 at the McMath-Pierce Solar Telescope. Their technique for producing images from the spectroscopic data provides images of both the sodium emission and of the sunlight reflected from the surface.
Derived from text
D Lines; Deposits; Mercury Atmosphere; Planetary Magnetic Fields; Sodium

92
SOLAR PHYSICS

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

20000038727 NASA Marshall Space Flight Center, Huntsville, AL USA
Overview of the Solar Ultraviolet Magnetograph Investigation
West, Edward A., NASA Marshall Space Flight Center, USA; Porter, Jason G., NASA Marshall Space Flight Center, USA; Davis, John M., NASA Marshall Space Flight Center, USA; Gary, G. A., NASA Marshall Space Flight Center, USA; Spann, James F., Jr., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Instrumentation for UV/EUV for Astronomy and Solar Missions, 30 Jul. - 4 Aug. 2000, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Traditional magnetographs measure the solar magnetic field at the visible "surface" of the Sun, the photosphere. The Solar Ultraviolet Magnetograph Investigation (SUMI) is a design study for an instrument to measure the solar magnetic field higher in the atmosphere, in the upper chromosphere and in the transition region at the base of the corona. The magnetic pressure at these levels is much stronger than the gas pressure (in contrast to the situation at the photosphere), and so the field is much more dynamic. Observations in this region will significantly improve our understanding of the physical processes driving flares and heating in the Sun's upper atmosphere. The instrument will incorporate new technologies to achieve the polarization efficiencies required to isolate the magnetic lines (Civ at 155nm and MgII at 280nm) to be observed in the UV. We describe the scientific goals, the SUMI baseline design and the optical components that are being developed for a sounding rocket program.
Author
Magnetic Fields; Magnetometers; Solar Instruments; Solar Magnetic Field; Ultraviolet Emission; Sun

20000039352 NASA Marshall Space Flight Center, Huntsville, AL USA

Onset of the Magnetic Explosion in Filament-Eruption Flares and CMEs

Moore, Ronald L., NASA Marshall Space Flight Center, USA; Sterling, Alphonse C., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English, 6-9 Mar. 2000, Washington, DC, USA; Sponsored by Catholic Univ. of America, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We present three-dimensional sketches of the magnetic field before and during filament eruptions in flares and coronal mass ejections. Before the eruption, the overall magnetic field is a closed bipole in which the core field (the field rooted along the bipole's neutral line in the photospheric magnetic flux) is strongly sheared and has oppositely curved "elbows" that bulge out from the opposite ends of the neutral line. This core-field sigmoid runs under and is pressed down in the middle by the rest of the field in the bipole, the less-sheared envelope field rooted outside the core field (as in the model of Antiochos, Dahlburg, & Klimchuk 1994, ApJ, 420, L4 1). A filament of chromospheric-temperature plasma is often held in the core field over the neutral line. In a filament eruption, the core field undergoes an explosive eruption, the frozen-in filament plasma providing a visible tracer of the erupting field. The core-field explosion may be either confined (as in some flares) or ejective (as in CMEs that begin together with the onset of a long-duration two-ribbon flare). We present examples of each of these two kind of events as observed in sequences of coronal X-ray images from the Yohkoh SXT, and consider (1) how the explosion begins, and (2) whether confined eruptions begin in basically the same way as ejective eruptions.

Author

Magnetic Flux; Confinement; Explosions; Three Dimensional Models; Magnetic Fields; Stellar Mass Ejection

20000039376 NASA Marshall Space Flight Center, Huntsville, AL USA

The Spectral Evolution of Solar Flare Hard X-Ray Emission Observed with BATSE

Newton, Elizabeth K., NASA Marshall Space Flight Center, USA; Giblin, Timothy, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

We present a more detailed characterization of spectral evolution in solar flare hard X-ray emission than has been previously described. Our characterization is consistent with some earlier results but utilizes higher time resolution data and reveals nuances in spectral evolution that have never been reported. We employ an underutilized data set, the Burst and Transient Source Experiment (BATSE) solar flare catalog, for our investigation and different methodology than previous studies. Our findings support the conclusion that properties of the particle Abstract: acceleration mechanism in flares, such as the acceleration rate or efficiency, are indeed important to understanding spectral evolution. On the other hand, time-of-flight models, which assume accelerator properties to be negligible, cannot explain the observed detailed spectral evolution, and correlations that we would expect to exist between spectral evolution patterns and parameters derived from time-of-flight model inversions are not supported by the data. In this fashion, we establish an observational context in which to interpret future High Energy Solar Spectroscopic Imager (HESSI) observations and delineate some constraints for theoretical models of particle acceleration.

Author

Particle Acceleration; Solar Flares; Sun; X Ray Astronomy; Spectrum Analysis

20000040154 NASA Ames Research Center, Moffett Field, CA USA

The Discrepancy Between Measured and Modeled Downwelling Solar Irradiance at the Ground: Dependence on Water Vapor

Pilewskie, P., NASA Ames Research Center, USA; Rabbette, M., NASA Ames Research Center, USA; Bergstrom, R., Bay Area Environmental Research Inst., USA; Marquez, J., Massachusetts Inst. of Tech., USA; Schmid, B., Bay Area Environmental Research Inst., USA; Russell, P. B., NASA Ames Research Center, USA; Geophysical Research Letters; Jan. 01, 2000; ISSN 0094-8276; Volume 27, No. 1, pp. 137-140; In English

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Report No.(s): Paper-1999GL011085; Copyright; Avail: Issuing Activity

Moderate resolution spectra of the downwelling solar irradiance at the around in north central Oklahoma were measured during the Department of Energy Atmospheric Radiation Measurement Program Intensive Observation Period in the fall of 1997. Spectra obtained under cloud-free conditions were compared with calculations using a coarse resolution radiative transfer model to examine the dependency of model-measurement bias on water vapor. It was found that the bias was highly correlated with water vapor and increased at a rate of 9 W/sq m per cm of water. The source of the discrepancy remains undetermined because of the complex dependencies of other variables, most notably aerosol optical depth, on water vapor.

Author

Solar Radiation; Spectra; Radiative Transfer; Aerosols; Optical Thickness; Water Vapor

20000040396 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Matahari dan Lingkungan Antariksa, Jakarta, Indonesia

Distribution of Longitudinal Flares in the Sun from November 1990 to October 1993 as Observed from the Watukosek SPD ***Distribusi Longitudinal Flare di Matahari Bulan November 1990 Sampai Dengan Oktober 1993 Diamati Dari SPD Watukosek***

Yatini, Clara, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; April - June 1999; Volume 1, No. 2, pp. 11-16; In Malay-Indonesian; See also 20000040393; Copyright; Avail: Issuing Activity

The east-west asymmetry and the distribution in longitude of H alpha solar flares observed from November 1990 to October 1993 have been analyzed. The flare events, did not uniformly spread in heliolongitude over solar disc. In this period the monthly east-west asymmetry shows that in general the flare occurrence is higher on the west hemisphere than on the east, although only a few show the contrary. Meanwhile, the longitude distribution show the concentration of flares toward the center of solar disc. Author

Solar Flares; Sun; Western Hemisphere; Eastern Hemisphere; Solar Longitude

20000040480 Lockheed Martin Corp., Space Operations, Houston, TX USA

Prospecting for Lunar Resources with Global Geochemical and Multispectral Data

Allen, C. C., Lockheed Martin Corp., USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 1-2; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Laboratory experiments have demonstrated correlations between the abundances of some lunar resources and specific chemical and mineralogical parameters of surface materials. Global remote sensing from the Apollo, Galileo, Clementine, and Lunar Prospector missions, combined with Earth-based observations, has now quantified these parameters. Combining experiments and remote sensing allows the first prospecting for resources across the entire lunar surface. The Moon's rocks and soil contain resources that could be used to support a future lunar base for research or for launching expeditions into deep space. Lunar O is the resource most likely to be exploited first, for both propulsion and life support. The efficiency of O extraction from lunar materials has been shown to depend strongly on the material's chemical and mineralogical composition.Some lunar materials may be rare and vital enough on Earth to justify the cost of their return. The rare isotope He-3, which can be used in an efficient and low-polluting fusion power reaction, has been cited as one such resource. Over 20 different processes have been proposed for O production on the Moon. Among the simplest and best studied of these processes is the reduction of oxides in lunar minerals and glass using H gas. It was reported that the results of O extraction experiments on 16 lunar soils. Each sample was reacted in flowing H for 3 h at 1050 C. Total O yield correlated strongly to each sample's initial Fe2+ abundance. A linear least-squares fit of O yield vs. Fe2+ for 16 lunar soils yielded a regression line with a slope of 0.19, an intercept of 0.55 wt% O and an r-square value of 0.87. Oxygen yield did not significantly correlate with the abundance of any element except Fe. Thus, O yield from lunar soils can be predicted with nearly 90% confidence based solely on their iron abundances. The potential for O production at any location on the Moon can be predicted if the soil's Fe concentration is known. On a global scale, Fe concentration in the near surface has been estimated from data returned by a variety of spacecraft. Iron was one of several elements measured from near equatorial orbits during the Apollo 15 and 16 missions, using gamma ray spectrometry. These data covered approximately 20% of the lunar surface, with spatial resolutions of about 100 km. An improved gamma ray spectrometer and a neutron spectrometer, flown on the Lunar Prospector spacecraft in a polar orbit, provided Fe abundance data for the entire lunar surface, again at a spatial resolution of about 100 km. A technique for iron assessment based on orbital multispectral imaging has been developed. This method correlates Fe abundance to a parameter derived from reflectance values at 750 and900nm. The authors use data from the Clementine spacecraft to map Fe abundances across nearly the entire lunar surface. These data can support identification of Fe-rich regions as small as a few hundred meters across. Researchers find good agreement between gamma-ray/neutron and multispectral Fe determinations for most areas on the Moon. The H-reduction experiments cited above also showed submillimeter volcanic glass beads could be highly desirable feedstocks for lunar O production. Iron-rich species, represented by glassy (orange) and crystalline (black) beads, promise particularly high O yields. Apollo 17 volcanic glass sample 74220, composed predominantly of orange glass beads with an average diameter of 40 mm, contains 17.8 wt% Fe2+. Reduction of this sample yielded 4.3 wt% O, well above the regression line defined by the experiments on 16 lunar soils. Sample 74001 is dominated by black crystalline beads, the isochemical equivalent of orange glasses. Reduction of 74001 yielded 4.7 wt% O, the highest value for any lunar sample. Extensive areas of the lunar surface covered by volcanic glass beads have been delineated using Earth based data and spacecraft orbital photography. Chemical compositions of the deposits have been estimated and mixing ratios of glassy and crystalline glass beads have been determined. Clementine multispectral imagery has been employed to determine the precise extent and estimate the thickness of one widespread deposit, that of the Aristarchus Plateau. Lunar ice could prove to be a highly advantageous O source, compared to O derived from soil reduction, in terms of process complexity and power requirements. Thus, a deposit of ice on the Moon is a potentially impor-

tant resource.Permanently shadowed polar craters have been modeled as possible cold traps for water ice, derived either from indigenous sources or from comets. Any lunar ice deposits must occur in extremely restricted areas near the poles. Only crater interiors that are permanently shadowed from sunlight are cold enough to have retained volatiles for a significant part of the Moon's history. Clementine images and Earth-based radar have demonstrated that craters whose interiors are never exposed to sunlight do exist near the lunar poles. Water ice has been tentatively identified in some of these craters using Clementine bi-static radar data. Lunar Prospector mapped the epithermal and fast-neutron fluxes across the entire Moon. Low epithermal fluxes are correlated with concentrations of H, and by extension ice, in the near-surface. Such signatures were observed near permanently-shadowed craters at both lunar poles. Calculation of the actual amount of water ice in these cold traps is strongly model-dependent but each polar region could contain as much as 3x10(exp 9) t of water ice. The concentration of solar wind-implanted He in mare regolith increases with the soil's Ti content. This correlation is apparently due to preferential adsorption of He by ilmenite grains. Thus, Ti in mare soils is a predictor of the He-3 resource. Additional information is contained in the original.
Author
Helium Isotopes; Lunar Resources; Lunar Soil; Oxygen; Oxygen Production; Correlation

20000042292 NASA Johnson Space Center, Houston, TX USA
Cleaning at the Edge of Science: NASA's Genesis Mission
Stansbery, Eileen K., NASA Johnson Space Center, USA; Biesinger, Paul H., Science Applications International Corp., USA; 2000; 1p; In English; The A2C2 Conf/Exh Critical Cleaning Contamination Control, 28-29 Mar. 2000, Baltimore, USA; Sponsored by Crest Ultrasonics, USA
Contract(s)/Grant(s): RTOP 698-00-01; No Copyright; Avail: Issuing Activity; Abstract Only

As part of NASA's continuing exploration of the origins of our solar system, the California Institute of Technology, Jet Propulsion Laboratory, Lockheed Martin Astronautics, Los Alamos National Laboratory, and the Johnson Space Center are working together to develop the Genesis mission to return solar matter for analysis in terrestrial laboratories. These samples will be used to define a baseline for the chemical and isotopic composition of the solar nebula. Deviations from the baseline resulted as the solar system evolved; thus, providing a tracer for materials incorporated into meteorites, comets and planetary bodies. These differences represent "fossil residues" that provide invaluable insight into how the solar nebula evolved to form the planets. We cannot collect a sample of the Sun as we would for a planet; fortunately, solar material comes to us in the form of the solar wind. Ultrapure materials will be exposed at the Earth-Sun L1, outside the Earth's magnetic influence, where solar wind nuclei will be captured for 2 years before returning to Earth in January 2001. The key challenge to obtaining a good sample of solar wind, uncontaminated by terrestrial atoms, is a clean collection surface in a clean sample canister and clean facilities with which to handle the samples for allocation and future reference. The Johnson Space Center QSQ is responsible for contamination control for the mission, for ensuring the cleanliness of collection surfaces and providing a clean environment for their subsequent handling. The level of cleanliness required is high; at the time of analysis (after sample return), the surface contamination by C, N, O must each be less than 10(exp 15) atoms per centimeter squared and for elements other than C, N, O, the number of atoms per centimeter squared of each surface contaminant shall not exceed the estimated solar wind fluence of the species (varies by element between U at approx. 10 (exp 4) atoms per centimeter squared to Fe, Si, Mg, and Ne at approx. 10(exp 12), atoms per centimeter squared). Typical spacecraft assembly is done in class 10,000 cleanrooms. The final cleaning and reintegration of the Genesis payload canister as well as all sample material handling will be done within a class 10 cleanroom using Dryden suits to protect the collector materials from any human debris. Each component is unique, no standard size, shape, material, or precleaning history. We are developing new final cleaning techniques utilizing ultra-pure water to minimize molecular residues on the hardware components.
Author
Genesis Mission; Solar System; Cleaning; Solar Wind; Laboratories

20000043594 National Optical Astronomy Observatories, Tucson, AZ USA
Evolving Flows Inside the Sun Seen by GONG
Howe, Rachel, National Optical Astronomy Observatories, USA; Komm, Rudi, National Optical Astronomy Observatories, USA; Hill, Frank, National Optical Astronomy Observatories, USA; March 2000, No. 61, pp. 8; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Gong observations of the solar oscillations have yielded this image of solar rotation inside the Sun, showing regions of relatively fast (light) and slow (dark) flows 700 km below the solar surface, which migrate towards the solar equator as the surface magnetic activity level rises. These flows extend down to depths of 60,000 km and provide the first detailed look at solar cycle-related internal motions.
Author
Data Acquisition; Sun; Solar Oscillations; Magnetic Variations

20000043646 National Optical Astronomy Observatories, Tucson, AZ USA

Sunspot Spectroscopy

Bernath, Peter, Waterloo Univ., Canada; March 2000, No. 61, pp. 63; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The McMath-Pierce Fourier transform spectrometer (FTS) offers strong laboratory astrophysics support for solar physics and for the study of cool astronomical sources. The infrared and visible spectra of cool objects are dominated by the spectra of molecules such as TiO, SiO, H2O and HF. All of these molecules have been detected in sunspots using high-resolution spectra recorded with the McMath-Pierce FTS. L. Wallace (KPNO) has reduced the solar and sunspot spectra into a series of spectral atlases, that are available electronically through the NSO WWW site. P Bernath (Waterloo) and R. Ram (Arizona) have been assisting with the molecular line identifications by the joint analysis of laboratory and astronomical spectra recorded mainly with the McMath-Pierce FTS.

Derived from text

Sunspots; Spectroscopy; Fourier Transformation; Infrared Spectra

20000043647 National Optical Astronomy Observatories, Tucson, AZ USA

Coronal Holes Coming to You

Jones, Harry, National Optical Astronomy Observatories, USA; March 2000, No. 61, pp. 62-63; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Harry Jones and NSO summer REU student Chad Bender (Illinois/Urbana-Champaign) analyzed imaging spectroscopy in the He I 1083 nm line of a solar coronal hole observed near disk center, and reported first results at the Atlanta AAS meeting in January. Observations were made on 12 January and 26 February 1999 with the NASA/NSO Spectromagnetograph at the NSO/Kitt Peak Vacuum Telescope. Jones and Bender computed images of the equivalent width of the He I absorption feature, along with its wing asymmetry as determined by the difference in wavelength positions between the line bisector at 30% of central line depth and line center. Dupree, Penn, and Jones previously used a similar measure to show that excess blue absorption, indicative of line-of-sight motion towards the observer, is found preferentially in some polar coronal holes where the line is weakest.

Derived from text

Coronal Holes; Imaging Techniques; Spectroscopy; Helium Isotopes; Solar Corona

20000043649 National Optical Astronomy Observatories, Tucson, AZ USA

Diffraction-Limited Magnetogram Movies

Keller, Christoph, National Optical Astronomy Observatories, USA; Rimmele, Thomas, National Optical Astronomy Observatories, USA; Paxman, Rick, National Optical Astronomy Observatories, USA; March 2000, No. 61, pp. 60; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Rick Paxman, John Seldin, Dave Carrara, and Kurt Gleichman of ERIM International in Ann Arbor, Michigan, and Thomas Rimmele and Christoph Keller of NSO recently joined forces to obtain the highest resolution magnetogram movies ever obtained. The ERIM team was responsible for restoring the images with phase-diverse speckle imaging; Rimmele operated the adaptive optics system at the Dunn Solar Telescope to provide the best possible image quality, and Keller ran the Zurich Imaging Polarimeter I (ZIMPOL) and performed the speckle deconvolution of the narrow-band images and magnetograms. The adaptive optics corrected the low-order aberrations with an update rate of about 1.5 kHz and fed a narrow-band channel with the Universal Birefringent Filter in the wing of the Ca 1610.3 nm line and two white-light channels that were used to obtain an in-focus and an out-of-focus image for the phase-diversity processing, which removes the remaining aberrations. All three channels were equipped with a ZIMPOL I camera running simultaneously at 5 frames/s. The one-hour duration was limited by the available hard-disk space.

