Scientific and Technical Aerospace Reports

STAR

Volume 40
October 4, 2002

National Aeronautics and
Space Administration
Langley Research Center

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Information Program Office**

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- NASA-owned patents and patent applications
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- Domestic and foreign dissertations and theses.

Also included are two indexes, Subject Term and Personal Author. The Subject Term Index is generated from the *NASA Thesaurus* terms associated and listed with each document.

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.

Abstracts in *STAR* are categorized by 10 major subject divisions that are divided further into 76 specific subject categories. The subject divisions and categories are listed in the Table of Contents together with a note for each that defines its scope and provides any cross-references.

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Subject Divisions

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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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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 1

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 2

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 3

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 4

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*.

07 Aircraft Propulsion and Power 6

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 10

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) 11

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

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14 Ground Support Systems and Facilities (Space) 12

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and test chambers and simulators. Also includes extraterrestrial bases and supporting equipment. For related information see also *09 Research and Support Facilities (Air).*

15 Launch Vehicles and Launch Operations 13

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 16

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*.

17 Space Communications, Spacecraft Communications, Command and Tracking 18

Includes space systems telemetry; space communications networks; astronavigation and guidance; and spacecraft radio blackout. For related information, see also *04 Aircraft Communications and Navigation* and *32 Communications and Radar.*

18 Spacecraft Design, Testing and Performance 19

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.*

20 Spacecraft Propulsion and Power 21

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. N.A. means no abstracts in that category.

23 Chemistry and Materials (General) 27

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see *categories 24 through 29*. For astrochemistry see category *90 Astrophysics*.

24 Composite Materials 29

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

25 Inorganic, Organic, and Physical Chemistry 35

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 39

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

27 Nonmetallic Materials 43

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 52

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*.

Subject Categories of the Division D. Engineering

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

31 Engineering (General) 62

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 65

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 67

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 71

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 79

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*.

37 Mechanical Engineering 84

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 95

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

39 Structural Mechanics 98

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. N.A. means no abstracts in that category.

42 Geosciences (General) 99

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 104

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 115

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 118

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

46 Geophysics 129

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 133

Includes weather observation forecasting and modification.

48 Oceanography 139

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 Sciences

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

51 Life Sciences (General) 145

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 149

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments see *53 Behavioral Sciences*. For the effects of space on animals and plants see *51 Life Sciences*.

54 Man/System Technology and Life Support 152

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*..

55 Exobiology 153

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

Subject Categories of the Division G. Mathematical and Computer Sciences

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

59 Mathematical and Computer Sciences (General) 153

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

60 Computer Operations and Hardware 154

Includes hardware for computer graphics, firmware and data processing. For components see *33 Electronics and Electrical Engineering*. For computer vision see *63 Cybernetics, Artificial Intelligence and Robotics*.

61 Computer Programming and Software 156

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 162

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 163

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 166

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

65 Statistics and Probability 167

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

66 Systems Analysis and Operations Research 168

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

67 Theoretical Mathematics 169

Includes algebra, functional analysis, geometry, topology set theory, group theory and and number theory.

Subject Categories of the Division H. Physics

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

70 Physics (General) 170

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 172

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 173

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

73 Nuclear Physics 177

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 179

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

75 Plasma Physics 181

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

76 Solid-State Physics 183

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

Subject Categories of the Division I. Social and Information Sciences

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

80 Social and Information Sciences (General) 187

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

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Includes management planning and research.

82 Documentation and Information Science 190

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

84 Law, Political Science and Space Policy 194

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

85 Technology Utilization and Surface Transportation 195

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

Subject Categories of the Division J. Space Sciences

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

88 Space Sciences (General) 196

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

89 Astronomy 196

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

90 Astrophysics 202

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

91 Lunar and Planetary Science and Exploration 207

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93 Space Radiation 212

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

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99 General 214

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

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VOLUME 40, OCTOBER 4, 2002

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.

20020073414 Wichita State Univ., National Inst. for Aviation Research, Wichita, KS USA
Survey of Aviation Technical Manuals, Phase 2, User Evaluation of Maintenance Documents ***Interim Report, 11 Jan. - 6-Nov. 2001***
Chaparro, A.; Groff, L. S.; Chaparro, B. S.; Scarlett, D.; May 2002; 40p; In English
Report No.(s): PB2002-107035; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report contains the results from Phase 2 of a 3-phase research effort. Phase 1 (Human Factors Survey of Aviation Technical Manuals Phase 1 report: Manual Development Procedures) of this research effort surveyed the procedures used by five manufacturers to deploy maintenance documentation. Several potential human factors issues were identified in the development processes employed by these manufacturers. They included the reactive rather than proactive use of user evaluations, the limited use of user input and procedure validation, no systematic attempts to track error, and the lack of standards for measuring document quality. In Phase 2, a written survey was used to solicit information about user perception of errors in current manuals, manual usage rates, and general manual quality. On-site interviews of technicians were also conducted to gather feedback about the types of problems encountered with manuals, the associated impact, and suggestions for improving manuals. Feedback was obtained from technicians responsible for maintenance on a wide variety of Federal Aviation Regulations, Part 25 aircraft. Survey results revealed that, although user evaluations of the accuracy and quality of technical manuals are generally good, they rate manuals as having poor usability. Comparing the results of Phase 1 to the Phase 2 results supports the need for a higher level of user involvement during the document development process.
NTIS
Aircraft Maintenance; Human Factors Engineering; Maintenance; User Requirements; Education

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.

20020073855 NASA Ames Research Center, Moffett Field, CA USA
Vortex Wakes of Subsonic Transport Aircraft
Rossow, Vernon J., NASA Ames Research Center, USA; Feb. 02, 1999; 1p; In English, 8 Apr. 1999, Berkeley, CA, USA
Contract(s)/Grant(s): RTOP 522-11-52; No Copyright; Avail: Issuing Activity; Abstract Only

A historical overview will be presented of the research conducted on the structure and modification of the vortices generated by the lifting surfaces of subsonic transport aircraft. The seminar will describe the three areas of vortex research; namely, the magnitude of the hazard posed, efforts to reduce the hazard to an acceptable level, and efforts to develop a systematic means for avoiding vortex wakes. It is first pointed out that the characteristics of lift-generated vortices are related to the aerodynamic shapes that produce them and that various arrangements of surfaces can be used to produce different vortex structures. The largest portion

of the research conducted to date has been directed at finding ways to reduce the hazard potential of lift-generated vortices shed by subsonic transport aircraft in the vicinity of airports during landing and takeoff operations. It is stressed that lift-generated vortex wakes are so complex that progress towards a solution requires application of a combined theoretical and experimental research program because either alone often leads to incorrect conclusions. It is concluded that a satisfactory aerodynamic solution to the wake-vortex problem at airports has not yet been found but a reduction in the impact of the wake-vortex hazard on airport capacity may become available in the foreseeable future through wake-vortex avoidance concepts currently under study. The material to be presented in this overview is drawn from articles published in aerospace journals that are available publicly.
Author
Subsonic Speed; Transport Aircraft; Vortices; Aircraft Wakes; Aircraft Structures

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.

20020071136 NASA Glenn Research Center, Cleveland, OH USA
Geometry Modeling and Grid Generation for Computational Aerodynamic Simulations Around Iced Airfoils and Wings
Choo, Yung K., NASA Glenn Research Center, USA; Slater, John W., NASA Glenn Research Center, USA; Vickerman, Mary B., NASA Glenn Research Center, USA; VanZante, Judith F., QSS Group, Inc., USA; [2002]; 10p; In English; 8th International Conference on Numerical Grid Generation in Computational Field Simulations, 3-6 Jun. 2002, Honolulu, HI, USA
Contract(s)/Grant(s): RTOP 708-20-13; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Issues associated with analysis of 'icing effects' on airfoil and wing performances are discussed, along with accomplishments and efforts to overcome difficulties with ice. Because of infinite variations of ice shapes and their high degree of complexity, computational 'icing effects' studies using available software tools must address many difficulties in geometry acquisition and modeling, grid generation, and flow simulation. The value of each technology component needs to be weighed from the perspective of the entire analysis process, from geometry to flow simulation. Even though CFD codes are yet to be validated for flows over iced airfoils and wings, numerical simulation, when considered together with wind tunnel tests, can provide valuable insights into 'icing effects' and advance our understanding of the relationship between ice characteristics and their effects on performance degradation.
Author
Airfoils; Aircraft Icing; Computational Fluid Dynamics; Grid Generation (Mathematics); Computer Programs

20020072961 National Aerospace Lab., Amsterdam Netherlands
Free Flight in a Ground Controlled ATM Environment
Post, W.; de Jonge, H. W. G.; Nov. 1997; 24p
Report No.(s): PB2002-105882; NLR/TP-97594-U; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Free Flight is the buzzwords of the recent years. They usually apply to the users of the airspace system, the airline operators and the aircraft. It does not indicate that flying is for free now, but that the users should be as free as possible in their operations. They can take-off from where they want, land where they want and take any route in between. and they should be able do do so whenever they want it. Now, it does not require a great deal of imagination to see that this will not always be possible for everyone. Some resources in the ATM system (especially runways) are so scarce that their use is restricted in some ways. In order to allow equal use by all users there will thus be a continuing need for a ground based ATM service. This paper tries to point out where the balance may be found.
NTIS
Free Flight; Air Traffic; Airline Operations; Runways

20020073412 Texas A&M Univ., Texas Transportation Inst., College Station, TX USA
Identification and Evaluation of Guide Signing for Airport Roadways with Specific Application to the Dallas/Fort Worth International Airport: Supplement
Hawkins, H. G.; Stoddard, A.; Collins, K.; Weatherby, C.; Jul. 1998; 65p; In English
Report No.(s): PB2002-106683; RR-467406-1S; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Airport users consist of many types of travelers. Many of those using an airport may never leave the airport terminal(s), passing through the airport when transferring from one flight to another. Others may arrive at or depart from the airport by some model of travel that does not require them to make travel decisions (such as public transit, taxi, or shuttle). Many airline passengers travel in a vehicle (personal, business, or rental vehicle) on the airport roadway network in order to arrive at or depart from the airport. Providing the drivers of these vehicles with the information and guide signing needed to successfully navigate into, through, and out of the airport property presents several unique challenges. Based on discussions with planning personnel at Dallas/Fort Worth International Airport, providing drivers with information and guide signing was judged to be one of the major challenges facing the airport. In an effort to address the challenges associated with airport roadway guide signing, the Southwest Region University Transportation Center (SWUTC) at Texas A&M University supported a research study to develop a generalized procedure that could be used by airport to assess the effectiveness of the signing at an airport. The procedure was developed and refined through application of the principles to roadway signing at DFW Airport. This report presents the analysis of the roadway signing at the international airport.
NTIS
Evaluation; Roads; Airports; Symbols

20020073472 NASA Ames Research Center, Moffett Field, CA USA
Classification of Aircraft Maneuvers for Fault Detection
Oza, Nikunj C., NASA Ames Research Center, USA; Tumer, Irem Y., NASA Ames Research Center, USA; Tumer, Kagan, NASA Ames Research Center, USA; Huff, Edward M., NASA Ames Research Center, USA; [2002]; 8p; In English; NIPS 2002, Dec. 2002, Vancouver, Canada; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Automated fault detection is an increasingly important problem in aircraft maintenance and operation. Standard methods of fault detection assume the availability of either data produced during all possible faulty operation modes or a clearly-defined means to determine whether the data is a reasonable match to known examples of proper operation. In our domain of fault detection in aircraft, the first assumption is unreasonable and the second is difficult to determine. We envision a system for online fault detection in aircraft, one part of which is a classifier that predicts the maneuver being performed by the aircraft as a function of vibration data and other available data. We explain where this subsystem fits into our envisioned fault detection system as well its experiments showing the promise of this classification subsystem.
Author
Fault Detection; Aircraft Maintenance; Aircraft Maneuvers; Systems Health Monitoring; Airborne/Spaceborne Computers

20020073520 NASA Ames Research Center, Moffett Field, CA USA
Helicopter Safety Research
Hart, Sandra G., NASA Ames Research Center, USA; Rutkowski, Michael, NASA Ames Research Center, USA; Feb. 16, 1999; 1p; In English; Symposium on Aviation Psychology, Apr. 1999, Columbia, OH, USA
Contract(s)/Grant(s): RTOP 581-31-22; No Copyright; Avail: Issuing Activity; Abstract Only
In response to the President's challenge to reduce civil aviation accidents by a factor of 10 by the year 2022, NASA has embarked on an ambitious safety program in partnership with other government agencies and industry. The helicopter element of the NASA initiative has been guided by a series of accident analyses aimed at identifying the most frequent causes and consequences and initiating research to prevent or mitigate these factors. This talk will summarize the key findings of three of the accident analyses, the major elements of the safety program, and how helicopter safety research relates to the safety program.
Author
Aircraft Accidents; Helicopters; Civil Aviation; Aircraft Safety

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.

20020073453 Defence Science and Technology Organisation, Airframes and Engines Div., Fishermans Bend, Australia
Application of the Global Positioning System (GPS) to Low Airspeed Measurement for Helicopter Usage Monitoring Systems
Gan, Soon-Aik, Defence Science and Technology Organisation, Australia; Dutton, Scott, Defence Science and Technology

Organisation, Australia; Knight, Chris, Defence Science and Technology Organisation, Australia; April 2002; 44p; In English
Report No.(s): DSTO-TN-0428; DODA-AR-012-319; Copyright; Avail: Issuing Activity

This report focuses on the field trial of a GPS unit for measuring low helicopter airspeeds. The results indicated that the GPS has the potential to be used as a low-speed indicator. However, the possible loss of GPS signal, transient GPS results due to changes in satellites being used for the solution, time lag in the results and whether the assumption of a constant wind-speed is valid need to be considered.

Author

Global Positioning System; Velocity Measurement; Helicopters; Low Speed

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.

20020073158 NASA Ames Research Center, Moffett Field, CA USA

Transonic Wing Shape Optimization Using a Genetic Algorithm

Holst, Terry L., NASA Ames Research Center, USA; Pulliam, Thomas H., NASA Ames Research Center, USA; Jul. 05, 2002; 12p; In English; Transonicum IV, 2-6 Sep. 2002, Goettingen, Germany; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A method for aerodynamic shape optimization based on a genetic algorithm approach is demonstrated. The algorithm is coupled with a transonic full potential flow solver and is used to optimize the flow about transonic wings including multi-objective solutions that lead to the generation of pareto fronts. The results indicate that the genetic algorithm is easy to implement, flexible in application and extremely reliable.

Author

Aerodynamic Configurations; Genetic Algorithms; Shape Optimization

20020073159 NASA Langley Research Center, Hampton, VA USA

A Numerical Scheme for Ordinary Differential Equations Having Time Varying and Nonlinear Coefficients Based on the State Transition Matrix

Bartels, Robert E., NASA Langley Research Center, USA; August 2002; 24p; In English
Contract(s)/Grant(s): RTOP 706-31-41-02
Report No.(s): NASA/TM-2002-211776; NAS 1.15:211776; L-18185; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A variable order method of integrating initial value ordinary differential equations that is based on the state transition matrix has been developed. The method has been evaluated for linear time variant and nonlinear systems of equations. While it is more complex than most other methods, it produces exact solutions at arbitrary time step size when the time variation of the system can be modeled exactly by a polynomial. Solutions to several nonlinear problems exhibiting chaotic behavior have been computed. Accuracy of the method has been demonstrated by comparison with an exact solution and with solutions obtained by established methods.

Author

Differential Equations; Matrices (Mathematics); Boundary Value Problems

20020073383 NASA Ames Research Center, Moffett Field, CA USA

Modeling of H-46 Tip Strikes

Zilliac, Greg, NASA Ames Research Center, USA; Long, Kurt, NASA Ames Research Center, USA; Oct. 22, 1998; 4p; In English; AHS 55th Annual Forum and Technology Display, 25-27 May 1999, Montreal, Canada; Sponsored by American Helicopter Society, Inc., USA
Contract(s)/Grant(s): RTOP 519-20-22; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

For over thirty years now, the H-46 Sea Knight tandem rotor helicopter has operated successfully from the decks of various U.S. Navy ships. There have been approximately 210 thousand landings and takeoffs at sea and the vast majority have occurred without incident. Only a small percent of the total H-46 landings and takeoffs have been less than fully satisfactory. On certain

ships, (e.g. the LHA amphibious assault ship) the combination of winds at 15 deg. or so off of the bow and low rotor r.p.m. are conditions under which, on occasion, the rear rotor blades have been observed to flap uncontrollably. Cases have been reported where the rotor blades have struck the H-46 sync-shaft cover during startup and shutdown while the H-46 is sitting on the deck. One life has been lost, several people injured and the repair costs total of the 110+ incidents has been estimated to exceed $20 million. to date, the root cause of this problem has not been identified.
Author
Tandem Rotor Helicopters; Takeoff; Ships; Maintenance; Flapping

20020073406 NASA Ames Research Center, Moffett Field, CA USA
Application of Function-Failure Similarity Method to Rotorcraft Component Design
Roberts, Rory A., Missouri Univ., USA; Stone, Robert E., Missouri Univ., USA; Tumer, Irem Y., NASA Ames Research Center, USA; [2002]; 18p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Performance and safety are the top concerns of high-risk aerospace applications at NASA. Eliminating or reducing performance and safety problems can be achieved with a thorough understanding of potential failure modes in the designs that lead to these problems. The majority of techniques use prior knowledge and experience as well as Failure Modes and Effects as methods to determine potential failure modes of aircraft. During the design of aircraft, a general technique is needed to ensure that every potential failure mode is considered, while avoiding spending time on improbable failure modes. In this work, this is accomplished by mapping failure modes to specific components, which are described by their functionality. The failure modes are then linked to the basic functions that are carried within the components of the aircraft. Using this technique, designers can examine the basic functions, and select appropriate analyses to eliminate or design out the potential failure modes. The fundamentals of this method were previously introduced for a simple rotating machine test rig with basic functions that are common to a rotorcraft. In this paper, this technique is applied to the engine and power train of a rotorcraft, using failures and functions obtained from accident reports and engineering drawings.
Author
Rotary Wing Aircraft; Failure Analysis; Failure Modes

20020073854 NASA Ames Research Center, Moffett Field, CA USA
An Integrated Vehicle Modeling Environment
Totah, Joseph J., NASA Ames Research Center, USA; Kinney, David J., NASA Ames Research Center, USA; Kaneshige, John T., NASA Ames Research Center, USA; Agabon, Shane, NASA Ames Research Center, USA; [1999]; 1p; In English; AIAA Atmospheric Flight Mechanics Conference, 9-11 Aug. 1999, Portland, OR, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 519-30-12; No Copyright; Avail: Issuing Activity; Abstract Only

This paper describes an Integrated Vehicle Modeling Environment for estimating aircraft geometric, inertial, and aerodynamic characteristics, and for interfacing with a high fidelity, workstation based flight simulation architecture. The goals in developing this environment are to aid in the design of next generation intelligent fight control technologies, conduct research in advanced vehicle interface concepts for autonomous and semi-autonomous applications, and provide a value-added capability to the conceptual design and aircraft synthesis process. Results are presented for three aircraft by comparing estimates generated by the Integrated Vehicle Modeling Environment with known characteristics of each vehicle under consideration. The three aircraft are a modified F-15 with moveable canards attached to the airframe, a mid-sized, twin-engine commercial transport concept, and a small, single-engine, uninhabited aerial vehicle. Estimated physical properties and dynamic characteristics are correlated with those known for each aircraft over a large portion of the flight envelope of interest. These results represent the completion of a critical step toward meeting the stated goals for developing this modeling environment.
Author
Aerodynamic Characteristics; Flight Simulation; Autonomy; Aircraft Design; Flight Envelopes

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.

20020070834 NASA Glenn Research Center, Cleveland, OH USA
Propulsion Controls and Health Management Research at NASA Glenn Research Center
Garg, Sanjay, NASA Glenn Research Center, USA; July 2002; 21p; In English; Combustion, Airbreathing Propulsion, Propulsion Systems Hazards, and Modelling and Simulation Subcommittees Joint Meeting, 8-12 Apr. 2002, Destin, FL, USA; Sponsored by Department of the Army, USA
Contract(s)/Grant(s): RTOP 704-30-13
Report No.(s): NASA/TM-2002-211590; E-13375; NAS 1.15:211590; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

With the increased emphasis on aircraft safety, enhanced performance and affordability, and the need to reduce the environmental impact of aircraft, there are many new challenges being faced by the designers of aircraft propulsion systems. The Controls and Dynamics Technology Branch at NASA Glenn Research Center (GRC) in Cleveland, Ohio, is leading and participating in various projects in partnership with the U.S. aerospace industry and academia to develop advanced controls and health management technologies that will help meet these challenges. These technologies are being developed with a view towards making the concept of ”Intelligent Engines” a reality. The major research activities of the Controls and Dynamics Technology Branch are described in the following.
Author
Engine Control; Health; Management Systems; Dynamic Models; Diagnosis

20020072843 NASA Glenn Research Center, Cleveland, OH USA
A Computer Code for Gas Turbine Engine Weight and Disk Life Estimation
Tong, Michael T., NASA Glenn Research Center, USA; Ghosn, Louis J., Ohio Aerospace Inst., USA; Halliwell, Ian, Modern Technologies Corp., USA; [2002]; 8p; In English; ASME Turbo Expo 2002: Land, Sea and Air 2002, 3-6 Jun. 2002, Amsterdam, Netherlands; Sponsored by American Society of Mechanical Engineers, USA
Report No.(s): GT-2002-30500; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Reliable engine-weight estimation at the conceptual design stage is critical to the development of new aircraft engines. It helps to identify the best engine concept amongst several candidates. In this paper, the major enhancements to NASA’s engine-weight estimate computer code (WATE) are described. These enhancements include the incorporation of improved weight-calculation routines for the compressor and turbine disks using the finite-difference technique. Furthermore, the stress distribution for various disk geometries was also incorporated, for a life-prediction module to calculate disk life. A material database, consisting of the material data of most of the commonly-used aerospace materials, has also been incorporated into WATE. Collectively, these enhancements provide a more realistic and systematic way to calculate the engine weight. They also provide additional insight into the design trade-off between engine life and engine weight. to demonstrate the new capabilities, the enhanced WATE code is used to perform an engine weight/life trade-off assessment on a production aircraft engine.
Author
Aircraft Engines; Gas Turbine Engines; Aircraft Construction Materials; Life (Durability); Computer Programs; Weight; Engine Design

20020073095 Wayne State Univ., Mechanical Engineering Dept., Detroit, MI USA
Direct Calculation of High-Speed Cavity Flows in a Scramjet Engine by the CESE Method
Yu, S.-T. John, Wayne State Univ., USA; Kim, C.-K., Wayne State Univ., USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 11-19; In English; Also announced as 20020073093
Contract(s)/Grant(s): F49620-01-1-0051; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

In this paper we report the application of the Space-Time CESE method to simulate supersonic flows over open cavities. In the setting of a dual-mode scramjet engine, flow features of cavity flows with and without an upstream injection are studied for mixing enhancement and flame holding. Without upstream injection, the present numerical results compared favorably with the experimental data for dominant frequencies and time-averaged pressure coefficients inside the cavities. The role of cavity-generated acoustic waves in fuel/air mixing enhancement is illustrated. With an upstream injection, the flow oscillations

are drastically suppressed. The present results show that the CESE method provides high-fidelity numerical results of unsteady flows relevant to advanced scramjet engine concepts.
Author
Computation; Cavities; High Speed; Supersonic Flow; Unsteady Flow

20020073098 Naval Air Station, Patuxent River, MD USA
Evaluation of High-Mach Turbine Engines for Missile Applications
Kretzing, J. R., Naval Air Station, USA; Snyder, C. D., Naval Air Station, USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 43-55; In English; Also announced as 20020073093; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Numerous small studies have been used to examine the viability of near-term turbine engines in Mach 5-class missile-sized vehicles. Performance has been evaluated for two missions with greatly different payload / range requirements to demonstrate the versatility of these engines. Engine performance data for several different engines have been generated and analyzed with a notional propulsion installation and vehicle design. All engines analyzed provide sufficient thrust to exceed the time-critical strike mission requirements. The higher-thrust engines have adequate thrust for the vehicles used in the penetrator missions, but the surface-launched version may not have sufficient range unless the payload size is reduced and sufficient fuel volume can be found. Initial drawings of the vehicle concepts indicate that propulsion system length is a critical issue, which will limit maximum inlet size and airflow and engine length.
Author
Hypersonic Speed; Payloads; Propulsion; Thrust; Turbine Engines; Viability

20020073100 SAF/AQRT Air Force Pentagon, Science and Technology Div., Washington, DC USA
The National Hypersonic Science and Technology Planning Report
Carrick, Patrick G., SAF/AQRT Air Force Pentagon, USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 69-74; In English; Also announced as 20020073093; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The Deputy Under Secretary of Defense (Science & Technology) directed an activity to formulate a National Hypersonic S&T plan. The intent of this planning activity was to initiate a much more focused government/industry effort to develop hypersonic technologies, which could enable a whole new range of Mach 5-plus air-breathing engines, weapons, and aircraft. The activity was led by the Air Force in coordination with NASA, Navy, Army, DARPA, industry, and academia. The final product, which is a report that details current hypersonic efforts and proposes coordinated national roadmaps, has been completed and is currently in review. This report is a major step in the formation of a complete national plan to integrate current hypersonic Science and Technology programs and construct a detailed program for long-term development of hypersonic systems. The national plan will provide the framework for the long-term commitment needed to develop this challenging technology.
Author
Technological Forecasting; Research and Development; Air Breathing Engines; Coordination; Planning

20020073108 Atlantic Research Corp., Gainesville, VA USA
Worldwide Developments in Ramjet-Powered Missiles (Update from 1995 Situational Review)
Hewitt, P. W., Atlantic Research Corp., USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 163-176; In English; Also announced as 20020073093; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

In 1995 a study was undertaken to review worldwide developments in ramjet-powered missiles, with a principal focus on recent developments in, and current plans for, these missiles. The study, derived primarily from open literature, corporate knowledge and private communications, examined the issue from a situational, rather than a technical, perspective. In the past seven years there have been significant developments in the US and worldwide that deserve additional discussion. Ramjet anti-ship missiles continue to proliferate and the US has responded with a ramjet missile target development and related weapon studies. Anti-radiation missiles, time-critical strike missiles, and air-air missiles are also in development. Several historical and current programs at ARC are helping to close the gap in US capabilities relative to other nations.
Author
Histories; Missile Design; Ramjet Missiles

20020073109 Missouri Univ., Rolla, MO USA

Analysis of the Magneto-Hydrodynamic (MHD) Energy Bypass Engine for High-Speed Air-Breathing Propulsion

Riggins, David W., Missouri Univ., USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 177-207; In English; Also announced as 20020073093

Contract(s)/Grant(s): NAG1-01122; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The performance of the MHD energy bypass air-breathing engine for high-speed propulsion is analyzed in this investigation. This engine is a specific type of the general class of inverse cycle engines. In this paper, the general relationship between engine performance (specific impulse and specific thrust) and the overall total pressure ratio through an engine (from inlet plane to exit plane) is first developed and illustrated. Engines with large total pressure decreases, regardless of cause or source, are seen to have exponentially decreasing performance. The ideal inverse cycle engine (of which the MHD engine is a sub-set) is then demonstrated to have a significant total pressure decrease across the engine; this total pressure decrease is cycle-driven, degrades rapidly with energy bypass ratio, and is independent of any irreversibility. The ideal MHD engine (inverse cycle engine with no irreversibility other than that inherent in the MHD work interaction processes) is next examined and is seen to have an additional large total pressure decrease due to MHD-generated irreversibility in the decelerator and the accelerator. This irreversibility mainly occurs in the deceleration process. Both inherent total pressure losses (inverse cycle and MHD irreversibility) result in a significant narrowing of the performance capability of the MHD bypass engine. The fundamental characteristics of MHD flow acceleration and flow deceleration from the standpoint of irreversibility and second-law constraints are next examined in order to clarify issues regarding flow losses and parameter selection in the MM modules. Severe constraints are seen to exist in the decelerator in terms of allowable deceleration Mach numbers and volumetric (length) required for meaningful energy bypass (work interaction). Considerable difficulties are also encountered and discussed due to thermal/work choking phenomena associated with the deceleration process. Lastly, full engine simulations utilizing inlet shock systems, finite-rate chemistry, wall cooling with thermally balanced engine (fuel heat sink), fuel injection and mixing, friction, etc. are shown and discussed for both the MHD engine and the conventional scramjet. The MHD bypass engine has significantly lower performance in all categories across the Mach number range (8 to 12.2). The lower performance is attributed to the combined effects of 1) additional irreversibility and cooling requirements associated with the MHD components and 2) the total pressure decrease associated with the inverse cycle itself.