Derived from text

Diffraction; Magnetic Signatures; Resolution; Image Resolution; Cameras

20000044101 Lembaga Penerbangan dan Antariksa Nasional, Jakarta, Indonesia

The Impact of Flares on August 21 and 25 on the Earth's Magnetic Field and the Ionosphere F2 Layer ***Dampak flare tanggal 21 dan 25 agustus 1998 pada medan magnet bumi dan lapisan F2 ionosfer***

Suhartini, Sri, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; April 1999; Volume 1, No. 2, pp. 34-42; In Malay-Indonesian; See also 20000044098; Copyright; Avail: Issuing Activity

Impact of two flare events on August 21 (M9.0/2B) and 25 (X1.0/3B) 1998, studied for knowing their influence on geomagnetic field, ionospheric F layer and MUF (Maximum Usable Frequency) of the HF (High Frequency) communication. The data used on this paper are geomagnetic H components of Biak (1.1 deg. S, 136.05 deg. E), critical frequency of ionospheric F2 layer (foF2) over Sumedang (6.5 deg. S, 107.47 deg. E) and MUF for HF communication between Manado (1.45 deg. N, 124.75 deg.

E) and Sumedang from 21 to 27 August 1998. The flare on August 21 caused active magnetic storm 23 hours after the event, caused by shock waves which accompany the flare. This magnetic storm followed by the decrease of foF2 and MUF Manado-Sumedang of about 25% and 20%, respectively. The flare on August 25 caused the decrease of foF2 of about 25 % only 3 hours after. The reason of this disturbance is the increase of the absorption in ionospheric F region. Magnetic storm commenced on August 26 (active to minor storm), followed by the ionospheric disturbance showed as 10% and 20% reduction of foF2 and MUF respectively. Major storm on August 27 caused by shock waves which accompany the flare, but the effect cannot be explained due to lack of data since the observation stopped on 09.45.
Author
Geomagnetism; Ionospheric Disturbances; F 2 Region; Solar Flares; Maximum Usable Frequency; Earth Magnetosphere

20000044319 NASA Marshall Space Flight Center, Huntsville, AL USA
When is O+ Observed in the High Altitude Polar Cap?
Elliott, H. A., Alabama Univ., USA; Comfort, R. H., Alabama Univ., USA; Craven, P. D., NASA Marshall Space Flight Center, USA; Chandler, M. O., NASA Marshall Space Flight Center, USA; Moore, T. E., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English, 30 May 2000, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Solar wind and IMF properties are correlated with the properties of O+ and H+ in the polar cap at altitudes greater than 5.5 Re geocentric using the Thermal Ion Dynamics Experiment (TIDE) on the Polar satellite. O+ is of primary interest in this study because the fraction of O+ present in the magnetosphere is commonly used as a measure of the ionospheric contribution to the magnetosphere. O+ is observed to be most abundant at lower latitudes when the solar wind speed is low and across most of the polar cap at high solar winds speeds and KP. As the solar wind dynamic pressures increases more O+ is present in the polar cap. The O+ density is also shown to be more highly correlated with the solar wind dynamic pressure when IMF Bz is positive. H+ was not as well correlated with solar wind and IMF parameters although some correlation with IMF By is observed. H+ is more plentiful when IMF by is negative than when it is positive. In this data set H+ is very dominate so that if this plasma makes it to the plasma sheet its contribution to the plasma sheet would have a very low O+ to H+ ratio.
Author
High Altitude; Polar Caps; Solar Wind; Solar Planetary Interactions; Oxygen Ions; Earth Magnetosphere; Interplanetary Magnetic Fields

93
SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see 52 Aerospace Medicine. For theory see 73 Nuclear Physics.

20000038366 Alabama Univ., Huntsville, AL USA
Gravity Wave Energetics Determined From Coincident Space-Based and Ground-Based Observations of Airglow Emissions ***Final Report, 1 Jul. 1996 - 31 Dec. 1999***
[2000]; 15p; In English
Contract(s)/Grant(s): NGT5-50094; NGT-51641; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Significant progress was made toward the goals of this proposal in a number of areas during the covered period. Section 5.1 contains a copy of the originally proposed schedule. The tasks listed below have been accomplished: (1) Construction of space-based observing geometry gravity wave model. This model has been described in detail in the paper accompanying this report (Section 5.2). It can simulate the observing geometry of both ground-based, and orbital instruments allowing comparisons to be made between them. (2) Comparisons of relative emission intensity, temperatures, and Krassovsky's ratio for space- and ground-based observing geometries. These quantities are used in gravity wave literature to describe the effects of the waves on the airglow. (3) Rejection of Bates [1992], and Copeland [1994] chemistries for gravity wave modeling purposes. Excessive 02(A(sup 13)(Delta)) production led to overproduction of O2(b(sup 1)(Sigma)), the state responsible for the emission of O2. Atmospheric band. Attempts were made to correct for this behavior, but could not adequately compensate for this. (4) Rejection of MSX dataset due to lack of coincident data, and resolution necessary to characterize the waves. A careful search to identify coincident data revealed only four instances, with only one of those providing usable data. Two high latitude overpasses and were contaminated by auroral emissions. of the remaining two mid-latitude coincidences, one overflight was obscured by cloud, leaving only one ten minute segment of usable data. Aside from the statistical difficulties involved in comparing measurements taken in this short period, the instrument lacks the necessary resolution to determine the vertical wavelength of the gravity wave. This means that

the wave cannot be uniquely characterized from space with this dataset. Since no observed wave can be uniquely identified, model comparisons are not possible.
Derived from text
Gravity Waves; Airglow; Emission; Mathematical Models; Temperate Regions

20000038728 NASA Marshall Space Flight Center, Huntsville, AL USA
Particle Identification in the ACCESS Mission
Wang, J. Z., Maryland Univ., USA; Adams, J. H., Jr., NASA Marshall Space Flight Center, USA; Kim, K. C., Maryland Univ., USA; Seo, E. S., Maryland Univ., USA; [2000]; 1p; In English, 30 Apr. 2000, Long Beach, CA, USA; Sponsored by American Physical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

ACCESS (Assembly Concept for Construction of Erectable Space Structures) is a planned Space Station mission to measure the elemental energy spectra of Galactic cosmic rays at energies above 100 GeV/nuc. ACCESS consists of a transition radiation detector (TRD) mounted on top of an ionization calorimeter (IC). A silicon matrix detector placed on top of the IC determines the elemental identity of each cosmic ray measured by the IC. The silicon matrix must be designed to identify each cosmic ray in the presence of backscatter from the calorimeter. Because the TRD is mounted above the IC, the matrix must also recognize cosmic rays that have interacted within the TRD before reaching the IC. We will report the results of detailed GEANT simulations of the silicon matrix in ACCESS. Results will be presented on backscatter interference with charge identification and the ability of the matrix to recognize cosmic rays that interacted in the TRD.
Author
Galactic Cosmic Rays; Mission Planning; Space Stations; Spacecraft Structures; Energy Spectra; Charged Particles

20000040069 Alabama Univ., Dept. of Physics, Huntsville, AL USA
Detailed Analysis of the Pulsations During and After Bursts from the Bursting Pulsar (GROJ1744-28)
Woods, Peter M., Alabama Univ., USA; Kouveliotou, Chryssa, Universities Space Research Association, USA; vanParadijs, Jan, Alabama Univ., USA; Koshut, Thomas M., Universities Space Research Association, USA; Finger, Mark H., Universities Space Research Association, USA; Briggs, Michael S., Alabama Univ., USA; Fishman, G. J., NASA Marshall Space Flight Center, USA; Lewin, W. H. G., Massachusetts Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The hard X-ray bursts observed during both major outbursts of the Bursting Pulsar (GRO J1744-28) show pulsations near the neutron star spin frequency with an enhanced amplitude relative to that of the persistent emission. Consistent with previous work, we find that the pulsations within bursts lag behind their expected arrival times based upon the persistent pulsar ephemeris. For an ensemble of 1293 bursts recorded with the Burst and Transient Source Experiment, the average burst pulse time delay (DELTA t (sub FWHM)) is 61.0 plus or minus 0.8 ms in the 25 - 50 keV energy range and 72 plus or minus 5 ms in the 50 - 100 keV band. The residual time delay (DELTA t (sub resid)) from 10 to 240 s following the start of the burst is 18.1 plus or minus 0.7 ms (25 - 50 keV). A significant correlation of the average burst time delay with burst peak flux is found. Our results are consistent with the model of the pulse time lags presented by Miller (1996).
Author
Gamma Ray Bursts; Pulsars; X Ray Sources; Unsteady Flow; Gamma Ray Observatory

20000040512 Observatoire de Midi-Pyrenees, Toulouse, France
High-Energy Neutrons from the Moon
Maurice, S., Observatoire de Midi-Pyrenees, France; Feldman, W. C., Los Alamos National Lab., USA; Lawrence, D. J., Los Alamos National Lab., USA; Elphic, R. E., Los Alamos National Lab., USA; Gasnault, O., Centre d'Etude Spatiale des Rayonnements, France; dUston, C., Centre d'Etude Spatiale des Rayonnements, France; Lucey, P. G., Hawaii Univ., USA; Workshop on New Views of the Moon 2: Understanding the Moon Through the Integration of Diverse Datasets; 1999, pp. 42-43; In English; See also 20000040479; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Galactic cosmic rays that impact the lunar soil produce neutrons with energies from fractions of eV's to about 100 MeV. The high-energy band from 0.6 to 8.0 MeV is referred as the "fast neutron" band, which is measured by Lunar Prospector (LP) Gamma Ray Spectrometer. Fast neutrons play an important role in neutron spectroscopy that may be summarized as follows: Fast neutrons define the total neutron input to the moderating process toward low-energy populations, so that epithermal and thermal neutron leakage currents must be normalized to the leakage of fast neutrons; they allow the determination of the burial depth of H, a measure necessary to understand characteristics of water deposits; they provide information on the surface content in heavy elements, such as Ti and Fe; and they provide a direct insight into the evaporation process. As discussed hereafter, fast neutrons may yield information on other oxides, such as Si02. missing data. Mare have numerous features, that are resolved in fast neutrons. For

instance, the region extending northwest of Aristarchus (23.7 deg N, 47.4 W) is clearly separated from Montes Harbinger (27.0N, 41.0W) by a high-emission channel, and Mare Vaporum (13.3 N, 3.6 E) is separated from Sinus Aestuun (10.9N, 8.8W) by a low-emission area. We present a new technique to extract information on soil composition from the fast-neutron measurements. The analysis is applied to the central mare region. There are two steps for the development of the technique. 1. For the first step, which has been fully completed, we assume that variations of fast-neutron counting rates are due solely to TiO. and FeO. Upon this assumption, we correlate Clementine Spectral Reflectance Fe and Ti oxide maps with fast measurements. Above 16.5% of FeO, effects of Ti02 variations show in LP data. Below 6.5% of FeO, Fe cannot be discriminated; this is the region of most highland terrains. Under assumption of only two oxides to modulate the signal, we show that fast counts are 3.2x more sensitive to FeO than to Ti02. The resolution in FeO is 1.2 wt% in Ti02 it is 3.8. These results are very satisfying, specially for the distribution of FeO. However, they do not permit reproduction of Clementine Ti02 map from the residual of the fast counting rates and Clementine FeO correlation. Particularly, the discrimination between hi-Ti and low-Ti mare is not striking. 2. The second step is still under development. We assume that variations of fast-neutron counting rates are primarily due to FeO, but also to TiO2, SiO2, CaO, A12O3, MgO, and Na2O. This simulation is for a FAN soil. It will have to be refined and iteratively adapted to the soil composition. With information on TiO2 and FeO distributions from Clementine and the coefficient above, we know the global soil content in the other oxides (weighted by Gasnault et al. coefficients). On the other hand, we have from return samples estimates of correlation between oxide concentrations. We demonstrate that such processing allows estimations of SiO2 variations in the lunar regolith. Additional information contained in original.

Author

Fast Neutrons; Iron Oxides; Lunar Rocks; Lunar Soil; Thermal Neutrons; Moon; Lunar Composition

20000043991 NASA Marshall Space Flight Center, Huntsville, AL USA

Estimating Cosmic Ray Spectral Parameters from Simulated Detector Responses

Howell, Leonard, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English, 29 Apr. - 3 May 2000, Long Beach, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A simple power law model consisting of a single spectral index al is believed to be an adequate description of the galactic cosmic ray (GCR) proton flux at energies below 100 TeV, with a transition at kink energy Ek to a steeper spectral index a2>al above Ek. The maximum likelihood procedure is developed for estimating these three spectral parameters of the broken power law energy spectrum from simulated detector responses. These estimates and their surrounding statistical uncertainty are being used to derive the requirements in energy resolution, calorimeter size, and energy response of a proposed sampling calorimeter for the Advanced Cosmic-ray Composition Experiment for the Space Station (ACCESS). This study thereby permits instrument developers to make important trade studies in design parameters as a function of the science objectives, which is particularly important for space-based detectors where physical parameters, such as dimension and weight, impose rigorous practical limits to the design envelope.

Author

Estimating; Spectrum Analysis; Computerized Simulation; Galactic Cosmic Rays; Cosmic Rays; Detectors

20000044323 NASA Marshall Space Flight Center, Huntsville, AL USA

Gamma-Ray Burst Spectral Indices: Evidence for Deceleration of Synchrotron Shocks

Preece, R. D., NASA Marshall Space Flight Center, USA; Briggs, M. S., NASA Marshall Space Flight Center, USA; Giblin, T., NASA Marshall Space Flight Center, USA; Mallozzi, R. S., NASA Marshall Space Flight Center, USA; Pendleton, G. N., NASA Marshall Space Flight Center, USA; Paciesas, W. S., NASA Marshall Space Flight Center, USA; Band, D. L., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The current scenario for gamma-ray bursts (GRBs) involves internal shocks for the prompt GRB emission phase and external shocks for the afterglow phase. Assuming synchrotron emission from energetic shocked electrons. GRB spectra observed with a low-energy power-law spectral index greater than -2/3 (for positive photon number indices E(sup alpha) indicate a problem with this model. The remaining spectra can test the synchrotron shock model prediction that the emission from a single distribution of electrons, cooling rapidly, is responsible for both the low-energy and high-energy power-low portions of the spectra. We find that the inferred relationship between the two spectral indices of observed GRB spectra is inconsistent with the constraints from the model, posing another problem for the synchrotron shock emission model. to overcome this problem, we describe a model where the average of -1, rather than the value of -3/2 predicted for cooling electrons. Situations where this might arise have been discussed in other contexts, and involve deceleration of the internal shocks during the GRB phase.

Author

Gamma Rays; Bursts; Deceleration

20000044330 NASA Marshall Space Flight Center, Huntsville, AL USA

XTE J1946+274 = GRO J1944+26 Observations with RXTE and BATSE

Wilson, Colleen A., NASA Marshall Space Flight Center, USA; Finger, Mark H., Universities Space Research Association, USA; Scott, D. Matthew, Universities Space Research Association, USA; [2000]; 1p; In English; Rossi 2000: Astrophysics with Rossi X-ray Timing Explorer, 22-24 Mar. 2000, Greenbelt, MD, USA; No Copyright; Avail: Issuing Activity; Abstract Only

XTE J1946+274 = GRO J1944+26 is a 15.8 second transient X-ray pulsar discovered simultaneously with the Rossi X-ray Timing Explorer (RXTE) and Burst and Transient Source Experiment (BATSE) onboard the Compton Gamma Ray Observatory (CGRO) during an outburst in September 1998. Since its discovery, XTE J1946+274 has undergone 7 regularly spaced outbursts, that were observed with BATSE and the RXTE All-Sky Monitor (ASM). The pulse frequency and pulsed flux measurements with BATSE suggest that XTE J1946+274 is in an about 170 day orbit and is outbursting twice per orbit. The first outburst, which was brighter and longer than subsequent outbursts, was also observed with the RXTE Proportional Counter Array (PCA). We present histories of pulse frequency, pulsed flux, and total flux measured in the 20-50 keV band with BATSE and a history of the 2-10 keV total flux measured with the RXTE ASM. From the first outburst, we present energy and power spectra and pulse profiles from RXTE PCA observations.

Author

Energy Spectra; Pulsars; Gamma Ray Sources (Astronomy); Gamma Ray Astronomy; X Ray Astronomy

99
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.

20000040071 NASA Marshall Space Flight Center, Huntsville, AL USA

Power to Explore: A History of Marshall Space Flight Center, *1960-1990*

Dunar, Andrew J., Alabama Univ., USA; Waring, Stephen P., Alabama Univ., USA; November 1999; 1p; In English

Contract(s)/Grant(s): NAS8-36955

Report No.(s): NASA/SP-1999-4313; NAS 1.60:4313; M-950; No Copyright; Avail: Issuing Activity; Abstract Only

This history covers the period from 1960 until 1990. It traces the history of the Marshall Space Flight Center in Huntsville, Alabama. The authors treat the Center's technological contributions to the Nation's space program. They also review the Center's cultural and institutional history.

Author

Histories; NASA Space Programs

20000040787 NASA, Washington, DC USA

National Aeronautics and Space Administration Accountability Report, *1 Oct. 1998 - 30 Sep. 1999*

1999; 112p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This Accountability Report consolidates reports required by various statutes and summarizes NASA's program accomplishments and its stewardship over budget and financial resources. It is a culmination of NASA's management process, which begins with mission definition and program planning, continues with the formulation and justification of budgets for the President and Congress, and ends with the resulting scientific and engineering program accomplishments. The report covers activities from October 1, 1998, through September 30, 1999, with a discussion of some subsequent events. Program accomplishments included the deployment and operation of the Chandra X-ray Observatory, the delivery of supplies and equipment needed to live and operate on the International Space Station, and the development of the first global 3-D map of Mars. Achievements are highlighted in the Statement of the Administrator and summarized in the performance section of this report. Accomplishments such as these continue despite declining budgetary resources. Agency budgets have fallen from a high of 4 percent of the Federal budget during the 1960's to less than 1 percent of the current Federal budget. This budgetary challenge has been met by reorienting programs, eliminating low-priority efforts, reducing support contracts and civil service stafting, and reforming procurement. Internal controls have been improved and budget and financial management streamlined. In that regard, Agency financial management systems substantially comply with the Federal Financial Management Improvement Act.

Derived from text

Federal Budgets; Financial Management; Management Systems; NASA Programs; Project Planning

20000043603 NASA Marshall Space Flight Center, Huntsville, AL USA

Scientific and Technical Reports, Articles, Papers, and Presentations, *FY 1999*

Turner, J. E., Compiler, NASA Marshall Space Flight Center, USA; March 2000; 78p; In English

Report No.(s): NASA/TM-2000-210130; M-976; NAS 1.15:210130; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This document presents formal NASA technical reports, papers published in technical journals, and presentations by MSFC personnel in FY99. It also includes papers of MSFC contractors. All of the NASA series reports may be obtained from the NASA Center for AeroSpace Information (CASI), 7121 Standard Drive, Hanover, MD 21076-1320 The information in this report may be of value to the scientific and engineering community in determining what information has been published and what is available. Author

NASA Programs; Reports; Aerospace Technology Transfer; Information Dissemination; Documents; Information; Catalogs (Publications)

Subject Term Index

A

A STARS, 183
ABIOGENESIS, 120
ABLATIVE MATERIALS, 154
ABSORPTION SPECTROSCOPY, 65
ABUNDANCE, 195, 212, 218
ACCELERATED LIFE TESTS, 45
ACCELEROMETERS, 70
ACCIDENT PREVENTION, 127
ACETYLATION, 159
ACHONDRITES, 105
ACOUSTICAL HOLOGRAPHY, 55
ACTIVE CONTROL, 7, 21, 35, 67, 79, 144
ACTIVE GALACTIC NUCLEI, 168
ACTIVITY CYCLES (BIOLOGY), 121
ACTUATORS, 53, 79
ADAPTERS, 171
ADAPTIVE CONTROL, 77
ADAPTIVE OPTICS, 175
ADHESIVES, 77
ADJOINTS, 3
ADMIXTURES, 146
ADRENERGICS, 121
ADSORBENTS, 38
ADVANCED MICROWAVE SOUNDING UNIT, 101
AERODYNAMIC CHARACTERISTICS, 4, 6, 7, 9, 11, 16, 23
AERODYNAMIC COEFFICIENTS, 74
AERODYNAMIC CONFIGURATIONS, 3, 4, 5, 6, 7, 14, 15, 16, 17, 20
AERODYNAMIC DRAG, 4, 9, 10, 17, 74
AERODYNAMIC FORCES, 3
AERODYNAMIC HEAT TRANSFER, 74
AERODYNAMIC INTERFERENCE, 4, 8
AERODYNAMICS, 1, 21
AEROELASTICITY, 4
AERONAUTICAL ENGINEERING, 1, 12, 76
AEROSOLS, 90, 93, 234
AEROSPACE ENGINEERING, 28, 165
AEROSPACE ENVIRONMENTS, 45, 69, 131, 169
AEROSPACE TECHNOLOGY TRANSFER, 242
AEROSPACE VEHICLES, 100
AEROTHERMODYNAMICS, 65
AFTERBODIES, 11, 16
AGGLUTINATION, 188, 209
AIR BREATHING ENGINES, 25
AIR DATA SYSTEMS, 19
AIR NAVIGATION, 12
AIR POLLUTION, 92, 94, 95, 97
AIR QUALITY, 93, 95
AIR TRANSPORTATION, 127
AIR WATER INTERACTIONS, 111, 115
AIRBORNE EQUIPMENT, 89
AIRBORNE/SPACEBORNE COMPUTERS, 31
AIRCRAFT ACCIDENTS, 125
AIRCRAFT CONFIGURATIONS, 17
AIRCRAFT DESIGN, 1, 3, 4, 14, 15, 16
AIRCRAFT ENGINES, 144
AIRCRAFT ICING, 6
AIRCRAFT LANDING, 21
AIRCRAFT MAINTENANCE, 95
AIRCRAFT MODELS, 16, 28
AIRCRAFT PILOTS, 124
AIRCRAFT STABILITY, 20
AIRCRAFT STRUCTURES, 21, 29, 44
AIRFOILS, 6
AIRFRAMES, 8, 95
AIRGLOW, 97, 239
AIRLINE OPERATIONS, 2, 11, 162
AIRPORT SURFACE DETECTION EQUIPMENT, 22
AIRPORTS, 11, 12, 56, 162
ALBUMINS, 119
ALERTNESS, 125
ALGORITHMS, 12, 13, 87, 98, 132, 134, 138, 141
ALIGNMENT, 169
ALLOYS, 43
ALPHA PARTICLES, 148
ALTITUDE SIMULATION, 34
ALUMINUM, 45, 49, 152
ALUMINUM ALLOYS, 44
ALUMINUM ARSENIDES, 152
ALUMINUM OXIDES, 180
AMINO ACIDS, 117
AMMONIUM PERCHLORATES, 48
AMORPHOUS MATERIALS, 182
ANALYTIC FUNCTIONS, 132
ANGULAR MOMENTUM, 209
ANGULAR RESOLUTION, 170, 177
ANIMALS, 121
ANISOTROPIC PLATES, 40
ANISOTROPY, 40
ANNUAL VARIATIONS, 90, 96, 98, 116
ANORTHOSITE, 216
ANTARCTIC REGIONS, 183
APPLICATIONS OF MATHEMATICS, 134
APPLICATIONS PROGRAMS (COMPUTERS), 15, 71, 133
APPROACH, 21
APPROXIMATION, 161
AQUIFERS, 81
ARAMID FIBER COMPOSITES, 37
ARC HEATING, 65
ARCHAEOLOGY, 91
ARCHITECTURE (COMPUTERS), 139
ARCTIC OCEAN, 116
ARCTIC REGIONS, 94, 116
AREA, 84
ARGON ISOTOPES, 197
ARITHMETIC, 142
ARMED FORCES, 85, 96
ARRAYS, 52, 70, 71, 172
ARTIFICIAL INTELLIGENCE, 136, 142
ASSESSMENTS, 162
ASTRO MISSIONS (STS), 26
ASTRONAUT LOCOMOTION, 131
ASTRONAUT TRAINING, 27
ASTRONAUTS, 122
ASTRONOMICAL MODELS, 184
ASTRONOMICAL OBSERVATORIES, 185
ASTRONOMICAL SATELLITES, 170
ASTRONOMY, 183
ASTROPHYSICS, 168, 183, 184
ATLANTIC OCEAN, 114
ATLANTIS (ORBITER), 26, 27
ATMOSPHERIC BOUNDARY LAYER, 109
ATMOSPHERIC CHEMISTRY, 93
ATMOSPHERIC CIRCULATION, 94, 107, 114
ATMOSPHERIC COMPOSITION, 13, 96, 99, 101
ATMOSPHERIC GENERAL CIRCULATION MODELS, 95
ATMOSPHERIC MODELS, 100, 111, 169
ATMOSPHERIC PHYSICS, 104
ATMOSPHERIC PRESSURE, 101
ATMOSPHERIC SOUNDING, 112, 113
ATMOSPHERIC TEMPERATURE, 101, 102, 114
ATOMIC COLLISIONS, 145

ATOMIC FORCE MICROSCOPY, 47
ATOMS, 182
ATTITUDE (INCLINATION), 24
ATTITUDE CONTROL, 24
AUDITORY SIGNALS, 124
AUGMENTATION, 164
AURORAS, 99, 100, 105
AUSTRALIA, 136
AUTOMATIC CONTROL, 89
AUTOMATIC FLIGHT CONTROL, 123
AUTOMOBILES, 44
AXISYMMETRIC FLOW, 10

B

BACKGROUND RADIATION, 170
BACTERIA, 120
BALLOON-BORNE INSTRUMENTS, 151
BASALT, 205, 209, 223, 224, 226, 231
BASE FLOW, 82
BEAMFORMING, 148
BEAMS (RADIATION), 153
BIBLIOGRAPHIES, 1
BIDIRECTIONAL REFLECTANCE, 151
BINARY STARS, 182
BIOCHEMISTRY, 117, 119
BIODYNAMICS, 50, 129
BIOLOGICAL EFFECTS, 128
BIOMASS, 88
BIOTECHNOLOGY, 165
BITS, 141
BLOWING, 67
BLURRING, 169
BOATTAILS, 9, 10
BODY-WING CONFIGURATIONS, 8, 9, 10, 17
BOLTZMANN-VLASOV EQUATION, 155
BONDED JOINTS, 77
BONE DEMINERALIZATION, 128, 131
BOREHOLES, 99
BORON, 42
BOSONS, 161
BOUNDARY LAYER FLOW, 109
BOUNDARY LAYER TRANSITION, 5, 109
BOUNDARY LAYERS, 8, 106, 114
BOUSSINESQ APPROXIMATION, 43
BRECCIA, 188, 199, 224
BRIDGES (STRUCTURES), 42
BROADBAND, 144
BROADCASTING, 53, 54, 58, 59, 60
BROWN DWARF STARS, 182, 185
BUFFERS (CHEMISTRY), 118
BUILDINGS, 42, 93
BURSTS, 240
BYPASS RATIO, 144

C

CALIBRATING, 86, 170, 177, 178, 217
CALORIMETERS, 32, 69, 70
CAMERAS, 24, 86, 120, 130, 169, 174, 200, 237
CANARD CONFIGURATIONS, 17
CANCER, 71
CARBON, 38
CARBON DIOXIDE, 95
CARBON FIBERS, 52
CASCADE WIND TUNNELS, 144
CASSEGRAIN OPTICS, 86
CATALOGS (PUBLICATIONS), 242
CATALYSIS, 42
CATHODIC COATINGS, 42
CAVITY FLOW, 67
CAVITY RESONATORS, 67
CCD CAMERAS, 172
CELESTIAL BODIES, 23
CELLS (BIOLOGY), 121
CERAMIC MATRIX COMPOSITES, 38, 39
CERAMICS, 46, 47
CERIUM ISOTOPES, 149
CERTIFICATION, 75
CHANGE DETECTION, 84
CHARACTERIZATION, 65
CHARGE COUPLED DEVICES, 86, 169, 178, 179
CHARGE TRANSFER, 169, 179
CHARGED PARTICLES, 147, 148, 149, 239
CHEMICAL COMPOSITION, 105, 197, 207, 209, 218, 229
CHEMICAL EVOLUTION, 185
CHEMICAL OXYGEN-IODINE LASERS, 73
CHEMICAL PROPERTIES, 49
CHEMORECEPTORS, 121
CHICKENS, 158
CHROMOSPHERE, 181
CHRONOLOGY, 90, 183
CINEMATOGRAPHY, 72
CIRCADIAN RHYTHMS, 121
CIRCUITS, 19
CIRCULAR PLATES, 40
CIRCULAR POLARIZATION, 180
CIRCULATION, 75
CIRRUS CLOUDS, 106
CITIES, 86
CIVIL AVIATION, 2, 3, 6, 7, 8, 9, 11, 12
CLASSIFICATIONS, 183, 220
CLEANING, 236
CLEAR AIR TURBULENCE, 101
CLIMATE, 116
CLIMATE CHANGE, 89, 95, 97
CLIMATE MODELS, 93, 94, 95
CLIMATOLOGY, 113, 115
CLOSED ECOLOGICAL SYSTEMS, 23
CLOUD COVER, 108
CLOUD PHYSICS, 108
CLOUDS (METEOROLOGY), 108
COATING, 68
COATINGS, 152
COCKPITS, 126, 127
COGNITION, 124
COLD PLASMAS, 101, 156
COLLIMATORS, 68
COLOR, 183
COMBINATORIAL ANALYSIS, 144
COMBUSTION, 49
COMETS, 184
COMMAND AND CONTROL, 85, 136
COMMERCIAL AIRCRAFT, 11, 162
COMMINUTION, 188
COMMUNICATION, 54, 126, 136, 143
COMMUNICATION CABLES, 138
COMMUNICATION EQUIPMENT, 57
COMMUNICATION NETWORKS, 57, 58
COMMUNICATION SATELLITES, 26, 58
COMPATIBILITY, 30
COMPETITION, 1, 11
COMPOSITE MATERIALS, 33, 38
COMPOSITE PROPELLANTS, 48
COMPOSITE STRUCTURES, 21, 38, 76
COMPOSITE WRAPPING, 78
COMPOSITION (PROPERTY), 210
COMPRESSED GAS, 52
COMPRESSION LOADS, 147
COMPUTATIONAL ELECTROMAGNETICS, 56, 143
COMPUTATIONAL FLUID DYNAMICS, 3, 4, 6, 8, 9, 10, 11, 14, 15, 16, 17, 20, 56, 64, 144, 154
COMPUTATIONAL GEOMETRY, 134
COMPUTATIONAL GRIDS, 15
COMPUTER AIDED DESIGN, 36
COMPUTER GRAPHICS, 36
COMPUTER INFORMATION SECURITY, 135, 140, 141
COMPUTER NETWORKS, 135, 137, 141
COMPUTER PROGRAM INTEGRITY, 135
COMPUTER PROGRAMMING, 19, 133, 135

COMPUTER PROGRAMS, 19, 79, 133, 135, 172
COMPUTER SYSTEMS DESIGN, 133, 139
COMPUTER TECHNIQUES, 2, 123, 141
COMPUTERIZED SIMULATION, 5, 16, 17, 24, 55, 63, 79, 82, 240
CONDENSATES, 114
CONDENSED MATTER PHYSICS, 157
CONFERENCES, 25, 26, 32, 33, 165, 185, 186
CONFIGURATION MANAGEMENT, 139
CONFINEMENT, 234
CONSTRAINTS, 105
CONTACTORS, 62
CONTAMINATION, 41, 97
CONTINENTAL SHELVES, 115
CONTINUOUS WAVE LASERS, 73
CONTOURS, 89
CONTROL EQUIPMENT, 77
CONTROL STABILITY, 6
CONTROL SYSTEMS DESIGN, 34, 35
CONTROL THEORY, 28
CONTROLLERS, 30, 116
CONVECTIVE HEAT TRANSFER, 154
CORE-MANTLE BOUNDARY, 223, 230, 231
CORONAL HOLES, 237
CORRECTION, 86
CORRELATION, 160, 236
CORRELATORS, 105
CORROSION, 68
COSINE SERIES, 132
COSMIC BACKGROUND EXPLORER SATELLITE, 168
COSMIC DUST, 179
COSMIC RAYS, 32, 182, 240
COSMOLOGY, 184
COST EFFECTIVENESS, 11, 30, 127
COST ESTIMATES, 36
COST REDUCTION, 53, 138
COSTS, 36
COUNTERMEASURES, 128, 129, 131
COUNTING, 141
COVARIANCE, 76
CRACK PROPAGATION, 44, 79
CRACKS, 44, 79
CRATERING, 200
CRATERS, 13, 192, 193, 205, 210, 225
CREEP PROPERTIES, 48
CREW PROCEDURES (PREFLIGHT), 27
CRITICAL CURRENT, 80
CRITICAL FLOW, 75
CRITICAL LOADING, 17
CROSS SECTIONS, 148
CROSSLINKING, 118
CRUSTAL FRACTURES, 12, 13
CRUSTS, 224
CRYOGENIC TEMPERATURE, 152
CRYSTAL GROWTH, 43, 118, 119, 158, 159
CRYSTALLIZATION, 117, 157, 159, 198
CRYSTALLOGRAPHY, 119
CRYSTALS, 118, 119, 152, 157, 158
CUES, 132
CULTURE TECHNIQUES, 121
CURIUM ISOTOPES, 149
CURRENT DENSITY, 80
CYLINDRICAL TANKS, 78

D

D LINES, 233
DAMAGE, 62, 110
DAMAGE ASSESSMENT, 167
DAMPING TESTS, 38
DARK MATTER, 171
DATA ACQUISITION, 35, 40, 88, 102, 153, 170, 175, 178, 182, 236
DATA BASE MANAGEMENT SYSTEMS, 166
DATA BASES, 13, 17, 164, 166, 167, 182
DATA INTEGRATION, 166, 186, 191
DATA LINKS, 58
DATA MANAGEMENT, 166
DATA PROCESSING, 36, 84, 169, 178, 186
DATA PROCESSING EQUIPMENT, 87
DATA PROCESSING TERMINALS, 53
DATA REDUCTION, 212
DATA RETRIEVAL, 164
DATA SYSTEMS, 163
DATA TRANSFER (COMPUTERS), 139
DATA TRANSMISSION, 55
DECELERATION, 240
DECISION MAKING, 85, 136
DECOMPRESSION SICKNESS, 122
DECONTAMINATION, 41
DEFENSE INDUSTRY, 33
DEFENSE PROGRAM, 136
DEFORESTATION, 84
DELAY, 71, 138
DEMOGRAPHY, 87
DEPLETION, 108
DEPLOYMENT, 137, 139
DEPOSITION, 6
DEPOSITS, 195, 233
DESIGN ANALYSIS, 14, 15, 19, 30, 71, 130, 142, 152, 166, 167
DESTRUCTION, 91
DETECTION, 19, 70, 112, 128, 145
DETECTORS, 240
DEVELOPING NATIONS, 95
DIAGNOSIS, 64, 65, 74, 75, 77
DIAMONDS, 47
DIFFERENTIAL EQUATIONS, 40
DIFFRACTION, 237
DIFFUSE RADIATION, 168
DIFFUSION, 46, 82
DIGITAL FILTERS, 61
DIGITAL SIMULATION, 19
DIGITAL TECHNIQUES, 59
DIGITAL TELEVISION, 58, 59, 60
DILUTION, 96
DIRECT BROADCAST SATELLITES, 58
DIRECT CURRENT, 41
DIRECT NUMERICAL SIMULATION, 66, 67
DISCRIMINATORS, 69
DISPERSIONS, 46
DISPLACEMENT MEASUREMENT, 74
DISPLAY DEVICES, 71, 124, 125, 126, 128
DISTANCE, 183
DISTRIBUTED INTERACTIVE SIMULATION, 138
DISTRIBUTED PROCESSING, 139, 140
DISTRIBUTION FUNCTIONS, 155, 159
DIVERTERS, 8, 9
DMSP SATELLITES, 107
DOCUMENTS, 2, 242
DOPED CRYSTALS, 46
DOSAGE, 49
DOWNLINKING, 26
DRAG MEASUREMENT, 20
DRAG REDUCTION, 4, 17, 74
DURABILITY, 45
DUST, 180, 185
DYNAMIC MODELS, 64, 156
DYNAMIC RESPONSE, 33, 156
DYNAMIC STRUCTURAL ANALYSIS, 33, 35
DYNAMICAL SYSTEMS, 95
DYNAMICS EXPLORER 1 SATELLITE, 100

E

EARLY STARS, 185
EARTH ATMOSPHERE, 13, 80, 147, 171, 184
EARTH CORE, 105, 230
EARTH CRUST, 223

EARTH IONOSPHERE, 99, 107
EARTH MAGNETOSPHERE, 103, 104, 238
EARTH MANTLE, 105, 230
EARTH OBSERVING SYSTEM (EOS), 87
EARTH ORIENTATION, 105
EARTH SCIENCES, 80
EARTH SURFACE, 89
EARTHQUAKES, 98, 99
EASTERN HEMISPHERE, 235
ECONOMIC ANALYSIS, 167
ECONOMICS, 117
ECOSYSTEMS, 86, 116
EDDY CURRENTS, 79
EDDY VISCOSITY, 64
EDUCATION, 22, 75, 108, 123, 162, 171
EGGS, 158
EJECTA, 173, 200, 202, 203, 210, 211
EL NINO, 115
ELASTIC DEFORMATION, 4, 17
ELASTIC PROPERTIES, 48, 231
ELASTOPLASTICITY, 193
ELECTRIC CURRENT, 55, 80
ELECTRIC MOTORS, 63
ELECTRICAL IMPEDANCE, 68
ELECTRICITY, 30
ELECTRO-OPTICS, 71, 73
ELECTROCHEMICAL CELLS, 68
ELECTROFORMING, 43
ELECTROMAGNETIC FIELDS, 55
ELECTROMAGNETIC PROPERTIES, 156
ELECTROMAGNETIC RADIATION, 55
ELECTROMAGNETIC SCATTERING, 56
ELECTROMAGNETIC SPECTRA, 183
ELECTRON DENSITY (CONCENTRATION), 13, 98, 99, 153
ELECTRON EMISSION, 145
ELECTRON IMPACT, 41
ELECTRON SCATTERING, 170
ELECTRONS, 99
ELECTRORETINOGRAPHY, 122
ELECTROSTATICS, 44, 152
ELEVATION, 219, 231
ELLIPTICAL ORBITS, 179
EMISSION, 92, 153, 239
EMISSION SPECTRA, 22, 182
EMPLOYEE RELATIONS, 55, 139
ENERGETIC PARTICLES, 103, 104
ENERGY CONSERVATION, 63, 92, 97
ENERGY CONSUMPTION, 49
ENERGY DISSIPATION, 145
ENERGY SPECTRA, 239, 241
ENERGY STORAGE, 62
ENERGY TECHNOLOGY, 42
ENERGY TRANSFER, 66
ENGINE AIRFRAME INTEGRATION, 3, 4, 5, 8, 15, 16
ENGINE DESIGN, 37
ENGINE TESTS, 34
ENTHALPY, 51, 65, 66, 154
ENVIRONMENT EFFECTS, 45, 117
ENVIRONMENT PROTECTION, 97
ENVIRONMENTS, 162
ENZYMES, 117
EQUATORIAL ATMOSPHERE, 107
EQUILIBRIUM EQUATIONS, 40
ERROR ANALYSIS, 77, 111
ERRORS, 87, 150
ESTIMATING, 46, 90, 110, 240
ETHYL ALCOHOL, 34
EULER EQUATIONS OF MOTION, 17, 56
EUROPE, 167
EUROPEAN SPACE AGENCY, 31
EUTECTICS, 182
EVALUATION, 2, 92, 125, 134, 139
EVAPORATION RATE, 114
EVOLUTION (DEVELOPMENT), 100, 175
EXCITONS, 157
EXERCISE PHYSIOLOGY, 131
EXHAUST EMISSION, 92, 97
EXHAUST GASES, 97
EXOBIOLOGY, 233
EXPECTATION, 76
EXPERIMENTATION, 54, 55, 87, 91, 137, 148, 154
EXPERT SYSTEMS, 77
EXPLOSIONS, 38, 41, 48, 234
EXPOSURE, 96
EXTRAPOLATION, 66
EXTRATERRESTRIAL RADIATION, 69
EXTRAVEHICULAR ACTIVITY, 122
EXTREME ULTRAVIOLET EXPLORER SATELLITE, 168