Author

Air Breathing Engines; Magnetohydrodynamics; High Speed; Performance Prediction; Rocket Thrust; Intake Systems

20020073113 NASA Glenn Research Center, Cleveland, OH USA

Development of a Turbofan Engine Simulation in a Graphical Simulation Environment

Parker, Khary I., NASA Glenn Research Center, USA; Guo, Ten-Heui, NASA Glenn Research Center, USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 249-257; In English; Also announced as 20020073093; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

This paper presents progress on the development of a generic component level model of a turbofan engine simulation, with a digital controller, in an advanced graphical simulation environment. The goal of this effort is to develop and demonstrate a flexible simulation platform for future research in propulsion system control and diagnostic technology. A FORTRAN-based model of a modem, high performance, military-type turbofan engine is being used to validate the platform development. The implementation process required the development of various innovative procedures, which are discussed in the paper. Open-loop and closed-loop comparisons are made between the two simulations. Future enhancements that are to be made to the modular engine simulation are summarized.

Author

Turbofan Engines; Simulation; Combustion Control

20020073120 NASA Glenn Research Center, Cleveland, OH USA

Airbreathing Pulse Detonation Engine Performance

Povinelli, Louis A., NASA Glenn Research Center, USA; Yungster, Shaye, Ohio Aerospace Inst., USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 337-349; In English; Also announced as 20020073093; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

This paper presents performance results for pulse detonation engines taking into account the effects of dissociation and recombination. The amount of sensible heat recovered through recombination in the PDE chamber and exhaust process was found to be significant. These results have an impact on the specific thrust, impulse and fuel consumption of the PDE.
Author
Air Breathing Engines; Pulse Detonation Engines; Performance Prediction

20020073121 Johns Hopkins Univ., Applied Physics Lab., Laurel, MD USA
Progress in the Development of a Nozzle Design Methodology for Pulsed Detonation Engines
Leary, B. A., Johns Hopkins Univ., USA; Waltrup, P. J., Johns Hopkins Univ., USA; Rice, T., Johns Hopkins Univ., USA; Cybyk, B. Z., Johns Hopkins Univ., USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 351-363; In English; Also announced as 20020073093
Contract(s)/Grant(s): NAG3-2569; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The Johns Hopkins University Applied Physics Laboratory (JHU/APL), in support of the NASA Glenn Research Center (NASA GRC), is investigating performance methodologies and system integration issues related to Pulsed Detonation Engine (PDE) nozzles. The primary goal of this ongoing effort is to develop design and performance assessment methodologies applicable to PDE exit nozzle(s). APL is currently focusing its efforts on a common plenum chamber design that collects the exhaust products from multiple PDE tubes prior to expansion in a single converging-diverging exit nozzle. to accomplish this goal, a time-dependent, quasi-one-dimensional analysis for determining the flow properties in and through a single plenum and exhaust nozzle is underway. In support of these design activities, parallel modeling efforts using commercial Computational Fluid Dynamics (CFD) software are on-going. These efforts include both two and three-dimensional as well as steady and time-dependent computations to assess the flow in and through these devices. This paper discusses the progress in developing this nozzle design methodology.
Author
Exhaust Nozzles; Design Optimization; Pulse Detonation Engines; Systems Integration; Nozzle Design

20020073808 NASA Glenn Research Center, Cleveland, OH USA
Propulsion Controls and Health Management Research at NASA GRC
Garg, Sanjay, NASA Glenn Research Center, USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 199-214; In English; Also announced as 20020073794; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

With the increased emphasis on aircraft safety, enhanced performance and affordability, and the need to reduce the environmental impact of aircraft, there are many new challenges being faced by the designers of aircraft propulsion systems. The Controls and Dynamics Technology Branch at NASA Glenn Research Center (GRC) in Cleveland, Ohio, is leading and participating in various projects in partnership with the U.S. aerospace industry and academia to develop advanced controls and health management technologies that will help meet these challenges. These technologies are being developed with a view towards making the concept of ”Intelligent Engines” a reality. The major research activities of the Controls and Dynamics Technology Branch are described.
Author
Aircraft Control; Jet Propulsion; Systems Health Monitoring; Engine Control

20020073815 NASA Glenn Research Center, Cleveland, OH USA
Development of A Turbofan Engine Simulation In A Graphical Simulation Environment
Parker, Khary I., NASA Glenn Research Center, USA; Guo, Ten-Heui, NASA Glenn Research Center, USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 307-315; In English; Also announced as 20020073794; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

This paper presents progress on the development of a generic component level model of a turbofan engine simulation, with a digital controller, in an advanced graphical simulation environment. The goal of this effort is to develop and demonstrate a flexible simulation platform for future research in propulsion system control and diagnostic technology. A FORTRAN-based model of a modern, high-performance, military-type turbofan engine is being used to validate the platform development. The implementation process required the development of various innovative procedures, which are discussed in the paper. Open-loop

and closed-loop comparisons are made between the two simulations. Future enhancements that are to be made to the modular engine simulation are summarized.
Author
Controllers; Digital Systems; Turbofan Engines; Simulation

20020073818 Engineering Research and Analysis Co., USA
Integration of Pulse Detonation Combustion Concepts with Turbofan Engines
Mawid, M. A., Engineering Research and Analysis Co., USA; Park, T. W., Engineering Research and Analysis Co., USA; Sekar, B., Air Force Research Lab., USA; Arana, C., Air Force Research Lab., USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 127-149; In English; Also announced as 20020073794; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The feasibility of placing pulse detonation devices in the rear of a turbofan engine as a new pulse detonation afterburner concept (PDAC) has been assessed in the present study for a given sea level static power condition and an engine size. A turbofan engine with a new pulse detonation afterburner design concept was studied and its performance was obtained. The thrust, SFC (Specific Fuel Consumption) and specific thrust of a turbofan engine with a conventional afterburner and with the new pulse detonation afterburner concept were calculated and compared. The turbofan engine performance with the new pulse detonation afterburner concept was obtained using multidimensional CFD (Computational Fluid Dynamics) and cycle analysis as a function of the engine core flow fraction passing through the pulse detonation device. The results showed that the engine performance, in terms of ideal total gross thrust, SFC and specific thrust, was improved as the engine core flow fraction allowed in the pulse detonation chamber was increased. The predicted ideal total thrust, SFC and specific thrust of the turbofan engine with a pulse detonation afterburner were predicted to be better than those of a turbofan engine with a conventional deflagration combustion afterburner.
Author
Turbofan Engines; Afterburning; Detonation

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.

20020073805 Air Force Research Lab., Control Sciences Div., Wright-Patterson AFB, OH USA
Autonomous Systems: Don't Be Surprised If They Say No
Clough, Burce, Air Force Research Lab., USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 167-177; In English; Also announced as 20020073794; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The aerospace research community is working hard at developing UAV (Unmanned Aerial Vehicle) control technology that requires as little human supervision as possible. 'Humans are expensive, let's give the machines the capability of making their own decisions - that'll save us money' are cries heard across the globe. Such autonomy comes at a price - if one gives UAVs the capability of making decisions in a noisy, latent data world then one should expect them to make decisions you might not. If you give free-will why would one not expect it to be executed? (Let's face it - human pilots don't always act deterministic, right?) 'But that's okay', some muse, we can test it before hand to insure it makes the right decisions.' Wrong - the proposed complex distributed control architectures using large blocks of complicated software will have too many paths to exhaustively test (assuming one finds them all) affordably. If one adds in the non-determinism inherent in multi-intelligent agent negotiation, biologically inspired control technology, and real-time adaptive systems it's enough to make any controls engineer run from the table screaming 'Not only don't I really know what's in it, I don't really know what it will do!'. This paper examines the challenges in allowing UAVs to have autonomy, while insuring they don't do anything stupid.
Author
Pilotless Aircraft; Artificial Intelligence; Autonomy; Errors

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).

20020071131 Hadron, Inc., Cleveland, OH USA

Cable Failures and Protective Relay Operation Associated with NASA Glenn's 10x10 Supersonic Wind Tunnel

Kuhl, Cass, Hadron, Inc., USA; Apr. 16, 2002; 18p; In English; Supersonic Tunnel Association International Meeting, 14-16 Apr. 2002, South Bend, IN, USA; Sponsored by Supersonic Tunnel Association, Unknown

Contract(s)/Grant(s): RTOP 950-20-03-21; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During a two-month period, NASA Glenn Research Center in Cleveland, Ohio experienced two failures of high voltage cables associated with its 10 x 10 supersonic wind tunnel (SWT) and a ground problem from the local utility. This paper addresses these problems and associated relay operations. The following incidents are reviewed: 1) Failure of 6.9kV transformer drive cable and operation of protective relaying; 2) Detection of problem on First Energy's 138kV utility power system with new microprocessor based relays; 3) Failure of 138kV transformer primary cable and operation of protective relaying. All three incidents were associated with transformer K10, one of four transformers feeding the 10 x 10 SWT complex.

Author

Failure; Electric Relays; Electric Wire; Transformers

20020073099 Alliant Techsystems, Inc., Rocket Center, WV USA

Development of the NAVSEA/Alliant Techsystems Tactical Airbreathing Propulsion, Integral-Rocket/Ramjet-Engine Test Facility

Randolph, G. D., Alliant Techsystems, Inc., USA; Beck, K. W., Alliant Techsystems, Inc., USA; Zajdel, L. S., Alliant Techsystems, Inc., USA; Snurr, G. R., Alliant Techsystems, Inc., USA; Castrogiovanni, A., General Applied Science Labs., Inc., USA; Lugbauer, J. P., General Applied Science Labs., Inc., USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 57-67; In English; Also announced as 20020073093; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

This document summarizes the design and installation of an air-breathing engine test facility at the Alliant Techsystems, Inc. (ATK) Rocket Center, WV plant located at NAVSEA's Allegany Ballistics Laboratory (ABL). The design process, requirements, and performance of the new facility are discussed. The purpose of the facility is to provide a state-of-the-art testing capability that addresses tactical air-breathing propulsion and materials testing needs. The facility project, a collaboration of the U.S. Navy and ATK, will enable testing that will address current and future U. S. interests in tactical integral-rocket/ramjet and next-generation propulsion. The tactical air-breathing propulsion test facility at ATK provides the capability to test integral-rocket/ramjet (IRR) propulsion and heat shield materials over a wide range of flight conditions. The facility provides computer controlled real-time variable airflow rates, temperatures, and pressures to engine test vehicles for trajectory performance evaluation. The state-of-the-art storage heating system provides clean-air to the test stand at pressures capable of evaluating high Mach, sea level systems. ATK, at its Rocket Center facility, performed detailed analyses of both domestic and foreign air-breathing test systems. Factors such as system architecture (pebble bed versus vitiated), capacity, efficiency, service life, and maintenance were evaluated. The ABL system was designed by GASL, a division of Allied Aerospace. GASL's extensive testing background for such agencies as DARPA, the Air Force, and NASA, provided unique user-based experience and lessons-learned in the test facility design. The initial phase of the system, to be completed this year, will provide 60-IBM/sec airflow at a max operating temperature of 3000 R. Subsequent phases address altitude simulation and instrumentation. The system provides 1500-psia airflow to the test article via high-pressure, internally insulated hot-flow piping. Nearly 2000-IBM of usable air is available which will provide full duration testing for most foreseeable, air-launch, and kinetic energy (KE) applications. The airflow capacity can be easily upgraded as the need arises, and the system was designed to provide adequate heating capacity for these future requirements. Air-breathing tactical propulsion addresses the need to develop lighter weapons, with longer ranges, and reduced time to target. ATK has been involved in the area of solid propellant, variable flow ducted rocket technology since the late 1960's. ATK innovations provided many contributions to the Air Force Variable-Flow Ducted Rocket (VFDR) AMRAAM program. These developments included hardware fabrication, injector technology, the solid-fuel and fuel delivery system, throttle control valve hardware, and throttle control software. ATK is continuing its heritage in tactical air-breathing propulsion at its Rocket Center, WV location.

Author

Test Facilities; Design Analysis; Fabrication; Air Breathing Engines; Installing

20020073106 General Applied Science Labs., Inc., Ronkonkoma, NY USA

Summary of Test Medium Working Group Workshop I

Chinitz, Wallace, General Applied Science Labs., Inc., USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 149-154; In English; Also announced as 20020073093; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The high total enthalpies (temperatures) required when ground testing airbreathing, high flight Mach number, aeropropulsion engines necessitates contaminating the facility ”air” (i.e., the test medium) to some extent. The presence of these contaminants can have a profound effect on the test results and on the interpretation of those results. The JANNAF Interagency Propulsion Committee’s Airbreathing Propulsion Subcommittee, through its Test and Evaluation Panel, has elected to convene a ”Test Medium Working Group” open to all members of the U.S. hypersonics community. The Working Group is charged (at a minimum) with arriving at recommendations to that community for dealing with these issues. A Workshop was convened at the 50th JANNAF Propulsion Meeting in July 2001. The conclusions reached at that Workshop, as well as actions taken based on those conclusions, are discussed herein.

Author

Conferences; Enthalpy; Air Breathing Engines; Ground Tests; High Temperature

20020073194 California Univ., California Inst. for Energy Efficiency, Berkeley, CA USA

Energy Performance of Cleanroom Environmental Systems

Xu, T.; Tschudi, W.; Nov. 2001; 16p; In English

Report No.(s): DE2002-793761; LBNL-49106; HT-438; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

By developing metrics for evaluating cleanroom air system performance and overall load intensity, this paper provides energy benchmarking results for thirteen cleanroom environmental system performance, and identifies opportunities for improving cleanroom energy efficiency while maintaining or improving cleanroom contamination control. Comparisons with IEST Recommended Practice are made to examine the performance of cleanroom air systems. These results can serve as a vehicle to identify energy efficient cleanroom design practices and to highlight important issues in cleanroom operation and maintenance. Results from this study confirm that there are opportunities in improving energy efficiency of cleanroom environmental systems while maintaining effective contamination control.

NTIS

Clean Rooms; Efficiency; Energy Conservation; Maintenance; Contamination

14
GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and test chambers and simulators. Also includes extraterrestrial bases and supporting equipment. For related information see also 09 Research and Support Facilities (Air).

20020070857 NASA Ames Research Center, Moffett Field, CA USA

PRACA Enhancement Pilot Study Report: Engineering for Complex Systems Program (formerly Design for Safety), DFS-IC-0006

Korsmeyer, David, NASA Ames Research Center, USA; Schreiner, John, NASA Ames Research Center, USA; August 2002; 110p; In English

Contract(s)/Grant(s): RTOP 704-10-12

Report No.(s): NASA/TM-2002-211846; NAS 1.15:211846; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This technology evaluation report documents the findings and recommendations of the Engineering for Complex Systems Program (formerly Design for Safety) PRACA Enhancement Pilot Study of the Space Shuttle Program’s (SSP’s) Problem Reporting and Corrective Action (PRACA) System. A team at NASA Ames Research Center (ARC) performed this Study. This Study was initiated as a follow-on to the NASA chartered Shuttle Independent Assessment Team (SIAT) review (performed in the Fall of 1999) which identified deficiencies in the current PRACA implementation. The Pilot Study was launched with an initial qualitative assessment and technical review performed during January 2000 with the quantitative formal Study (the subject of this

report) started in March 2000. The goal of the PRACA Enhancement Pilot Study is to evaluate and quantify the technical aspects of the SSP PRACA systems and recommend enhancements to address deficiencies and in preparation for future system upgrades. Author

Safety; Correction; Management Systems; Data Bases; Operational Problems

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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.

20020070918 NASA Glenn Research Center, Cleveland, OH USA

SRM-Assisted Trajectory for the GTX Reference Vehicle

Riehl, John, NASA Glenn Research Center, USA; Trefny, Charles, NASA Glenn Research Center, USA; June 2002; 22p; In e; Combustion, Airbreathing Propulsion, Propulsion Systems Hazards, and Modelling and Simulation Subcommittees Joint Meeting, 8-12 Apr. 2002, Destin, FL, USA; Sponsored by Department of the Navy, USA

Contract(s)/Grant(s): RTOP 708-90-63

Report No.(s): NASA/TM-2002-211599; E-13386; NAS 1.15:211599; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A goal of the GTX effort has been to demonstrate the feasibility of a single stage-to-orbit (SSTO) vehicle that delivers a small payload to low earth orbit. The small payload class was chosen in order to minimize the risk and cost of development of this revolutionary system. A preliminary design study by the GTX team has resulted in the current configuration that offers considerable promise for meeting the stated goal. The size and gross lift-off weight resulting from scaling the current design to closure however may be considered impractical for the small payload. In lieu of evolving the project' reference vehicle to a large-payload class, this paper offers the alternative of using solid-rocket motors in order to close the vehicle at a practical scale. This approach offers a near-term, quasi-reusable system that easily evolves to reusable SSTO following subsequent development and optimization. This paper presents an overview of the impact of the addition of SRM's to the GTX reference vehicle#s performance and trajectory. The overall methods of vehicle modeling and trajectory optimization will also be presented. A key element in the trajectory optimization is the use of the program OTIS 3.10 that provides rapid convergence and a great deal of flexibility to the user. This paper will also present the methods used to implement GTX requirements into OTIS modeling. Author

Solid Propellant Rocket Engines; Launch Vehicles; Hypersonic Combustion; Trajectory Optimization

20020071141 NASA Glenn Research Center, Cleveland, OH USA

Design Evolution and Performance Characterization of the GTX Air-Breathing Launch Vehicle Inlet

DeBonis, James R., NASA Glenn Research Center, USA; Steffen, C. J., Jr., NASA Glenn Research Center, USA; Rice, T., Johns Hopkins Univ., USA; Trefny, C. J., NASA Glenn Research Center, USA; [2002]; 18p; In English; JANNAF 26th Airbreathing Propulsion Subcommittee Meeting, 8-21 Apr. 2002, Destin, FL, USA; Sponsored by Department of the Navy, USA

Contract(s)/Grant(s): RTOP 708-90-63; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The design and analysis of a second version of the inlet for the GTX rocket-based combine-cycle launch vehicle is discussed. The previous design did not achieve its predicted performance levels due to excessive turning of low-momentum corner flows and local over-contraction due to asymmetric end-walls. This design attempts to remove these problems by reducing the spike half-angle to 10- from 12-degrees and by implementing true plane of symmetry end-walls. Axisymmetric Reynold s-Averaged Navier-Stokes simulations using both perfect gas and real gas, finite rate chemistry, assumptions were performed to aid in the design process and to create a comprehensive database of inlet performance. The inlet design, which operates over the entire air-breathing Mach number range from 0 to 12, and the performance database are presented. The performance database, for use in cycle analysis, includes predictions of mass capture, pressure recovery, throat Mach number, drag force, and heat load, for the entire Mach range. Results of the computations are compared with experimental data to validate the performance database. Author

Design Analysis; Engine Inlets; Air Breathing Engines; Launch Vehicles; Inlet Nozzles; Computational Fluid Dynamics; Propulsion System Performance

20020073102 NASA Glenn Research Center, Cleveland, OH USA

Performance Validation Approach for the GTX Air-Breathing Launch Vehicle

Trefny, Charles J., NASA Glenn Research Center, USA; Roche, Joseph M., NASA Glenn Research Center, USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 85-105; In English; Also announced as 20020073093; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The primary objective of the GTX effort is to determine whether or not air-breathing propulsion can enable a launch vehicle to achieve orbit in a single stage. Structural weight, vehicle aerodynamics, and propulsion performance must be accurately known over the entire flight trajectory in order to make a credible assessment. Structural, aerodynamic, and propulsion parameters are strongly interdependent, which necessitates a system approach to design, evaluation, and optimization of a single-stage-to-orbit concept. The GTX reference vehicle serves this purpose, by allowing design, development, and validation of components and subsystems in a system context. The reference vehicle configuration (including propulsion) was carefully chosen so as to provide high potential for structural and volumetric efficiency, and to allow the high specific impulse of air-breathing propulsion cycles to be exploited. Minor evolution of the configuration has occurred as analytical and experimental results have become available. With this development process comes increasing validation of the weight and performance levels used in system performance determination. This paper presents an overview of the GTX reference vehicle and the approach to its performance validation. Subscale test rigs and numerical studies used to develop and validate component performance levels and unit structural weights are outlined. The sensitivity of the equivalent, effective specific impulse to key propulsion component efficiencies is presented. The role of flight demonstration in development and validation is discussed.

Author

Aerodynamics; Air Breathing Engines; Design Optimization; Flight Tests; Launch Vehicles; Structural Design

20020073103 NASA Glenn Research Center, Cleveland, OH USA

Design Evolution and Performance Characterization of the GTX Air-Breathing Launch Vehicle Inlet

DeBonis, J. R., NASA Glenn Research Center, USA; Steffen, C. J., Jr., NASA Glenn Research Center, USA; Rice, T., Johns Hopkins Univ., USA; Trefny, C. J., NASA Glenn Research Center, USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 107-123; In English; Also announced as 20020073093; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The design and analysis of a second version of the inlet for the GTX rocket-based combine-cycle launch vehicle is discussed. The previous design did not achieve its predicted performance levels due to excessive turning of low-momentum comer flows and local over-contraction due to asymmetric end-walls. This design attempts to remove these problems by reducing the spike half-angle to 10- from 12-degrees and by implementing true plane of symmetry end-walls. Axisymmetric Reynolds-Averaged Navier-Stokes simulations using both perfect gas and real gas, finite rate chemistry, assumptions were performed to aid in the design process and to create a comprehensive database of inlet performance. The inlet design, which operates over the entire air-breathing Mach number range from 0 to 12, and the performance database are presented. The performance database, for use in cycle analysis, includes predictions of mass capture, pressure recovery, throat Mach number, drag force, and heat load, for the entire Mach range. Results of the computations are compared with experimental data to validate the performance database.

Author

Air Breathing Boosters; Inlet Nozzles; Design Analysis; Performance Prediction; Engine Inlets

20020073104 NASA Glenn Research Center, Cleveland, OH USA

Status of the RBCC Direct-Connect Mixer Combustor Experiment

Walker, James F., NASA Glenn Research Center, USA; Kamhawi, Hani, NASA Glenn Research Center, USA; Krivanek, Thomas M., NASA Glenn Research Center, USA; Thomas, Scott R., NASA Glenn Research Center, USA; Smith, Timothy D., NASA Glenn Research Center, USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 125-134; In English; Also announced as 20020073093; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The NASA Glenn Research Center is developing hydrogen based combined cycle propulsion technology for a single-stage-to-orbit launch vehicle application under a project called GTX. Rocket Based Combined Cycle (RBCC) propulsion systems incorporate one or more rocket engines into an airbreathing flow path to increase specific impulse as compared to an all rocket-powered vehicle. In support of this effort, an RBCC direct-connect test capability was established at the Engine Components Research Laboratory to investigate low speed, ejector ramjet, and initial ramjet operations and performance. The facility and test article enables the evaluation of two candidate low speed operating schemes; the simultaneous mixing and combustion (SMC) and independent ramjet stream (IRS). The SMC operating scheme is based on the fuel rich operations of the rocket where performance depends upon mixing between the rocket plume and airstream. In contrast, the IRS scheme fuels the

airstream separately and uses the rocket plume to ignite the fuel-air mixture. This paper describes the test hardware and facility upgrades installed to support the RBCC tests. It also defines and discusses low speed technical challenges being addressed by the experiments. Finally, preliminary test results, including rocket risk mitigating tests, unfueled airflow tests, and the integrated system hot fire test will be presented.
Author
Rocket-Based Combined-Cycle Engines; Combustion Chambers; Technology Assessment; Propulsion System Performance; Engine Tests

20020073112 NASA Ames Research Center, Moffett Field, CA USA
Cost Per Pound From Orbit
Merriam, M. L., NASA Ames Research Center, USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 245-248; In English; Also announced as 20020073093; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC
Traditional studies of Reusable Launch Vehicle (RLV) designs have focused on designs that are completely reusable except for the fuel. This may not be realistic with current technology . An alternate approach is to look at partially reusable launch vehicles. This raises the question of which parts should be reused and which parts should be expendable. One approach is to consider the cost/pound of returning these parts from orbit. With the shuttle, this cost is about three times the cost/pound of launching payload into orbit. A subtle corollary is that RLVs are much less practical for higher orbits, such as the one on which the International Space Station resides, than they are for low earth orbits.
Author
Reusable Launch Vehicles; Costs; Design Optimization

20020073119 NASA Glenn Research Center, Cleveland, OH USA
Affordable Flight Demonstration of the GTX Air-Breathing SSTO Vehicle Concept
Krivanek, Thomas M., NASA Glenn Research Center, USA; Roche, Joseph M., NASA Glenn Research Center, USA; Riehl, John P., NASA Glenn Research Center, USA; Kosareo, Daniel N., ZIN Technologies, Inc., USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 321-335; In English; Also announced as 20020073093; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC
The rocket based combined cycle (RBCC) powered single-stage-to-orbit (SSTO) reusable launch vehicle has the potential to significantly reduce the total cost per pound for orbital payload missions. to validate overall system performance, a flight demonstration must be performed. This paper presents an overview of the first phase of a flight demonstration program for the GTX SSTO vehicle concept. Phase 1 will validate the propulsion performance of the vehicle configuration over the supersonic and hypersonic airbreathing portions of the trajectory. The focus and goal of Phase 1 is to demonstrate the integration and performance of the propulsion system flowpath with the vehicle aerodynamics over the air-breathing trajectory. This demonstrator vehicle will have dual mode ramjet/scramjets, which include the inlet, combustor, and nozzle with geometrically scaled aerodynamic surface outer mold lines (OML) defining the forebody, boundary layer diverter, wings, and tail. The primary objective of this study is to demonstrate propulsion system performance and operability including the ram to scram transition, as well as to validate vehicle aerodynamics and propulsion airframe integration. to minimize overall risk and development cost the effort will incorporate proven materials, use existing turbomachinery in the propellant delivery systems, launch from an existing unmanned remote launch facility, and use basic vehicle recovery techniques to minimize control and landing requirements. A second phase would demonstrate propulsion performance across all critical portions of a space launch trajectory (lift off through transition to all-rocket) integrated with flight-like vehicle systems.
Author
Air Breathing Engines; Cost Reduction; Engine Airframe Integration; Propulsion System Configurations; Propulsion System Performance; Reusable Launch Vehicles

20020073122 NASA Lewis Research Center, Cleveland, OH USA
28th Aerospace Mechanisms Symposium
Rohn, Douglas A., Compiler, NASA Lewis Research Center, USA; May 1994; 120p; In English, 18-20 May 1994, Cleveland, OH, USA; Sponsored by NASA Lewis Research Center, USA; Also announced as 20020073123 through 20020073154
Contract(s)/Grant(s): RTOP 506-43-41
Report No.(s): NASA-CP-3260; E-8667; NAS 1.55:3260; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
The proceedings of the 28th Aerospace Mechanisms Symposium, which was hosted by the NASA Lewis Research Center and held at the Cleveland Marriott Society Center on May 18, 19, and 20, 1994, are reported. Technological areas covered include

actuators, aerospace mechanism applications for ground support equipment, lubricants, pointing mechanisms joints, bearings, release devices, booms, robotic mechanisms, and other mechanisms for spacecraft.
Author
Conferences; Aeronautical Engineering; Actuators; Spacecraft Equipment; Ground Support Equipment; Aerospace Technology Transfer; Spacecraft Lubrication; Robotics; Spacecraft Instruments

20020073802 SpaceWorks Engineering, Inc., Atlanta, GA USA
System Level Uncertainty Assessment for Collaborative RLV Design
Charania, A. C., SpaceWorks Engineering, Inc., USA; Bradford, John E., SpaceWorks Engineering, Inc., USA; Olds, John R., SpaceWorks Engineering, Inc., USA; Graham, Matthew, SpaceWorks Engineering, Inc., USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 99-120; In English; Also announced as 20020073794; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

A collaborative design process utilizing Probabilistic Data Assessment (PDA) is showcased. Given the limitation of financial resources by both the government and industry, strategic decision makers need more than just traditional point designs, they need to be aware of the likelihood of these future designs to meet their objectives. This uncertainty, an ever-present character in the design process, can be embraced through a probabilistic design environment. A conceptual design process is presented that encapsulates the major engineering disciplines for a Third Generation Reusable Launch Vehicle (RLV). Toolsets consist of aerospace industry standard tools in disciplines such as trajectory, propulsion, mass properties, cost, operations, safety, and economics. Variations of the design process are presented that use different fidelities of tools. The disciplinary engineering models are used in a collaborative engineering framework utilizing Phoenix Integration's ModelCenter and AnalysisServer environment. These tools allow the designer to join disparate models and simulations together in a unified environment wherein each discipline can interact with any other discipline. The design process also uses probabilistic methods to generate the system level output metrics of interest for a RLV conceptual design. The specific system being examined is the Advanced Concept Rocket Engine 92 (ACRE-92) RLV. Previous experience and knowledge (in terms of input uncertainty distributions from experts and modeling and simulation codes) can be coupled with Monte Carlo processes to best predict the chances of program success.
Author
Computerized Simulation; Probability Theory; Assessments; Design Analysis

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SPACE TRANSPORTATION AND SAFETY

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information, see also 03 Air Transportation and Safety 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.

20020070807 Massachusetts Inst. of Tech., Dept. of Aeronautics and Astronautics, Cambridge, MA USA
Microgravity Investigation of Crew Reactions in 0-G (MICR0-G): Ground-Based Development Effort ***Final Report***
Newman, Dava J., Massachusetts Inst. of Tech., USA; [2002]; 157p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG9-1003; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This report describes the technology development of an advanced load sensor ground-based prototype and details the preliminary tests in microgravity during parabolic flights. The research effort is entitled, the Microgravity Investigation and Crew Reactions in 0-G (MICR0-G), a ground-based research effort funded by the National Aeronautics and Space Administration (NASA). The MICR0-G project was a follow-on to the Enhanced Dynamic Load Sensors (EDLS) spaceflight experiment flown on the Russian Space Station Mir. The technology development of the advanced load sensor prototype has been carried out by the Massachusetts Institute of Technology (MIT), with collaboration from Politecnico di Milano University and the Italian Space Agency (ASI). The key hardware of the advanced sensor prototype is a set of two types of load sensors - a hand-hold and foot restraints - similar in appearance to the mobility aids found in the Space Shuttle orbiter to assist the crew in moving inside the spacecraft, but able to measure the applied forces and moments about the x-, y-, and z- axes. The aim of Chapter 1 is to give a brief overview of the report contents. The first section summarizes the previous research efforts on astronaut-induced loads in microgravity. The second section provides information on the MICR0-G research project and the technology development work conducted at MIT. Section 1.3 details the motivation for designing a new generation of load sensors and describes the main

enhancements and contributions of the MICR0-G advanced load sensors system compared to the EDLS system. Finally, the last section presents the outline of the report.
Derived from text
Microgravity; Spacecrews; Dynamic Loads; Research and Development

20020071140 Pace Univ., New York, NY USA
The Interstellar Probe (ISP): Pre-Perihelion Trajectories and Application of Holography ***Final Report***
Matloff, G. L., Pace Univ., USA; Vulpetti, G., Telespazio S.p.A., Italy; Bangs, C., Art Resource Transfer, Inc., USA; Haggerty, R., Pace Univ., USA; June 2002; 86p; In English
Contract(s)/Grant(s): NASA Order H-29712-D
Report No.(s): NASA/CR-2002-211730; NAS 1.26:211730; M-1046; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
Between February and September 2001, a number of aspects of the solar-sail-launched Interstellar probe (ISP), which is under consideration by NASA for launch in the 2010-2015 timeframe, were researched. The effort was conducted in New York City (NYC) February-May, at Marshall Space Flight Center (MSFC) May-July (when the PI served as a NASA Summer 2001 Faculty Fellow), and in NYC August-September. In addition to the people listed on the title sheet, many people in NYC and at MSFC participated in this research.
Author
Solar Sails; Propulsion; Space Transportation; Holography

20020073101 NASA Marshall Space Flight Center, Huntsville, AL USA
NASA's Hypersonic Investment Area
Hueter, Uwe, NASA Marshall Space Flight Center, USA; Hutt, John, NASA Marshall Space Flight Center, USA; McClinton, Charles, NASA Langley Research Center, USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 75-84; In English; Also announced as 20020073093; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC
NASA has established long term goals for access to space. The third generation launch systems are to be fully reusable and operational around 2025. The goal for third-generation launch systems represents significant reduction in cost and improved safety over the current first generation system. The Advanced Space Transportation Office (ASTP) at NASA s Marshall Space Flight Center (MSFC) has the agency lead to develop space transportation technologies. Within ASTP, under the Hypersonic Investment Area (HIA), third generation technologies are being pursued in the areas of propulsion, airframe, integrated vehicle health management (IVHM), avionics, power, operations and system analysis. These technologies are being matured through research and both ground and flight-testing. This paper provides an overview of the HIA program plans and recent accomplishments.
Author
Flight Tests; Hypersonics; Systems Analysis; Space Transportation; Safety; Reusable Launch Vehicles

20020073111 NASA Ames Research Center, Moffett Field, CA USA
Space Transportation and the Computer Industry: Learning from the Past
Merriam, M. L., NASA Ames Research Center, USA; Rasky, D., NASA Ames Research Center, USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 233-243; In English; Also announced as 20020073093; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC
Since the space shuttle began flying in 1981, NASA has made a number of attempts to advance the state of the art in space transportation. In spite of billions of dollars invested, and several concerted attempts, no replacement for the shuttle is expected before 2010. Furthermore, the cost of access to space has dropped very slowly over the last two decades. On the other hand, the same two decades have seen dramatic progress in the computer industry. Computational speeds have increased by about a factor of 1000 and available memory, disk space, and network bandwidth has seen similar increases. At the same time, the cost of computing has dropped by about a factor of 10000. Is the space transportation problem simply harder? Or is there something to be learned from the computer industry? In looking for the answers, this paper reviews the early history of NASA's experience with supercomputers and NASA's visionary course change in supercomputer procurement strategy.
Author
Computers; Costs; Progress; Replacing; Space Transportation

20020073804 NASA Ames Research Center, Moffett Field, CA USA

A Geometry-Centered Approach For Two-Stage-to-Orbit Vehicle Synthesis

Papadopoulos, P. E., Eloret Corp., USA; Reuther, J., NASA Ames Research Center, USA; Haimes, B., Massachusetts Inst. of Tech., USA; Harris, S., NASA Langley Research Center, USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 151-165; In English; Also announced as 20020073794

Contract(s)/Grant(s): NAS2-99092; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

A geometry-centered approach to vehicle analysis and design is demonstrated for classes of two-stage-to-orbit (TSTO) launch configurations. The core capability unique to the new environment is its reliance on a CAD-neutral geometry application program interface. The environment permits a flexible vehicle closure process that includes (a) geometry manipulation, (b) propulsion system selection, (c) weights and sizing, (d) aerodynamic and aero-thermodynamic analysis, and (e) trajectory optimization. Conceptual level analysis tools are integrated into an automated framework using the Phoenix Integration ModelCenter software. The actual vehicle closure is highly iterative with several levels of interface between disciplines. Fundamental to these loops is the geometric manipulation. to provide robust yet accurate and automated geometry, software libraries have been created that allow bidirectional access to and control of a choice of user-chosen CAD kernels. The geometry libraries contain utilities that assemble a vehicle configuration according to prescribed parameter specifications, extract needed geometry parameters, and provide user-controllable water-tight surface tessellations of selected vehicle components. These operations are performed via commands given to the CAD kernel API. The CAPRI programming interface used to broker all the CAD API calls allows the higher-level vehicle assembly and parameter extraction utilities to remain CAD-neutral. The CAPRI interface also provides a consistent (CAD system independent) algorithm for surface tessellations. The geometry-centered philosophy in this analysis and design environment bypasses issues currently associated with CAD output translation, geometry manipulation and grid generation.

Author

Computer Aided Design; Computer Programs; Aerodynamic Configurations

20020073860 Pace Univ., New York, NY USA

The Interstellar Probe (ISP): Pre-Perihelion Trajectories and Application of Holography ***Final Report***

Matloff, G. L., Pace Univ., USA; Vulpetti, G., Telespazio S.p.A., Italy; Bangs, C., Art Resorce Transfer, Inc., USA; Haggerty, R., Pace Univ., USA; June 2002; 88p; In English; Original contains color illustrations

Contract(s)/Grant(s): NASA Order H-29712-D

Report No.(s): NASA/CR-2002-211730; NAS 1.26:211730; M-1046; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Between February and September 2001, a number of aspects of the solar-sail-launched Interstellar probe (ISP), which is under consideration by NASA for launch in the 2010-2015 timeframe, were researched. The effort was conducted in New York City (NYC) February-May, at Marshall Space Flight Center (MSFC) May-July (when the PI served as a NASA Summer 2001 Faculty Fellow), and in NYC August-September. In addition to the people listed on the title sheet, many people in NYC and at MSFC participated in this research.

Author

Holography; Launching; Solar Sails; Perihelions

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SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes space systems telemetry; space communications networks; astronavigation and guidance; and spacecraft radio blackout. For related information, see also 04 Aircraft Communications and Navigation and 32 Communications and Radar.

20020072733 NASA Goddard Space Flight Center, Greenbelt, MD USA

Science Goal Driven Observing and Spacecraft Autonomy

Jones, Jeremy, NASA Goddard Space Flight Center, USA; Grosvenor, Sandy, Booz-Allen and Hamilton, Inc., USA; Korathkar, Anuradha, Space Telescope Science Inst., USA; Memarsadeghi, Nargess, NASA Goddard Space Flight Center, USA; Wolf, Karl, Commerce One, Inc., USA; [2002]; 1p; In English; SpaceOps 2002, 9-12 Oct. 2002, Houston, TX, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Spacecraft autonomy will be an integral part of mission operations in the coming decade. While recent missions have made great strides in the ability to autonomously monitor and react to changing health and physical status of spacecraft, little progress

has been made in responding quickly to science driven events. For observations of inherently variable targets and targets of opportunity, the ability to recognize early if an observation will meet the science goals of a program, and react accordingly, can have a major positive impact on the overall scientific returns of an observatory and on its operational costs. If the onboard software can reprioritize the schedule to focus on alternate targets, discard uninteresting observations prior to downloading, or download a subset of observations at a reduced resolution, the spacecraft's overall efficiency will be dramatically increased. The science goal monitoring (SGM) system is a proof- of-concept effort to address the above challenge. The SGM will have an interface to help capture higher-level science goals from the scientists and translate them into a flexible observing strategy that SGM can execute and monitor. We are developing an interactive distributed system that will use on-board processing and storage combined with event-driven interfaces with ground-based processing and operations, to enable fast re-prioritization of observing schedules, and to minimize time spent on non-optimized observations. This paper will focus on our strategy for developing SGM and the technical challenges that we have encountered. We will discuss the SGM architecture as it applies to the proposed MIDEX-class mission Kronos. However, the architecture and interfaces will also be designed for easy adaptability to other observing platforms, including ground-based systems and to work with different scheduling and pipeline processing systems.
Author
Space Laboratories; Command and Control; Applications Programs (Computers); Spaceborne Telescopes; Satellite Observation; Flight Management Systems

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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.

20020071070 NASA Goddard Space Flight Center, Greenbelt, MD USA
Simulation of Guidance, Navigation, and Control Systems for Formation Flying Missions
Burns, Rich, NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; International Symposium on Formation Flying Missions and Technologies, 29-31 Oct. 2002, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Concepts for missions of distributed spacecraft flying in formation abound. From high resolution interferometry to spatially distributed in-situ measurements, these mission concepts levy a myriad of guidance, navigation, and control (GNC) requirements on the spacecraft/formation as a single system. A critical step toward assessing and meeting these challenges lies in realistically simulating distributed spacecraft systems. The Formation Flying TestBed (FFTB) at NASA Goddard Space Flight Center's (GSFC) Guidance, Navigation, and Control Center is a hardware-in-the-loop simulation and development facility focused on GNC issues relevant to formation flying systems. The FFTB provides a realistic simulation of the vehicle dynamics and control for formation flying missions in order to: (1) conduct feasibility analyses of mission requirements, (2) conduct and answer mission and spacecraft design trades, and (3) serve as a host for GNC software and hardware development and testing. The initial capabilities of the FFTB are based upon an integration of high fidelity hardware and software simulation, emulation, and test platforms developed or employed at GSFC in recent years, including a high-fidelity Global Positioning System (GPS) simulator which has been a fundamental component of the GNC Center's GPS Test Facility. The FFTB will be continuously evolving over the next several years from a tool with capabilities in GPS navigation hardware/software-in-the-loop analysis and closed loop GPS-based orbit control algorithm assessment. Eventually, it will include full capability to support all aspects of multi-sensor, absolute and relative state determination and control, in all (attitude and orbit) degrees of freedom, as well as information management for satellite clusters and constellations. A detailed description of the FFTB architecture is presented in the paper.
Author
Formation Flying; Flight Management Systems; Computerized Simulation; Spacecraft Guidance; Control Simulation; Applications Programs (Computers)

20020072850 NASA Glenn Research Center, Cleveland, OH USA
ACTS of Education
Bauer, Robert, NASA Glenn Research Center, USA; Krawczyk, Richard, NASA Glenn Research Center, USA; Gargione, Frank, Satellite Systems Consultant, USA; Kruse, Hans, Ohio Univ., USA; [2002]; 4p; In English; 8th Ka-band Utilization Conference, 25-28 Sep. 2002, Baveno-Stresa, Italy
Contract(s)/Grant(s): RTOP 329-10-00; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Now in its ninth year of operations, the Advanced Communications Technology Satellite (ACTS) program has continued, although since May 2000 in a new operations arrangement involving a university based consortium, the Ohio Consortium for Advanced Communications Technology (OCACT), While NASA has concluded its experimental intentions of ACTS, the spacecraft's ongoing viability has permitted its further operations to provide educational opportunities to engineering and communications students interested in satellite operations, as well as a Ka-band test bed for commercial interests in utilizing Kaband space communications. The consortium has reached its first year of operations. This generous opportunity by NASA has already resulted in unique educational opportunities for students in obtaining "hands-on" experience, such as, in satellite attitude control. An update is presented on the spacecraft and consortium operations.
Author
ACTS; Education; Satellite Attitude Control; Space Communication; Telecommunication

20020073124 Indian Space Research Organization, Spacecraft Mechanisms Group, Bangalore, India
INSAT-2A and 2B Deployment Mechanisms
Sathyanarayan, M. N., Indian Space Research Organization, India; Rao, M. Nageswara, Indian Space Research Organization, India; Nataraju, B. S., Indian Space Research Organization, India; Viswanatha, N., Indian Space Research Organization, India; Chary, M. Laxmana, Indian Space Research Organization, India; Balan, K. S., Indian Space Research Organization, India; Murthy, V. Sridhara, Indian Space Research Organization, India; Aller, Raju, Indian Space Research Organization, India; Kumar, H. N. Suresha, Indian Space Research Organization, India; 28th Aerospace Mechanisms Symposium; May 1994, pp. 17-34; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche
The Indian National Satellite (INSAT) 2A and 2B have deployment mechanisms for deploying the solar array, two C/S band antenna reflectors and a coilable lattice boom with sail. The mechanisms have worked flawlessly on both satellites. The configuration details, precautions taken during the design phase, the test philosophy, and some of the critical analysis activities are discussed.
Author
Indian Spacecraft; Satellite Design; Conferences; Solar Arrays; Satellite Antennas; Equipment Specifications; Solar Sails

20020073125 Honeywell Space Systems, Phoenix, AZ USA
Roll Ring Assemblies for the Space Station
Batista, J., Honeywell Space Systems, USA; Vise, J., Honeywell Space Systems, USA; Young, K., Honeywell Space Systems, USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 35-50; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche
Space Station Freedom requires the transmission of high power and signals through three different rotational interfaces. Roll ring technology was baselined by NASA for rotary joints to transfer up to 65.5 kW of power for 30 years at greater than 99 percent efficiency. Signal transfer requirements included MIL-STD-l553 data transmission and 4.5 MHz RS250A base band color video. A unique design for each rotary joint was developed and tested to accomplish power and signal transfer. An overview of roll ring technology is presented, followed by design requirements, hardware configuration, and test results.
Author
Space Station Freedom; Conferences; Joints (Junctions); Data Transmission; Equipment Specifications

20020073126 Rockwell International Corp., Rocketdyne Div., Canoga Park, CA USA
International Space Station Alpha's Bearing, Motor, and Roll Ring Module Developmental Testing and Results
OBrien, David L., Rockwell International Corp., USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 51-61; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche
This paper presents the design and developmental testing associated with the bearing, motor, and roll ring module (BMRRM) used for the beta rotation axis on International Space Station Alpha (ISSA). The BMRRM with its controllers located in the electronic control unit (ECU), provides for the solar array pointing and tracking functions as well as power and signal transfer across a rotating interface.
Author
International Space Station; Conferences; Equipment Specifications; Controllers; Bearings; Motors

20020073135 NASA Lewis Research Center, Cleveland, OH USA
Design, Characterization, and Control of the NASA Three Degree of Freedom Reaction Compensation Platform
Birkhimer, Craig, Case Western Reserve Univ., USA; Newman, Wyatt, Case Western Reserve Univ., USA; Choi, Benjamin, NASA Lewis Research Center, USA; Lawrence, Charles, NASA Lewis Research Center, USA; 28th Aerospace Mechanisms

Symposium; May 1994, pp. 147-152; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

Increasing research is being done into industrial uses for the microgravity environment aboard orbiting space vehicles. However, there is some concern over the effects of reaction forces produced by moving objects, especially motors, robotic actuators, and astronauts. Reaction forces produced by movement of these objects may manifest themselves as undesirable accelerations in the space vehicle, making the vehicle unusable for microgravity applications. It is desirable to provide compensation for such forces using active means. This paper presents the design and experimental evaluation of the NASA three degree of freedom reaction compensation platform, a system designed to be a testbed for the feasibility of active attenuation of reaction forces caused by moving objects in a microgravity environment. Unique 'linear motors', which convert electrical current directly into rectilinear force, are used in the platform design. The linear motors induce accelerations of the displacer inertias. These accelerations create reaction forces that may be controlled to counteract disturbance forces introduced to the platform. The stated project goal is to reduce reaction forces by 90%, or -20 dB. Description of the system hardware, characterization of the actuators and the composite system, and design of the software safety system and control software are included.
Author
Microgravity; Attenuators; Actuators

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SPACECRAFT PROPULSION AND POWER

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

20020070846 Temple Univ., Dept. of Chemistry, Philadelphia, PA USA
Solid State Electrolytes Prepared from PEO (360) Silanated Silica
Maitra, P., Temple Univ., USA; Ding, J., Temple Univ., USA; Liu, B., Temple Univ., USA; Wunder, S. L., Temple Univ., USA; Lin, H.-P., MaxPower, Inc., USA; Chua, D., MaxPower, Inc., USA; Salomon, M., MaxPower, Inc., USA; [2002]; 4p; In English; 40th Power Sources Conference, 10-13 Jun. 2002, Cherry Hill, NJ, USA
Contract(s)/Grant(s): NAS3-01160; RTOP 755-20-00; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

All solid state composite electrolytes were prepared using fumed silica (SiO2) silanated with an oligomeric polyethylene oxide (PEO) silane containing 6-9 ethylene oxide repeat units, a PEO matrix and LiClO4 (8/1 O/Li). The PEO-silane covalently attached to the silica was amorphous, with a T(sub g) that increased from -90 C to -53 C after attachment. The conductivity of films prepared using the PEO-silanated silica increased to approx. 6 x 10(exp -5) S/cm at RT compared with approx. 1 x 10(-5) S/cm for films prepared with unsilanated SiO2.
Author
Electrolytes; Polyethylenes; Silicon Dioxide; Solid State

20020070888 Temple Univ., Dept. of Chemistry, Philadelphia, PA USA
Preparation and Characterization of Single Ion Conductors from High Surface Area Fumed Silica
Zhang, H., Temple Univ., USA; Maitra, P., Temple Univ., USA; Liu, B., Temple Univ., USA; Wunder, S. L., Temple Univ., USA; Lin, H.-P., MaxPower, Inc., USA; Salomon, M., MaxPower, Inc., USA; [2002]; 4p; In English; 40th Power Sources Conference, 10-13 Jun. 2002, Cherry Hill, NJ, USA
Contract(s)/Grant(s): NAS3-01160; RTOP 755-20-00; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Anions that can form dissociative salts with Li(+) have been prepared and covalently attached to high surface area fumed silica. When blended with polyethylene oxide (PEO), the functionalized fumed silica suppresses the crystallization of the PEO, provides dimensional stability, and serves as a single ion conductor. Since functionalized fumed silica is easily dispersed in common polar solvents, it can be incorporated in both the polymer electrolyte and the electrodes.
Author
Anions; Conductors; Polyethylenes; Silicon Dioxide; Metal Ions

20020072715 NASA Glenn Research Center, Cleveland, OH USA

LIF Density Measurement Calibration Using a Reference Cell

Domonkos, Matthew T., NASA Glenn Research Center, USA; Williams, George J., Jr., Ohio Aerospace Inst., USA; May 27, 2002; 13p; In English; 29th International Conference of Plasma Science, 27-30 May 2002, Banff, Canada; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Flight qualification of ion thrusters typically requires testing on the order of 10,000 hours. Extensive knowledge of wear mechanisms and rates is necessary to establish design confidence prior to long duration tests. Consequently, real-time erosion rate measurements offer the potential both to reduce development costs and to enhance knowledge of the dependency of component wear on operating conditions. Several previous studies have used laser induced fluorescence (LIF) to measure real-time, in situ erosion rates of ion thruster accelerator grids. Those studies provided only relative measurements of the erosion rate. In the present investigation, a molybdenum tube was resistively heated such that the evaporation rate yielded densities within the tube on the order of those expected from accelerator grid erosion. A pulsed UV laser was used to pump the ground state molybdenum at 345.64nm, and the non-resonant fluorescence at 550-nm was collected using a bandpass filter and a photomultiplier tube or intensified CCD array. The sensitivity of the fluorescence was evaluated to determine the limitations of the calibration technique. The suitability of the diagnostic calibration technique was assessed for application to ion engine erosion rate measurements.
Author

Laser Induced Fluorescence; Calibrating; Density Measurement; Evaporation Rate; Wear

20020072717 NASA Glenn Research Center, Cleveland, OH USA

Extending Ion Engine Technology to NEXT and Beyond

Domonkos, Matthew T., NASA Glenn Research Center, USA; Patterson, Michael J., NASA Glenn Research Center, USA; Foster, John E., NASA Glenn Research Center, USA; Rawlin, Vince K., NASA Glenn Research Center, USA; Soulas, George C., NASA Glenn Research Center, USA; Sovey, James S., NASA Glenn Research Center, USA; Kovaleski, Scott D., NASA Glenn Research Center, USA; Roman, Robert F., NASA Glenn Research Center, USA; Williams, George J., Jr., NASA Glenn Research Center, USA; May 27, 2002; 19p; In English; 29th International Conference on Plasma Science, 27-30 May 2002, Banff, Canada; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Extending ion engine technology beyond the current state-of-the art primary interplanetary electric propulsion system, the 2.3-kW NASA Solar Electric Propulsion Technology and Applications Readiness (NSTAR) system, will require thrusters with improved propellant throughput and total impulse capability. Many of the design choices that culminated in the NSTAR thrusters must be revisited, and their application to next generation ion engine technology must be evaluated. The concept of derating, which was successfully employed in NSTAR, has been applied to the 40 cm NASA Evolutionary Xenon Thruster (NEXT) currently under development at NASA Glenn Research Center (GRC). At 5-kW, NEXT operates with the same average beam current density as NSTAR, and at 10-kW, the peak beam current density is only ten percent greater than NSTAR. The result is that similar Ion optics technology is expected to yield comparable lifetime. Thick-accelerator- grid ion optics are also being tested to realize additional lifetime benefits. A 40-A discharge cathode is being developed for NEXT based on scaling the NSTAR design. Nevertheless, the experiences of the NSTAR ground tests and the thruster on the Deep Space One spacecraft indicate that the discharge cathode wear must be studied experimentally and theoretically to ensure that it meets the lifetime requirements. Although NEXT is in its infancy, investigations have already begun to examine possible modifications to engine design for even higher-power and higher-specific impulse engines. Ion optics using alternate materials such as titanium, graphite, or carbon-carbon composite are currently being investigated due to their low sputter yields at high voltage. to avoid the difficulties encountered using electrodes at high-currents, the use of a microwave-based ion thruster is under investigation for potential high-power ion thruster systems requiring long lifetimes. Additionally, alternative propellants are being considered for applications requiring high-specific impulse (>> 5000 s) and extremely long-life (>> 15,000 hr). Testing requirements make condensable propellants attractive for high-power engines. Although the NSTAR ion engine demonstrated the flight maturity of ion thruster technology, many challenges remain for the development of thrusters with improved propellant throughput and power handling capabilities.
Author

Electric Propulsion; Engine Design; Solar Electric Propulsion; Interplanetary Spacecraft; Xenon; Carbon-Carbon Composites; Ion Propulsion

20020072739 NASA Marshall Space Flight Center, Huntsville, AL USA

Simplified Analysis of Pulse Detonation Rocket Engine Blowdown Gasdynamics and Performance

Morris, Christopher I., NASA Marshall Space Flight Center, USA; Nov. 20, 2001; 1p; In English; 38th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 7-10 Jul. 2002, Indianapolis, IN, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Pulsed detonation rocket engines (PDREs) have generated considerable research interest in recent years as a chemical propulsion system potentially offering improved performance and reduced complexity compared to conventional rocket engines. The detonative mode of combustion employed by these devices offers a thermodynamic advantage over the constant-pressure deflagrative combustion mode used in conventional rocket engines and gas turbines. However, while this theoretical advantage has spurred a great deal of interest in building PDRE devices, the unsteady blowdown process intrinsic to the PDRE has made realistic estimates of the actual propulsive performance problematic. The goal of this paper is to improve understanding of PDRE blowdown gasdynamics and performance issues through use of a simplified model that captures the essential features of the unsteady blowdown process, and yet remains computationally inexpensive. The PDRE system studied here is highly idealized, consisting of a constant-area detonation tube with one end closed and the other end open to the environment. The tube is prefilled with a gaseous propellant mixture with no initial velocity or outflow to the environment. The detonation is initiated instantaneously at the closed end of the device. Chapman-Jouguet (C-J) post-detonation gas conditions are calculated using the CET89 version of the NASA thermochemical code. The 1-D, unsteady method of characteristics is used to calculate the flowfield following the detonation front. Parametric studies of the effect of mixture stoichiometry, fill temperature, and blowdown pressure ratio on performance are reported. A comparison of the performance of an idealized straight-tube PDRE with a conventional steady-state rocket engine is provided. The effect of constant gamma and equilibrium chemistry assumptions is also examined. Additionally, in order to form an assessment of the accuracy of the model, the flowfield time history is compared to experimental data from Stanford University.