F

F 2 REGION, 89, 238
F REGION, 108
FABRICATION, 21, 23, 35, 52, 70, 71, 77, 89, 151, 152, 171, 173
FAILURE ANALYSIS, 78
FALLING, 131
FAN BLADES, 144
FAR INFRARED RADIATION, 181
FAR ULTRAVIOLET RADIATION, 86, 104
FAST NEUTRONS, 218, 240
FAST NUCLEAR REACTORS, 166, 167
FATIGUE (MATERIALS), 69, 125
FAULT DETECTION, 69, 77
FAULT TOLERANCE, 77, 136
FEDERAL BUDGETS, 163, 241
FEET (ANATOMY), 128, 131
FELDSPARS, 197
FIBER COMPOSITES, 40, 52
FIBER OPTICS, 21, 52, 55, 69, 86
FIBERS, 46
FIELD ALIGNED CURRENTS, 99, 105
FIELD OF VIEW, 126, 171, 174, 175, 176
FIELD TESTS, 164
FIGHTER AIRCRAFT, 21
FILAMENT WINDING, 78
FINANCIAL MANAGEMENT, 241
FINITE DIFFERENCE THEORY, 3
FINITE DIFFERENCE TIME DOMAIN METHOD, 55, 56
FINITE ELEMENT METHOD, 40, 43, 44, 48, 78, 79, 152, 177, 193
FINITE VOLUME METHOD, 93
FIRES, 42
FIRING (IGNITING), 48
FISHERIES, 117
FISSION, 147, 148, 149
FITTING, 62
FLAMMABILITY, 41
FLAPPING, 14
FLAPS (CONTROL SURFACES), 14, 15
FLIGHT CHARACTERISTICS, 18, 20
FLIGHT CONTROL, 20, 21, 28, 125, 127
FLIGHT MANAGEMENT SYSTEMS, 125
FLIGHT OPERATIONS, 18, 162
FLIGHT PATHS, 134
FLIGHT SAFETY, 124, 126
FLIGHT SIMULATION, 27, 124
FLIGHT SIMULATORS, 128, 130
FLIGHT TESTS, 27, 28, 29
FLIGHT TRAINING, 2, 123, 134
FLIR DETECTORS, 101
FLOATING POINT ARITHMETIC, 142
FLOODS, 110
FLOW CHARACTERISTICS, 23, 154
FLOW DISTRIBUTION, 107
FLOW MEASUREMENT, 66, 81
FLOW STABILITY, 159
FLOW VELOCITY, 75
FLOWMETERS, 81
FLUID FLOW, 64
FLUORESCENCE, 65, 119, 122, 158
FLUX PINNING, 80
FLYBY MISSIONS, 28

FLYWHEELS, 62
FORECASTING, 76, 83, 111
FOREIGN POLICY, 167
FORESTS, 88, 91
FORMAT, 87
FORMICA, 120
FOSSIL FUELS, 92
FOUR BODY PROBLEM, 160
FOURIER TRANSFORMATION, 181, 237
FRACTURE MECHANICS, 43, 44
FRACTURE STRENGTH, 43
FRACTURING, 79, 193
FRAGMENTATION, 146, 149, 150
FREE CONVECTION, 41
FREE FLIGHT, 28, 126
FREE FLOW, 66
FREQUENCIES, 60, 61, 143
FREQUENCY SYNTHESIZERS, 73
FRESH WATER, 81
FRICTION WELDING, 75
FUEL TANKS, 52
FUELS, 49
FULL SCALE TESTS, 77
FUNCTIONAL INTEGRATION, 126
FUSION REACTORS, 148

G

GALACTIC COSMIC RAYS, 32, 239, 240
GALACTIC EVOLUTION, 173, 185
GALACTIC STRUCTURE, 168
GALAXIES, 171
GALLIUM ARSENIDES, 152
GAMMA RAY ASTRONOMY, 241
GAMMA RAY BEAMS, 149
GAMMA RAY BURSTS, 239
GAMMA RAY OBSERVATORY, 239
GAMMA RAY SOURCES (ASTRONOMY), 241
GAMMA RAY SPECTRA, 149
GAMMA RAYS, 71, 240
GAPS (GEOLOGY), 171
GAS COMPOSITION, 96
GAS FLOW, 185
GAS LASERS, 73
GAS PRESSURE, 131
GAS TRANSPORT, 93
GAUSS EQUATION, 160
GEMINI PROJECT, 174
GENERAL AVIATION AIRCRAFT, 1
GENERAL OVERVIEWS, 7
GENESIS MISSION, 236
GEOCHEMISTRY, 83, 85, 105, 120, 189, 204, 205, 208, 233
GEOCHRONOLOGY, 200, 205, 210
GEOGRAPHIC INFORMATION SYSTEMS, 85, 163
GEOLOGY, 222
GEOMAGNETIC TAIL, 111
GEOMAGNETISM, 32, 83, 103, 104, 176, 206, 238
GEOPHYSICS, 109
GEOS 3 SATELLITE, 102
GIANT STARS, 181
GLASS, 198
GLOBAL AIR POLLUTION, 97
GLOBAL POSITIONING SYSTEM, 12, 13, 35, 99
GLOBAL WARMING, 92
GLOW DISCHARGES, 41
GLUONS, 161
GOLD COATINGS, 46
GOVERNMENT/INDUSTRY RELATIONS, 6, 162
GRADIENTS, 3
GRAIN BOUNDARIES, 80
GRAVITATION, 45, 187
GRAVITATIONAL FIELDS, 187
GRAVITATIONAL PHYSIOLOGY, 130
GRAVITY WAVES, 239
GRAZING INCIDENCE, 151
GRAZING INCIDENCE TELESCOPES, 153
GREEN'S FUNCTIONS, 160
GREENHOUSES, 97
GRINDING MACHINES, 47
GROUND BASED CONTROL, 163
GROUND STATIONS, 26
GROUND TESTS, 66, 74
GROUND WATER, 81, 82, 97
GROUND-AIR-GROUND COMMUNICATION, 56
GROUP VELOCITY, 152
GUATEMALA, 91
GUIDANCE (MOTION), 35
GUIDANCE SENSORS, 89
GULF OF MEXICO, 82, 116, 117
GYROSCOPES, 31

H

HABITATS, 121
HAMILTONIAN FUNCTIONS, 116, 160
HANDBOOKS, 41
HARDWARE DESCRIPTION LANGUAGES, 19
HARMONIC OSCILLATORS, 161
HARNESSES, 128, 129
HAWAII, 82, 83
HAZARDOUS MATERIALS, 48
HAZARDS, 33, 40, 41, 48, 164
HEAD-UP DISPLAYS, 130
HEAT, 86
HEAT FLUX, 39, 66, 154
HEAT ISLANDS, 86
HEAT MEASUREMENT, 66
HEAT TRANSFER, 66, 154
HEAT TREATMENT, 159
HEAVY IONS, 147, 148
HELIOSPHERE, 180
HELIUM ISOTOPES, 236, 237
HELMET MOUNTED DISPLAYS, 56
HEURISTIC METHODS, 134, 140
HIGGS BOSONS, 161
HIGH ALTITUDE, 238
HIGH DEFINITION TELEVISION, 58, 60
HIGH ENERGY FUELS, 42
HIGH FREQUENCIES, 61
HIGH RESOLUTION, 32, 168, 169, 175, 178
HIGH REYNOLDS NUMBER, 11
HIGH SPEED, 3, 6, 7, 139
HIGH SPEED CAMERAS, 72
HIGH SPEED PHOTOGRAPHY, 72
HIGH STRENGTH ALLOYS, 43
HIGH TEMPERATURE, 94
HIGH TEMPERATURE PLASMAS, 99
HISTORIES, 233, 241
HMX, 48
HOLES (ELECTRON DEFICIENCIES), 157
HOLES (MECHANICS), 79
HOMING DEVICES, 35
HOT ISOSTATIC PRESSING, 80
HUBBLE SPACE TELESCOPE, 29, 181
HUMAN BODY, 131
HUMAN FACTORS ENGINEERING, 56, 124, 130, 132
HUMAN PERFORMANCE, 22, 123, 138
HUMAN REACTIONS, 131
HUMAN-COMPUTER INTERFACE, 130
HUMIDITY, 101
HURRICANES, 106
HYDRAZINES, 70
HYDROCARBONS, 41
HYDROGEN, 153, 196
HYDROGEN OXYGEN ENGINES, 34
HYDROGEN PEROXIDE, 49
HYDROGEOLOGY, 82
HYDROLOGY, 81
HYDROLOGY MODELS, 81, 82
HYPERSONIC FLOW, 65
HYPOXIA, 82, 116, 117

I

ICE, 6, 196
IGNEOUS ROCKS, 198, 222, 223, 225
IGNITION, 48
IGNITION LIMITS, 41
ILLUMINATING, 122
IMAGE ANALYSIS, 85, 177
IMAGE CLASSIFICATION, 84
IMAGE CONTRAST, 56
IMAGE PROCESSING, 84
IMAGE RECONSTRUCTION, 169
IMAGE RESOLUTION, 56, 172, 176, 237
IMAGERY, 192, 219
IMAGES, 164
IMAGING SPECTROMETERS, 90, 151, 169, 174, 175, 178
IMAGING TECHNIQUES, 32, 52, 85, 90, 101, 104, 153, 168, 171, 172, 173, 174, 175, 180, 186, 200, 237
IMPACT DAMAGE, 38
IMPACT LOADS, 130
IMPACT VELOCITY, 37
IMPEDANCE, 68
IMPEDANCE MEASUREMENT, 68
IMPROVEMENT, 162, 172
IMPURITIES, 157, 159
IN-FLIGHT SIMULATION, 18
INDEXES (DOCUMENTATION), 1
INDONESIA, 89, 96, 114, 167
INDONESIAN SPACE PROGRAM, 82, 83
INDOOR AIR POLLUTION, 93
INDUSTRIAL PLANTS, 52, 80, 167
INDUSTRIAL SAFETY, 52
INDUSTRIES, 26
INELASTIC SCATTERING, 149
INERTIAL NAVIGATION, 13
INFORMATION, 242
INFORMATION DISSEMINATION, 242
INFORMATION FLOW, 85
INFORMATION MANAGEMENT, 126
INFORMATION RETRIEVAL, 141
INFORMATION SYSTEMS, 49, 54, 57, 82, 85, 126, 135, 141, 142, 163, 164, 165
INFRARED ASTRONOMY, 182
INFRARED DETECTORS, 176
INFRARED IMAGERY, 176, 180
INFRARED INSPECTION, 77
INFRARED INSTRUMENTS, 70, 175
INFRARED RADIATION, 168, 174, 175
INFRARED SPECTRA, 237
INFRARED SPECTROMETERS, 172
INFRARED SPECTROSCOPY, 41
INSECTS, 120
INSPECTION, 52, 77, 183
INSTRUMENT FLIGHT RULES, 12
INTAKE SYSTEMS, 9
INTEGRATED CIRCUITS, 73, 142
INTEGRATED OPTICS, 45
INTELLIGENCE, 136
INTELLIGIBILITY, 56
INTERFACES, 135
INTERNAL WAVES, 115
INTERNATIONAL COOPERATION, 53
INTERNATIONAL SPACE STATION, 29, 31, 122
INTERNETS, 55, 137, 139, 140, 142
INTERPLANETARY MAGNETIC FIELDS, 180, 238
INTERPLANETARY MEDIUM, 180
INTERPROCESSOR COMMUNICATION, 137
INTERSTELLAR MATTER, 179
INTRUSION, 65
IODINE, 73
ION CYCLOTRON RADIATION, 105, 155
ION DENSITY (CONCENTRATION), 108
ION DISTRIBUTION, 101
ION IMPACT, 153
IONIC COLLISIONS, 145, 147, 148
IONIZATION, 32, 41, 182
IONIZED GASES, 63
IONOSONDES, 60
IONOSPHERIC CURRENTS, 99
IONOSPHERIC DISTURBANCES, 238
IONOSPHERIC SOUNDING, 60
IONS, 105, 151
IRON, 212
IRON OXIDES, 190, 213, 214, 216, 227, 240
IRRADIANCE, 96
ISRAEL, 110

J

JAPAN, 12, 85, 98, 112, 113
JAVA (PROGRAMMING LANGUAGE), 135

K

K LINES, 170
KALMAN FILTERS, 31
KELVIN WAVES, 107
KINEMATICS, 131, 184
KNOWLEDGE BASED SYSTEMS, 136
KNOWLEDGE BASES (ARTIFICIAL INTELLIGENCE), 136
KNOWLEDGE REPRESENTATION, 136
KORTEWEG-DEVRIES EQUATION, 115
KREEP, 189, 199, 204, 208, 215, 221

L

LABORATORIES, 236
LAKES, 81
LAMINAR BOUNDARY LAYER, 7
LAMINATES, 40
LAND, 80
LAND USE, 84
LANDFORMS, 210
LANDING, 127
LANDSAT 5, 85
LANDSAT 7, 87, 88
LAP JOINTS, 79
LARGE EDDY SIMULATION, 64
LASER APPLICATIONS, 36
LASER BEAMS, 43
LASER INDUCED FLUORESCENCE, 22, 74
LASER OUTPUTS, 152
LASER RANGE FINDERS, 89
LASER SPECTROSCOPY, 65
LASER WELDING, 43
LASERS, 74
LAUNCH VEHICLE CONFIGURATIONS, 36
LAUNCH VEHICLES, 13, 26, 28
LAVA, 202, 203
LEAD ACID BATTERIES, 61
LEAD TELLURIDES, 160
LEONID METEOROIDS, 184
LEVITATION, 44
LEXAN (TRADEMARK), 45
LIFE (DURABILITY), 38
LIFE SCIENCES, 40
LIFT, 7
LIFTOFF (LAUNCHING), 35
LIGHT BEAMS, 151
LIGHT EMITTING DIODES, 122
LIGHT SOURCES, 122
LIGHTNING, 30, 112
LIMBS (ANATOMY), 131
LINE SPECTRA, 71
LINEAR ENERGY TRANSFER (LET), 69
LIQUID OXYGEN, 34
LIQUID ROCKET PROPELLANTS, 37
LIQUID-VAPOR INTERFACES, 67
LIQUIDS, 40
LITERATURE, 165
LITHIUM, 42

LITHIUM BATTERIES, 61, 63
LITHIUM ISOTOPES, 146
LOADS (FORCES), 75, 91, 128
LOCAL AREA NETWORKS, 137
LOCOMOTION, 131
LONG TERM EFFECTS, 39
LONGITUDINAL CONTROL, 21
LOSSES, 127
LUMINESCENCE, 114, 122
LUMINOSITY, 114
LUNAR ATMOSPHERE, 228
LUNAR COMPOSITION, 191, 195, 196, 199, 200, 211, 212, 214, 215, 218, 225, 228, 229, 230, 240
LUNAR CORE, 215, 230, 231
LUNAR CRATERS, 193, 194, 196, 199, 200, 202, 203, 209
LUNAR CRUST, 187, 189, 190, 193, 195, 204, 205, 212, 216, 221, 224, 225, 231
LUNAR ENVIRONMENT, 218, 232
LUNAR EVOLUTION, 188, 215, 216, 221, 222, 230
LUNAR EXPLORATION, 194
LUNAR FAR SIDE, 194
LUNAR GEOLOGY, 186, 189, 191, 192, 194, 195, 198, 199, 200, 204, 213, 214, 215, 218, 219, 223, 224, 225, 231
LUNAR LABORATORIES, 232
LUNAR MAGNETIC FIELDS, 206
LUNAR MANTLE, 194, 217, 221, 230, 231
LUNAR MAPS, 192, 206, 219
LUNAR MARIA, 189, 190, 191, 192, 194, 198, 199, 200, 202, 203, 204, 205, 207, 208, 209, 210, 211, 214, 215, 216, 217, 221, 223, 224, 225, 226, 229, 231
LUNAR OBSERVATORIES, 186
LUNAR RAYS, 202
LUNAR RESOURCES, 207, 232, 236
LUNAR ROCKS, 188, 191, 194, 197, 198, 207, 209, 211, 213, 215, 216, 220, 222, 224, 225, 226, 228, 229, 230, 240
LUNAR ROVING VEHICLES, 232
LUNAR SOIL, 186, 188, 191, 194, 195, 199, 207, 208, 209, 213, 216, 217, 225, 226, 227, 236, 240
LUNAR SURFACE, 186, 188, 189, 190, 192, 194, 196, 205, 207, 208, 210, 211, 213, 219, 224, 225, 229
LUNAR TIDES, 231
LUNAR TOPOGRAPHY, 192, 202, 203, 210, 214, 219
LYMAN ALPHA RADIATION, 173
LYSOZYME, 118, 119, 158, 159