Author

Pulse Detonation Engines; Gas Dynamics; Chemical Propulsion; Performance Prediction; Numerical Analysis; Systems Analysis; Combustion

20020072846 NASA Glenn Research Center, Cleveland, OH USA

Comprehensive Evaluation of Power Supplies at Cryogenic Temperatures for Deep Space Applications

Patterson, Richard L., NASA Glenn Research Center, USA; Gerber, Scott, ZIN Technologies, Inc., USA; Hammoud, Ahmad, QSS Group, Inc., USA; Elbuluk, Malik E., Akron Univ., USA; [2002]; 13p; In English

Contract(s)/Grant(s): NAS3-00145; RTOP 297-60-10; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The operation of power electronic systems at cryogenic temperatures is anticipated in many future space missions such as planetary exploration and deep space probes. In addition to surviving the space hostile environments, electronics capable of low temperature operation would contribute to improving circuit performance, increasing system efficiency, and reducing development and launch costs. DC/DC converters are widely used in space power systems in the areas of power management, conditioning, and control. As part of the on-going Low Temperature Electronics Program at NASA, several commercial-off-the-shelf (COTS) DC/DC converters, with specifications that might fit the requirements of specific future space missions have been selected for investigation at cryogenic temperatures. The converters have been characterized in terms of their performance as a function of temperature in the range of 20 C to - 180 C. These converters ranged in electrical power from 8 W to 13 W, input voltage from 9 V to 72 V and an output voltage of 3.3 V. The experimental set-up and procedures along with the results obtained on the converters' steady state and dynamic characteristics are presented and discussed.

Author

Spacecraft Power Supplies; Cryogenic Temperature; Deep Space; Space Exploration; Voltage Converters (DC to DC); Low Temperature; Electric Potential

20020073105 NASA Glenn Research Center, Cleveland, OH USA

Three Dimensional CFD Analysis of the GTX Combustor

Steffen, C. J., Jr., NASA Glenn Research Center, USA; Bond, R. B., North Carolina State Univ., USA; Edwards, J. R., North Carolina State Univ., USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 135-148; In English; Also announced as 20020073093

Contract(s)/Grant(s): NAG3-2658; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The annular combustor geometry of a combined-cycle engine has been analyzed with three-dimensional computational fluid dynamics. Both subsonic combustion and supersonic combustion flowfields have been simulated. The subsonic combustion

analysis was executed in conjunction with a direct-connect test rig. Two cold-flow and one hot-flow results are presented. The simulations compare favorably with the test data for the two cold flow calculations; the hot-flow data was not yet available. The hot-flow simulation Indicates that the conventional ejector-ramjet cycle would not provide adequate mixing at the conditions tested. The supersonic combustion ramjet flowfield was simulated with frozen chemistry model. A five-parameter test matrix was specified, according to statistical design-of-experiments theory. Twenty-seven separate simulations were used to assemble surrogate models for combustor mixing efficiency and total pressure recovery. Scramjet injector design parameters (injector angle, location, and fuel split) as well as mission variables (total fuel mass flow and freestream Mach number) were included in the analysis. A promising injector design has been identified that provides good mixing characteristics with low total pressure losses. The surrogate models can be used to develop performance maps of different injector designs. Several complex three-way variable interactions appear within the dataset that are not adequately resolved with the current statistical analysis.
Author
Computational Fluid Dynamics; Three Dimensional Flow; Combustion Chambers; Dimensional Analysis; Fuel Flow

20020073110 NASA Langley Research Center, Hampton, VA USA
Comparison of Engine Cycle Codes for Rocket-Based Combined Cycle Engines
Waltrup, Paul J., Johns Hopkins Univ., USA; Auslender, Aaron H., NASA Langley Research Center, USA; Bradford, John E., Georgia Inst. of Tech., USA; Carreiro, Louis R., Air Force Research Lab., USA; Gettinger, Christopher, Pratt and Whitney Aircraft, USA; Komar, D. R., NASA Marshall Space Flight Center, USA; McDonald, J., NASA Marshall Space Flight Center, USA; Snyder, Christopher A., NASA Glenn Research Center, USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 209-232; In English; Also announced as 20020073093
Contract(s)/Grant(s): NASA Order H-33136-D; NAG8-1648; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

This paper summarizes the results from a one day workshop on Rocket-Based Combined Cycle (RBCC) Engine Cycle Codes held in Monterey CA in November of 2000 at the 2000 JANNAF JPM with the authors as primary participants. The objectives of the workshop were to discuss and compare the merits of existing Rocket-Based Combined Cycle (RBCC) engine cycle codes being used by government and industry to predict RBCC engine performance and interpret experimental results. These merits included physical and chemical modeling, accuracy and user friendliness. The ultimate purpose of the workshop was to identify the best codes for analyzing RBCC engines and to document any potential shortcomings, not to demonstrate the merits or deficiencies of any particular engine design. Five cases representative of the operating regimes of typical RBCC engines were used as the basis of these comparisons. These included Mach 0 sea level static and Mach 1.0 and Mach 2.5 Air-Augmented-Rocket (AAR), Mach 4 subsonic combustion ramjet or dual-mode scramjet, and Mach 8 scramjet operating modes. Specification of a generic RBCC engine geometry and concomitant component operating efficiencies, bypass ratios, fuel/oxidizer/air equivalence ratios and flight dynamic pressures were provided. The engine included an air inlet, isolator duct, axial rocket motor/injector, axial wall fuel injectors, diverging combustor, and exit nozzle. Gaseous hydrogen was used as the fuel with the rocket portion of the system using a gaseous H2/O2 propellant system to avoid cryogenic issues. The results of the workshop, even after post-workshop adjudication of differences, were surprising. They showed that the codes predicted essentially the same performance at the Mach 0 and I conditions, but progressively diverged from a common value (for example, for fuel specific impulse, Isp) as the flight Mach number increased, with the largest differences at Mach 8. The example cases and results are compared and discussed in this paper.
Author
Rocket-Based Combined-Cycle Engines; Combustion Chambers; Performance Prediction; Air Intakes; Dynamic Pressure; Thrust Augmentation

20020073115 NASA Glenn Research Center, Cleveland, OH USA
Integrated Nozzle Design for the GTX RBCC Flowpath
Smith, Timothy D., NASA Glenn Research Center, USA; Blaha, Bernard J., Ohio Aerospace Inst., USA; Rice, Tharen, Johns Hopkins Univ., USA; Yungster, Shaye, Institute for Computational Fluid Dynamics, UK; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 271-279; In English; Also announced as 20020073093; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The development of rocket based combined cycle (RBCC) engines are highly dependent upon integrating several different modes of operation into a single system. Due to the integrated nature of the propulsion system, each operating mode relies on the same expansion system to provide thrust. A fixed geometry, altitude-compensating aft-expansion configuration is used for the GTX flowpath configuration. Initial studies on the GTX expansion designs have demonstrated the importance of a smooth, highly integrated design for propulsion system performance. Based upon the results from the initial studies, further design improvements were made to the expansion system. Nozzles designed based on both conical and streamline traced flowfields; are discussed.

Results from 3-D CFD calculations on an optimized geometry are also presented. A series of cold-flow experiments are proposed to validate the CFD analysis and quantify performance of the flowpath expansions surface design. A discussion is provided of the research hardware designs and experimental test plans.
Author
Nozzle Design; Rocket-Based Combined-Cycle Engines; Computational Fluid Dynamics; Experiment Design

20020073116 NASA Glenn Research Center, Cleveland, OH USA
Modes 1 and 4 Testing of an Axisymmetric GTX RBCC Engine
Rice, Tharen, Johns Hopkins Univ., USA; Smith, Timothy D., NASA Glenn Research Center, USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 281-290; In English; Also announced as 20020073093
Contract(s)/Grant(s): NAG3-2333; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Under sponsorship of the NASA Glenn Research Center (NASA GRC), the Johns Hopkins University Applied Physics Laboratory (JHU/APL) designed and built a five-inch diameter, Rocket-Based Combined Cycle (RBCC) engine to investigate mode 1 and mode 4 performance. This engine was designed so that engine area and length ratios were similar to the NASA GRC GTX engine. Unlike the GTX semi-circular engine design, the APL engine is completely axisymmetric. For this design, a traditional rocket thruster was installed inside of the scramjet flowpath, along the engine centerline. A three part test series is currently underway to determine mode 1 and mode 4 engine performance and compare those results to the rocket thruster operating by itself. All tests are to be conducted in APL's Cell 2 Freejet Engine Facility. Testing of the rocket thruster alone has been accomplished and its performance determined (average Isp efficiency = 90%). Mode 1 (air-augmented rocket) testing is to be conducted at various chamber pressure-to-ambient pressure ratios with the engine inlet fully open. Mode 4 (vacuum rocket) testing is to be conducted with chamber pressure-to-ambient pressure ratios greater than 600 with the inlet fully closed to simulate high-altitude flight conditions. The engine is currently installed in Cell 2 and awaiting testing. This paper discusses the engine design and details the results of the rocket-only testing. Comparisons to previous tests and projected mode 1 and mode 4 test conditions are also discussed.
Author
Rocket-Based Combined-Cycle Engines; Models; Manufacturing; Performance Prediction; Engine Design

20020073117 NASA Glenn Research Center, Cleveland, OH USA
GTX Reference Vehicle Structural Verification Methods and Weight Summary
Hunter, J. E., NASA Glenn Research Center, USA; McCurdy, D. R., QSS Group, Inc., USA; Dunn, P. W., NASA Glenn Research Center, USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 291-303; In English; Also announced as 20020073093; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The design of a single-stage-to-orbit air breathing propulsion system requires the simultaneous development of a reference launch vehicle in order to achieve the optimal mission performance. Accordingly, for the GTX study a 300-lb payload reference vehicle was preliminary sized to a gross liftoff weight (GLOW) of 238,000 lb. A finite element model of the integrated vehicle/propulsion system was subjected to the trajectory environment and subsequently optimized for structural efficiency. This study involved the development of aerodynamic loads mapped to finite element models of the integrated system in order to assess vehicle margins of safety. Commercially available analysis codes were used in the process along with some internally developed spread-sheets and FORTRAN codes specific to the GTX geometry for mapping of thermal and pressure loads. A mass fraction of 0.20 for the integrated system dry weight has been the driver for a vehicle design consisting of state-of-the-art composite materials in order to meet the rigid weight requirements. This paper summarizes the methodology used for preliminary analyses and presents the current status of the weight optimization for the structural components of the integrated system.
Author
Air Breathing Engines; Finite Element Method; Mathematical Models; Payloads; Structural Design; Structural Weight

20020073118 NASA Glenn Research Center, Cleveland, OH USA
SRM-Assisted Trajectory for the GTX Reference Vehicle
Riehl, John, NASA Glenn Research Center, USA; Trefny, Charles, NASA Glenn Research Center, USA; Kosareo, Daniel, ZIN Technologies, Inc., USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 305-320; In English; Also announced as 20020073093; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

A goal of the GTX effort has been to demonstrate the feasibility of a single stage- to- orbit (SSTO) vehicle that delivers a small payload to low earth orbit. The small payload class was chosen in order to minimize the risk and cost of development of this revolutionary system. A preliminary design study by the GTX team has resulted in the current configuration that offers considerable promise for meeting the stated goal. The size and gross lift-off weight resulting from scaling the current design to closure however may be considered impractical for the small payload. In lieu of evolving the project's reference vehicle to a large-payload class, this paper offers the alternative of using solid-rocket motors in order to close the vehicle at a practical scale. This approach offers a near-term, quasi-reusable system that easily evolves to reusable SSTO following subsequent development and optimization. This paper presents an overview of the impact of the addition of SRM's to the GTX reference vehicle's performance and trajectory. The overall methods of vehicle modeling and trajectory optimization will also be presented. A key element in the trajectory optimization is the use of the program OTIS 3.10 that provides rapid convergence and a great deal of flexibility to the user. This paper will also present the methods used to implement GTX requirements into OTIS modeling.
Author
Solid Propellant Rocket Engines; Single Stage to Orbit Vehicles; Low Earth Orbits

20020073408 NASA Ames Research Center, Moffett Field, CA USA
A Three-Dimensional Parallel Time-Accurate Turbopump Simulation Procedure Using Overset Grid System
Kiris, Cetin, NASA Ames Research Center, USA; Chan, William, NASA Ames Research Center, USA; Kwak, Dochan, NASA Ames Research Center, USA; Jul. 08, 2002; 40p; In English; Second Internationl Conference on Computational Fluid Dynamics, 15-19 Jul. 2002, Sydney, Australia; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of the current effort is to provide a computational framework for design and analysis of the entire fuel supply system of a liquid rocket engine, including high-fidelity unsteady turbopump flow analysis. This capability is needed to support the design of pump sub-systems for advanced space transportation vehicles that are likely to involve liquid propulsion systems. to date, computational tools for design/analysis of turbopump flows are based on relatively lower fidelity methods. An unsteady, three-dimensional viscous flow analysis tool involving stationary and rotational components for the entire turbopump assembly has not been available for real-world engineering applications. The present effort provides developers with information such as transient flow phenomena at start up, and nonuniform inflows, and will eventually impact on system vibration and structures. In the proposed paper, the progress toward the capability of complete simulation of the turbo-pump for a liquid rocket engine is reported. The Space Shuttle Main Engine (SSME) turbo-pump is used as a test case for evaluation of the hybrid MPI/Open-MP and MLP versions of the INS3D code. CAD to solution auto-scripting capability is being developed for turbopump applications. The relative motion of the grid systems for the rotor-stator interaction was obtained using overset grid techniques. Unsteady computations for the SSME turbo-pump, which contains 114 zones with 34.5 million grid points, are carried out on Origin 3000 systems at NASA Ames Research Center. Results from these time-accurate simulations with moving boundary capability are presented along with the performance of parallel versions of the code.
Author
Turbine Pumps; Three Dimensional Flow; Propulsion System Configurations; Computational Grids; Simulation

20020073495 Air Force Research Lab., Propulsion Directorate, Edwards AFB, CA USA
Current Efforts to Develop Alternate 'TB 700-2' Test Protocols for the Hazard Classification of Large Rocket Motors
Schwartz, Daniel F., Air Force Research Lab., USA; Bennett, Robert R., Thiokol Propulsion, USA; Graham, Kenneth J., Atlantic Research Corp., USA; Boggs, Thomas A., Naval Air Warfare Center, USA; Atwood, Alice I., Naval Air Warfare Center, USA; Butcher A. Garn, Safety Management Services, Inc., USA; JANNAF 30th Propellant Development and Characterization Subcommittee Meeting; March 2002; Volume 1, pp. 177-206; In English; Also announced as 20020073479; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

When the Department of Defense (DoD) revised Technical Bulletin (TB) 700-2, NAVSEAINST 8020.8B, TO 11A-1-47, DLAR 8220.12 hazard classification guidelines in January 1998, it significantly changed the procedures used to determine the explosive classification of rocket motors, to be shipped or placed in DoD storage facilities. The revised test protocols outlined in this document, (hereafter referred to as TB 700-2) are far more conservative and costly to implement than the previous ones. These changes could have a profound impact on the solid rocket community and in particular those involved with the research and development and manufacture of large (larger than 304.8-millimeter (larger than 12-inch)) diameter solid rocket motors (SRMs). The ramifications may include higher development costs and limitations on performance improvements. This paper outlines current efforts of the solid rocket community to develop acceptable alternate test protocols for large rocket motors that

could fulfill the intent of TB 700-2 and be considered by the Department of Defense Explosive Safety Board (DDESB) for incorporation into a future revision to TB 700-2.
Author
Solid Propellant Rocket Engines; Solid Propellants; Propellant Storage; Hazards; Shock Resistance; Propellant Chemistry; Propellant Tests; Simulation; Safety Management

20020073863 Johns Hopkins Univ., Applied Physics Lab., Laurel, MD USA
Integrated Power Source Grant ***Final Report, 12 Apr. - 30 Oct. 2001***
Oct. 31, 2001; 7p; In English
Contract(s)/Grant(s): CUFS-X466-Y00-2441-2500; NAG1-01059
Report No.(s): SEE-01-076; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Traditional spacecraft power systems incorporate a solar array energy source, an energy storage element (battery), and battery charge control and bus voltage regulation electronics to provide continuous electrical power for spacecraft systems and instruments. Dedicated power conditioning components provide limited fault isolation between systems and instruments, while a centralized power-switching unit provides spacecraft load control. Battery undervoltage conditions are detected by the spacecraft processor, which removes fault conditions and non-critical loads before permanent battery damage can occur. Cost effective operation of a micro-sat constellation requires a fault tolerant spacecraft architecture that minimizes on-orbit operational costs by permitting autonomous reconfiguration in response to unexpected fault conditions. A new micro-sat power system architecture that enhances spacecraft fault tolerance and improves power system survivability by continuously managing the battery charge and discharge processes on a cell-by-cell basis has been developed. This architecture is based on the Integrated Power Source (US patent 5644207), which integrates dual junction solar cells, Lithium Ion battery cells, and processor based charge control electronics into a structural panel that can be deployed or used to form a portion of the outer shell of a micro-spacecraft. The first generation Integrated Power Source is configured as a one inch thick panel in which prismatic Lithium Ion battery cells are arranged in a 3x7 matrix (26VDC) and a 3x1 matrix (3.7VDC) to provide the required output voltages and load currents. A multi-layer structure holds the battery cells, as well as the thermal insulators that are necessary to protect the Lithium Ion battery cells from the extreme temperatures of the solar cell layer. Independent thermal radiators, located on the back of the panel, are dedicated to the solar cell array, the electronics, and the battery cell array. In deployed panel applications, these radiators maintain the battery cells in an appropriate operational temperature range.
Derived from text
Power Conditioning; Spacecraft Instruments; Solar Cells; Microsatellites; Systems Integration; Microelectronics

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CHEMISTRY AND MATERIALS (GENERAL)

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see categories 24 through 29. For astrochemistry see category 90 Astrophysics.

20020070889 NASA Glenn Research Center, Cleveland, OH USA
Oxidation and Volatilization of Silica-Formers in Water Vapor
Opila, E. J., NASA Glenn Research Center, USA; [2002]; 37p; In English
Contract(s)/Grant(s): RTOP 714-04-70; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
At high temperatures SiC and Si3N4 react with water vapor to form a silica scale. Silica scales also react with water vapor to form a volatile Si(OH)4 species. These simultaneous reactions, one forming silica and the other removing silica, are described by paralinear kinetics. A steady state, in which these reactions occur at the same rate, is eventually achieved, After steady state is achieved, the oxide found on the surface is a constant thickness and recession of the underlying material occurs at a linear rate. The steady state oxide thickness, the time to achieve steady state, and the steady state recession rate can all be described in terms of the rate constants for the oxidation and volatilization reactions. In addition, the oxide thickness, the time to achieve steady state, and the recession rate can also be determined from parameters that describe a water vapor-containing environment. Accordingly, maps have been developed to show these steady state conditions as a function of reaction rate constants, pressure, and gas velocity. These maps can be used to predict the behavior of silica formers in water-vapor containing environments such as combustion environments. Finally, these maps are used to explore the limits of the paralinear oxidation model for SiC and Si3N4
Author
Oxidation; Silicon Nitrides; Vaporizing

20020071015 NASA Glenn Research Center, Cleveland, OH USA

Durability of Solar Selective Coatings in a Simulated Space Environment

Jaworske, Donald A., NASA Glenn Research Center, USA; [2002]; 10p; In English; 34th International SAMPE Technical Conference, 4-7 Nov. 2002, Baltimore, MD, USA; Sponsored by Society for the Advancement of Materials and Process Engineering, USA

Contract(s)/Grant(s): RTOP 274-00-00; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Solar selective coatings are being considered for heat engine and thermal switching applications on minisatellites. Such coatings must have the combined properties of high solar absorptance and low infrared emittance. High solar absorptance is needed to collect solar energy as efficiently as possible while low infrared emittance is needed to minimize radiant energy loss at operating temperature. These properties are achieved in sputter deposited thin films through the use of molecular mixtures of metal and dielectric. Solar selective coatings having a solar absorptance to infrared emittance ratio of 9 have been successfully deposited using a mixture of nickel and aluminum oxide. The space environment, however, presents some challenges for the use of materials on the exterior of spacecraft, including durability to atomic oxygen and vacuum ultraviolet radiation. to address these concerns, several candidate solar selective coatings were exposed to atomic oxygen in a plasma asher and to ultraviolet radiation in a vacuum facility equipped with calibrated deuterium lamps. The optical properties of the coatings were monitored as a function of time to evaluate their performance over long term exposure to the simulated space environment. Several coatings were found to be durable to both the atomic oxygen and the vacuum ultraviolet environments.

Author

Durability; Coatings; Aerospace Environments; Solar Energy; Optical Properties; Computerized Simulation; Far Ultraviolet Radiation; Heat Engines

20020073070 NASA Ames Research Center, Moffett Field, CA USA

Protein Kinase Classification with 2866 Hidden Markov Models and One Support Vector Machine

Weber, Ryan, NASA Ames Research Center, USA; New, Michael H., NASA Ames Research Center, USA; Feb. 11, 2002; 1p; In English; RECOMB 2002: 6th Annual International Conference on Research in Computational Molecular Biology, 18-21 Apr. 2002, Washington, DC, USA

Contract(s)/Grant(s): RTOP 344-38-00-04; No Copyright; Avail: Issuing Activity; Abstract Only

The main application considered in this paper is predicting true kinases from randomly permuted kinases that share the same length and amino acid distributions as the true kinases. Numerous methods already exist for this classification task, such as HMMs, motif-matchers, and sequence comparison algorithms. We build on some of these efforts by creating a vector from the output of thousands of structurally based HMMs, created offline with Pfam-A seed alignments using SAM-T99, which then must be combined into an overall classification for the protein. Then we use a Support Vector Machine for classifying this large ensemble Pfam-Vector, with a polynomial and chisquared kernel. In particular, the chi-squared kernel SVM performs better than the HMMs and better than the BLAST pairwise comparisons, when predicting true from false kinases in some respects, but no one algorithm is best for all purposes or in all instances so we consider the particular strengths and weaknesses of each.

Author

Enzymes; Vectors (Mathematics); Functions (Mathematics); Classifications; Numerical Analysis; Performance Prediction

20020073387 Search for Extraterrestrial Intelligence Inst., Moffett Field, CA USA

Carboxylic and Dicarboxylic Acids Extracted from Crushed Magnesium Oxide Single Crystals *Final Report*

Freund, Friedemann, Search for Extraterrestrial Intelligence Inst., USA; Gupta, Alka D., Search for Extraterrestrial Intelligence Inst., USA; Kumar, Devendra, Search for Extraterrestrial Intelligence Inst., USA; Dec. 23, 1998; 28p; In English

Contract(s)/Grant(s): NCC2-957; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Carboxylic and dicarboxylic acids (glycolic, oxalic, malonic and succinic) have been extracted with tetrahydrofuran (THE) and H2O from large synthetic MgO crystals, crushed to a medium fine powder. The extracts were characterized by infrared spectroscopy and (sup 1)H-NMR (Nuclear Magnetic Resonance). The THF extracts were derivatized with tert-butyldimethylsilyl (t-BDMS) for GC-MS (Gas Chromatography - Mass Spectroscopy) analysis. A single crystal separated from the extract was used for an x-ray structure analysis, giving the monoclinic unit cell, space group P2(sub 1)/c with a(sub o) = 5.543 A, b(sub o) = 8.845 A, c(sub o) = 5.086 A, and beta = 91.9 degrees, consistent with beta-succinic acid, HOOC(CH2)COOH. The amount of extracted acids is estimated to be of the order of 0.1 to 0.5 mg/g MgO. The MgO crystals from which these organic acids were extracted grew from the 2360 C hot melt, saturated with CO/CO2 and H2O, thereby incorporating small amounts of the gaseous components to form a solid solution (ss) with MgO. Upon cooling, the ss becomes supersaturated, causing solute carbon and other solute species to segregate not only to the surface but also internally, to dislocations and subgrain boundaries. The organic acids extracted from the MgO crystals after crushing appear to derive from these segregated solutes that formed C-C, C-H, and C-O bonds along

dislocations and other defects in the MgO structure, leading to entities that can generically be described as (HxCyOz)(sup n-). The processes underlying the formation of these precursors are fundamental in nature and expected to be operational in any minerals, preferentially those with dense structures, that crystallized in H2O-CO2-laden environments. This opens the possibility that common magmatic and metamorphic rocks when weathering at the surface of a tectonically active planet like Earth may be an important source of abiogenically formed complex organic compounds.
Author
Carboxylic Acids; Dicarboxylic Acids; Magnesium Oxides; Single Crystals; Tetrahydrofuran; Organic Compounds

20020073526 NASA Ames Research Center, Moffett Field, CA USA
Tholins: Can They Provide a Substrate, Carbon and Nitrogen for Plant Production?
Wignarajah, Kanapathipillai, Lockheed Martin Engineering and Science Services, USA; Khare, Bishun, National Academy of Sciences - National Research Council, USA; Cruikshank, Dale, NASA Ames Research Center, USA; McKay, Christopher, NASA Ames Research Center, USA; [1999]; 1p; In English; International Conference for Life Support Science, Jan. 1999, Houston, TX, USA
Contract(s)/Grant(s): RTOP 199-61-01; No Copyright; Avail: Issuing Activity; Abstract Only
Tholin is a word coined to describe the entire class of complex organic solids produced in laboratory experiments where pre-biotic gaseous chemicals are subject to bombardment by high energy. The atomic composition of Titan tholin produced from 10 percent CH4 and 90 percent N2 in a simulation of Titan atmosphere irradiated by charged particles trapped in the magnetosphere of Saturn gave 67 percent C and 33 percent N. Hydrolysis of Titan tholin with 6N HCl produced a racemic mixture of biological and non-biological amino acids that was confirmed by GC/MS. Other tholins, that revealed the presence of amino acids, were UV tholin produced under possible primitive Earth conditions by irradiation of a mixture of gases (CH4, C2H6, NH3, H2S and liquid H2O) with long-wavelength ultraviolet light, representing the most abundant useful energy source for prebiological organic synthesis; Spark tholin in a crude simulation of Jupiter atmosphere using electrical discharge through a mixture of CH4, NH3, and H2O vapor. Pyrolytic GC/MS of Titan tholin produced more than one hundred organic compounds including saturated and unsaturated aliphatic hydrocarbons, substituted polycyclic aromatics, nitriles, amines, pyrroles, pyrazines, pyridines, pyrimidines, and the purine, adenine. Similar rich pyrolytic products were obtained with UV as well as Spark tholins. A range of two to four ring PAHs (Polycyclic Aromatic Hydrocarbons) in Spark as well as Titan tholins, some with one to four alkylation sites, were identified by two-step laser desorption/multiphoton ionization mass spectrometry and also confirmed by the synchronous fluorescence technique. Previous studies have demonstrated the potential for use of tholins as a source of carbon and energy by microbes. This paper describes studies that evaluate the potential for using different types of tholins as (a) a substrate for growing plants and (b) a source of carbon and nitrogen for plants. The data are interpreted in terms of the potential for using such tholins to grow plants for food in extraterrestrial habitats and also to speculate on the possibilities of abiotic evolution of plants.
Author
Carbon; Nitrogen; Organic Compounds; Ultraviolet Radiation; Abiogenesis

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COMPOSITE MATERIALS

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

20020070784 NASA Glenn Research Center, Cleveland, OH USA
High Temperature Si-doped BN Interphases for SiC/SiC Composites
Morscher, Gregory N., Ohio Aerospace Inst., USA; Hurwitz, Frances, NASA Glenn Research Center, USA; Yun, Hee Mann, Cleveland State Univ., USA; [2002]; 8p; In English
Contract(s)/Grant(s): NCC3-763; RTOP 714-04-30; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The hydrolytic stability of high-temperature deposited Si-doped BN has been shown in the past to be superior in comparison to ”pure” BN processed at similar or even higher temperatures. This type of material would be very desirable as a SiC/SiC composite interphase that is formed by chemical infiltration into multi-ply woven preform. However, due to rapid deposition on the preform outer surface at the high processing temperature, this has proven very difficult. to overcome this issue, single plies of woven fabric were infiltrated with Si-doped BN. Three composite panels of different SiC fiber types were fabricated with Si-doped BN interphases including Sylramic, Hi-Nicalon Type S and Sylramic-iBN fiber-types. The latter fiber-type possesses a thin in-situ grown BN layer on the fiber surface. High Si contents (approx. 7 to 10 a/o) and low oxygen contents (less than 1 a/o) were achieved. All three composite systems demonstrated reasonable debonding and sliding properties. The coated Sylramic

fabric and composites were weak due to fiber degradation apparently caused during interphase processing by the formation of TiN crystals on the fiber surface. The Hi-Nicalon Type S composites with Si-doped BN interphase were only slightly weaker than Hi-Nicalon Type S composites with conventional BN when the strength on the load-bearing fibers at failure was compared. On the other hand, the Sylramic-iBN fabric and composites with Si-doped BN showed excellent composite and intermediate temperature stress-rupture properties. Most impressive was the lack of any significant interphase oxidation on the fracture surface of stress-ruptured specimens tested well above matrix cracking at 815C.
Author
Doped Crystals; Silicon Carbides; Boron Nitrides; Interlayers

20020070788 Georgia Inst. of Tech., Atlanta, GA USA
Permeability of Impacted Coated Composite Laminates ***Final Report, 1 Jun. 2001 - 31 Aug. 2002***
Johnson, W. S., Georgia Inst. of Tech., USA; Findley, Benjamin, Georgia Inst. of Tech., USA; August 2002; 139p; In English
Contract(s)/Grant(s): NAG8-1819; GIT Proj. 1806675
Report No.(s): E-18-675; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
Composite materials are being considered for use on future generations of Reusable Launch Vehicles (RLVs) for both fuel tanks and fuel feedlines. Through the use of composite materials NASA can reduce the overall weight of the vehicle dramatically. This weight savings can then be translated into an increase in the weight of payload sent into orbit, reducing the cost per pound of payload. It is estimated that by switching to composite materials for fuel tanks the weight of the tanks can be reduced by 40 percent, which translates to a total vehicle weight savings of 14 percent. In this research, carbon/epoxy composites were studied for fuel feedline applications. There are concerns about using composite materials for feedlines and fuel tanks because these materials are extremely vulnerable to impact in the form of inadvertent bumping or dropped tools both during installation and maintenance. Additionally, it has been found that some of the sample feedlines constructed have had leaks, and thus there may be a need to seal preexisting leaks in the composite prior to usage.
Derived from text
Composite Materials; Carbon Fibers; Coatings; Epoxy Matrix Composites; Fiber Composites

20020070893 QSS Group, Inc., Cleveland, OH USA
Recent Developments in the Environmental Durability of SiC/SiC Composites ***Final Report***
Ogbuji, Linus U. J. T., QSS Group, Inc., USA; July 2002; 14p; In English; CIMTEC 2002 International Conferences on Modern Materials and Technologies, 14-19 Jul. 2002, Florence, Italy; Sponsored by International Society of Ceramics, Switzerland
Report No.(s): NASA/CR-2002-211687; NAS 1.26:211687; E-13416; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Two types of pest behavior in SiC/BN/SiC composites are distinguished and illustrated: one intrinsic and progressive, the other extrinsic and catastrophic. Their similarities and differences are presented. Some recent remedies for SiC/BN/SiC pest are discussed.
Author
Silicon Carbides; Analogies

20020071142 NASA Glenn Research Center, Cleveland, OH USA
Progress in SiC/SiC Ceramic Composite Development for Gas Turbine Hot-Section Components under NASA EPM and UEET Programs
DiCarlo, J. A., NASA Glenn Research Center, USA; Morscher, Gregory N., NASA Glenn Research Center, USA; Bhatt, Ramakrishna T., NASA Glenn Research Center, USA; [2002]; 7p; In English; 2002 ASME Turbo Expo Land, Sea, and Air, 3-6 Jun. 2002, Amsterdam, Netherlands; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): RTOP 714-04-30; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The successful application of ceramic matrix composites as hot-section components in advanced gas turbine engines will require the development of constituent materials and processes that can provide the material systems with the key thermostructural properties required for long-term component service. Much initial progress in identifying these materials and processes was made under the former NASA Enabling Propulsion Materials Program using stoichiometric Sylramic (trademark) silicon-carbide (SiC) fibers, 2D (two dimensional)-woven fiber architectures, chemically vapor-infiltrated (CVI) BN fiber coatings (interphases), and SiC-based matrices containing CVI SiC interphase over-coatings, slurry-infiltrated SiC particulate, and melt-infiltrated (MI) silicon. The objective of this paper is to discuss the property benefits of this SiC/SiC composite system for high-temperature engine components and to elaborate on further progress in SiC/SiC development made under the new NASA Ultra Efficient Engine Technology Program. This progress stems from the recent development of advanced constituent materials and

manufacturing processes, including specific treatments at NASA that improve the creep, rupture, and environmental resistance of the Sylramic fiber as well as the thermal conductivity and creep resistance of the CVI SiC over-coatings. Also discussed are recent observations concerning the detrimental effects of inadvertent carbon in the fiber-BN interfacial region and the beneficial effects of certain 2D-architectures for thin-walled SiC/SiC panels.
Author
Ceramic Matrix Composites; Silicon Carbides; Fibers; Engine Parts; Gas Turbine Engines

20020072226 NASA Glenn Research Center, Cleveland, OH USA
HOTPC PMC Project Overview
Sutter, Jim, NASA Glenn Research Center, USA; [2002]; 26p; In English; High Temple Workshop XXII, 21-24 Jan. 2002, Santa Fe, NM, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A review of NASA GRCs Higher Operating Temperature Propulsion Components Project (HOTPC) on polymer matrix composites (PMCs) will be described. The summary includes research from NASA GRC in-house, university and industry's cooperative programs. Current research emphasis focuses on developing high temperature PMCs used in rapidly heated structures, erosion coatings for PMCs, nano-materials compatible with polyimide resins, and development of more durable high temperature PMCs.
Author
University Program; NASA Programs; Polymer Matrix Composites; High Temperature; Polyimide Resins

20020072718 NASA Glenn Research Center, Cleveland, OH USA
Properties of M40J Carbon/PMR-II-50 Composites Fabricated with Desized and Surface Treated Fibers. Characterization of M40J Desized and Finished Fibers
Allred, Ronald E., Adherent Technologies, Inc., USA; Gosau, Jan M., Adherent Technologies, Inc., USA; Shin, E. Eugene, NASA Glenn Research Center, USA; McCorkle, Linda S., NASA Glenn Research Center, USA; Sutter, James K., NASA Glenn Research Center, USA; OMalley, Michelle, NASA Glenn Research Center, USA; [2002]; 32p; In English; High Temple Workshop XXII, 21-24 Jan. 2002, Santa Fe, NM, USA
Contract(s)/Grant(s): RTOP 708-31-13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
To increase performance and durability of high temperature composites for potential rocket engine components, it is necessary to optimize wetting and interfacial bonding between high modulus carbon fibers and high temperature polyimide resins. It has been previously demonstrated that the electro-oxidative shear treatments used by fiber manufacturers are not effective on higher modulus fibers that have fewer edge and defect sites in the surface crystallites. In addition, sizings commercially supplied on most carbon fibers are not compatible with polyimides. This study was an extension of prior work characterizing the surface chemistry and energy of high modulus carbon fibers (M40J and M60J, Torray) with typical fluorinated polyimide resins, such as PMR-II-50. A continuous desizing system which utilizes environmentally friendly chemical- mechanical processes was developed for tow level fiber and the processes were optimized based on weight loss behavior, surface elemental composition (XPS) and morphology (FE-SEM) analyses, and residual tow strength of the fiber, and the similar approaches have been applied on carbon fabrics. Both desized and further treated with a reactive finish were investigated for the composite reinforcement. The effects of desizing and/or subsequent surface retreatment on carbon fiber on composite properties and performance including fiber-matrix interfacial mechanical properties, thermal properties and blistering onset behavior will be discussed in this presentation.
Author
Fiber Composites; Carbon Fibers; Bonding; Wetting; Rocket Engines; Residual Strength; Polyimide Resins

20020072720 NASA Glenn Research Center, Cleveland, OH USA
Evaluation of Graphite Fiber/Polyimide PMCs from Hot Melt versus Solution Prepreg
Shin, Eugene E., Ohio Aerospace Inst., USA; Sutter, James K., NASA Glenn Research Center, USA; Eakin, Howard, NASA Glenn Research Center, USA; Inghram, Linda, Ohio Aerospace Inst., USA; McCorkle, Linda, Ohio Aerospace Inst., USA; Scheiman, Dan, QSS Group, Inc., USA; Papadopoulos, Demetrios, Akron Univ., USA; Thesken, John, Ohio Aerospace Inst., USA; Fink, Jeffrey E., Boeing Co., USA; [2002]; 32p; In English; High Temple Workshop XXII, 21-24 Jan. 2002, Santa Fe, NM, USA
Contract(s)/Grant(s): RTOP 708-31-13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Carbon fiber reinforced high temperature polymer matrix composites (PMC) have been extensively investigated as potential weight reduction replacements of various metallic components in next generation high performance propulsion rocket engines. The initial phase involves development of comprehensive composite material-process-structure-design-property in-service

performance correlations and database, especially for a high stiffness facesheet of various sandwich structures. Overview of the program plan, technical approaches and current multi-team efforts will be presented. During composite fabrication, it was found that the two large volume commercial prepregging methods (hot-melt vs. solution) resulted in considerably different composite cure behavior. Details of the process-induced physical and chemical modifications in the prepregs, their effects on composite processing, and systematic cure cycle optimization studies will be discussed. The combined effects of prepregging method and cure cycle modification on composite properties and isothermal aging performance were also evaluated.
Author
Polymer Matrix Composites; Carbon Fibers; Composite Materials; Sandwich Structures; Weight Reduction; Prepregs

20020072845 NASA Glenn Research Center, Cleveland, OH USA
The Influence of Interfacial Roughness on Fiber Sliding in Oxide Composites with La-Monazite Interphases
Davis, J. B., Rockwell Scientific Co., LLC, USA; Hay, R. S., Air Force Research Lab., USA; Marshall, D. B., Rockwell Scientific Co., LLC, USA; Morgan, P. E. D., Rockwell Scientific Co., LLC, USA; Sayir, A., NASA Glenn Research Center, USA; [2002]; 40p; In English
Contract(s)/Grant(s): NCC3-850; NCC3-372; F49620-96-C-0026; F49620-00-1-0048; RTOP 708-31-13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Room temperature debonding and sliding of La-Monazite coated fibers is assessed using a composite with a polycrystalline alumina matrix and fibers of several different single crystal (mullite, sapphire) and directionally solidified eutectic (Al2O3/Y3Al5O12 and Al2O3/Y-ZrO2) compositions. These fibers provide a range of residual stresses and interfacial roughnesses. Sliding occurred over a debond crack at the fiber-coating interface when the sliding displacement and surface roughness were relatively small. At large sliding displacements with relatively rough interfaces, the monazite coatings were deformed extensively by fracture, dislocations and occasional twinning, whereas the fibers were undamaged. Dense, fine-grained (10 nm) microstructures suggestive of dynamic recrystallization were also observed in the coatings. Frictional heating during sliding is assessed. The possibility of low temperature recrystallization is discussed in the light of the known resistance of monazite to radiation damage. The ability of La-Monazite to undergo plastic deformation relatively easily at low temperatures may be enabling for its use as a composite interface.
Author
Debonding (Materials); Fiber Composites; Single Crystals; Polycrystals; Surface Roughness; Sliding; Aluminum Oxides; Zirconium Oxides

20020072848 NASA Glenn Research Center, Cleveland, OH USA
Characterization of C/SiC Ceramic Matrix Composites (CMCs) with Novel Interface Fiber Coatings
Petko, Jeanne F., QSS Group, Inc., USA; Kiser, James Douglas, NASA Glenn Research Center, USA; Verilli, Mike, NASA Glenn Research Center, USA; McCue, Terry, QSS Group, Inc., USA; [2002]; 23p; In English; 26th Annual Conference on Materials and Structures, 28-31 Jan. 2002, Cape Canaveral, FL, USA
Contract(s)/Grant(s): RTOP 708-73-25; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Ceramic Matrix Composites (CMCs) are attractive candidate materials in the aerospace industry due to their high specific strength, low density and higher temperature capabilities. The National Aeronautics and Space Administration (NASA) is pursuing the use of CMC components in advanced Reusable Launch Vehicle (RLV) propulsion applications. Carbon fiber-reinforced silicon carbide (C/SiQ is the primary material of interest for a variety of RLV propulsion applications. These composites offer high-strength carbon fibers and a high modulus, oxidation-resistant matrix. For comparison, two types of carbon fibers were processed with novel types of interface coatings (multilayer and pseudoporous). For RLV propulsion applications, environmental durability will be critical. The coatings show promise of protecting the carbon fibers from the oxidizing environment. The strengths and microstructures of these composite materials are presented.
Author
Ceramic Matrix Composites; Fiber-Matrix Interfaces; Carbon Fibers; Silicon Carbides; Reusable Launch Vehicles; High Strength

20020072948 Istituto Superiore di Sanita, Lab. di Ingegneria Biomedica, Rome, Italy
Restoration of Posterior Teeth by Means of Silicone Moulds: Analysis of Mechanical Properties of a Composite Resin
Restauro dei Settori Posteriori dei Denti Mediante Mascherine in Silicone: Analisi delle Proprieta Meccanich di una Resina Composita
Bedini, R.; Bassi, M. A.; Ioppolo, P.; 2001; 50p; In Italian
Report No.(s): PB2002-105624; ISTISAN-01/33; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

The aim of this in vitro study is to evaluate the surface hardness and the compressive strength of a dental composite, induced by using a new operative technique useful to reproduce the primitive occlusal morphology in posterior teeth presenting carious lesions with still-intact enamel. This technique is based upon the registration of pre-operative occlusal morphology through a transparent silicone. Composite resin specimens were performed, with a cylindrical shape, by means a Denril mold. The specimens were performed, with and without the application of transparent silicone, adopting different curing time. After 24 hours the specimens were submitted to hardness test and then to compressive test. The results obtained showed that this operative technique does not cause appreciable effects on surface hardness in direct composite restoration but compressive strength could be reduced.
NTIS
Resins; Teeth; Compressive Strength; Dentistry; Hardness Tests; Transparence; Composite Materials

20020073076 NASA Glenn Research Center, Cleveland, OH USA
C-Coupon Studies of SiC/SiC Composites, Part 1, Acoustic Emission Monitoring
Morscher, Gregory N., Ohio Aerospace Inst., USA; Hurwitz, Frances I., NASA Glenn Research Center, USA; Calomino, Anthony M., NASA Glenn Research Center, USA; [2002]; 8p; In English
Contract(s)/Grant(s): NCC3-763; RTOP 714-04-30; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Modal acoustic emission (AE) was used to monitor the acoustic activity during room temperature and elevated temperature c-coupon tests for a variety of SiC/SiC systems including composites containing Sylramic (trademark), ZMI (trademark), or Hi-Nicalon (trademark) fibers with melt-infiltrated or polymer-infiltrated SiC matrices. Modal AE proved excellent at monitoring matrix cracking in the curved portion of the C-coupon specimen with increasing load. This included the load at which the first AE event occurred and the location of AE events during the test that were, presumably, caused by the formation and growth of interlaminar cracks and, at higher loads, transverse cracks. Graphical techniques were employed to estimate the load for first AE. It was determined that for this test with these material systems, the first AE could be estimated within the load range bounded by the load at which initial deviation from linearity of the load-displacement curve occurs and the load where the 98% offset of the linear regression fit intercepted the load-displacement curve. The calculation of interlaminar tensile (ILT) stress from the load for first AE was determined for all the systems. Ultimate ILT strength usually corresponded to ILT stress determined from the ultimate load to failure of the C-coupon test, which was considerably higher than the first cracking stress.
Author
Silicon Carbides; Polymer Matrix Composites; Loads (Forces); Acoustic Emission; Crack Propagation; Interlaminar Stress; Cracking (Fracturing); Fatigue Tests; Linearity

20020073132 TRW Space and Electronics Group, Redondo Beach, CA USA
Leveraging Metal Matrix Composites to Reduce Costs in Space Mechanisms
Nye, Ted, TRW Space and Electronics Group, USA; Claridge, Rex, TRW Space and Electronics Group, USA; Walker, Jim, TRW Space and Electronics Group, USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 129-134; In English; Also announced as 20020073122
Contract(s)/Grant(s): F33615-90-C-3200; F33733-89-C-1011; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche
Advanced metal matrix composites may be one of the most promising technologies for reducing cost in structural components without compromise to strength or stiffness. A microlight 12.50 N (2.81 lb), two-axis, solar array drive assembly (SADA) was made for the Advanced Materials Applications to Space Structures (AMASS) Program flight experiment. This SADA had both its inner and outer axis housings fabricated from silicon carbide particulate reinforced aluminum. Two versions of the housings were made. The first was machined from a solid billet of material. The second was plaster cast to a near net shape that required minimal finish machining. Both manufacturing methods were compared upon completion. Results showed a cost savings with the cast housing was possible for quantities greater than one and probable for quantities greater than two. For quantities approaching ten, casting resulted in a reduction factor of almost three in the cost per part.
Author
Spacecraft Structures; Metal Matrix Composites; Cost Reduction; Structural Members

20020073442 NASA Glenn Research Center, Cleveland, OH USA
High Temperature Tensile Properties and Fatigue Behavior of a Melt-Infiltrated SiC/SiC Composite
Kalluri, Sreeramesh, Ohio Aerospace Inst., USA; Calomino, Anthony M., NASA Glenn Research Center, USA; Brewer, David N., Army Research Lab., USA; [2002]; 8p; In English; Fatigue 202: 8th International Fatigue Congress, 2-7 Jun. 2002, Stockholm, Sweden; Sponsored by EMAS, Unknown
Contract(s)/Grant(s): NCC3-618; RTOP 714-04-30; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

High temperature fatigue behavior of a woven, SiC/SiC ceramic matrix composite (CMC) was investigated in air at two temperatures. The reinforcement for the CMC consisted of 5HS Sylramic(Trademark) fabric with a [0deg/90deg]4s lay-up. The SiC matrix material was infiltrated into the fiber-preform with a slurry-cast, melt-infiltration process. Tensile and fatigue test specimens were machined from the CMC plates. Initially tensile tests were conducted to obtain the average values of tensile properties at 1038 and 1204 C. Subsequently, low-cycle fatigue (LCF) tests with zero and two-hour hold-times at the maximum stress were conducted at the same two temperatures. Fatigue life data generated in the LCF tests were used to determine the geometric mean fatigue lives. In this paper, the tensile behavior and the fatigue durability of the CMC determined under different loading conditions are documented. In addition, reductions observed in the cyclic lives of the composite due to the two hour hold-time at maximum tensile stress are discussed.
Author
Tensile Properties; Ceramic Matrix Composites; Durability; Fatigue Tests; High Temperature; Woven Composites; Lay-Up

20020073443 NASA Glenn Research Center, Cleveland, OH USA
Acoustic Emission and Damage Accumulation for Various Woven C/SiC Composites Tested in Tension at Room Temperature
Morscher, Gregory N., Ohio Aerospace Inst., USA; Petko, Jeanne, DYNACS Engineering Co., Inc., USA; Kiser, James D., NASA Glenn Research Center, USA; [2002]; 1p; In English; National Space and Missile Materials Symposium, 24-27 Jun. 2002, Colorado Springs, CO, USA
Contract(s)/Grant(s): RTOP 708-73-27; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
Modal acoustic emission (AE) has proven to be an excellent technique to monitor damage accumulation in ceramic matrix composites. In this study, AE was used to monitor tensile load-unload-reload hysteresis tests for a variety of C fiber reinforced, SiC matrix composites. C/SiC composites were reinforced with T300 and IM7 fibers, had C, multilayer, or pseudo-porous C interphases, and had chemical vapor infiltrated SiC or melt-infiltrated SiC matrices. All of the composites exhibited considerable AE during testing. The extent and nature of the AE activity will be analyzed and discussed in light of matrix cracking and the variety of composite constituents. It is hoped that understanding the nature of stress dependent damage accumulation in these materials can be of use in life modeling for these types of composites.
Author
Acoustic Emission; Ceramic Matrix Composites; Silicon Carbides; Damage Assessment

20020073462 NASA Glenn Research Center, Cleveland, OH USA
Environmental/Thermal Barrier Coatings for Ceramic Matrix Composites: Thermal Trade-off Studies
Mital, Subodh K., Toledo Univ., USA; Murthy, Pappu L. N., NASA Glenn Research Center, USA; Gyekenyesi, John P., NASA Glenn Research Center, USA; [2002]; 2p; In English; Ninth International Conference on Composite Engineering: ICCE/9, 1-6 Jul. 2002, San Diego, CA, USA
Contract(s)/Grant(s): NASA Order C-73506-N; NASA Order C-77905-T; RTOP 714-04-30; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
Advanced high temperature Ceramic Matrix Composites (CMC) hold an enormous potential for use in aero and space related applications specifically for propulsion system components. Consequently, this has led to a multitude of research activities pertaining to fabrication, testing and modeling of these materials. The efforts directed at the development of ceramic matrix composites have focused primarily on improving the properties of the constituents as individual phases. It has, however, become increasingly clear that for CMC to be successfully employed in high temperature applications, research and development efforts should also focus on optimizing the synergistic performance of the constituent phases within the as-produced microstructure of the complex shaped CMC part. Despite their attractive features, the introduction of these materials in a wide spectrum of applications has been excruciatingly slow. The reasons are the high costs associated with the manufacturing and a complete experimental testing and characterization of these materials. Often designers/analysts do not have a consistent set of necessary properties and design allowables to be able to confidently design and analyze structural components made from these composites. Furthermore, the anisotropy of these materials accentuates the burden both on the test engineers and the designers by requiring a vastly increased amount of data/characterization compared to conventional materials.
Author
Ceramic Matrix Composites; Thermal Control Coatings; Engine Parts; High Temperature Research; Structural Design

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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.