M

MACH NUMBER, 19
MACHINE LEARNING, 77
MAGELLANIC CLOUDS, 173
MAGMA, 83, 202, 204, 221, 222, 224, 231
MAGNETIC ANOMALIES, 206
MAGNETIC CLOUDS, 180
MAGNETIC DISTURBANCES, 103
MAGNETIC EFFECTS, 159
MAGNETIC FIELD CONFIGURATIONS, 180
MAGNETIC FIELD RECONNECTION, 180
MAGNETIC FIELDS, 80, 103, 104, 145, 153, 159, 233, 234
MAGNETIC FLUX, 104, 147, 180, 234
MAGNETIC MEASUREMENT, 102
MAGNETIC SIGNATURES, 237
MAGNETIC STORMS, 103, 104
MAGNETIC VARIATIONS, 236
MAGNETOHYDRODYNAMIC FLOW, 22, 51, 154
MAGNETOHYDRODYNAMICS, 111
MAGNETOMETERS, 233
MAGNETOPAUSE, 103, 106
MAGNETOSHEATH, 103
MAINTENANCE, 75, 172
MAINTENANCE TRAINING, 123
MAMMARY GLANDS, 71
MANAGEMENT, 134, 162
MANAGEMENT METHODS, 23, 174
MANAGEMENT PLANNING, 85, 174
MANAGEMENT SYSTEMS, 57, 172, 241
MANGANESE OXIDES, 63
MANUFACTURING, 76, 96
MAPPING, 171
MARIA, 193, 213, 220
MARKET RESEARCH, 32, 49, 91, 95
MARS (PLANET), 28, 233
MARS GLOBAL SURVEYOR, 28
MARS MISSIONS, 28
MARS SURFACE, 28
MASS, 184
MASS DISTRIBUTION, 171
MASS FLOW RATE, 181
MASS SPECTROSCOPY, 41
MATERIALS, 50
MATHEMATICAL LOGIC, 142
MATHEMATICAL MODELS, 3, 5, 22, 33, 35, 48, 51, 61, 64, 67, 69, 75, 79, 81, 83, 90, 147, 152, 159, 177, 239
MAXIMUM USABLE FREQUENCY, 238
MEASURING INSTRUMENTS, 23
MECHANICAL ENGINEERING, 62
MECHANICAL PROPERTIES, 39
MERCURY ATMOSPHERE, 233
MERCURY CADMIUM TELLURIDES, 43
MERIDIONAL FLOW, 107
METAL FATIGUE, 44
METAL FILMS, 46
METAL MATRIX COMPOSITES, 51
METAL SHEETS, 44
METALLIC GLASSES, 44
METALLIC PLASMAS, 156
METALS, 44
METAMORPHISM (GEOLOGY), 120
METASTABLE STATE, 182
METEORITE CRATERS, 192, 202
METEORITES, 105, 183, 197, 211
METEORITIC COMPOSITION, 183, 197, 211
METEOROID SHOWERS, 184
METEOROLOGICAL INSTRUMENTS, 87
METEOROLOGICAL PARAMETERS, 102, 110, 112, 113, 114
METEOROLOGICAL RADAR, 111
METEOROLOGICAL SATELLITES, 80
METEOROLOGICAL SERVICES, 87
METEOROLOGY, 109
METHOD OF CHARACTERISTICS, 56
METHOD OF MOMENTS, 66, 67
METHYL COMPOUNDS, 95
METROLOGY, 151, 170
MICROELECTRONICS, 25
MICROGRAVITY, 40, 50, 51, 70, 131
MICROSCOPY, 46
MICROSTRUCTURE, 118
MICROWAVE HOLOGRAPHY, 55
MICROWAVE IMAGERY, 89, 114
MIGRATION, 54, 83
MILITARY OPERATIONS, 85, 123
MILITARY TECHNOLOGY, 33
MILLIMETER WAVES, 87
MINERALOGY, 105, 189, 190, 191, 204, 216, 222, 226, 227
MINERALS, 226
MIRRORS, 52, 150, 151, 152, 169, 177
MISSILE DESIGN, 137
MISSILES, 38
MISSION PLANNING, 232, 239
MISSISSIPPI RIVER (US), 94
MIXING CIRCUITS, 73
MIXING LAYERS (FLUIDS), 109
MODAL RESPONSE, 156
MODELS, 160, 163
MOIRE INTERFEROMETRY, 17
MOLECULAR CLOUDS, 145, 182

MOLECULAR INTERACTIONS, 158
MOLECULAR IONS, 145
MOLYBDENUM ALLOYS, 70
MONITORS, 177
MONTE CARLO METHOD, 69, 155
MOON, 166, 186, 187, 188, 189, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 202, 203, 206, 207, 211, 212, 215, 216, 217, 218, 219, 221, 222, 225, 226, 228, 231, 240
MOTION PERCEPTION, 132
MOTION PICTURES, 72
MOTION SIMULATORS, 132
MOUNTAINS, 12
MULTIMEDIA, 135
MULTIPLIERS, 142
MULTISENSOR FUSION, 191
MUSCULOSKELETAL SYSTEM, 121, 128

N

NACELLES, 8, 9, 10
NAMING, 220
NANOCRYSTALS, 47
NASA PROGRAMS, 1, 23, 25, 108, 241, 242
NASA SPACE PROGRAMS, 26, 241
NATURAL GAS, 52
NAVIER-STOKES EQUATION, 5, 14, 16, 17, 64
NAVIGATION AIDS, 12, 134
NEAR FIELDS, 46
NETWORKS, 54, 139
NEUTRAL ATMOSPHERES, 98
NEUTRINOS, 147
NEUTRON COUNTERS, 71
NEUTRON EMISSION, 71
NEUTRON PHYSICS, 149
NEUTRON SPECTRA, 71
NEUTRONS, 207
NEXT GENERATION SPACE TELESCOPE PROJECT, 150, 177
NICKEL ALLOYS, 153
NIGHT, 87
NIGHT VISION, 56
NIOBIUM COMPOUNDS, 80
NITRATES, 82
NITROGEN, 82
NOISE (SOUND), 144
NOISE PREDICTION, 144
NOISE REDUCTION, 144
NOMENCLATURES, 46, 220
NONDESTRUCTIVE TESTS, 38, 52, 76, 77
NONEQUILIBRIUM FLOW, 64
NONINTRUSIVE MEASUREMENT, 22, 38
NONLINEAR OPTICS, 143, 152
NONLINEAR SYSTEMS, 66, 143
NORMAL DENSITY FUNCTIONS, 155
NORTH ATLANTIC TREATY ORGANIZATION (NATO), 167
NORWAY, 11
NOZZLE EFFICIENCY, 33
NOZZLELESS ROCKET ENGINES, 33
NUCLEAR INTERACTIONS, 147
NUCLEAR PHYSICS, 146
NUCLEAR POTENTIAL, 160
NUCLEAR PROPULSION, 147
NUCLEAR SCATTERING, 149
NUCLEAR STRUCTURE, 147, 148, 149
NUCLEATION, 118, 119, 158, 159
NUCLEI (NUCLEAR PHYSICS), 146, 149, 150
NUCLEONS, 149, 161
NUMERICAL ANALYSIS, 88, 155
NUMERICAL DIFFERENTIATION, 88
NUTRITION, 82, 116

O

O STARS, 185
OBSERVATION, 100, 171, 174, 176
OBSERVATORIES, 102, 170, 177
OCEAN CURRENTS, 113
OCEAN DYNAMICS, 113
OCEAN MODELS, 111, 113, 116
OCEAN SURFACE, 89, 110, 113
OCEANS, 80, 116
OLIVINE, 226
ON-LINE SYSTEMS, 174
OPERATIONAL PROBLEMS, 54
OPTICAL COMMUNICATION, 53, 137, 143
OPTICAL EQUIPMENT, 150, 151
OPTICAL FIBERS, 138
OPTICAL MEASUREMENT, 23
OPTICAL MEASURING INSTRUMENTS, 68, 175
OPTICAL PROPERTIES, 152, 227
OPTICAL RADAR, 106, 151
OPTICAL SCANNERS, 46
OPTICAL SWITCHING, 152
OPTICAL THICKNESS, 234
OPTICAL TRACKING, 35
OPTICAL WAVEGUIDES, 152
OPTIMIZATION, 3, 14, 15, 17, 144
OPTOELECTRONIC DEVICES, 73
ORBITAL RENDEZVOUS, 29
ORBITAL VELOCITY, 31
ORGANIC MATERIALS, 45
ORGANIZATIONS, 50
OROGRAPHY, 109
ORTHOGONALITY, 40
ORTHONORMAL FUNCTIONS, 132
OSCILLATIONS, 61, 67
OXYGEN, 147, 236
OXYGEN BREATHING, 122
OXYGEN IONS, 105, 238
OXYGEN PRODUCTION, 236
OZONE, 96
OZONE DEPLETION, 94

P

PACKET SWITCHING, 140
PARALLAX, 173
PARALLEL PLATES, 52
PARALLEL PROCESSING (COMPUTERS), 136
PARITY, 146
PARTIAL DIFFERENTIAL EQUATIONS, 132
PARTICLE ACCELERATION, 103, 234
PARTICLE COLLISIONS, 161
PARTICLE DECAY, 161
PARTICLE EMISSION, 94
PARTICLE INTERACTIONS, 51
PARTICLE PRODUCTION, 161
PARTICLE SIZE DISTRIBUTION, 94
PARTICULATES, 46, 93, 94
PATTERN RECOGNITION, 164
PENNING EFFECT, 41
PEPTIDES, 117
PERFECTLY MATCHED LAYERS, 143
PERFORMANCE PREDICTION, 11, 18, 42, 123, 154
PERFORMANCE TESTS, 74, 89, 154
PERIODIC VARIATIONS, 115
PERIODICALS, 83
PERSONNEL, 174
PERSONNEL DEVELOPMENT, 123
PESTICIDES, 97
PETROGENESIS, 204
PETROGRAPHY, 204
PETROLOGY, 105, 220
PH, 118
PHASE TRANSFORMATIONS, 48
PHASE VELOCITY, 152
PHONONS, 146
PHOSPHINES, 181
PHOSPHORESCENCE, 183
PHOSPHORIC ACID FUEL CELLS, 92
PHOTOCHEMICAL REACTIONS, 152
PHOTOELECTRIC EMISSION, 180
PHOTOGRAMMETRY, 17
PHOTOGRAPHIC RECORDING, 72

PHOTOGRAPHY, 90
PHOTOMETRY, 24, 186
PHOTONICS, 73, 137, 152
PHYSICAL EXERCISE, 122, 128, 129, 130, 131
PHYSIOLOGICAL EFFECTS, 128, 131
PIEZOELECTRIC CERAMICS, 53
PIEZOELECTRICITY, 21, 79
PIEZOMETERS, 82
PIEZORESISTIVE TRANSDUCERS, 53
PILOTLESS AIRCRAFT, 18, 130
PINEAL GLAND, 122
PINS, 75
PIPES (TUBES), 45
PLANETARY GEOLOGY, 233
PLANETARY MAGNETIC FIELDS, 233
PLANETARY SURFACES, 23
PLANETARY TEMPERATURE, 131
PLANFORMS, 17
PLANNING, 173
PLASMA BUBBLES, 108
PLASMA DENSITY, 108
PLASMA DRIFT, 108
PLASMA DYNAMICS, 111
PLASMA FLUX MEASUREMENT, 154
PLASMA HEATING, 105, 155
PLASMA PHYSICS, 156
PLASMA RADIATION, 156
PLASMAS (PHYSICS), 38, 51, 100, 101, 108, 111, 147, 155
PLASMASPHERE, 100, 153
PLASMATRONS, 154
PLUGS, 75
PLUMES, 36
POINT SOURCES, 185
POLAR CAPS, 196, 238
POLAR CUSPS, 101, 103
POLAR REGIONS, 99, 105, 107
POLARIMETRY, 180
POLARIZATION (CHARGE SEPARATION), 63
POLARIZATION CHARACTERISTICS, 180
POLICIES, 11, 176
POLITICS, 167
POLLUTION CONTROL, 93, 96
POLLUTION MONITORING, 92, 94
POLLUTION TRANSPORT, 93, 97
POLYBUTADIENE, 46, 167
POLYETHYLENE TEREPHTHALATE, 45
POLYMER MATRIX COMPOSITES, 37
POLYMERIC FILMS, 45
POLYMERIZATION, 45, 46
POLYMERS, 45, 120
POPULATIONS, 91, 185
POROSITY, 116
POSTFLIGHT ANALYSIS, 26
POWER EFFICIENCY, 147
PRE-IMBRIAN PERIOD, 221
PRE-MAIN SEQUENCE STARS, 185
PRECIPITATION (CHEMISTRY), 51
PRECIPITATION (METEOROLOGY), 94, 110, 111
PREDICTION ANALYSIS TECHNIQUES, 18, 42, 60
PREDICTIONS, 90
PREFIRING TESTS, 27
PREFLIGHT ANALYSIS, 27
PREFLIGHT OPERATIONS, 27
PRELAUNCH TESTS, 27
PRESSURE CHAMBERS, 77
PRESSURE DRAG, 20
PRESSURE VESSELS, 78
PREVENTION, 179
PRIMARY BATTERIES, 63
PRIVACY, 141
PROBABILITY THEORY, 30
PROCEDURES, 22, 39, 51, 65, 154
PRODUCT DEVELOPMENT, 38, 139
PROGRAMMING LANGUAGES, 12
PROJECT MANAGEMENT, 173
PROJECT PLANNING, 241
PROPELLANT ADDITIVES, 49
PROPELLANT COMBUSTION, 48
PROPELLANT DECOMPOSITION, 48
PROPELLANT TESTS, 34
PROPELLANTS, 33, 49, 70
PROPORTIONAL COUNTERS, 69
PROPULSION, 32, 36, 37
PROPULSION SYSTEM CONFIGURATIONS, 25, 36, 37
PROPULSION SYSTEM PERFORMANCE, 25, 34, 37, 147
PROPYLENE, 95
PROTEIN CRYSTAL GROWTH, 117, 157, 158
PROTEINS, 118, 158
PROTOCOL (COMPUTERS), 137
PROTOTYPES, 55
PROVING, 23, 164
PULSARS, 239, 241
PULSED LASER DEPOSITION, 46
PULSED RADIATION, 156
PUMPING, 75
PURIFICATION, 38, 117
PURITY, 39
PUSHING, 51
PYROMETERS, 70
PYROXENES, 204

Q

QUALITY, 18
QUANTITATIVE ANALYSIS, 41, 145
QUANTUM CHROMODYNAMICS, 161
QUANTUM DOTS, 157
QUANTUM MECHANICS, 149, 157
QUANTUM THEORY, 149
QUARKS, 148, 161
QUARTZ TRANSDUCERS, 79
QUASARS, 173
QUEUEING THEORY, 140

R

RADAR CROSS SECTIONS, 72
RADAR DATA, 111
RADAR IMAGERY, 72, 115
RADAR MEASUREMENT, 88, 106
RADAR SIGNATURES, 72
RADAR TRACKING, 114
RADIATION BELTS, 176
RADIATION CHEMISTRY, 93
RADIATION COUNTERS, 148, 149, 176, 178
RADIATION DAMAGE, 151
RADIATION DETECTORS, 72
RADIATION MEASUREMENT, 176
RADIATION PROTECTION, 72
RADIATION SHIELDING, 3
RADIATION SOURCES, 156
RADIATIVE HEAT TRANSFER, 93
RADIATIVE TRANSFER, 234
RADIO COMMUNICATION, 56
RADIO EQUIPMENT, 56
RADIO FREQUENCIES, 73
RADIO FREQUENCY HEATING, 155
RADIO METEOROLOGY, 102
RADIO WAVES, 54
RADIOACTIVE CONTAMINANTS, 177
RADIOACTIVITY, 177
RADIOMETERS, 87, 88, 89
RAIN, 111
RANGE SAFETY, 18
REACTION PRODUCTS, 148
REACTIVITY, 70
REACTOR MATERIALS, 167
REACTOR SAFETY, 80
REACTOR TECHNOLOGY, 52
READOUT, 178
REAL TIME OPERATION, 77, 120, 160, 171
RECEIVING, 5
RED SHIFT, 171, 173

REENTRY, 154
REENTRY EFFECTS, 39
REENTRY SHIELDING, 154
REENTRY VEHICLES, 23
REFINING, 91
REFLECTANCE, 217, 227
REFLECTION, 171
REGOLITH, 188, 190, 194, 209, 211
REGRESSION ANALYSIS, 76
REINFORCED PLASTICS, 37
RELATIONAL DATA BASES, 136
RELAY, 62
RELIABILITY, 80
RELIABILITY ANALYSIS, 35, 52, 77, 133
RELIEF MAPS, 89, 192
REMOTE CONTROL, 130
REMOTE SENSING, 74, 80, 85, 89, 90
RENEWABLE ENERGY, 49
REPLACING, 29
REPORTS, 242
RESEARCH, 54, 71, 109, 158, 160, 162, 183, 184
RESEARCH AND DEVELOPMENT, 23, 44, 55, 82, 83, 142, 157, 163, 165
RESEARCH FACILITIES, 74, 96
RESEARCH MANAGEMENT, 42
RESEARCH VEHICLES, 19
RESERVOIRS, 81, 84
RESIDENTIAL AREAS, 63
RESIDUAL STRENGTH, 78, 79
RESOLUTION, 237
RESONANCE, 146
RETARDING, 122
RETINA, 122
RETRACTABLE EQUIPMENT, 75
REUSABLE LAUNCH VEHICLES, 25, 29, 34
REUSABLE ROCKET ENGINES, 34
REYNOLDS AVERAGING, 64
REYNOLDS STRESS, 64
RHEOLOGY, 193, 202
RICE, 90
RING GALAXIES, 173
RISK, 40, 80, 133, 184
RIVER BASINS, 81, 94
RIVERS, 81, 85
RIVETED JOINTS, 79
RIVETS, 79
ROCK INTRUSIONS, 202
ROCKET ENGINE CASES, 38
ROCKET ENGINES, 34, 36
ROCKET NOZZLES, 33
ROCKET PROPELLANTS, 34
ROCKET TEST FACILITIES, 34
ROCKET-BASED COMBINED-CYCLE ENGINES, 25
ROTATION, 65, 159
RUNNING, 128
RUNWAYS, 12

S

S WAVES, 99
SAFETY, 22, 33, 38, 126, 127, 164
SAFETY DEVICES, 125
SAFETY FACTORS, 33
SAFETY MANAGEMENT, 11, 42
SALINITY, 81
SAMPLING, 41
SANDWICH STRUCTURES, 38
SATELLITE ATTITUDE CONTROL, 31
SATELLITE COMMUNICATION, 58
SATELLITE CONTROL, 24
SATELLITE IMAGERY, 85, 101, 112, 113
SATELLITE INSTRUMENTS, 104
SATELLITE NAVIGATION SYSTEMS, 24
SATELLITE OBSERVATION, 100, 112, 113, 116
SATELLITE SOUNDING, 112, 113
SATELLITE TELEVISION, 60
SCALE MODELS, 64
SCALING LAWS, 80
SCANNING TUNNELING MICROSCOPY, 47
SCHEDULES, 40
SCHOOLS, 108
SCIENTIFIC VISUALIZATION, 88
SCINTILLATION COUNTERS, 3
SEA ICE, 116
SEA SURFACE TEMPERATURE, 111, 114, 115
SEARCH RADAR, 22
SECURITY, 167
SEDIMENTS, 99, 116
SEGMENTED MIRRORS, 152
SEISMOGRAPHS, 99
SEISMOLOGY, 12, 13, 98
SELECTIVE DISSEMINATION OF INFORMATION, 85, 141
SELENIDES, 160
SELENOGRAPHY, 192, 198, 202, 206, 219
SELENOLOGY, 191, 192, 196, 199, 200, 205, 206, 209, 210, 212, 216, 217, 219, 221, 222, 228, 229, 230, 231
SENSITIVITY, 90
SENSORIMOTOR PERFORMANCE, 131
SENSORS, 89
SERVICE LIFE, 52, 80
SET THEORY, 134
SETTLING, 40
SEYFERT GALAXIES, 170
SHALLOW WATER, 115
SHAPE FUNCTIONS, 3
SHEAR STRESS, 111
SHIPS, 55
SHOCK LAYERS, 64
SHOCK MEASURING INSTRUMENTS, 62
SHOCK TESTS, 62
SHOCK TUNNELS, 65
SHOCK WAVE PROPAGATION, 63
SHOES, 131
SIGNATURE ANALYSIS, 72
SILICON RADIATION DETECTORS, 32
SILICONES, 45
SILVER ALLOYS, 70
SIMULATION, 19, 22, 28, 35, 64, 66, 69, 129, 134, 152, 154, 168
SIMULATORS, 22, 129
SINGULARITY (MATHEMATICS), 160
SKY SURVEYS (ASTRONOMY), 168
SMART MATERIALS, 53
SNOW, 109
SOBOLEV SPACE, 132
SODIUM, 233
SOFTWARE DEVELOPMENT TOOLS, 12, 74
SOFTWARE ENGINEERING, 5, 132, 133, 164
SOIL EROSION, 84
SOIL MAPPING, 84
SOILS, 95
SOLAR ACTIVITY, 82
SOLAR ACTIVITY EFFECTS, 32, 103
SOLAR CORONA, 237
SOLAR FLARES, 234, 235, 238
SOLAR INSTRUMENTS, 173, 233
SOLAR LONGITUDE, 235
SOLAR MAGNETIC FIELD, 233
SOLAR OSCILLATIONS, 236
SOLAR PLANETARY INTERACTIONS, 238
SOLAR POWER SATELLITES, 91
SOLAR RADIATION, 114, 234
SOLAR REFLECTORS, 152
SOLAR STORMS, 103
SOLAR SYSTEM, 184, 236
SOLAR TERRESTRIAL INTERACTIONS, 103
SOLAR WIND, 103, 111, 206, 207, 236, 238
SOLID LUBRICANTS, 47