20020070793 Department of Energy, Washington, DC USA
Innovative Technology Summary Report: Direct Chemical Oxidation. Mixed Waste Focus Area
Dec. 1998; 34p; In English
Report No.(s): DE2002-767466; DOE/EM-0459; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The DOE complex has a need to demonstrate technologies that are alternatives to incineration for the destruction of organic solvents, chlorinated hydrocarbons, plastics, and organic solids. The current industry practice for the targeted waste streams is treatment by incineration. There has been increased public concern on the use of incinerators because of the potential release of products of incomplete combustion, dioxins, furans, and emission of radionuclides. Direct Chemical Oxidation is a technology for the destruction of organic solids and liquids that uses peroxydisulfate as the oxidant to destroy organics and treats residue immobilized using phosphate ceramic solidification.
NTIS
Incinerators; Ceramics; Oxidation; Oxidizers

20020071119 NASA Glenn Research Center, Cleveland, OH USA
Effect of Wind Velocity on Flame Spread in Microgravity
Prasad, Kuldeep, National Inst. of Standards and Technology, USA; Olson, Sandra L., NASA Glenn Research Center, USA; Nakamura, Yuji, Nagoya Univ., Japan; Fujita, Osamu, Hokkaido Univ., Japan; Nishizawa, Katsuhiro, Hokkaido Univ., Japan; Ito, Kenichi, Hokkaido Univ., Japan; Kashiwagi, Takashi, National Inst. of Standards and Technology, USA; Jul. 01, 2002; 17p; In English; 29th International Symposium on Combustion, Unknown
Contract(s)/Grant(s): NASA Order C-32090-K; NCC3-919; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A three-dimensional, time-dependent model is developed describing ignition and subsequent transition to flame spread over a thermally thin cellulosic sheet heated by external radiation in a microgravity environment. A low Mach number approximation to the Navier Stokes equations with global reaction rate equations describing combustion in the gas phase and the condensed phase is numerically solved. The effects of a slow external wind (1-20 cm/s) on flame transition are studied in an atmosphere of 35% oxygen concentration. The ignition is initiated at the center part of the sample by generating a line-shape flame along the width of the sample. The calculated results are compared with data obtained in the 10s drop tower. Numerical results exhibit flame quenching at a wind speed of 1.0 cm/s, two localized flames propagating upstream along the sample edges at 1.5 cm/s, a single line-shape flame front at 5.0 cm/s, three flames structure observed at 10.0 cm/s (consisting of a single line-shape flame propagating upstream and two localized flames propagating downstream along sample edges) and followed by two line-shape flames (one propagating upstream and another propagating downstream) at 20.0 cm/s. These observations qualitatively compare with experimental data. Three-dimensional visualization of the observed flame complex, fuel concentration contours, oxygen and reaction rate isosurfaces, convective and diffusive mass flux are used to obtain a detailed understanding of the controlling mechanism, Physical arguments based on lateral diffusive flux of oxygen, fuel depletion, oxygen shadow of the flame and heat release rate are constructed to explain the various observed flame shapes.
Author
Wind Velocity; Flame Propagation; Microgravity; Three Dimensional Models; Flames; Oxygen

20020071144 Florida State Univ., Dept. of Physics, Tallahassee, FL USA
Theoretical Studies of Liquid He-4 Near the Superfluid Transition ***Final Report***
Manousakis, Efstratios, Florida State Univ., USA; Aug. 16, 2002; 14p; In English
Contract(s)/Grant(s): NAG3-1841; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We performed theoretical studies of liquid helium by applying state of the art simulation and finite-size scaling techniques. We calculated universal scaling functions for the specific heat and superfluid density for various confining geometries relevant for experiments such as the confined helium experiment and other ground based studies. We also studied microscopically how the substrate imposes a boundary condition on the superfluid order parameter as the superfluid film grows layer by layer. Using path-integral Monte Carlo, a quantum Monte Carlo simulation method, we investigated the rich phase diagram of helium monolayer, bilayer and multilayer on a substrate such as graphite. We find excellent agreement with the experimental results using no free parameters. Finally, we carried out preliminary calculations of transport coefficients such as the thermal conductivity for

bulk or confined helium systems and of their scaling properties. All our studies provide theoretical support for various experimental studies in microgravity.
Author
Monte Carlo Method; Liquid Helium; Substrates; Superfluidity; Boundary Conditions; Mathematical Models; Scaling Laws; Geometry; Direct Numerical Simulation

20020072949 Swedish Defence Research Establishment, Weapons and Protection Div., Tumba Sweden
Boron Containing Propellants for Ramjets-An Area of Great Current Interest *Borinnehallande Drivaemnen i Rammotoere ett Hoegaktuellt Omrade*
Sanden, R.; Aug. 2001; 34p; In Swedish
Report No.(s): PB2002-104970; FOI-R-0153-SE; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
In future air-to-air missiles for the Swedish defense, ramjet engines with solid boron propellants are a very probable motor alternative. It is important to collect as much relevant information as possible and to up-date our knowledge in this field of great currency. This report is based on information from the open literature. It gives a short background to the use of boron propellants in ramjets and is meant to be an aid for evaluating different propellants. Basic data as well as basic relationships have been summarized. Recent research in the area has been reviewed. Boron is a highly energetic fuel and has a high potential as a performance-increasing additive in ramjet fuels. It has, however, shown to be difficult to prepare useful boron propellants. Boron involves problems at manufacturing, initiation and combustion. Granulation of the boron particles seems to be an efficient way to reduce these problems. A simple analysis shows that ramjets with solid boron propellants, described in the literature, have a considerably lower regulating range of fuel, compared to ordinary hydrocarbon-fuelled liquid ramjets.
NTIS
Boron; Ramjet Engines; Solid Propellants

20020072968 Iowa State Univ. of Science and Technology, Ames, IA USA
Hydrogen Storage Properties of Lithium Aluminohydride Modified by Dopants and Mecahnochemistry
Hosokawa, K.; 2002; 78p; In English
Report No.(s): DE2002-795180; No Copyright; Avail: Department of Energy Information Bridge
Alkali metal aluminohydrides have high potential as solid hydrogen storage materials. They have been known for their irreversible dehydrogenation process below 100 atm until Bogdanovic et al, succeeded in the re-hydrogenation of NaAlH4 below 70 atm. They achieved 4 wt.% H2 reversible capacity by doping NaAlH4 with Ti and/or Fe organo-metalic compounds as catalysts. This suggests that other alkali and, possibly alkaline earth metal aluminohydrides can be used for reversible hydrogen storage when modified by proper dopants. In this research, Zr27Ti9Ni38V5Mn16Cr5, LaNi4.85Sn0.15, Al3Ti, and PdCl2 were combined with LiAlH4 by ball-milling to study whether or not LiAlH4 is capable to both absorb and desorb hydrogen near ambient conditions. X-ray powder diffraction, differential thermal analysis, and scanning electron microscopy were employed for sample characterizations. All four compounds worked as catalysts in the dehydrogenation reactions of both LiAlH4 and Li3AlH6 by inducing the decomposition at lower temperature. However, none of them was applicable as catalyst in the reverse hydrogenation reaction at low to moderate hydrogen pressure.
NTIS
Lithium; Alkali Metals; Decomposition; Titanium Alloys; X Ray Diffraction; Gas Pressure

20020073027 NASA Ames Research Center, Moffett Field, CA USA
Heats of NF(sub n) (n= 1-3) and NF(sub n)(+)(n = 1-3)
Ricca, Alessandra, NASA Ames Research Center, USA; [1998]; 14p; In English
Contract(s)/Grant(s): NAS2-14031; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Accurate heats of formation are computed for NF(sub n) and NF(sub n)(+), for n = 1-3. The geometries and the vibrational frequencies are determined at the B3LYP level of theory. The energetics are determined at the CCSD(T) level of theory. Basis set limit values are obtained by extrapolation. In those cases where the CCSD(T) calculations become prohibitively large, the basis set extrapolation is performed at the MP2 level. The temperature dependence of the heat of formation, heat capacity, and entropy are computed for the temperature range 300 to 4000 K and fit to a polynomial.
Author
Heat of Formation; Nitrogen Fluorides; Vibrational Spectra; Geometry; Temperature Dependence; Specific Heat

20020073192 Advanced Technologies Management, Cleveland, OH USA

Second Staget Intercooling Using LNG for Turbocharged Heavy Duty Road Vehicles ***Final Report***

Sep. 21, 1999; In English

Report No.(s): DE2002-771212; No Copyright; Avail: National Technical Information Service (NTIS)

It is well documented in engine performance literature that reduced engine inlet air temperature increases power output and reduces NO, emissions for both diesel and spark ignited (SI) engines. In addition, reduced inlet temperature increases the knock resistance of SI engines. In that most HD natural gas engines are SI derivatives of diesel engines it is appropriate to evaluate the benefits of reduced engine air temperature through LNG fuel. This project investigated the real world possibilities of a patented process for utilizing the cold in LNG to chill engine inlet air. The results support the conclusion that doing so is a practical means to increase engine power and reduce engine-out NOx.

NTIS

Pollution Control; Air Pollution; Temperature Control; Cooling; Spark Machining; Ignition Systems

20020073409 Eloret Corp., Moffett Field, CA USA

A Time-Dependent Quantum Dynamics Study of the H2 + CH3 yields H + CH4 Reaction

Wang, Dunyou, Eloret Corp., USA; Jul. 08, 2002; 26p; In English

Contract(s)/Grant(s): NAS2-00062; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present a time-dependent wave-packet propagation calculation for the H2 + CH3 yields H + CH4 reaction in six degrees of freedom and for zero total angular momentum. Initial state selected reaction probability for different initial rotational-vibrational states are presented in this study. The cumulative reaction probability (CRP) is obtained by summing over initial-state-selected reaction probability. The energy-shift approximation to account for the contribution of degrees of freedom missing in the 6D calculation is employed to obtain an approximate full-dimensional CRP. Thermal rate constant is compared with different experiment results.

Author

Hydrogen; Methane; Methyl Compounds; Chemical Reactions; Time Dependence; Potential Energy; Wave Packets; Wave Propagation; Degrees of Freedom

20020073446 NASA Ames Research Center, Moffett Field, CA USA

Sources of Hydrogen as Food for Deep Microbial Communities

Freund, Friedemann, Search for Extraterrestrial Intelligence Inst., USA; Oct. 13, 1998; 9p; In English

Contract(s)/Grant(s): NCC2-957; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

To survive in deep subsurface environments autolithotrophic microbial communities require a sustainable food supply. One possible source is H2 which forms when H2O reacts with ferrous iron at rock surfaces or mineral grain boundaries to produce H2 plus ferric iron. The amount of H2 that can be supplied in this way, however, is relatively small and may not last for more than a few hundred or thousand years. A much larger reservoir of H2 exists in the rocks, inside mineral grains, arising from an as yet little-known redox conversion that affects OH- in nominally anhydrous minerals. These OH- represent small amounts of ”water” that become incorporated during crystallization in H2O-laden environments. A corollary of the H2 formation from OH- is the formation of peroxy, an oxidized form of oxygen. While the peroxy become part of the mineral structure, the H2 molecules are diffusively mobile and can escape from within the mineral grains, entering the intergranular space. Assuming cautiously realistic number densities of OH- undergoing the in situ redox conversion to H2 plus peroxy, a 10 km deep rock column is expected to contain enough H2 to allow for a constant degassing rate of 50-100 nmole H2 per day per sq cm over 30 million years.

Author

Hydrogen; Microorganisms; Oxidation-Reduction Reactions; Grain Boundaries; Degassing; Crystallization

20020073496 NASA White Sands Test Facility, NM USA

Applications of Solid Phase Microextraction Coupled with Gas Chromatography/Mass Spectroscopy to Some Contamination Problems

Dee, Louis A., Honeywell Technology Solutions, Inc., USA; Beeson, Harold, NASA White Sands Test Facility, USA; JANNAF 30th Propellant Development and Characterization Subcommittee Meeting; March 2002; Volume 1, pp. 207-215; In English; Also announced as 20020073479; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Several applications of solid phase microextraction for identification of rocket engine hardware contamination are described. This selective sampling technique in concert with gas chromatography/mass spectroscopy was applied to identification of very small particles of polymeric materials and to quantifying low parts-per-million levels of trapped solvents in small components.

In addition, a method for creation of a polymer pyrolyzate mass spectral library is described that allows direct identification of polymeric materials.
Author
Rocket Engines; Engine Failure; Solvent Extraction; Mass Spectroscopy; Gas Chromatography

20020073497 NASA White Sands Test Facility, NM USA
Comparison of Two Techniques for Determining the Stability of Hydrogen Peroxide
McClure, Mark B., Honeywell Technology Solutions, Inc., USA; Johnson, Harry T., NASA White Sands Test Facility, USA; JANNAF 30th Propellant Development and Characterization Subcommittee Meeting; March 2002; Volume 1, pp. 217-221; In English; Also announced as 20020073479; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Reducing the amount of time required to do an analysis without reducing the accuracy of the result is always a desirable goal. The stability test described in MIL-PRF-16005 is a 24-hour (h) test performed at 100 C. The sample is weighed before and after the test, and the loss of active oxygen is determined gravimetrically. A technique published by Solvay Interox describes the measurement of the gas volume of oxygen evolved by the decomposing hydrogen peroxide over a one-hour period. A comparison of these two stability measurement techniques is discussed.
Author
Stability Tests; Hydrogen Peroxide; Solid Rocket Propellants; Testing Time

20020073517 NASA Ames Research Center, Moffett Field, CA USA
The Atomization Energy of Mg4
Bauschlicher, Charles W., Jr., NASA Ames Research Center, USA; [1998]; 1p; In English
Contract(s)/Grant(s): RTOP 242-80-01; No Copyright; Avail: Issuing Activity; Abstract Only

The atomization energy of Mg4 is determined using the MP2 and CCSD(T) levels of theory. Basis set incompleteness, basis set extrapolation, and core-valence effects are discussed. Our best atomization energy, including the zero-point energy and scalar relativistic effects, is 24.6+/-1.6 kcal per mol. Our computed and extrapolated values are compared with previous results, where it is observed that our extrapolated MP2 value is good agreement with the MP2-R12 value. The CCSD(T) and MP2 core effects are found to have the opposite signs.
Author
Atomizing; Field Theory (Physics)

20020073533 NASA Ames Research Center, Moffett Field, CA USA
A Further Study of the Products of Sc and Dioxygen Reactions
Bauschlicher, Charles W., Jr., NASA Ames Research Center, USA; Zhou, Mingfei, Virginia Univ., USA; Andrews, Lester, Virginia Univ., USA; Johnson, J. R. Tobias, Gothenburg Univ., Sweden; Panas, Itai, Gothenburg Univ., Sweden; Snis, Anders, Gothenburg Univ., Sweden; Roos, Bjoern O., Lund Univ., Sweden; [1999]; 1p; In English
Contract(s)/Grant(s): RTOP 519-40-12; No Copyright; Avail: Issuing Activity; Abstract Only

The products of the reaction of Sc and dioxygen have been reinvestigated. By adding the electron-trapping molecule CC14, additional information about the IR spectra has been obtained, as well as the observation of new bands. New ab initio calculations are also performed on possible products of the Sc plus O2 reaction. The previously observed band at 722.5 per cm is assigned as the b2 mode of ScO2(-). Bands arising from ScO(+), Sc(O2)(+), and(O2)ScO are also assigned. We are still unable to assign any bands to OScO. The problems associated with the computational study of ScO2 are discussed.
Author
Scandium; Oxygen; Infrared Spectra

20020073797 Engineering Research and Analysis Co., USA
Development and Validation of A Detailed JP-8 Fuel Chemistry Model
Sekar, B., Air Force Research Lab., USA; Mawid, M. A., Engineering Research and Analysis Co., USA; Park, T. W., Engineering Research and Analysis Co., USA; Arana, C., Air Force Research Lab., USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 21-37; In English; Also announced as 20020073794; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Progress on development of a detailed JP-8 fuel chemical reaction model is reported in this article. A twelve-component surrogate JP-8 fuel composition was considered in this study. The developed JP-8 reaction model presently consists of 200 chemical species and 1,330 chemical reactions. Low pressure limited validation of the JP-8 detailed model was carried out against

available ignition data. The comparison with the ignition data was quite satisfactory for higher initial temperature conditions than for lower initial temperature conditions and indicated that further model's refinement and sensitivity analyses are still required. Perfectly Stirred Reactor (PSR) computations were also carried out. However, no comparison with data was made due to lack of PSR data in the open literature.
Author
Chemical Reactions; Ignition; JP-8 Jet Fuel

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METALS AND METALLIC MATERIALS

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

20020070852 Westinghouse Electric Corp., Pittsburgh, PA USA
AISI/DOE Advanced Process Control Program Vol.2 of 6: Improved Liquid Steel Feeding System for Slab Casters
Issacson, B.; Slepian, M.; Richter, T.; 2002; 28p; In English
Report No.(s): DE2002-795001; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This report describes the development, construction and testing of the Electromagnetic Valve System (EVS), conducted as a project entitled 'Improved Liquid Steel Feeding System for Slab Casters'. This program ran from November 1992 to January 1995. Many of the technical issues in bringing the EVS to the steel industry were identified and resolved during the course of the program. During this time, significant hardware improvements in Westinghouse's electromagnetic valve were made to easily integrate it with existing continuous casting processes. An improved refractory nozzle was developed and tested which had superior thermal shock and anti-cracking performance. In addition, several trials were conducted with molten steel to verify the proof-of-principle of the electromagnetic valve and its auxiliary equipment. However, improvements in other conventional pouring technologies have greatly diminished the potential value of this project to the steel industry.
NTIS
Steels; Casting; Slabs

20020070853 Measurex-DMC, Gaithersburg, MD USA
Industrial Gauge for Measuring the Phase Distribution of Galvanneal ***Final Report, 30 Nov. 1992 - 22 Nov. 1995***
Burnett, C.; Gouel, R.; Phillips, J. R.; Jan. 19, 1996; 60p; In English
Report No.(s): DE2002-794999; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Augmentation of the internal software of a commercial x-ray fluorescence gauge is shown to enable the instrument to extend its continuous on-line real-time measurements of a galvanneal coating's total elemental content to encompass similar measurements of the relative thickness of the coating's three principal metallurgical phases. The mathematical structure of this software augmentation is derived from the theory of neural networks. The empirical basis for the numerics embedded in the software's decision logic is presented. The performance of the augmented gauge is validated by comparing the gauge-implied real-time phase distribution with the phase distribution independently measured off-line on time-tagged samples drawn from the galvanneal production line where the measurement gauge had been installed. The performance validation is shown to demonstrate good agreement between the gauge and laboratory measurements and to suggest preferred approaches to be followed in future applications of the augmented gauge.
NTIS
Steels; X Ray Fluorescence; Measuring Instruments

20020070864 NASA Glenn Research Center, Cleveland, OH USA
Effect of Melt Convection and Solid Transport on Macrosegregation and Grain Structure in Equiaxed Al-Cu Alloys
Rerko, Rodney S., Iowa Univ., USA; deGroh, Henry C., III, NASA Glenn Research Center, USA; Beckermann, Christoph, Iowa Univ., USA; Jan. 04, 2002; 43p; In English
Contract(s)/Grant(s): NCC8-100; RTOP 398-35-01; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Macrosegregation in metal casting can be caused by thermal and solutal melt convection, and the transport of unattached solid crystals. These free grains can be a result of, for example, nucleation in the bulk liquid or dendrite fragmentation. In an effort to develop a comprehensive numerical model for the casting of alloys, an experimental study has been conducted to generate benchmark data with which such a solidification model could be tested. The specific goal of the experiments was to examine equiaxed solidification in situations where sinking of grains is (and is not) expected. The objectives were: 1) experimentally study the effects of solid transport and thermosolutal convection on macrosegregation and grain size distribution patterns; and 2) provide

a complete set of controlled thermal boundary conditions, temperature data, segregation data, and grain size data, to validate numerical codes. The alloys used were Al-1 wt. pct. Cu, and Al-10 wt. pct. Cu with various amounts of the grain refiner TiB2 added. Cylindrical samples were either cooled from the top, or the bottom. Several trends in the data stand out. In attempting to model these experiments, concentrating on experiments that show clear trends or differences is recommended.
Author
Copper Alloys; Grain Size; Melts (Crystal Growth); Mathematical Models; Casting; Separation; Aluminum Alloys; Solidification

20020070911 NASA Glenn Research Center, Cleveland, OH USA
Surface Composition of NiPd Alloys
Noebe, Ronald D., NASA Glenn Research Center, USA; Khalil, Joe, Ohio Aerospace Inst., USA; Bozzolo, Guillermo, Ohio Aerospace Inst., USA; Aug. 22, 2002; 2p; In English; Poster Presentation at Applied Surface Modeling: Experiment, Theory, and Simulations Conference, 21-23 Aug. 2002, Cleveland, OH, USA; Original contains color illustrations
Contract(s)/Grant(s): RTOP 708-31-13; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
Surface segregation in Ni-Pd alloys has been studied using the BFS method for alloys. Not only does the method predict an oscillatory segregation profile but it also indicates that the number of Pd-enriched surface planes can vary as a function of orientation. The segregation profiles were computed as a function of temperature, crystal face, and composition. Pd enrichment of the first layer is observed in (111) and (100) surfaces, and enrichment of the top two layers occurs for (110) surfaces. In all cases, the segregation profile shows oscillations that are actually related to weak ordering tendencies in the bulk. An atom-by-atom analysis was performed to identify the competing mechanisms leading to the observed surface behaviors. Large-scale atomistic simulations were also performed to investigate the temperature dependence of the segregation profiles as well as for analysis of the bulk structures. Finally, the observed surface behaviors are discussed in relation to the bulk phase structure of Ni-Pd alloys, which exhibit a tendency to weakly order.
Author
Surface Layers; Temperature Dependence; Oscillations; Alloys; Simulation

20020071080 NASA Glenn Research Center, Cleveland, OH USA
The General Isothermal Oxidation Behavior of Cu-8Cr-4Nb
Thomas-Ogbuji, L. U., NASA Glenn Research Center, USA; Jan. 04, 2002; 28p; In English
Contract(s)/Grant(s): NAS3-98008; RTOP 721-26-54; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Oxidation kinetics of Cu-8Cr-4Nb was investigated by TGA (thermogravimetric) exposures between 500 and 900-C (at 25-50 C intervals) and the oxide scale morphologies examined by microscopy and micro-analysis. Because Cu-8Cr-4Nb is comprised of fine Cr2Nb precipitates in a Cu matrix, the results were interpreted by comparison with the behavior of copper (OFHC) and 'NARloy-Z' (a rival candidate material for thrust cell liner applications in advanced rocket engines) under the same conditions. While NARloy-Z and Cu exhibited identical oxidation behavior, Cu-8Cr-4Nb differed markedly in several respects: below approx. 700 C its oxidation rates were significantly lower than those of Cu; At higher temperatures its oxidation rates fell into two categories: an initial rate exceeding that of Cu, and a terminal rate comparable to that of Cu. Differences in oxide morphologies paralleled the kinetic differences at higher temperature: While NARloy-Z and Cu produced a uniform oxide scale of Cu2O inner layer and CuO outer layer, the inner (Cu2O) layer on Cu-8Cr-4Nb was stratified, with a highly porous/spongy inner stratum (responsible for the fast initial kinetics) and a dense/blocky outer stratum (corresponding to the slow terminal kinetics). Single and spinel oxides of Nb and Cr were found at the interface between the oxide scale and Cu-8Cr-4Nb substrate and it appears that these oxides were responsible for its suppressed oxidation rates at the intermediate temperatures. No difference was found between Cu-8Cr-4Nb oxidation in air and in oxygen at 1.0 atm.
Author
Thermogravimetry; Oxidation; Copper Oxides; Precipitates

20020071128 NASA Glenn Research Center, Cleveland, OH USA
Atomistic Modeling of RuAl and (RuNi) Al Alloys
Gargano, Pablo, Comision Nacional de Energia Atomica, Argentina; Mosca, Hugo, Comision Nacional de Energia Atomica, Argentina; Bozzolo, Guillermo, Ohio Aerospace Inst., USA; Noebe, Ronald D., NASA Glenn Research Center, USA; Jun. 15, 2002; 17p; In English
Contract(s)/Grant(s): RTOP 708-31-13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Atomistic modeling of RuAl and RuAlNi alloys, using the BFS (Bozzolo-Ferrante-Smith) method for alloys is performed. The lattice parameter and energy of formation of B2 RuAl as a function of stoichiometry and the lattice parameter of (Ru(sub 50-x)Ni(sub x)Al(sub 50)) alloys as a function of Ni concentration are computed. BFS based Monte Carlo simulations indicate

that compositions close to Ru25Ni25Al50 are single phase with no obvious evidence of a miscibility gap and separation of the individual B2 phases.
Author
Aluminum Alloys; Ruthenium Alloys; Nickel Alloys; Intermetallics; Computerized Simulation

20020071129 NASA Glenn Research Center, Cleveland, OH USA
Atomistic Modeling of Surface and Bulk Properties of Cu, Pd and the Cu-Pd System
Bozzolo, Guillermo, NASA Glenn Research Center, USA; Garces, Jorge E., Ohio Aerospace Inst., USA; Noebe, Ronald D., NASA Glenn Research Center, USA; Abel, Phillip, NASA Glenn Research Center, USA; Mosca, Hugo O., Comision Nacional de Energia Atomica, Argentina; Jun. 01, 2002; 60p; In English
Contract(s)/Grant(s): RTOP 708-31-13; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The BFS (Bozzolo-Ferrante-Smith) method for alloys is applied to the study of the Cu-Pd system. A variety of issues are analyzed and discussed, including the properties of pure Cu or Pd crystals (surface energies, surface relaxations), Pd/Cu and Cu/Pd surface alloys, segregation of Pd (or Cu) in Cu (or Pd), concentration dependence of the lattice parameter of the high temperature fcc CuPd solid solution, the formation and properties of low temperature ordered phases, and order-disorder transition temperatures. Emphasis is made on the ability of the method to describe these properties on the basis of a minimum set of BFS universal parameters that uniquely characterize the Cu-Pd system.
Author
Surface Properties; Copper Alloys; Lead Alloys; Crystals; Mechanical Properties

20020072220 NASA Glenn Research Center, Cleveland, OH USA
Conducting High Cycle Fatigue Strength Step Tests on Gamma TiAl
Lerch, Brad, NASA Glenn Research Center, USA; Draper, Sue, NASA Glenn Research Center, USA; Pereira, J. Mike, NASA Glenn Research Center, USA; [2002]; 6p; In English
Contract(s)/Grant(s): RTOP 708-24-13; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
High cycle fatigue strength testing of gamma TiAl by the step test method is investigated. A design of experiments was implemented to determine if the coaxing effect occurred during testing. Since coaxing was not observed, step testing was deemed a suitable method to define the fatigue strength at 106 cycles.
Author
Fatigue Tests; Intermetallics; Fatigue (Materials); Titanium Aluminides

20020072957 American Iron and Steel Inst., Pittsburgh, PA USA
Behavior of Phosphorus in DRI/HBI During Electric Furnace Steelmaking. AISI/DOE Technology Roadmap Program *Final Report*
Fruehan, R. J.; Manning, C. P.; Oct. 05, 2001; 218p; In English
Report No.(s): DE2002-797096; No Copyright; Avail: Department of Energy Information Bridge
In modern electric arc furnace (EAF) steelmaking, ore based scrap substitute materials are often used to control the chemistry of the steel produced and/or improve the efficiency of the process. At the present time, the most common forms of direct reduced scrap substitute materials are direct reduced iron (DRI) and hot briquetted Iron (HBI). DRI is produced from a combination of pelletized and lump ore, which is reduced by reformed natural gas in a shaft furnace such as the Midrex furnace. HBI is currently produced by hot pressing either reduced DRI pellets or reduced iron ore fines into dense metallic iron briquettes. Due to the great similarities of most direct reduced materials, this large group of materials will be referred to generically as DRI/HBI unless greater specification is required. Most commercially available forms of DRI/HBI contain significantly higher levels of phosphorus as compared with scrap. As increasing quantities of these materials are used in EAF steelmaking for the production of higher quality steels, control of phosphorus levels in the metal will become a concern. The goal of this research include the development of a more complete understanding of the behavior of phosphorus in DRI/HBI dUring EAF steelmaking.
NTIS
Iron Alloys; Electric Furnaces; Arc Heating; Heating Equipment

20020072989 NASA Glenn Research Center, Cleveland, OH USA

Oxidation Behavior of Copper Alloy Candidates for Rocket Engine Applications (Technical Poster)

Ogbuji, Linus U. J., QSS Group, Inc., USA; Humphrey, Donald H., QSS Group, Inc., USA; Barrett, Charles A., NASA Glenn Research Center, USA; [2002]; 1p; In English; TMS IV Meeting, 6-10 Oct. 2002, Columbus, OH, USA; Sponsored by Minerals, Metals and Materials Society, USA; Original contains color illustrations

Contract(s)/Grant(s): NAS3-98008; RTOP 721-20-XX; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A rocket engine's combustion chamber is lined with material that is highly conductive to heat in order to dissipate the huge thermal load (evident in a white-hot exhaust plume). Because of its thermal conductivity copper is the best choice of liner material. However, the mechanical properties of pure copper are inadequate to withstand the high stresses, hence, copper alloys are needed in this application. But copper and its alloys are prone to oxidation and related damage, especially "blanching" (an oxidation-reduction mode of degradation). The space shuttle main engine combustion chamber is lined with a Cu-Ag-Zr alloy, "NARloy-Z", which exhibits blanching. A superior liner is being sought for the next generation of RLVs (Reusable Launch Vehicles) It should have improved mechanical properties and higher resistance to oxidation and blanching, but without substantial penalty in thermal conductivity. GRCop84, a Cu-8Cr-4Nb alloy (Cr2Nb in Cu matrix), developed by NASA Glenn Research Center (GRC) and Case Western Reserve University, is a prime contender for RLV liner material. In this study, the oxidation resistance of GRCop-84 and other related/candidate copper alloys are investigated and compared

Author

Rocket Engines; Oxidation; Copper Alloys; Oxidation Resistance

20020073195 Brookhaven National Lab., Riken BNL Research Center, Upton, NY USA

Mechanisms of Radionuclide-Hydroxycarboxylic Acid Interactions for Decontamination of Metallic Surfaces *Final Report, 1 Oct. 1998 - 30 Sep. 2001*

Francis, A. J.; Dodge, C. J.; Halada, G. P.; Clayton, C. R.; Gillow, J. B.; 2002; 32p; In English

Report No.(s): DE2002-794072; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Is this EMSP program we investigated the key fundamental issues involved in the use of simple and safe methods for the removal of radioactive contamination from equipment and facilities using hydroxycarboxylic acids. Specifically, we investigate: (1) the association of uranium with various iron oxides commonly formed on corroding plain carbon steel surfaces, (2) the association of uranium with corroding metal coupons under a variety of conditions, and (3) the decontamination of the uranium contaminated metal coupons by citric acid or citric acid formulations containing oxalic acid and hydrogen peroxide.