SOLID OXIDE FUEL CELLS, 92
SOLID PROPELLANT ROCKET ENGINES, 33, 69, 164
SOLID PROPELLANTS, 48
SOLID ROCKET PROPELLANTS, 42
SOLIDIFICATION, 40, 43, 44
SOLUBILITY, 40
SOLVENTS, 46
SONAR, 116
SOOT, 36
SORPTION, 95
SOUND TRANSMISSION, 143
SOUNDING ROCKETS, 35, 102
SOUTHERN OSCILLATION, 115
SPACE COMMERCIALIZATION, 26
SPACE EXPLORATION, 32, 91
SPACE FLIGHT, 50
SPACE HEATING (BUILDINGS), 63
SPACE INFRARED TELESCOPE FACILITY, 163
SPACE MISSIONS, 24, 184
SPACE OBSERVATIONS (FROM EARTH), 168
SPACE PLASMAS, 106
SPACE PLATFORMS, 62
SPACE PROBES, 106
SPACE PROCESSING, 40, 50
SPACE PROGRAMS, 31
SPACE SHUTTLE BOOSTERS, 27
SPACE SHUTTLE MAIN ENGINE, 37
SPACE SHUTTLE MISSIONS, 70
SPACE SHUTTLE PAYLOADS, 29
SPACE SHUTTLES, 90, 184
SPACE STATION POWER SUPPLIES, 29
SPACE STATIONS, 32, 239
SPACE SUITS, 131
SPACE TRANSPORTATION, 25
SPACE TRANSPORTATION SYSTEM, 26, 27, 28, 29, 70
SPACE TRANSPORTATION SYSTEM FLIGHTS, 26, 50
SPACEBORNE ASTRONOMY, 26, 170
SPACEBORNE EXPERIMENTS, 13, 25
SPACEBORNE TELESCOPES, 26, 151, 177
SPACECRAFT CONFIGURATIONS, 36
SPACECRAFT DOCKING, 29
SPACECRAFT INSTRUMENTS, 88
SPACECRAFT LAUNCHING, 13, 76
SPACECRAFT MAINTENANCE, 29
SPACECRAFT PROPULSION, 25
SPACECRAFT STRUCTURES, 239
SPACING, 12, 134
SPATIAL DEPENDENCIES, 124
SPATIAL DISTRIBUTION, 81
SPATIAL RESOLUTION, 153, 200
SPECIFICATIONS, 111, 125
SPECTRA, 145, 217, 234
SPECTRAL RESOLUTION, 169, 200
SPECTRAL SIGNATURES, 227
SPECTROGRAPHS, 178
SPECTROMETERS, 71, 200
SPECTRORADIOMETERS, 90
SPECTROSCOPY, 65, 149, 227, 237
SPECTRUM ANALYSIS, 39, 114, 234, 240
SPEECH RECOGNITION, 56
SPRINGS (ELASTIC), 78
SPUTTERING, 41
STABILITY, 124, 154, 160
STANDARDIZATION, 53, 75
STAR FORMATION, 182, 185
STARS, 177, 184
STATISTICAL ANALYSIS, 147
STELLAR ENVELOPES, 173, 182, 185
STELLAR EVOLUTION, 182
STELLAR MASS EJECTION, 180, 234
STELLAR MODELS, 180
STELLAR SPECTROPHOTOMETRY, 174
STELLAR WINDS, 181
STOPPING, 153
STORMS, 110
STRAIN DISTRIBUTION, 80
STRATEGIC MATERIALS, 39
STRATOSPHERE, 102
STREAMS, 81
STRESS ANALYSIS, 44
STRESS CORROSION, 79
STRUCTURAL ANALYSIS, 79, 166, 167
STRUCTURAL BASINS, 214
STRUCTURAL DESIGN, 43, 53
STRUCTURAL RELIABILITY, 69
STRUCTURAL STABILITY, 144
STRUCTURAL VIBRATION, 35
STUDENTS, 1, 171
SUBDIVISIONS, 172
SUBSONIC FLOW, 67
SUBSONIC SPEED, 14
SUN, 233, 234, 235, 236
SUNSPOTS, 237
SUPERCONDUCTORS (MATERIALS), 80
SUPERGIANT STARS, 181
SUPERNOVA 1987A, 173
SUPERSONIC COMBUSTION RAM-JET ENGINES, 19
SUPERSONIC FLIGHT, 7
SUPERSONIC FLOW, 7
SUPERSONIC INLETS, 8
SUPERSONIC TRANSPORTS, 3, 4, 5, 6, 7, 8, 9, 14, 15, 16, 17, 20
SUPPORT SYSTEMS, 58, 125, 126, 137
SURFACE TEMPERATURE, 154
SURFACE WATER, 81, 82, 85
SURFACTANTS, 66
SURVEYOR PROJECT, 28
SURVEYS, 2, 162, 171, 173
SWITCHES, 62, 155
SYMMETRY, 148
SYNCHROTRONS, 148
SYNOPTIC MEASUREMENT, 174
SYNTHESIS (CHEMISTRY), 46
SYNTHETIC APERTURE RADAR, 115
SYSTEM IDENTIFICATION, 5
SYSTEMS ANALYSIS, 27, 140
SYSTEMS ENGINEERING, 30
SYSTEMS INTEGRATION, 5, 7
SYSTEMS MANAGEMENT, 25

T

T TAURI STARS, 182
TACTICS, 123
TAIWAN, 115
TANKS (CONTAINERS), 77
TEAMS, 123
TEARING, 156
TECHNOLOGICAL FORECASTING, 126, 164
TECHNOLOGIES, 36
TECHNOLOGY ASSESSMENT, 5, 7, 21, 25, 39, 95, 97, 124, 126, 138, 139
TECHNOLOGY UTILIZATION, 6, 7, 29, 31, 32, 52, 54, 91
TECTONICS, 209, 222
TEFLON (TRADEMARK), 45
TELECOMMUNICATION, 54, 57, 58
TELEMETRY, 13
TELESCOPES, 69, 171, 174, 175, 176
TELEVISION SYSTEMS, 58, 59
TELEVISION TRANSMISSION, 60
TEMPERATE REGIONS, 110, 239
TEMPERATURE CONTROL, 30
TEMPERATURE DEPENDENCE, 33
TEMPERATURE DISTRIBUTION, 159, 160
TEMPERATURE EFFECTS, 23, 147
TEMPERATURE MEASUREMENT, 38, 39, 65, 70, 74, 102
TEMPERATURE PROFILES, 193
TERMINAL BALLISTICS, 37
TERRA SPACECRAFT, 102
TERRAIN, 84, 90, 125, 217
TERRAIN ANALYSIS, 84, 127
TEST EQUIPMENT, 13, 150

TEST FACILITIES, 23, 153
TEST FIRING, 27
TEST STANDS, 57, 137
TESTS, 33
THEMATIC MAPPERS (LANDSAT), 87
THERMAL DECOMPOSITION, 48
THERMAL EMISSION, 92
THERMAL ENERGY, 86
THERMAL INSULATION, 131
THERMAL NEUTRONS, 240
THERMAL PLASMAS, 99, 107
THERMAL PROTECTION, 22, 39, 74, 154
THERMAL RADIATION, 70
THERMISTORS, 70
THERMOCHEMICAL PROPERTIES, 160
THERMOCHEMISTRY, 39
THERMODYNAMIC EQUILIBRIUM, 148
THERMODYNAMIC PROPERTIES, 208
THERMOGRAPHY, 70, 77
THERMOLUMINESCENCE, 72
THICKNESS, 187
THORIUM, 190, 199, 208
THREE DIMENSIONAL MODELS, 43, 70, 124, 234
THUNDERSTORMS, 109, 112
TIDAL WAVES, 113
TIME DEPENDENCE, 149
TIME FUNCTIONS, 132
TIME LAG, 176
TIME SHARING, 163
TITANIUM, 191
TITANIUM OXIDES, 190, 224, 226
TITRATION, 118
TOLERANCES (MECHANICS), 38
TOPOGRAPHY, 84, 109, 192, 193, 231
TORNADOES, 112
TOROIDAL PLASMAS, 155
TOTAL OZONE MAPPING SPECTROMETER, 94
TOXIC HAZARDS, 49
TOXICITY, 34, 40, 49
TOXICOLOGY, 40
TRACE CONTAMINANTS, 93
TRACE ELEMENTS, 92
TRAINING ANALYSIS, 75, 123, 162
TRAINING DEVICES, 2, 134
TRAINING EVALUATION, 75
TRAINING SIMULATORS, 22, 27
TRAJECTORIES, 120, 134
TRANSMISSION ELECTRON MICROSCOPY, 145
TRANSMISSOMETERS, 36
TRANSMITTERS, 13
TRANSONIC FLOW, 9, 10
TRANSONIC NOZZLES, 10
TRANSONIC WIND TUNNELS, 8
TRANSPARENCE, 45, 183
TRANSPORT PROPERTIES, 39
TREADMILLS, 128, 129, 130, 131
TRENDS, 55, 102
TRIBOLOGY, 47
TROPICAL METEOROLOGY, 115
TROPICAL REGIONS, 88, 106, 107, 110, 111
TROPOPAUSE, 93
TRUSSES, 79
TURBINE BLADES, 74
TURBULENCE, 67, 109
TURBULENT BOUNDARY LAYER, 109
TURBULENT FLOW, 66, 67, 109, 144
TWO DIMENSIONAL BODIES, 6
TWO DIMENSIONAL FLOW, 10, 66
TWO DIMENSIONAL MODELS, 43
TWO PHASE FLOW, 67, 75

U

ULTRASONICS, 40
ULTRAVIOLET EMISSION, 233
ULTRAVIOLET IMAGERY, 86, 100
ULTRAVIOLET RADIATION, 45, 96, 181
ULTRAVIOLET SPECTRA, 86, 168
UNDERWATER ACOUSTICS, 143
UNDERWATER STRUCTURES, 69
UNITED STATES, 12, 31, 141
UNIVERSE, 183
UNIVERSITIES, 1, 162
UNSTEADY FLOW, 239
UPPER ATMOSPHERE, 109
UPWIND SCHEMES (MATHEMATICS), 56
URBAN DEVELOPMENT, 87
URBAN RESEARCH, 86
USER MANUALS (COMPUTER PROGRAMS), 166
USER REQUIREMENTS, 54

V

VACUUM, 155
VAPOR DEPOSITION, 46
VARIABILITY, 98, 168
VARIATIONAL PRINCIPLES, 161
VARIATIONS, 101
VELOCITY MEASUREMENT, 65
VERY LONG BASE INTERFEROMETRY, 105, 200
VIBRATION, 76, 78, 79
VIBRATION DAMPING, 78
VIBRATION ISOLATORS, 53, 131
VIBRATION METERS, 74
VIBRATIONAL STRESS, 78
VIEWING, 86
VIGNETTING, 169
VIRTUAL REALITY, 139
VISCOPLASTICITY, 193
VISCOSITY, 193
VISCOUS FLOW, 15
VISUAL ACUITY, 56
VISUAL OBSERVATION, 80, 90, 102
VISUAL PERCEPTION, 102
VISUAL STIMULI, 120
VOICE COMMUNICATION, 57
VOLCANOES, 13, 83, 93, 198, 199, 202, 203, 208, 215
VOLCANOLOGY, 195, 198, 199, 203, 205, 222, 224, 231
VOLUME, 84
VOLUMETRIC ANALYSIS, 46
VORTICES, 114
VULNERABILITY, 84

W

WALKING, 131
WALLS, 38
WARFARE, 133
WARNING SYSTEMS, 70, 125
WASTE MANAGEMENT, 92
WASTE TREATMENT, 92
WATER, 196
WATER FLOW, 81, 82
WATER POLLUTION, 97
WATER RECLAMATION, 19
WATER RESOURCES, 81, 97
WATER TEMPERATURE, 82
WATER VAPOR, 87, 106, 114, 234
WAVE FRONTS, 68
WAVE PROPAGATION, 55, 143
WEAK INTERACTIONS (FIELD THEORY), 161
WEAPON SYSTEMS, 33, 35
WEATHER FORECASTING, 102, 110
WEATHERING, 209
WEIGHTING FUNCTIONS, 101
WEIGHTLESSNESS, 128, 129, 130, 131
WELDED JOINTS, 75
WELLS, 81
WESTERN HEMISPHERE, 235
WHEELS, 47
WIDE AREA NETWORKS, 137
WIND (METEOROLOGY), 83, 110
WIND SHEAR, 111

WIND TUNNEL MODELS, 4, 5, 16, 17
WIND TUNNEL TESTS, 4, 8, 10, 11, 16, 17, 19, 23, 35
WIND TUNNELS, 22, 23
WIND VARIATIONS, 114
WIND VELOCITY, 61
WINDPOWER UTILIZATION, 92
WINDS ALOFT, 98
WING NACELLE CONFIGURATIONS, 4, 8, 20
WINTER, 102
WIRE, 78, 80
WIRELESS COMMUNICATION, 140, 142
WOOD, 120

X

X RAY ASTRONOMY, 153, 168, 234, 241
X RAY ASTROPHYSICS FACILITY, 151, 168, 169, 170, 176, 177, 179
X RAY DIFFRACTION, 117
X RAY OPTICS, 43, 151, 169
X RAY SOURCES, 168, 239
X RAY SPECTRA, 145, 170
X RAY SPECTROSCOPY, 145, 182
X RAY TELESCOPES, 3, 151, 170
X RAYS, 169, 177, 178, 182
X-33 REUSABLE LAUNCH VEHICLE, 77
X-34 REUSABLE LAUNCH VEHICLE, 33
X-37 VEHICLE, 29
X-38 CREW RETURN VEHICLE, 23, 28

Z

ZINC OXIDES, 46

Personal Author Index

A

Aagaard, Finn, 167
Abbas, M. M., 179
Abbas, Mian M., 179
Abbott, Larry Wayne, 30
Abdeldayem, Hossin, 151
Abe, Hirofumi, 139
Abiad, R., 86, 104
Ablowitz, Mark J., 142
Abraham, Tony, 172
Abrams, Howard Allan, 139
Achouri, L., 149
Acuna, M., 205
Adams, J. H., Jr., 31
Adams, Hal E., 124
Adams, J. H., Jr., 239
Addy, Harold E., Jr., 5
Agrawal, Shreekant, 6, 9, 14, 15, 17
Agterhuis, E., 56
Aldcroft, T., 169
Aleksandrov, D., 145
Alexander, H. A., 159
Alexandru, Adriana, 77
Allen, C. C., 120, 235
Aman, A., 69
Amzajerdian, Farzin, 151
Anderson, Gregory, 115
Anderson, H., 153
Anderson, J. M., 186
Antani, Tony, 6
Antcliff, Richard R., 20
Applin, Z. T., 7
Ardizzone, J., 110
Arief, Hamzah, 90
Arifin, Samsul, 90
Armandroff, Taft, 174
Arnold, T., 90
Arslan, Alan, 9, 17
Arslan, Alan E., 14, 15
Asmar, S., 187
Asquith, Thomas E., 19
Atlas, R., 110
Atwood, A. I., 47, 48
Ault, J. P., 44
Aumann, T., 145
Auslender, Aaron H., 63
Austin, R. A., 150, 151
Austin, Thomas, 9
Auweter-Kurtz, Monika, 22, 23
Avanov, L. A., 105

B

Baca, Ernest, 143
Badhwar, G. D., 69
Badhwar, Gautam D., 32
Bailey, Michelle D., 39
Baker, David L., 69
Baker, Myles L., 4
Ball, Doug, 6
Ballabrera-Poy, J., 110
Band, D. L., 240
Barbosa, Claudio Clemente Faria, 84
Bard, Bill, 3
Barker, Ballard M., 2
Barker, John L., 88
Baron, Heidi A., 129
Barraclough, B. L., 195, 211, 228
Barreau, G., 189
Barthold, G. B., 44
Bartolino, J. R., 82
Bastien, Pierre, 145
Basu, A., 187
Bates, L. B., 34
Bauer, Steven X. S., 14
Bauman, J. J., 93
Bautz, M., 178
Beck, W. H., 65
Beggs, John H., 56
Behrens, R., 47
Bell, J. F., III, 201
Bell, Leon, 13
Belleguic, M., 149
Bellucci, G., 217
Ben-Dor, E., 110
Bencze, Daniel P., 6
Benz, Frank J., 40
Bergstrom, R., 234
Bergstrom, R. W., 93
Beris, Antony N., 66
Berkovich, Simon, 141
Bernath, Peter, 237
Bertrand, T., 160
Bertulani, C. A., 146
Beshears, D. L., 52
Beveridge, James, 28
Bharadvaj, Bala, 7, 17
Biesinger, Paul H., 236
Bijvoet, Jan A., 70
Binder, A., 205
Binder, A. B., 195, 211, 228
Birn, J., 111
Bishop, Craig V., 40
Bjerke, Pal, 85
Blackwell, Tim, 151
Blackwell, W. C., 168, 178
Blake, A. M., 164
Blake, David A., 20
Blalock, Stephen, 55
Blewett, D. T., 201, 213, 215
Blom, Gordon, 15
Blom, Harald, 142
Blum, Bob, 172
Bman, B., 32, 69
Bocage, F., 147
Bogatikov, O. A., 222
Bogatilkov, O. A., 221
Boggs, D. H., 231
Boggs, T. L., 48
Bohannan, Bruce, 172, 173
Bok, Michael J., 133
Bonnaud, G., 156
Book, Michael L., 89
Bordano, Aldo J., 28
Born, Sabine, 41
Borodkova, N. L., 105
Boroson, Todd, 173, 174
Bots, M. J., 122
Bottin, B., 154
Boubert, P., 23
Bouchet, P., 175
Bouchut, F., 155, 156
Bourdon, A., 23
Bourgeois-Bougrine, S., 125
Bowen, Brent D., 2, 11
Bower, Mark V., 39
Brandon, W. C., 81
Brathen, S., 11
Braun, Scott, 109
Brekosky, Regis, 70
Brickhouse, N. S., 182
Bridge, K. Y., 120
Briggs, M. S., 240
Briggs, Michael S., 239
Bringfelt, B., 95
Brinkman, A. C., 178
Brittnacher, M. J., 99
Broadfoot, Lyle, 101
Brower, D. V., 33
Brower, David V., 69
Brown, Andrew M., 33
Bryan, Thomas C., 89
Buechler, D. E., 112