NTIS

Carbon Steels; Decontamination; Uranium; Metal Surfaces

20020073197 Department of Energy, Idaho Falls, ID USA

Advanced Anodes and Cathodes Utilized in Energy Efficient Aluminum Production Cells *Final Report*

May 07, 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-794978; No Copyright; Avail: National Technical Information Service (NTIS)

During Phase I of the present program, Alcoa developed a commercial cell concept that has been estimated to save 30% of the energy required for aluminum smelting. Phase ii involved the construction of a pilot facility and operation of two pilots. Phase iii of the Advanced Anodes and Cathodes Program was aimed at bench experiments to permit the resolution of certain questions to be followed by three pilot cells. All of the milestones related to materials, in particular metal purity, were attained with distinct improvements over work in previous phases of the program. NiO additions to the ceramic phase and Ag additions to the Cu metal phase of the cermet improved corrosion resistance sufficiently that the bench scale pencil anodes met the purity milestones. Some excellent metal purity results have been obtained with anodes of the following composition: Further improvements in anode material composition appear to be dependent on a better understanding of oxide solubilities in molten cryolite. For that reason, work was commissioned with an outside consultant to model the MeO - cryolite systems.

NTIS

Electrochemical Cells; Smelting; Efficiency; Anodes; Cathodes; Aluminum; Energy Conservation

20020073459 Idaho National Engineering and Environmental Lab., Idaho Falls, ID USA

Underground Corrosion of Activated Metals in an Arid Vadose Zone Environment

Adler Flitton, M. K.; Mizia, R. E.; Bishop, C. W.; Apr. 2002; 18p; In English

Report No.(s): DE2002-795189; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The subsurface radioactive disposal site located at the Idaho National Engineering and Environmental Laboratory contains neutron-activated metals from nonfuel nuclear-reactor- core components. A long-term corrosion test is being conducted to obtain

site-specific corrosion rates to support efforts to more accurately estimate the transfer of activated elements in an arid vadose zone environment. The tests use nonradioactive metal coupons representing the prominent neutron-activated material buried at the disposal location, namely, Type 304L stainless steel, Type 315L stainless steel, nickel-chromium alloy (UNS NO7718), beryllium, aluminum 6061-T6, and a zirconium alloy, (UNS R60804). In addition, carbon steel (the material presently used in the cask disposal liners and other disposal containers) and a duplex stainless steel (UNS S32550) (the proposed material for the high-integrity disposal containers) are also included in the test program. This paper briefly describes the test program and presents the early corrosion rate results after 1 year and 3 years of underground exposure.
NTIS
Corrosion Tests; Barrels (Containers); Nickel Alloys; Aluminum Alloys

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NONMETALLIC MATERIALS

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

20020070781 NASA Glenn Research Center, Cleveland, OH USA
Thin Film CuInS2 Prepared by Spray Pyrolysis with Single-Source Precursors
Jin, Michael H., Ohio Aerospace Inst., USA; Banger, Kulinder K., Ohio Aerospace Inst., USA; Harris, Jerry D., Cleveland State Univ., USA; Cowen, Jonathan E., Cleveland State Univ., USA; Hepp, Aloysius F., NASA Glenn Research Center, USA; [2002]; 4p; In English; 29th IEEE Photovoltaic Specialists Conference, 17-24 May 2002, New Orleans, LA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): NCC3-947; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
Both horizontal hot-wall and vertical cold-wall atmospheric chemical spray pyrolysis processes deposited near single-phase stoichiometric CuInS2 thin films. Single-source precursors developed for ternary chalcopyrite materials were used for this study, and a new liquid phase single-source precursor was tested with a vertical cold-wall reactor. The depositions were carried out under an argon atmosphere, and the substrate temperature was kept at 400 C. Columnar grain structure was obtained with vapor deposition, and the granular structure was obtained with (liquid) droplet deposition. Conductive films were deposited with planar electrical resistivities ranging from 1 to 30 Omega x cm.
Author
Pyrolysis; Thin Films; Copper Indium Selenides; Solar Cells; Aerosols; Spraying

20020070876 QSS Group, Inc., Cleveland, OH USA
Mechanical Properties and Microstructure of Biomorphic Silicon Carbide Ceramics Fabricated from Wood Precursors
Singh, Mrityunjay, QSS Group, Inc., USA; Salem, J. A., NASA Glenn Research Center, USA; [2002]; 24p; In English
Contract(s)/Grant(s): NAS3-00145; RTOP 708-73-25; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Silicon carbide based, environment friendly, biomorphic ceramics have been fabricated by the pyrolysis and infiltration of natural wood (maple and mahogany) precursors. This technology provides an eco-friendly route to advanced ceramic materials. These biomorphic silicon carbide ceramics have tailorable properties and behave like silicon carbide based materials manufactured by conventional approaches. The elastic moduli and fracture toughness of biomorphic ceramics strongly depend on the properties of starting wood preforms and the degree of molten silicon infiltration. Mechanical properties of silicon carbide ceramics fabricated from maple wood precursors indicate the flexural strengths of 3441+/-58 MPa at room temperature and 230136 MPa at 1350C. Room temperature fracture toughness of the maple based material is 2.6 +/- 0.2 MPa(square root of)m while the mahogany precursor derived ceramics show a fracture toughness of 2.0 +/- 0.2 Mpa(square root of)m. The fracture toughness and the strength increase as the density of final material increases. Fractographic characterization indicates the failure origins to be pores and chipped pockets of silicon.
Author
Ceramics; Fabrication; Microstructure; Mechanical Properties; Silicon Carbides; Wood; Composite Materials

20020070887 QSS Group, Inc., Cleveland, OH USA
Environment Conscious, Biomorphic Ceramics from Pine and Jelutong Wood Precursors
Singh, Mrityunjay, QSS Group, Inc., USA; Yee, Bo-Moon, Lehigh Univ., USA; [2002]; 8p; In English
Contract(s)/Grant(s): NAS3-00145; RTOP 708-73-25; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Environment conscious, biomorphic ceramics have been fabricated from pine and jelutong wood precursors. A carbonaceous preform is produced through wood pyrolysis and subsequent infiltration with oxides (ZrO2 sols) and liquid silicon to form ceramics. These biomorphic ceramics show a wide variety of microstructures, densities, and hardness behavior that are determined by the type of wood and infiltrants selected.
Author
Ceramics; Fabrication; Wood; Composite Materials; Zirconium Oxides; Silicon

20020070913 NASA Glenn Research Center, Cleveland, OH USA
Tribological Properties of Polymer Films and Solid Bodies in a Vacuum Environment
Fusaro, Robert L., NASA Glenn Research Center, USA; May 01, 1987; 32p; In English; 1987 Annual Meeting of the American Society of Lubrication Engineers, 11-14 May 1987, Anaheim, CA, USA
Contract(s)/Grant(s): RTOP 505-63-01
Report No.(s): NASA/TM-88966; E-3429; NAS 1.15:88966; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The tribological properties of ten different polymer based materials were evaluated in a vacuum environment to determine their suitability for possible lubrication applications In a space environment, such as might be encountered on the proposed space station. A pin-on-disk tribometer was used and the polymer materials were evaluated either as solid body disks or as films applied to 440C HT stainless steel disks. A 440C HT stainless steel hemispherically tipped pin was slid against the polymer materials. For comparison, similar tests were conducted in a controlled air atmosphere of 50 percent relative humidity air. In most instances, the polymer materials lubricated much better under vacuum conditions than in air. thus, several of the materials show promise as lubricants for vacuum applications. Friction coefficients of 0.05 or less and polymer material wear rates of up to 2 orders of magnitude less than found in air were obtained. One material showed considerable promise as a traction drive material. Relatively high friction coefficients (0.36 to 0.52) and reasonably low wear rates were obtained in vacuum.
Author
Tribology; Polymeric Films; Coefficient of Friction; Lubricants; Wear

20020071035 Argonne National Lab., Energy Technology Div., IL USA
Residual Stress Measurement in YBCO Thin Films
Cheon, J. H.; Singh, J. P.; Apr. 2002; In English; This docuent is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-43098; No Copyright; Avail: National Technical Information Service (NTIS)
Residual stress in YBCO films on Ag and Hastelloy C substrates was determined by using 3-D optical interferometry and laser scanning to measure the change in curvature radius before and after film deposition. The residual stress was obtained by appropriate analysis of curvature measurements. Consistent with residual thermal stress calculations based on the thermal expansion coefficient mismatch between the substrates and YBCO film, the measured residual stress in the YBCO film on Hastelloy C substrate was tensile, while it was compressive on the Ag substrate. The stress values measured by the two techniques were generally in good agreement, suggesting that optical interferometry and laser scanning have promise for measuring residual stresses in thin films.
NTIS
Thin Films; Ceramics; Residual Stress; Stress Analysis; Stress Measurement; Copper Oxides; Barium Oxides

20020071135 NASA Glenn Research Center, Cleveland, OH USA
High Temperature Corrosion of Silicon Carbide and Silicon Nitride in Water Vapor
Opila, E. J., Cleveland State Univ., USA; Robinson, Raymond C., QSS Group, Inc., USA; Cuy, Michael D., NASA Glenn Research Center, USA; [2002]; 12p; In English; 10th International Conferences on Modern Materials and Technologies (CIMTEC 2002), 1 Jan. 2002, Unknown
Contract(s)/Grant(s): RTOP 714-04-30; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Silicon carbide (SiC) and silicon nitride (Si3N4) are proposed for applications in high temperature combustion environments containing water vapor. Both SiC and Si3N4 react with water vapor to form a silica (SiO2) scale. It is therefore important to understand the durability of SiC, Si3N4 and SiO2 in water vapor. Thermogravimetric analyses, furnace exposures and burner rig results were obtained for these materials in water vapor at temperatures between 1100 and 1450 C and water vapor partial pressures ranging from 0.1 to 3.1 atm. First, the oxidation of SiC and Si3N4 in water vapor is considered. The parabolic kinetic rate law, rate dependence on water vapor partial pressure, and oxidation mechanism are discussed. Second, the volatilization of silica to form Si(OH)4(g) is examined. Mass spectrometric results, the linear kinetic rate law and a volatilization model based on diffusion through a gas boundary layer are discussed. Finally, the combined oxidation and volatilization reactions, which occur when SiC

or Si3N4 are exposed in a water vapor-containing environment, are presented. Both experimental evidence and a model for the paralinear kinetic rate law are shown for these simultaneous oxidation and volatilization reactions.
Author
Silicon Carbides; Silicon Nitrides; Water Vapor; Hot Corrosion; Characterization; Thermogravimetry

20020071143 NASA Glenn Research Center, Cleveland, OH USA
Spiral Orbit Tribometry, 2, Evaluation of Three Liquid Lubricants in Vacuum
Pepper, Stephen V., NASA Glenn Research Center, USA; Kingsbury, Edward P., Interesting Rolling Contact, USA; [2002]; 11p; In English
Contract(s)/Grant(s): RTOP 274-00-00; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The coefficients of friction and relative degradation rates of three lubricants run in the boundary regime in vacuum are evaluated in a Spiral Orbit Tribometer. This tribometer subjected the lubricants to rolling contact conditions similar to those found in angular contact ball bearings. A multiply alkylated cyclopentane (MAC) hydrocarbon lubricant suffered degradation at a rate almost two orders of magnitude less than the degradation rate of two perfluoropolyalkylether (PFPE) lubricants.
Author
Coefficient of Friction; Degradation; Lubricants; Tribology; Measuring Instruments

20020072222 NASA Glenn Research Center, Cleveland, OH USA
Optical Properties of Thin Film Molecular Mixtures
Jaworske, Donald A., NASA Glenn Research Center, USA; Shumway, Dean A., Brigham Young Univ., USA; [2002]; 6p; In English; 5th Conference on Aerospace Materials, Processes and Environmental Technology, 16-18 Sep. 2002, Huntsville, AL, USA; Sponsored by Integrated Concept and Research Corp., USA
Contract(s)/Grant(s): RTOP 274-00-00; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Thin films composed of molecular mixtures of metal and dielectric are being considered for use as solar selective coatings for a variety of space power applications. by controlling the degree of molecular mixing, the solar selective coatings can be tailored to have the combined properties of high solar absorptance, alpha, and low infrared emittance, epsilon. On orbit, these combined properties would simultaneously maximize the amount of solar energy captured by the coating and minimize the amount of thermal energy radiated. Mini-satellites equipped with solar collectors coated with these cermet coatings may utilize the captured heat energy to power a heat engine to generate electricity, or to power a thermal bus that directs heat to remote regions of the spacecraft. Early work in this area identified the theoretical boundary conditions needed to operate a Carnot cycle in space, including the need for a solar concentrator, a solar selective coating at the heat inlet of the engine, and a radiator. A solar concentrator that can concentrate sunlight by a factor of 100 is ideal. At lower values, the temperature of the solar absorbing surface becomes too low for efficient heat engine operation, and at higher values, cavity type heat receivers become attractive. In designing the solar selective coating, the wavelength region yielding high solar absorptance must be separated from the wavelength region yielding low infrared emittance by establishing a sharp transition in optical properties. In particular, a sharp transition in reflectance is desired in the infrared to achieve the desired optical performance. For a heat engine operating at 450C, a sharp transition at 1.8 micrometers is desired. The radiator completes the heat flow through the Carnot cycle. Additional work has been done supporting the use of molecular mixtures for terrestrial applications. Sputter deposition provides a means to apply coatings to the tubes that carry a working fluid at the focus of trough-style collectors. Sputtering offers considerable flexibility in coating conditions, including a wide variety of metal and dielectric targets. Coating designs range from simple two or three layer coatings to complex coatings that are purposely graded to be metal-rich at their base and oxide-rich at their surface in order to yield the desired solar selective properties. In these cermet coatings, molecular islands of metal are thought to be embedded in a three dimensional matrix of dielectric. Recent work has identified the use of custom made ion beam sputter deposition targets to produce coatings containing molecular mixtures of metal and dielectric. The targets are cylindrical and the surface consists of a gradually changing composition of metal and dielectric. Rotating the cylinder under the beam during ion beam sputter deposition yields a coating that is a molecular mixture of metal and dielectric, with the composition changing through the thickness of the coating. The optical properties of these coatings are not only dependent on their thickness and chemical composition, but are also dependent on the extent of the through thickness gradient established during deposition. This paper presents a summary of the optical properties of several thin film molecular mixtures designed as solar selective coatings. Optical performance is first identified as a function of wavelength, from the ultraviolet to the visible and infrared. Coating composition, thickness, and gradient from metal to dielectric also play an important role. Additional work for future activities is also identified.
Author
Ceramic Coatings; Optical Properties; Thin Films; Solar Energy; Metal Coatings; Solar Collectors; Working Fluids

20020072716 NASA Glenn Research Center, Cleveland, OH USA

Bn and Si-Doped Bn Coatings on Woven Fabrics

Hurwitz, Frances I., NASA Glenn Research Center, USA; Scott, John M., Refractory Composites, Inc., USA; Wheeler, Donald R., Sest, Inc., USA; Chayka, Paul V., MS and E Resources, USA; [2002]; 8p; In English; 26th Annual International Conference on Advanced Ceramics and Composites, 13-18 Jan. 2002, Cocoa Beach, FL, USA

Contract(s)/Grant(s): NASA Order C-72116-N; RTOP 708-90-43; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A computer controlled, pulsed chemical vapor infiltration (CVI) system has been developed to deposit BN from a liquid borazine (B3N3H6) source, as well as silicon doped BN coatings using borazine and a silicon source, into 2-D woven ceramic fabric preforms. The coating process was evaluated as a function of deposition temperature, pressure, and precursor flow rate. Coatings were characterized by field emission scanning electron microscopy, electron dispersive spectroscopy and Auger spectroscopy. by controlling the reactant feed ratios, Si incorporation could be controlled over the range of 6-24 atomic percent. Author

Chemical Vapor Infiltration; Doped Crystals; Silicon; Preforms; Ceramics; Fabrics

20020072851 NASA Glenn Research Center, Cleveland, OH USA

Paralinear Oxidation of Silicon Nitride in a Water Vapor/Oxygen Environment

Fox, Dennis S., NASA Glenn Research Center, USA; Opila, Elizabeth J., Cleveland State Univ., USA; Nguyen, QuynhGiao, NASA Glenn Research Center, USA; Humphrey, Donald L., QSS Group, Inc., USA; Lewton, Susan M., Ohio Aerospace Inst., USA; [2002]; 45p; In English

Contract(s)/Grant(s): RTOP 708-31-13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Three silicon nitride materials were exposed to dry oxygen flowing at 0.44 cm/s at temperatures between 1200 and 1400 C. Reaction kinetics were measured with a continuously recording microbalance. Parabolic kinetics were observed. When the same materials were exposed to a 50% H2O - 50% O2 gas mixture flowing at 4.4 cm/s, all three types exhibited paralinear kinetics. The material is oxidized by water vapor to form solid silica. The protective silica is in turn volatilized by water vapor to form primarily gaseous Si(OH)4. Nonlinear least squares analysis and a paralinear kinetic model were used to determine both parabolic and linear rate constants from the kinetic data. Volatilization of the protective silica scale can result in accelerated consumption of Si3N4. Recession rates under conditions more representative of actual combustors are compared to the furnace data. Author

Oxidation; Silicon Nitrides; Reaction Kinetics; Water Vapor; Silicon Dioxide; Gas Mixtures

20020072938 Argonne National Lab., IL USA

Development of Nondestructive Evaluation Methods for Ceramic Coatings

Ellingson, W. A.; Deemer, C.; Sun, J. G.; Erdman, S.; Muliere, D.; May 2002; 12p; In English

Report No.(s): DE2002-43589; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Nondestructive evaluation (NDE) methods are being developed for use with ceramic coatings for components in the hot-gas path of advanced gas-fired turbine engines with low emissions. Two types of coatings are being studied: thermal barrier coatings (TBCs), which are under development for vanes, blades, and combustor liners to allow hotter gas-path temperatures, and environmental barrier coatings (EBCs), which are under development to reduce environmental damage to high temperature components made of ceramic matrix composites. The NDE methods will be used to (1) provide data to assess the reliability of new coating application processes, (2) identify defective components that could cause unscheduled outages, (3) track growth rates of defects during use in engines, and (4) allow rational judgment for replace/repair/re-use decisions of components. NTIS

Nondestructive Tests; Ceramic Matrix Composites; Thermal Control Coatings; Protective Coatings; Ceramic Coatings

20020072966 NASA Glenn Research Center, Cleveland, OH USA

Mullite+CAS Bond Coat for Environmental Barrier Coatings for Si-Based Ceramics

Lee, Kang N., NASA Glenn Research Center, USA; Opila, Elizabeth J., NASA Glenn Research Center, USA; [2002]; 13p; In English; 201st Meeting of the Electrochemical Society, 12-17 May 2002, Philadelphia, PA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Current environmental barrier coatings (EBCs) for silicon-based ceramics consist of a bond coat and a top coat. Mullite bond coat modified by adding low CTE glass ceramics, such as BSAS (xBaO.1xSRO.Al2O3.2SiO2) or CAS (CaO.Al2O3.2SiO2), was developed in the NASA Enabling Propulsion Materials (EPM) Program. EBCs based on mullite+CAS bond coat were characterized using high steam thermal cycling test and high steam isothermal thermogravemitry (TGA) at 1225 C - 13,000 C. The Mullite+CAS bond coat showed far superior durability compared to mullite bond coat, due to enhanced crack resistance. A

BSAS top coat provided further improved durability compared to EBCs with a yttria-stabilized zirconia (YSZ) top coat. Still further improvement in the durability was achieved by adding a silicon bond coat between the mullite and the substrate. However, the silicon/mullite+CAS/BSAS EBC showed inferior long-term durability compared to the current state-of-the art EBC (silicon/mullite+BSAS/BSAS EBC), presumably due to the higher CAS-silica chemical reactivity.
Author
Mullites; Protective Coatings; Thermal Cycling Tests; Ceramics; Thermogravimetry; Crack Initiation; Crack Propagation; Yttria-Stabilized Zirconia; Durability

20020073025 NASA Glenn Research Center, Cleveland, OH USA
Characterization of Ceramic Matrix Composite Fasteners Exposed in a Combustion Liner Rig Test
Verrilli, Michael J., NASA Glenn Research Center, USA; Brewer, David, NASA Glenn Research Center, USA; [2002]; 6p; In English; ASME TURBO EXPO 2002, 3-6 Jun. 2002, Amsterdam, Netherlands; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): RTOP 714-04-30; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Combustion tests on SiC/SiC CMC (Ceramic Matrix Composite) components were performed in an aircraft combustion environment using the Rich-burn, Quick-quench, Lean-burn (RQL) sector rig. SiC/SiC fasteners were used to attach several of these components to the metallic rig structure. The effect of combustion exposure on the fastener material was characterized via microstructural examination. Fasteners were also destructively tested, after combustion exposure, and the failure loads of fasteners exposed in the sector rig were compared to those of as-manufactured fasteners. Combustion exposure reduced the fastener failure load by 50% relative to the as-manufactured fasteners for exposure times ranging from 50 to 260 hours. The fasteners exposed in the combustion environment demonstrated failure loads that varied with failure mode. Fasteners that had the highest average failure load, failed in the same manner as the unexposed fasteners.
Author
Ceramic Matrix Composites; Fasteners; Destructive Tests; Failure Analysis; Combustion; Turbine Engines; Combustion Chambers; Linings

20020073049 Praxair, Inc., Tonawanda, NY USA
Ceramic Membrane Enabling Technology for Improved IGCC Efficiency ***Quarterly Report, Jan. - Mar. 00***
Prasad, R.; Apr. 2000; 14p; In English
Report No.(s): DE2002-795781; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The objective of this program is to conduct a technology development program to advance the state-of-the-art in ceramic Oxygen Transport Membranes (OTM) to the level required to produce step change improvements in process economics, efficiency, and environmental benefits for commercial IGCC systems and other applications. The IGCC program is focused on addressing key issues in materials, processing, manufacturing, engineering and system development that will make the OTM a commercial reality. The objective of the OTM materials development task is to identify a suitable material that can be formed into a thin film to produce the target oxygen flux. This requires that the material have an adequate permeation rate, and thermo-mechanical and thermo-chemical properties such that the material is able to be supported on the desired substrate and sufficient mechanical strength to survive the stresses involved in operation.
NTIS
Ceramics; Membranes; Commerce; Economics; Thermochemical Properties

20020073050 Alaska Univ., School of Mineral Industry, Fairbanks, AK USA
Oxygen Transport Ceramic Membranes ***Quarterly Report, Jan. - Mar. 2002***
Bandopadhyay, S.; Nagabhushana, N.; Apr. 2002; 16p; In English
Report No.(s): DE2002-795773; No Copyright; Avail: Department of Energy Information Bridge
This report covers the following tasks: Task 1--Design, fabricate and evaluate ceramic to metal seals based on graded ceramic powder/metal braze joints; Task 2--Evaluate the effect of defect configuration on ceramic membrane conductivity and long term chemical and structural stability; Task 3--Determine materials mechanical properties under conditions of high temperatures and reactive atmospheres; Task 4--Evaluate phase stability and thermal expansion of candidate perovskite membranes and develop techniques to support these materials on porous metal structures; Task 5--Assess the microstructure of membrane materials to evaluate the effects of vacancy-impurity association, defect clusters, and vacancy-dopant association on the membrane

performance and stability; and Task 6--Measure kinetics of oxygen uptake and transport in ceramic membrane materials under commercially relevant conditions using isotope labeling techniques.
NTIS
Ceramics; Mechanical Properties; Oxygen; Membranes