Bull, Barton, 35
Bultel, A., 23
Bune, Andris V., 43
Burch, J. L., 106
Burgess, R., 196
Burke, Michael, 158
Burner, A. W., 16
Busalacchi, A., 110
Bussey, D. B. J., 188, 203, 224
Butt, Y. M., 176, 178
Byrne-Kelly, Darcy, 96

C

Cabell, Ran, 144
Cabon, P., 125
Cadirola, M., 106
Cahyono, Waluyo Eko, 113
Calloway, Robert L., 6
Cam, G., 42
Cameron, R., 169, 178
Campbell, B. A., 201
Campbell, Richard L., 14
Capelato, Hugo Vicente, 183
Capone, Francis J., 16
Capote, R., 157
Cappuccio, Gelsomina, 4, 7
Carbonaro, M., 154
Cardinali, A., 156
Cardullo, Frank M., 132
Carlson, Harry W., 14
Carlson, John R., 10
Carlsson, J., 155
Carman, Mike, 125
Carney, Thomas Q., 2
Carpenter, Kenneth G., 181
Carreno, Victor, 134
Carson, Steven, 88
Carstenson, Larry G., 2
Castelberry, Daniel, 126
Catalina, A. V., 51
Caughlin, Don, 5
Cavanagh, P. R., 128
Cavanagh, Peter R., 128, 129, 130
Celarier, E., 96
Cervisi, Richard T., 29
Chaderjian, Neal, 17
Chafetz, H. S., 120
Chambers, Lin H., 107
Chan, Siew-Loong, 56
Chandler, M. O., 238
Chandler, Michael O., 101
Chaney, Steve, 8, 15
Chang, James B., 78
Chaudhri, Vinay K., 135
Chavers, Greg, 150
Chazot, O., 154
Cheggour, N., 80
Chen, Harn C., 78
Chen, J., 102
Chen, Jiasheng, 103
Chen, L. J., 99
Chen, Qun, 136
Chen, Sherwin S., 127
Chen, Y., 2
Chen, Z., 79
Chernov, A. A., 157, 159
Chevrel, S., 212
Chevrel, S. D., 189
Chevrot, I., 148
Chiu, Stanley T., 78
Chokani, Ndaona, 67
Chomaz, P., 149
Christian, H. J., 112
Chrysostomou, Antonio, 180
Chubb, Gerald P., 2
Church, P. E., 81
Ciszak, Ewa, 117
Clark, B. C., 193
Clark, P. E., 190
Clark, Stuart, 180
Claver, C. F., 171
Claver, Chuck, 172
Clemena, G. G., 41
Cline, John, 144
Clothiaux, Eugene J., 155
Coen, Peter G., 7
Coffey, Victoria N., 101
Cohen, Martin, 168
Coleman, M., 40
Collett, Thomas, 120
Collis, S. Scott, 5
Comfort, R. H., 179, 238
Comfort, Richard H., 100, 179
Conaty, Austin, 102
Condit, Richard, 88
Connell, Richard B., 130
Cook, A. C., 191
Cook, Stephen A., 26
Corson, C., 171
Cowherd, C., 93
Cox, Gary, 30
Craig, Larry, 177
Craven, P. D., 99, 238
Craven, Paul, 100
Craven, Paul D., 105, 106
Crepani, Edison, 84
Cresitello-Dittmar, M., 169
Crotts, 175
Cudney, Harley H., 52
Curran, P. O., 47
Cutlip, William, 24

D

Darcy, Philip, 95
Das, S. K., 44
Dash, R. G., 81
Daugas, J. M., 149
David, L. P., 177
Davies, A., 77
Davis, Brian L., 129
Davis, Dennis D., 69
Davis, John M., 233
Davis, Mark C., 18
Day, J. W., 82
Daydou, Y., 189, 212
deAraujoSousa, Manoel, Jr., 84
DeBonis, James R., 9
deCastroMilone, Andre, 171
Dees, Paul W., 19
DellAntonio, Ian, 171
Delventhal, Rex A., 62
Demille, David R., 133
Demoz, B., 106
Denison, S. K., 47
Denton, R. E., 153
Derr, Janice, 128
Derr, Janice A., 129
deSousaJunior, Wilson Cabral, 83
Deutekom, M. J., 37
Devenport, William J., 144
deVries, S. C., 127, 130, 138
Dewey, D., 177
Diaz, R. J., 117
Dickey, J. O., 231
Dickman, J., 63
Dietz, David, 143
Diffey, William M., 152
Dimanlig, Arsenio, 3
Dirgahayu, Dede, 90
Dobson, C. C., 36
Domack, Christopher S., 14
Dombard, A. J., 192
Done, C., 170
Donnelly, R. H., 177
Donovan, David, 118
Dortch, Q., 116
Dougani, H., 86
Douglas, Vonnie M., 41
Douglass, Anne R., 93
Drake, J. J., 178
Drake, Michael J., 105

Driscoll, K. T., 112
Drunert, V., 92
Druyan, L., 110
Duarte, Valdete, 84
Duke, M. B., 193
Dunar, Andrew J., 241
Dunkin, S. K., 203
Dunstan, Steve, 95
Dussy, S., 156
dUston, C., 239
Dutra, Luciano Vieira, 84
Dutta, S. B., 152
Dutta, Sanghamitra B., 51

E

Ebisawa, Katsuji, 60
Eckardt, F. D., 90
Edelmann, P., 81
Edgar, R. J., 169, 170, 177
EdiRusnadi, Iyus, 89
Edwards, David L., 45
Effinger, Michael, 38, 39
Eggleston, Debra S., 33
Ellingson, Bill, 38
Elliott, H. A., 238
Ellor, J. A., 44
Elphic, R. C., 195, 211, 228
Elphic, R. E., 239
Elsey, A., 125
Elsner, R. E., 176
Elsner, R. F., 150, 151, 178
Elvidge, Christopher, 87
Emmerich, S. J., 93
Engelhaupt, D., 43, 151, 153
Erard, S., 212
Erickson, G. E., 16
Eriksen, K. S., 11
Eskridge, R. H., 36
Estes, Jay, 28
Estes, Maurice G., Jr., 85
Evans, K. D., 106
Evans, L., 190
Ewin, Audrey J., 51
Ewing, Felecia, 118

F

Fainstein, P. D., 144
Farhart, Samir, 38
Farrand, W. H., 194
Fedrizzi, Mariangel, 98
Feigl, Markus, 22
Feix, M. R., 155
Feldman, W. C., 189, 195, 211, 228, 239
Feltz, W., 106
Fernandes, V. A., 196
Ferris, Michael C., 136
Figua, H., 155
Figueroa-Feliciano, Enectali, 70
Fijalkow, E., 155
Filho, Edson Pereira Marques, 109
Filho, Pedro Hernandez, 84
Fillingim, M. O., 99
Finckenor, Miria M., 45
Finger, Mark H., 239, 241
Fischer, Mike, 7
Fishman, G. J., 239
Fleming, G. A., 16
Fletcher, Douglas G., 64
Florenzano, Teresa Gallotti, 84
Fontaine, R. A., 81
Fork, Richard L., 152
Forrest, Jeffrey S., 134
Forsythe, Elizabeth, 118, 119
Foster, Philip P., 122
Frankland, J. D., 149
Franks, Rick, 18
Frazier, Donald O., 45, 151
Freestone, Todd, 13
Frey, H. U., 86, 104
Fritz, T. A., 102
Fritz, Theodore A., 103
Fujii, Nobuo, 137
Fujisaki, Tomohiro, 137
Fukano, Tohru, 74
Fukao, Shoichiro, 114
Fukuyama, Francis, 165
Furukawa, Akinori, 74
Furuya, Norio, 142

G

Gaddis, L. R., 194, 197, 223
Gaetz, T. J., 169, 170, 177
Gallagher, D. L., 153
Gamber, T., 193
Gamble, Lisa J., 152
Garbet, X., 156
Garcia, Hector D., 40
Garcia-Ruiz, J. M., 157
Gary, G. A., 233
Gasiewski, Al, 87
Gasnault, O., 239
Gatebe, C. K., 90
Geary, Joe, 68
Geary, Joseph, 150
Gehris, Allen, 38
Gelis, F., 160
Geller, S. P., 86, 104
George, M. A., 46
Germany, G., 99, 105
Germany, G. A., 99
Gernhardt, Michael, 122
Getenay, I., 195
Gholdston, Edward W., 62
Gianakon, T. A., 156
Giblin, T., 240
Giblin, Timothy, 234
Gibson, E. K., 120
Gibson, Everett K., 232
Gibson, U. J., 118
Giesing, Joseph, 17
Gietl, Eric B., 62
Gilbert, William P., 6
Giles, B. L., 105
Gilliam, J. W., 82
Gillies, Donald C., 43
Gillis, J. J., 188, 192, 198, 207
Ginting, Salam, 35
Giruzzi, G., 156
Gledhill, Tim, 180
Glessner, Paul T., 20
Glover, J., 162
Goenardi, Lilies M., 35
Goldstein, J., 153
Gonzalez, A., 157
Goodman, S. J., 112
Goodman, W. L., 16
Goodsell, Aga M., 16
Gordeev, A. N., 39, 153
Goyer, John, 155
Granviken, Alf, 167
Grasza, K., 159
Gratama, T. N., 54
Green, Carolyn J., 107
Green, Mavis F., 2
Green, Richard, 172, 174, 175
Greene, Phil, 155
Greenhouse, M. A., 152
Greenisen, Michael, 130
Greenwood, Andy, 143
Grier, J. A., 199
Grisch, F., 65
Groffman, P. M., 82
Grugel, R. N., 40
Guelhan, A., 66, 70
Guidry, S., 120
Gundersen, Rune, 142
Gussenhoven, S., 178

Gutman, S. I., 106

H

Haberer, Susan J., 107
Habraken, S., 104
Hackley, V. A., 46
Hadaway, James B., 150
Haerter, Fabricio Pereira, 61
Hager, James O., 3, 17
Halpern, J. P., 168
Hamada, Junichi, 114
Hamel, Andrew J., 128
Hamilton, Tracy P., 42
Hampshire, D. P., 80
Han, Yong, 87
Haneda, Takashi, 109
Hanson-Parr, D. M., 47
Hansson, U., 95
Harijono, Sri Woro B., 114
Harimaya, Toshio, 108
Harms, Paul, 55
Harraf, Abe, 2
Hartwich, Peter, 9, 17
Hartwich, Peter M., 4
Haruyama, J., 200
Hasegawa, Toyoaki, 59
Hashiguchi, Hiroyuki, 114
Hashimoto, Akihiro, 108
Haskin, L. A., 207
Hasler, A. F., 80
Hassett, James E., 70
Hawke, B. R., 201, 213, 215, 224
Hayden, H. W., 44
Haynes, Tim, 17
Head, J. W., 202
Head, J. W., III, 205, 209
Headley, Dean, 11
Hearty, T., 181
Heathcote, S., 175
Heather, D. J., 203
Hebert, Thomas, 184
Hedin, J., 155
Heeke, D., 121
Heelis, R. A., 108
Heetderks, H., 86, 104
Heinrich, Richard E., 126
Hellsten, T., 155
Henderson, Derek, 136
Henyey, Frank, 115
Herman, J. R., 96
Hess, G. W., 81
Hess, P. C., 204
Hesse, M., 111
Hey, D. L., 82
Hiesinger, H., 205
Hill, B. R., 81
Hill, Frank, 236
Hillebrand, C., 156
Hirahara, Toshiyuki, 138
Hirooka, Akira, 54
Hjelle, H. M., 11
Hodgkinson, J., 18
Hoellinger Fabien,, 148
Hogari, Kazuo, 138
Holcomb, R. T., 83
Holford, Warren, 88
Holley, Daniel C., 121
Holmes, John F., 143
Holte, Mats Ruge, 167
Holtzmann, J., 213
Hong, Y. S., 117
Hood, L. L., 205
Hopper, Nicholas J., 140
Horisawa, Shingo, 142
Horrell, E. E., 118
Horwitz, J. L., 99, 105, 106
Hosogai, H., 166
Houde, Martin, 145
Hough, James, 180
Howard, R. T., 89
Howe, Rachel, 236
Howell, Joe, 32
Howell, Joe T., 91
Howell, Leonard, 240
Howington-Kraus, A., 219
Hsu, Ming-K., 115
Hudson, M. K., 153
Hudson, Peter, 38
Huegele, Vince, 152
Hueter, Uwe, 25
Hyde, David W., 19
Hyer, Joseph, 88
Hyers, Robert W., 44
Hyuga, Fumiaki, 55, 164

I

Ichiyanagi, Masayoshi, 12
Iguchi, Toshio, 111
IIda, Takashi, 58
Ikeda, Satoshi, 53
Imatani, Kazumichi, 109
Imhoff, Marc, 87, 88
Incerti, S., 161
Inman, Daniel J., 52
Irons, James R., 88
Isbister, Katherine, 55
Ishizuka, Shigeki, 54
Itaya, Yoshio, 137
Iwama, Miki, 57

J

Jablonska, Mariola, 182
Jablonski, Francisco Jose, 183
Jackson, D. R., 41
Jackson, Mike, 11
Jacobsen, Alan R., 127
Jacobson, Dave, 177
Jacoby, George, 172, 174
James, J., 40
Jamet, D., 67
Jauch, Thomas W., 75
Jayawardhana, R., 181
Jedlovec, G. J., 106
Jerius, D., 169, 170, 177
Jhabvala, Murzy, 51
Ji, Q., 90
Jinno, Kenji, 109
Jiyo, Habirun, 60
Johnson, Anyika N., 122
Johnson, C. O., 178
Johnson, D. L., 30
Johnson, F. S., 108
Johnson, J. R., 206
Johnson, Jeffrey A., 2
Johnson, Patrick, 88
Jolliff, B. L., 198, 207
Jones, David, 87
Jones, Harry, 237
Jones, Jay, 9
Jones, Jeffrey, 111
Jones, John H., 105
Jones, W. D., 43, 153
Jones, William D., 151
Joslin, Ronald D., 7
Juda, M., 177
Judge, Russell, 158
Juretzko, F., 51
Jusem, C. J., 110
Justic, D., 116

K

Kaastra, J. S., 178
Kane, Karisa D., 11
Kaneso, Takayuki, 12
Karner, James M., 182
Karnieli, A., 110
Karovska, M., 169
Kasahara, N., 166

Kasemodel, Carlos A., 145
Kashya, V., 178
Kato, Syuko, 163
Kato, T., 153
Kawarasaki, Masatoshi, 53
Kawasaki, Masahisa, 53
Kawasaki, N., 166
Kawashima, Masahisa, 139
Keidel, John, 150
Keil, Steve, 173
Keith, E. L., 34
Keller, Christoph, 237
Keller, L. P., 208, 226
Kellner, David L., 94
Kellogg, E. M., 177
Kennedy, Paul, 13
Kesler, Morris P., 55
Kester, Thomas J., 151
Keys, S. A., 80
Kieffer, H. H., 186
Killi, M., 11
Kilowasid, L. Muh. Musafar, 113
Kim, K. C., 239
Kim, Shinwood, 40
King, Lyn, 7
King, M. D., 90
Kingston, Gina, 136
Kinne, S., 93
Kirk, R., 219
Kitamura, Mamoru, 53
Kjolberg, Anders, 167
Klein, F., 83
Klein, R. M., 42
Klima, B., 161
Kluiters, C. E., 61
Knutsen, Bjorn Olav, 167
Kobayashi, Youichi, 135
Kocak, M., 42
Kochemasov, G. G., 209
Koehler, U., 209
Koenig, John, 38
Kolenikov, A. F., 65
Kolesnikov, A. F., 154
Kollmus, H., 144
Kolodziejczak, J. J., 150, 151, 176, 178
Koltun, G. F., 110
Komm, Rudi, 236
Konnert, John H., 158
Konopliv, A., 187
Kooi, F. L., 56
Korotev, R. L., 210
Korteling, J. E., 21
Korth, Deborah W., 130
Koshut, Thomas M., 239
Koszalinski, S., 63
Kotecki, Carl A., 51
Kou, Y., 118
Kouveliotou, Chryssa, 239
Koyama, Junji, 12
Kozu, Toshiaki, 111
Kraeutle, K. J., 47
Krikeb, A., 160
Krist, Steven E., 14
Kubiatko, Paul, 20
Kubota, Fumito, 57
Kudela, K., 102
Kuhn, J. L., 152
Kuhn, Jonathan L., 51
Kulcinski, G. L., 231
Kulfan, Robert M., 6
Kumai, Mitsuyuki, 57
Kummerow, Christian, 109
Kuruvila, Geojoe, 3, 14
Kuruvila, George, 4
Kuster, Eric, 55

L

Lacroix, D., 149
Lago, Alisson Dal, 180
Lait, Leslie R., 102
Lakin, David R., II, 19
Lam, C., 40
Lamich, David, 102
Lammertsma, Koop, 42
Lampton, M., 104
Langevin, Y., 212
Langsing, Matthew D., 76
Lansing, Mathew D., 77
Lapir, Gennadi M., 141
Larko. D., 96
Larson, D. E., 100
Lawrence, D. J., 195, 211, 228, 239
Lawrence, S., 175
Lawrence, William, 87, 88
Le Fevre, A., 150
Le, L., 105
Ledvina, Andrea, 102
Lee, Jeongin, 31, 68
Lee, M. H., 36
Lee, Stuart M. C., 122
Lee, Y. T., 181
Leeson, Michael J., 126
Lefebvre, E., 156
Lehoczky, Sandor L., 43, 46
Leighly, K., 168
Lemmon, David R., 130
LeMouelic, S., 212
Levack, Daniel J. H., 35, 36
LeVine, David M., 88
Lewin, W. H. G., 239
Li, Huayu, 158
Li, Mary, 70
Li, Ruo D., 73
Liang, Nai K., 115
Liao, Jin-Hua, 100
Liao, Liang, 111
Licht, R. W., 47
Liddy, David W., 143
Lidestri, Joe, 155
Lieber, Charles M., 47
Lin, Mike C., 95
Lin, R. P., 100, 205
Lin, Ray Q., 113
Lin, Shian-Jiann, 93
Lindahl, D., 135
Lindfors, A. J., 48
Lindseth, Paul D., 161
Lindstrom, Marilyn, 182
Litchford, Ronald J., 146
Liu, Antony K., 115
Livings, Jeffrey, 22
Lockwood, J. P., 83
Logan, Ronald T., Jr., 73
Lopez-Jimenez, M. J., 149
Losee, L. A., 33, 164
Lucas, P. W., 185
Lucero, Javier, 130
Lucey, P. G., 193, 199, 201, 206, 211, 213, 215, 228, 239
Luedtke, Jacqueline R., 2
Lulla, K. P., 90
Lutte, Rebecca K., 11
Luvall, Jeffrey C., 85

M

Ma, C., 104
Mack, Marilyn, 141
Maddux, Gary A., 25, 137
Madejski, G. M., 170
Magee, Todd, 17
Magee, Todd E., 14, 17
Mahmud, 89
Makihata, Kazuhisa, 57
Mallozzi, R. S., 240
Malone, Michael, 3
Malone, Michael B., 10
Maloney, Jim, 55
Mani, Mori, 9
Manik, Timbul, 96
Mankins, John C., 91
Manley, David J., 29
Mann, Michael J., 14
Manners, Bruce A., 62

Manning, Will, 87
Markevitch, M., 169
Markham, Brian L., 88
Marks, Robert, 115
Marquez, J., 234
Marshall, H. L., 168
Marshall, Laurie A., 18
Marshall, Susan, 94
Marteau Jacques,, 147
Martel, Hugh, 35
Martin, Grant L., 14
Martin, T., 71
Mashburn, Michael J., 18
Massey, Phil, 172
Mast, Dion J., 69
Matsubayashi, Yoshinori, 109
Matsumura, Kimiharu, 74
Matsunaga, T., 200
Matsunami, Noriaki, 41
Matsuo, Eric K., 133
Mattie, David R., 49
Maulana, Moch. Erwin, 107
Maurice, S., 189, 195, 211, 228, 239
May, Lisa, 88
Mazuruk, K., 159
Mazzocato, Maria Eugenia, 84
McAmis, R. W., 34
McCall, Alan, 180
McCrory, J. L., 128
McCrory, Jean L., 128, 129, 130
McEwen, A. S., 199
McGowan, Anna-Marie R., 20
McKay, D. S., 120, 187, 208, 226
McKay, David S., 232
McKay, G., 105
McMillin, S. Naomi, 3
McNamara, B. R., 170, 177
McSpadden, S. B., 47
Meja, Dari, 83
Mejia, Kevin M., 4
Mele, G., 121
Melfi, S. H., 106
Menard, L., 71
Mende, S. B., 86, 104
Meneghini, Robert, 111
Menietti, J. D., 153
Midea, Anthony C., 9
Miftakhova, E. G., 153
Mikami, Hirohide, 137
Mikouchi, T., 105
Milazzo, M., 199
Miller, J. C., 48
Minier, L., 47
Minnis, P., 93
Minow, J. I., 168, 178
Mitchell, D. L., 205
Mitsch, W. J., 82
Mittlefehldt, D. W., 105
Miyaho, Noriharu, 55, 137, 164
Miyarnoto, Robert, 115
Mizukawa, Makoto, 53, 164
Mogahed, E. A., 231
Mogi, Kazuo, 137
Mollard, R., 125
Moody, R. C., 37
Moore, Andrew, 134
Moore, Jim, 130
Moore, Ronald L., 234
Moore, T. E., 99, 238
Moore, Thomas E., 101, 105, 106
Moore, W., 187
Moriya, Takeo, 12
Morris, R. V., 208, 226
Moshammer, R., 144
Mosier, Gary, 177
Motoya, Yoshinobu, 98
Mott, D. B., 152
Mott, D. Brent, 51
Mueller-Mellin, R., 176
Mukherjee, S., 51
Mulder, E. J., 48
Muleski, G. E., 93
Munday, Steve, 28
Munoz, Cesar, 134
Murai, Shigeki, 108
Murakami, Katsumi, 136
Murakami, S., 153
Murman, Scott, 17
Murtugudde, R., 110

N

Nabinger, S. J., 93
Nadarajah, Arunan, 158
Naitutu, Rosalina, 96
Nakamura, Hiroshi, 58
Nakanishi, Hideyuki, 55
Nakashima, Kenji, 53
Narducci, Robert P., 14, 15
Neal, C. R., 214
Nebuda, Sharon, 93
Neergaard, Lynn, 39
Nein, Max, 177
Nelson, Chester P., 5
Neto, Thyrso Villela, 184
Neukum, G., 209
Newman, J. C., Jr., 44, 79
Newman, Paul A., 94, 102
NewMeyer, David A., 2
NewMyer, David A., 162
Newton, Elizabeth K., 234
Ng, T. S., 140
Nguyen, Hai, 30
Nielsen, J. Eric, 93
Niimi, Kazuyoshi, 138
Nikolaev, Valeri, 73
Nishida, Brian A., 20
Nishiyama, Koji, 109
Niswonger, R. G., 82
Novean, Michael G., 14
Nuth, Joseph A., II, 182

O

ODell, S. L., 43, 150, 151, 153, 168, 169, 176, 178
ODell, Stephen L., 151
Oelgoetz, Peter A., 75
Ogg, Steven S., 8
Oglesby, Robert, 94
Ohira, Hidetoshi, 54
Okada, Kazuhiko, 54
Okamoto, Kenichi, 111
Okamura, A. R., 83
Okazaki, Noritoshi, 12
Oki, D. S., 82
Oks, Eugene, 155
Okuma, Kusuo, 74
OLeary, Mike, 124
Olsen, K., 175
Olsen, Knut, 185
ONeill, P., 32
ONeill, P. M. O., 69
Onstott, E. D., 18
Orndoff, Evelyne, 131
Orton, G. S., 181
Ota, Kenji, 137
Otake, H., 200
Otterman, J., 110
Oving, A. B., 124

P

Pacchioli, David, 131
Paciesas, W. S., 240
Padmos, P., 130
Paerels, F. B., 178
Page, Timothy, 177
Pahle, Joseph W., 18
Paley, Mark S., 151
Palosz, W., 159
Palumbo, Dan, 144
Pantling, Carey M., 78

Pao, S. Paul, 9
Papike, J. J., 223
Parikh, Pradip, 7
Paris, S., 154
Parkinson, Claire L., 116
Parks, G. K., 99, 105
Parmentier, E. M., 204
Parr, T. P., 47
Parriaux, N., 125
Parsa, I. Made, 90
Parten, R. J., 47
Partomo, Sri Wahyu, 96
Patchen, A., 226
Patel, Mulchand, 117
Paulsen, Nolan, 38
Pawlowski, James F., 184
Pawson, S., 102
Pawson, Steven, 93
Paxman, Rick, 237
Pease, D., 178
Peavey, Charles C., 10
Peavey, Charlie, 3
Pedelty, Jeffrey A., 88
Pelleg, Dan, 134
Pendleton, G. N., 240
Peng, Ruisheng, 145
Perez, Joseph D., 155
Perrinet, M., 125
Peterman, M., 128
Peterman, Marc M., 128
Peters, Bruce, 150
Peterson, C. A., 201, 215
Phillips, R. J., 230
Phillips, Thomas G., 145
Piacentini, R. D., 96
Piazza, S., 128
Piazza, Stephen J., 128
Picone, J. W., 47
Pieters, C., 208, 226
Pieters, C. M., 216, 225
Pilachowski, Caty, 174
Pilewskie, P., 234
Pinet, P., 212
Pinet, P. C., 189
Pinori, S., 217
Ploszajczak, M., 150
Plucinsky, P. P., 176, 178
Ponomarev, V., 146
Porter, Jason G., 233
Potter, Drew, 233
Prather, C. Daniel, 162
Preece, R. D., 240
Pritchard, R. W., 48
Probst, Ron, 175
Prout, Brian, 130
Pusey, Marc, 118, 119, 157, 158
Pusey, Marc L., 158
Putnam, Lawrence E., 23
Putnam, Sid, 155

Q

Quattrochi, Dale A., 85
Quiroga, L., 157

R

Rabalais, N. N., 116
Rabbette, M., 234
Racel, Anne M., 107
Racette, P., 87
Raeisaenen, J., 95
Ragab, Saad A., 144
Ramsey, B., 151
Ramsey, B. D., 2, 43, 153
Rao, Raj B. K. N., 75
Ratcliff, J. T., 231
Ratzel, A., 47
Ratzlaff, P. W., 178
Reardon, Patrick, 150
Redding, Dave, 177
Reedy, R. C., 218
Reid, Michael R., 86
Renlund, A. M., 48
Rich, F. J., 99, 106
Richard, G., 189
Richards, Philip G., 98
Riekehr, S., 42
Riemersma, J. B. J., 123
Rietmeijer, Fans J. M., 182
Rimmele, Thomas, 237
Ritonga, Gemuru, 165
Rivest, M., 63
Roads, John, 94
Robertson, Franklin R., 94, 114
Robin, L., 23, 73
Robinson, M. S., 191, 201
Robinson, Michael B., 44
Roche, P. F., 185
Rodrigues, Claudia Vilega, 184
Rodriguez, B. A., 157
Rodriguez, F. J., 157
Rogers, Jan R., 44
Rood, Richard B., 93
Rosida, 96
Rosiek, M. R., 219
Rothschild, W. J., 34
Roy, O., 72
Rubinstein, Robert, 63
Rubinstein, Robert, 66
Ruiz, Jose R., 162
Rummukainen, M., 95
Russell, J. K., 43
Russell, P. B., 93, 234
Russell, Samual S., 76, 77
Ryder, G., 165, 193, 220

S

Saaroni, H., 110
Sabatie, F., 161
Saha, Abhijit, 171, 174
Saint-Laurent, M. G., 149
Samanant, Paul, 11
Samiaji, Toni, 96
Sanders, Clark W., 32
Sani, Syafei, 96
Santos, J. F., 42
Sarghini, F., 64
Saric, William S., 74
Saroso, Sarmoko, 13, 89
Sasatani, Tsutomu, 99
Sato, Kiminori, 138
Savage, Larry, 44
Sawyer, D., 171
Scarfe, Alison Lamp, 67
Scarpaci, J. A., 149
Schaafstal, A. M., 122
Schmal, D., 61
Schmid, B., 234
Schmidlin, F., 106
Schmidlin, F. J., 101
Schmitt, H. H., 220
Schmitt, R. G., 48
Schmitt, W., 144
Schneider, Suzanne M., 122
Schommer, Bob, 174
Schommer, R. A., 175
Schrock, Ken, 13
Schubert, G., 187
Schulz, N. S., 169
Schwartz, D. A., 169, 170, 177
Schwass, John P., 130
Schwemmer, G. K., 106
Scott, Carl D., 38
Scott, D. Matthew, 241
Sears, Robert D., 101
Sen, S., 51
Seo, E. S., 239
Serabyn, E., 181
Seshadri, B. R., 79
Seshia, Sanjit A., 140
Setiadi, Mujtahid, 35

Sever, Thomas L., 91
Sharkey, N. A., 128
Sharkey, Neil, 129
Sharkey, Neil A., 128
Sharkov, E. V., 221, 222
Shearer, C. K., 223
Sheyner, Oleg, 140
Shibata, Nori, 137, 164
Shieh, Chih F., 15
Shieh, Chih Fang, 9
Shigematsu, Mitsuhiro, 139
Siegmund, O. H. W., 86, 104
Silver, Andrew L., 113
Simon, H., 145
Sims, Herb, 13
Sinambela, Wilson, 113
Singh, Sardul, 108
Siqueira, Jose Ricardo, 100
Sitindjak, Alfred, 31
Sjarifudin, M., 60
Slocum, D. C., 34
Sluimer, R. R., 21
Smirnov, V. N., 105
Smith, Charles A., 28
Smith, Damon, 130
Smith, Eric A., 114
Smith, R. C., 175
Smith, Rogers E., 21
Smith, W. S., 153
Smith, Walter P., 95
Snell, J. E., 42
Snyder, Phil, 6
Socki, Richard A., 232
Sohn, Byung-Ju, 114
Solow, A., 117
Sommer, H. Joseph, 130
Spann, J., 86
Spann, J. F., 179
Spann, J. F., Jr., 100
Spann, James F., Jr., 179, 233
Speegle, C. O., 151
Spence, Phil, 155
Speyer, J.-J., 125
Spindel, Robert C., 115
Spohnholtz, Todd, 38
Spudis, P. D., 188, 203, 215, 224
Spurlock, F., 96
Stahle, Carl, 70
Stahle, Caroline, 70
Staid, M. I., 225
Stanislaw, Greg S., 17
Stansbery, Eileen K., 236
Starbuck, J. M., 52
Starr, O C., 106
Staszak, Paul R., 29
Steele, A., 120
Steeneken, H. J. M., 56
Stefanescu, Doru M., 51
Sterling, Alphonse C., 234
Stern, Daniel, 173
Stern, S. A., 227
Stevenson, B. A., 99, 105, 106
Stock, J. M., 104
Stodel-Le Lay, C., 148
Stoica, Ion, 140
Strom, R. G., 199
Strom, Steve, 163
Su, Ching-Hua, 46
Su, Y. J., 105
Su, Y.-J., 99, 106
Suess, S. T., 179
Suggs, R. M., 169
Suhartini, Sri, 237
Sullivan, Brenda, 144
Sumardi, 96
Sumida, John, 119, 157
Summers, H. P., 153
Sunardi, 96
Sundaram, P., 3, 9, 14, 15
Sutherlin, Steve, 177
Suzuki, Ryutaro, 57, 135
Suzuki, Yoshinori, 109
Sviatoslavsky, I. N., 231
Swartz, D. A., 2, 169, 176, 178
Swindle, T. D., 206
Syahbuddin, Basman, 165
Syrkin, N., 121

T

Takahashi, Chiaki, 54
Takahashi, Hiroaki, 12
Takahashi, Kenji, 139
Takasugi, Hidetoshi, 138
Tamaki, Norio, 136
Tanaka, Chihaya, 164
Tananbaum, H., 168
Tatsuta, Tsutomu, 53
Tawara, Hiroyuki, 41
Taylor, G. J., 193, 213, 215
Taylor, L. A., 208, 226
Taylor, R. L., 81
Telban, Robert J., 132
Tennant, A. F., 169, 176
Terry, J., 110
terVeen, W. R., 61
Thomas, B. R., 157, 159
Thomas, L. Dale, 28
Thomas-Keprta, Kathie, 232
Thome, Rogerio, 163
Thomsen, D. R., 228
Tilling, R. I., 83
Tinetti, Ana, 9
Tjasyono, Bayong H. K., 107
Tobin, D., 106
Tomita, Nobuo, 138
Toneev, V. D., 150
Toporski, J., 120
Tralshawala, Nilesh, 70
Tremsin, A. S., 86, 104
Trevino, Luis A., 131
Tri, Terry O., 23
Trimble, James D., 24
Troung, A., 32
Troutman, B. M., 81
Tsay, S.-C., 90
Tucker, Brian G. S., 127
Turner, G., 196
Turner, J. E., 242
Turner, R. E., 116
Tyson, Tony, 171

U

Ullerstig, A., 95
Ullrich, J., 144
Unger, Eric, 17
Unger, Eric R., 14
Unnasch, S., 92
Urakami, Koichi, 85
Usener, M., 77

V

Vaisberg, O. L., 105
van Wijngaarden, S. J., 56
vanAnahold, J. E., 78
vanBerlo, M. P. W., 123
vanBragt, F. J., 62
vanBreda, L., 124, 127, 129
vanDam, C., 54
VanDerHaegen, V., 154
vanderMeer, R., 178
vanErp, J. B. F., 129
Vaniman, D., 228
Vaniman, D. T., 218
vanOotegem, B., 23
vanParadijs, Jan, 239
VanSpeybroeck, L., 168
VanSpeybroeck, L. P., 169, 170
vanWesting, E. P. M., 68
Vaughan, W. W., 30
Vaughn, J. R., 120

Vegter, Chris A., 17
Veltman, J. A., 127
Venturini, C. C., 179
Venturini, Catherine C., 179
Vernik, Rudi, 136
Vervisch, P., 23
VicentedeBrum, Antonio Gil, 24
Vikram, Chandra S., 46
Villemoes, L. F., 132
Virani, S. N., 169, 176, 178
Vizzini, Anthony J., 37
Vogt, Jay D., 31
Volz, Martin P., 159

W

Waesche, R. H. Woodward, 48
Wagner, Caroline S., 165
Wahyuni, Dwi, 167
Wainwright, William, 126
Waite, J. H., Jr., 105
Wakimizu, Kenji, 109
Walker, A., 175
Walker, Alistair, 172
Walker, James L., II, 76, 77
Wallace, Hoyt, 15
Walraven, J., 56
Walsh, M. M., 120
Wang, J. Z., 239
Wannebo, A., 132
Wargelin, B. J., 178
Waring, Stephen P., 241
Warner, J. S., 18
Warren, K., 169
Warren, P. H., 229
Watanabe, Ryuichi, 54
Watanabe, Satoshi, 74
Watts, John, 68
Waugh, Darryn, 102
Wegmann, Thomas, 23
Weisskopf, M. C., 151, 168, 176
Weisskopf, Martin C., 170
Wellman, G. W., 48
Wentworth, S., 226
Wentworth, S. J., 187, 208
Werkhoven, P. J., 124
West, Edward A., 233
Westall, F., 120
Westall, Frances, 232
Westra, Bryan, 3
Westwater, Ed, 87
Whitaker, Ann, 76
White, John Terry, 18
Whiteman, D. N., 106
Wibowo, Heri Budi, 46
Widiyatmi, Ipuk, 114
Wieczorek, M. A., 230
Wiedemann, John, 127
Wilkerson, Gary, 177
Wilkinson, M. J., 90
Williams, B. M., 34
Williams, Darrel L., 88
Williams, J. G., 231
Wilson, Colleen A., 241
Wilson, Douglas L., 6, 20
Wilson, L., 202
Wilson, Robert M., 114, 115
Wing, Jeannette, 140
Wing, Jeannette M., 140
Winter, Michael, 22
Wirasamita, Mulyana, 107
Wirasasmita, Mulyana, 114
Wiryosumarto, Harsono, 114
Wiseman, W. J., 116
Witherow, William K., 46, 151
Wittenberg, L. J., 231
Wolf, U., 209
Wolfenstine, Jeff, 63
Wolff, Richard, 172
Wolff, Sidney C., 176
Wolk, S. J., 181
Won, Mark J., 4
Wood, Richard M., 6
Woodruff, Kristin K., 122
Woods, Peter M., 239
Worrells, D. Scott, 162
Wright, Joseph, 88
Wu, Ge, 129
Wu, Weimin, 132
Wu, X., 99, 106
Wuensche, Carlos Alexandre, 184

Y

Yakura, S. J., 143
Yamada, Osamu, 59
Yamamoto, Hideo, 54, 137
Yamanaka, Manabu D., 114
Yamashita, Hiroyuki, 53, 54
Yamauchi, Noriyoshi, 53
Yamazaki, Takefumi, 55
Yana, Eiji, 139
Yates, Jeremy, 180
Yatini, Clara, 235
Yeh, David T., 14, 17
Yingst, A., 205
Yoder, C. F., 231
Yoshida, Kunikazu, 99
Yoshimura, Hiraku, 85
Yoshiya, Kiyosumi, 163
Young, David F., 107
Young, Ronald B., 120

Z

Zabiego, M., 156
Zeng, W., 99, 106
Zhang, Hui, 140
Zhu, Shen, 46
Ziemke, J., 96
Zycki, P., 170