20020073052 National Defence Research Establishment, Avd. foer Vapen och Skydd, Tumba, Sweden
FOX-7 Formulations, Part 1 ***FOX-7 Formulering, Del 1***
Bergman, H.; Eldsaeter, C.; Ostmark, H.; Sep. 2001; In Swedish; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-104967; FOI-R-0195-SE; No Copyright; Avail: National Technical Information Service (NTIS)
A preliminary study concerning the formulation of FOX-7 with energetic polymers aiming towards changes with low sensitivity and high performance has been performed. The results from this study is given and points in the direction of possibilities to make main charges with low sensitivity and high performance.
NTIS
Polymerization; Data Acquisition; Polymers

20020073074 NASA Glenn Research Center, Cleveland, OH USA
Measured Propagation Characteristics of Finite Ground Coplanar Waveguide on Silicon with a Thick Polyimide Interface Layer
Ponchak, George E., NASA Glenn Research Center, USA; Papapolymerou, John, Georgia Inst. of Tech., USA; Tentzeris, Emmanouil M., Georgia Inst. of Tech., USA; 20020101; 4p; In English; European Microwave Conference, 23 Sep. 2002, Milan, Italy
Contract(s)/Grant(s): RTOP 755-08-0B; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
Measured propagation characteristics of Finite Ground Coplanar (FGC) waveguide on silicon substrates with resistivities spanning 3 orders of magnitude (0.1 to 15.5 Ohm cm) and a 20 micron thick polyimide interface layer is presented as a function of the FGC geometry. Results show that there is an optimum FGC geometry for minimum loss, and silicon with a resistivity of 0.1 Ohm cm has greater loss than substrates with higher and lower resistivity. Lastly, substrates with a resistivity of 10 Ohm cm or greater have acceptable loss.
Author
Electrical Resistivity; Wave Propagation; Silicon; Substrates; Waveguides; Attenuation; Polyimides; Dielectric Loss

20020073144 NASA Lewis Research Center, Cleveland, OH USA
The Preliminary Evaluation of Liquid Lubricants for Space Applications by Vacuum Tribometry
Jones, W. R., Jr., NASA Lewis Research Center, USA; Pepper, S. V., NASA Lewis Research Center, USA; Herrera-Fierro, P., NASA Lewis Research Center, USA; Feuchter, D., NASA Lewis Research Center, USA; Toddy, T. J., NASA Lewis Research Center, USA; Jayne, D. T., NASA Lewis Research Center, USA; Wheeler, D. R., NASA Lewis Research Center, USA; Abel, P. B., NASA Lewis Research Center, USA; Kingsbury, E., NASA Lewis Research Center, USA; Morales, W., NASA Lewis Research Center, USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 265-277; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche
Four different vacuum tribometers for the evaluation of liquid lubricants for space applications are described. These range from simple ball-on-flat sliders with maximum in-situ control and surface characterization to an instrument bearing apparatus having no in-situ characterization. Thus, the former provide an abundance of surface chemical information but is not particularly simulative of most triboelements. On the other hand, the instrument bearing apparatus is completely simulative, but only allows post-mortem surface chemical information. Two other devices, a four-ball apparatus and a ball-on-plate tribometer, provide varying degrees of surface chemical information and tribo-simulation. Examples of data from each device are presented.
Author
Tribology; Lubricants

20020073157 QSS Group, Inc., Cleveland, OH USA
Precursor Selection for Property Optimization in Biomorphic SiC Ceramics
Varela-Feria, F. M., Seville Univ., Spain; Lopez-Robledo, M. J., Seville Univ., Spain; Martinez-Fernandez, J., Seville Univ., Spain; deArellano-Lopez, A. R., Seville Univ., Spain; Singh, M., QSS Group, Inc., USA; [2002]; 7p; In English
Contract(s)/Grant(s): NAS3-00145; 1FD97-2335; RTOP 708-73-25; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Biomorphic SiC ceramics have been fabricated using different wood precursors. The evolution of volume, density and microstructure of the woods, carbon performs, and final SiC products are systematically studied in order to establish experimental guidelines that allow materials selection. The wood density is a critical characteristic, which results in a particular final SiC density, and the level of anisotropy in mechanical properties in directions parallel (axial) and perpendicular (radial) to the growth of the wood. The purpose of this work is to explore experimental laws that can help choose a type of wood as precursor for a final SiC product, with a given microstructure, density and level of anisotropy. Preliminary studies of physical properties suggest that not only mechanical properties are strongly anisotropic, but also electrical conductivity and gas permeability, which have great technological importance.
Author (revised)
Wood; Microstructure; Mechanical Properties; Ceramics; Optimization

20020073193 Department of Energy, Washington, DC USA
Multiyear Program Plan for the High Temperature Materials Laboratory
Mar. 17, 2000; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-771209; No Copyright; Avail: National Technical Information Service (NTIS)
Recently, the U.S. Department of Energy's (DOE) Office of Heavy Vehicle Technologies (OHVT) prepared a Technology Roadmap describing the challenges facing development of higher fuel efficiency, less polluting sport utility vehicles, vans, and commercial trucks. Based on this roadmap, a multiyear program plan (MYPP) was also developed, in which approaches to solving the numerous challenges are enumerated. Additional planning has been performed by DOE and national laboratory staff, on approaches to solving the numerous challenges faced by heavy vehicle system improvements. Workshops and planning documents have been developed concerning advanced aerodynamics, frictional and other parasitic losses, and thermal management.
NTIS
Ceramics; High Temperature Tests; Efficiency; Propulsion System Configurations; Energy Technology; Fuels

20020073201 Cincinnati Univ., Dept. of Chemical Engineering, OH USA
Proton-Conducting Dense Ceramic Membranes for Hydrogen Separation ***Progress Report***
Lin, J. Y. S.; Nov. 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-794294; No Copyright; Avail: National Technical Information Service (NTIS)
This project is aimed at preparation of thin (1-10 micron) membranes of a modified strontium ceramic material with improved hydrogen permeance on mesoporous substrates. The research work conducted in this reporting period was focused on the following three aspects: (1) preparation of thick proton-conducting ceramic membranes and synthesis of porous substrates as support for thin proton-conducting ceramic film, (2) setting up RF sputter deposition unit for deposition of thin ceramic films and performing deposition experiments with the sputter deposition unit, and (3) modeling hydrogen permeation through the proton-conducting ceramic membranes.
NTIS
Membranes; Ceramics; Hydrogen; Thin Films; Strontium

20020073234 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Inst. fuer Bauweisen- und Konstruktionsforschung, Cologne, Germany
Fiber Reinforced Ceramics for Hot Structures of Reentry Vehicles: Simulation, Test and Comparison with Experimental Flight Data ***Faserkeramiken fuer Heisse Strukturen von Wiedereintrittsfahzeugen: Simulation, Test und Vergleich mit Experimentellen Flugdaten***
Hald, Hermann, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; 2001; ISSN 1434-8454; 180p; In German; Original contains color illustrations
Report No.(s): DLR-FB-2001-17; Copyright; Avail: Issuing Activity
This work systematically investigates reentry relevant properties of fiber reinforced ceramics (C/C-SiC). This includes both ground based plasma wind tunnel tests under simulated operation conditions and sample exposure to orbital environment (D2-Spacelab mission) and also to real reentry flight conditions (Russian reentry capsule missions FOTON-8 and -9). Consequently the hot structure flight experiment CETEX had been designed, qualified and tested during the EXPRESS (Experimental Reentry Space System) mission. For the first time in Europe, experimental results from various ground based testing efforts and theoretical considerations with respect to the oxidative-erosive behavior of SiC in a high enthalpy flow field could be compared with real flight data and experiences from reentry missions. Considerations concerning the temperature jump

effect which principally marks the transition from passive to active oxidation of SiC showed strong evidence that catalytically intensified recombination of atomic nitrogen by free silicon is the dominating reason for this phenomenon. The results achieved so far may lead to a material derived trajectory optimization of future space reentry vehicles.
Author
Reentry Shielding; Reentry Effects; Fiber Composites; Ceramics; Silicon Carbides

20020073405 NASA Glenn Research Center, Cleveland, OH USA
Nonlinear Viscoelastic Mechanics of Cross-Linked Rubbers
Freed, Alan D., NASA Glenn Research Center, USA; Leonov, Arkady I., Akron Univ., USA; [2002]; 14p; In English; 2nd Canadian Conference on Nonlinear Solid Mechanics, 19-23 Jun. 2002, Vancouver, British Columbia, Canada
Contract(s)/Grant(s): RTOP 708-24-13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The paper develops a general theory for finite rubber viscoelasticity, and specifies it in the form, convenient for solving problems important for rubber, tire and space industries. Based on the quasi-linear approach of non-equilibrium thermodynamics, a general nonlinear theory has been developed for arbitrary nonisothermal deformations of viscoelastic solids. In this theory, the constitutive equations are presented as the sum of known equilibrium (rubber elastic) and non-equilibrium (liquid polymer viscoelastic) terms. These equations are then simplified using several modeling arguments. Stability constraints for the proposed constitutive equations are also discussed. It is shown that only strong ellipticity criteria are applicable for assessing stability of the equations governing viscoelastic solids.
Author
Rubber; Nonlinear Systems; Thermodynamic Equilibrium; Viscoelasticity; Mechanics (Physics); Constitutive Equations; Crosslinking

20020073481 Naval Surface Warfare Center, Indian Head, MD USA
Coating of PEP Ingredients Using Supercritical Carbon Dioxide
Nauflett, George W., Naval Surface Warfare Center, USA; Farncomb, Robert E., Naval Surface Warfare Center, USA; JANNAF 30th Propellant Development and Characterization Subcommittee Meeting; March 2002; Volume 1, pp. 13-19; In English; Also announced as 20020073479; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Supercritical carbon dioxide (scCO2) polymer coating techniques were used for coating of various propellant, explosive, and pyrotechnic (PEP) ingredients. Ammonium dinitramide (ADN),2,4,6,8,10,12-hexanitrohexaazaisowurtzitane (CL-20), cyclotrimethylenetrinitramine (RDX), and the ballistic modifiers for AA-7 lead free propellant were polymer coated to reduce sensitivity, improve moisture resistance, and improve chemical compatibility with other ingredients. Carbon dioxide (CO2) has modest critical properties (Tc = 31 C, P(sub c)= 73.8 bar [1071 psi]) and is non-toxic, non-corrosive, and low-cost. CO2 is an environmentally acceptable solvent for polymer coating applications. It has proven to be a very good solvent for a variety of polymer and copolymers. Coating of ADN and CL-20 reduced their friction and electrostatic discharge (ESD) sensitivity. The AA-7 lead-free propellant uses bismuth subsalicylate (BiS), 1.5%; copper salicylate (CuS) 1.0%; copper stannate (CuSt), 0.77%; and carbon black, 0.1% as the ballistic modifier. The CuS caused stabilizer depletion due to the catalysis of the nitroglycerin (NG). The combination of CuS and BiS has only one half the depletion rate of the copper compound alone, An unexpected result was obtained with the coated ballistic modifier, the reduction of a stability by the combination of the two (copper and bismuth) was eliminated.
Author
Carbon Dioxide; Coatings; Pyrotechnics; Propellants; Chemical Analysis

20020073488 FMC Corp., Lithium Div., Gastonia, NC USA
Designable Functional Polymers-Tailored to Meet Specific Customer Needs
Brockmann, Thorsten W., FMC Corp., USA; JANNAF 30th Propellant Development and Characterization Subcommittee Meeting; March 2002; Volume 1, pp. 71-80; In English; Also announced as 20020073479; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

FMC Corporation (Lithium Division) is developing a novel family of low molecular weight reactive functionalized polymers. Both saturated and unsaturated hydrocarbon backbones with hydroxyl, amine or carboxyl functionalities are prepared by using our proprietary organolithium initiator and polymer technologies. The functionalized polymers with an unsaturated backbone are characterized by low viscosity, hydrolytic stability, precise terminal functionality and low polydispersity. Along with these benefits, the saturated analogs also demonstrate superior heat, light and oxidative stability. In addition to telechelic polymers,

heterotelechelic polymers can also be prepared, which allows for mixed or hybrid curing chemistries. These functionalized polymers have been applied towards improved coatings, adhesives, propellant binders and sealants.
Author
Chemical Reactions; Low Molecular Weights; Propellant Binders; Rocket Propellants; Copolymerization; Combustion Chemistry

20020073516 NASA Ames Research Center, Moffett Field, CA USA
Low-Speed Pressure Sensitive Paint Studies
Owen, Brown, NASA Ames Research Center, USA; Mehta, Rabindra, NASA Ames Research Center, USA; Sep. 25, 1998; 1p; In English; 60th Annual Pressure Sensitive Paint Workshop, 6-8 Oct. 1998, Renton, WA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A series of low speed (M less than 0.2) experiments using University of Washington Fib-07 Pressure Sensitive Paint (PSP) have been conducted at NASA Ames on a NACA 0012 airfoil. Significant improvements in results have been shown: PSP calibration errors of the improved data (with pressure taps as a reference) now agree with theoretical error limits. Additional measurements on the 0012 airfoil using Temperature Sensitive Paint have been made. These TSP measurements now fully quantify the impact of temporal temperature changes on model surfaces on PSP measurements. Finally, simultaneous PSP - TSP measurements have been performed, allowing in-situ temperature correction of PSP data with good results.
Author
Airfoils; Pressure Sensitive Paints; Flow Measurement

20020073518 NASA Glenn Research Center, Cleveland, OH USA
Oxidation of a Silica-Containing Material in a Mach 0.3 Burner Rig
Nguyen, QuynhGiao N., NASA Glenn Research Center, USA; Cuy, Michael D., QSS Group, Inc., USA; [2002]; 2p; In English; 35th Annual International Metallographic Society Convection, 4-8 Aug. 2002, Quebec City, Canada; Sponsored by American Society for Metals, USA; Original contains color illustrations
Contract(s)/Grant(s): RTOP 714-04-90; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A primarily silica-containing material with traces of organic compounds, as well as aluminum and calcium additions, was exposed to a Mach 0.3 burner rig at atmospheric pressure using jet fuel. The sample was exposed for 5 continuous hours at 1370 C. Post exposure x-ray diffraction analyses indicate formation of cristobalite, quartz, NiO and Spinel (Al(Ni)CR2O4). The rig hardware is composed of a nickel-based superalloy with traces of Fe. These elements are indicated in the energy dispersive spectroscopy (EDS) results. This material was studied as a candidate for high temperature applications under an engine technology program.
Author
Silicon Dioxide; Thermal Cycling Tests; Jet Engine Fuels; X Ray Diffraction

20020073829 European Space Tribology Lab., Risley, UK
Towards an Optimized Sputtered MoS2 Lubricant Film
Roberts, E. W., European Space Tribology Lab., UK; 20th Aerospace Mechanisms Symposium; May 1986, pp. 103-119; In English; Also announced as 20020073821; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

It is shown that the tribological quality of MoS2 lubricant films formed by magnetron sputtering is determined by the choice of sputtering conditions. By selecting the appropriate conditions, films of extremely high lubricity and endurance (in vacuum), which are well suited to many space applications, are obtained. Such MoS2 films, when applied to precision ball bearings, give rise to the lowest torques (for the given test conditions) yet seen in our laboratory. Whilst a remarkably good performance is obtained in vacuum, tests in air show a marked deterioration in lubricating qualities. It is demonstrated that this is attributable to the adsorption of water vapor on MoS2 surfaces and that the degree of deterioration is related to the partial pressure of water vapor present. Analysis of results indicates that the factors relevant to obtaining optimum films are deposition rate and film composition.
Author
Lubricants; Molybdenum Disulfides; Tribology; Magnetron Sputtering; Deposition

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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.

20020070854 Oak Ridge National Lab., TN USA
Estimating Externalities of Natural Gas Fuel Cycles, Report 4
Barnthouse, L. W.; Cada, G. F.; Cheng, M. D.; Easterly, C. E.; Kroodsma, R. L.; Jan. 1998; 448p; In English
Report No.(s): DE2002-757382; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This report describes methods for estimating the external costs (and possibly benefits) to human health and the environment that result from natural gas fuel cycles. Although the concept of externalities is far from simple or precise, it generally refers to effects on individuals well being, that result from a production or market activity in which the individuals do not participate, or are not fully compensated. In the past two years, the methodological approach that this report describes has quickly become a worldwide standard for estimating externalities of fuel cycles. me approach is generally applicable to any fuel cycle in which a resource, such as coal, hydro, or biomass, is used to generate electric power. This particular report focuses on the production activities, pollution, and impacts when natural gas is used to generate electric power. In the 1990s, natural gas technologies have become, in many countries, the least expensive to build and operate.
NTIS
Natural Gas; Cycles; Cost Analysis

20020072940 Department of Energy, Office of Oil and Gas, Washington, DC USA
Petroleum Marketing Monthly, July 2002, with Data for April 2002
Jul. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-108632; DOE/EIA-0380(2002/07); No Copyright; Avail: National Technical Information Service (NTIS)

The Petroleum Marketing Monthly (PMM) provides information and statistical data on a variety of crude oils and refined petroleum products. The publication presents statistics on crude oil costs and refined petroleum products sales for use by industry, government, private sector analysts, educational institutions, and consumers. Data on crude oil include the domestic first purchase price, the f.o.b. and landed cost of imported crude oil, and the refiners' acquisition cost of crude oil. Refined petroleum product sales data include motor gasoline, distillates, residuals, aviation fuels, kerosene, and propane.
NTIS
Petroleum Products; Costs; Statistical Analysis; Refining

20020072941 Department of Energy, Office of Oil and Gas, Washington, DC USA
Petroleum Marketing Monthly, June 2002, with Data for March 2002
Jun. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-108633; DOE/EIA-0380(2002/06); No Copyright; Avail: National Technical Information Service (NTIS)

The Petroleum Marketing Monthly (PMM) provides information and statistical data on a variety of crude oils and refined petroleum products. The publication presents statistics on crude oil costs and refined petroleum products sales for use by industry, government, private sector analysts, educational institutions, and consumers. Data on crude oil include the domestic first purchase price, the f.o.b. and landed cost of imported crude oil, and the refiners' acquisition cost of crude oil. Refined petroleum product sales data include motor gasoline, distillates, residuals, aviation fuels, kerosene, and propane.
NTIS
Petroleum Products; Costs; Statistical Analysis; Marketing

20020072942 Department of Energy, Office of Oil and Gas, Washington, DC USA
Petroleum Marketing Monthly, August 2002, with Data for May 2002
Aug. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-108634; DOE/EIA-0380(2002/08); No Copyright; Avail: National Technical Information Service (NTIS)

The Petroleum Marketing Monthly (PMM) provides information and statistical data on a variety of crude oils and refined petroleum products. The publication presents statistics on crude oil costs and refined petroleum products sales for use by industry, government, private sector analysts, educational institutions, and consumers. Data on crude oil include the domestic first purchase

price, the f.o.b. and landed cost of imported crude oil, and the refiners' acquisition cost of crude oil. Refined petroleum product sales data include motor gasoline, distillates, residuals, aviation fuels, kerosene, and propane.
NTIS
Petroleum Products; Costs; Marketing; Statistical Analysis

20020072984 Defence Science and Technology Organisation, Combatant Protection and Nutrition Branch, Fishermans Bend, Australia
Modelling the Concentration Levels of Zinc Chloride Produced by the Release of HC Smoke
Hill, Alexander, Defence Science and Technology Organisation, Australia; June 2002; 24p; In English; Original contains color illustrations
Report No.(s): DSTO-CR-0252; DODA-AR-012-338; Copyright; Avail: Issuing Activity
The pyrotechnic smoke known as HC smoke, (a hexachloroethane based obscurant), which is used by the army for training purposes, is produced by the release of the M84A1 artillery projectile. The majority of HC smoke (by weight) is zinc chloride, which is particularly toxic. The smoke was modelled using computer based dispersion models to determine minimum safe downwind distances from the point of release, and approximate dispersion times. A brief explanation of likely atmospheric conditions is given, as well as a summary of the results obtained from the models.
Author
Meteorology; Pyrotechnics; Smoke; Toxicity; Zinc Chlorides

20020073051 North Dakota Univ., Energy and Environmental Research Center, Grand Forks, ND USA
Barrier Issues to the Utilization of Biomass ***Progress Report***
Gunderson, J. R.; Folkedahl, R. C.; Schmidt, D. D.; Weber, G. F.; Zygarlicke, C. J.; May 2002; 64p; In English
Report No.(s): DE2002-795768; No Copyright; Avail: Department of Energy Information Bridge
The Energy & Environmental Research Center (EERC) is conducting a project to examine the fundamental issues limiting the use of biomass in small industrial steam/power systems in order to increase the future use of this valuable domestic resource. Specifically, the EERC is attempting to elucidate the ash-related problems--grate clinkering and heat exchange surface fouling--associated with cofiring coal and biomass in grate-fired systems. Utilization of biomass in stoker boilers designed for coal can be a cause of concern for boiler operators. Boilers that were designed for low-volatile fuels with lower reactivities can experience damaging fouling when switched to higher-volatile and more reactive lower-rank fuels, such as when cofiring biomass. Higher heat release rates at the grate can cause more clinkering or slagging at the grate because of higher temperatures. Combustion and loss of volatile matter can start too early with biomass fuels compared to design fuel, vaporizing alkali and chlorides which then condense on rear walls and heat exchange tube banks in the convective pass of the boiler, causing noticeable increases in fouling. In addition, stoker-fired boilers that switch to biomass blends may encounter new chemical species such as potassium sulfates and various chlorides in combination with different flue gas temperatures because of changes in fuel heating value, which can adversely affect ash deposition behavior.
NTIS
Biomass; Electric Generators; Reaction Kinetics; Energy Technology

20020073096 Engineering Research and Analysis Co., USA
Development and Validation of a Detailed JP-8 Fuel Chemistry Model
Mawid, M. A., Engineering Research and Analysis Co., USA; Park, T. W., Engineering Research and Analysis Co., USA; Sekar, B., Air Force Research Lab., USA; Arana, C., Air Force Research Lab., USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 21-37; In English; Also announced as 20020073093; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC
Progress on development of a detailed JP-8 fuel chemical reaction model is reported in this article. A 12-component surrogate JP-8 fuel composition was considered in this study. The developed JP-8 reaction model presently consists of 200 chemical species and 1,330 chemical reactions. Low pressure limited validation of the JP-8 detailed model was carried out against available ignition data. The comparison with the ignition data was quite satisfactory for higher initial temperature conditions than for lower initial temperature conditions and indicated that further model's refinement and sensitivity analyses are still required. Perfectly stirred reactor (PSR) computations were also carried out. However, no comparison with data was made due to lack of PSR data in the open literature.
Author
Sensitivity Analysis; JP-8 Jet Fuel; Product Development

20020073177 Energy Information Administration, Washington, DC USA
Short-Term Energy Outlook, *Aug. 2002*
Aug. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-108611; No Copyright; Avail: National Technical Information Service (NTIS)

Oil prices remained relatively high in July, averaging close to the expectations reported in the July Outlook. The average spot West Texas Intermediate (WTI) price in July was approximately $27 per barrel. As always, a wide range of possibilities exists for oil price movements over the next year and a half. However, given the amount of growth in world demand expected through 2003, we think that likely scenarios for OPEC and non-OPEC output growth imply continued tightening of markets (lower commercial inventories) and continued support for crude oil prices near or slightly above current levels through mid-2003. The average WTI spot price is expected to edge upward toward $30 per barrel by early to mid 2003 under our current Base Case assumptions.
NTIS
Market Research; Crude Oil; Cost Analysis

20020073178 Energy Information Administration, Washington, DC USA
Short-Term Energy Outlook, *Jul. 2002*
Jul. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-108619; No Copyright; Avail: National Technical Information Service (NTIS)

World oil price markers fell in June, with both Brent crude oil and the OPEC basket prices averaging $1.00 - $1.50 per barrel below May averages. Nevertheless, June marked the fourth consecutive month that the OPEC basket price averaged above $22 per barrel, the lower end of OPEC's target range. The basket price has been above $22 per barrel since March 8 and is projected to remain within the target range ($22-28 per barrel) through 2003. Moderate OPEC restraint, combined with accelerating world demand growth later in 2002 and into 2003 is expected to maintain elevated prices. The U.S. benchmark West Texas Intermediate (WTI) oil price averaged almost $2 per barrel lower in June than in May but WTI prices were rising at months end and averaged more than $1 per barrel higher than the June average of $25.50 per barrel during the first week of July. Our base case projection for WTI in 2002 is almost $26 per barrel, rising to just above $29 in 2003.
NTIS
Forecasting; Crude Oil; Supplying; Cost Analysis

20020073179 Energy Information Administration, Washington, DC USA
Natural Gas Monthly
Jun. 2002; 96p; In English
Report No.(s): PB2002-108620; DOE/EIA-0130(2002/06); No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Natural Gas Monthly (NGM) highlights activities, events, and analyses of interest to public and private sector organizations associated with the natural gas industry. Volume and price data are presented each month for natural gas production, distribution, consumption, and interstate pipeline activities. Producer-related activities and underground storage data are also reported.
NTIS
Fuels; Natural Gas; Energy Consumption; Organizations

20020073185 Bureau of Export Administration, Strategic Analysis Div., Washington, DC USA
National Security Assessment of the High Performance Explosives and Explosive Components Industries
Jun. 2001; 166p; In English
Report No.(s): PB2002-105711; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The USA' supplier base for high-performance explosives and related components-products essential to the defense of the nation-has been operating under increasing stress since the late-1980s. Reduced production orders and lower revenues have made it difficult for both federal government production facilities and private companies to maintain their full capabilities. Manufacturers of high performance explosive (HPEs) and high-performance explosive components (HPECs), whether U.S. government-owned production operations or private companies, face a number of challenges in the years ahead. Munitions R&D dollar spending has been falling for the past 10 years, and will continue to fall another 50 percent by 2005, according to Defense Department projections. Munitions R&D is also falling as a percentage of the overall Defense R&D budget. In addition, some manufacturers report an aging of their workforces-a phenomenon that is found in these organizations' research laboratories as well as in their production facilities. For the moment, the nation does not face a supply crisis in HPE and HPECs. But if the USA is to retain sufficient explosive production capacity for the future, greater thought must be given in the next few years on how to

maintain infrastructure-in terms of manufacturing facilities, trained personnel, and R&D. This study examines these matters and other factors affecting the HPE and HPEC industries.
NTIS
Explosives; Security; Government Procurement

20020073212 Energy Information Administration, Washington, DC USA
International Energy *Annual Report, 2000*
May 2002; 254p
Report No.(s): PB2002-108602; DOE/EIA-0219(2000); No Copyright; Avail: CASI; A03, Microfiche; A12, Hardcopy
The International Energy Annual 2000 presents an overview of key international energy trends for production, consumption, imports, and exports of primary energy commodities in over 220 countries, dependencies, and areas of special sovereignty. Also included are population and gross domestic product data, as well as prices for crude oil and petroleum products in selected countries. Renewable energy sources reported in the International Energy Annual 2000 include hydroelectric power and geothermal, solar, wind, and wood and waste electric power. Also included for the USA are geothermal, solar, and wood and waste energy not used for electricity generation.
NTIS
Petroleum Products; Renewable Energy; Windpower Utilization; Solar Wind; Energy Consumption; Hydroelectricity

20020073213 Department of Energy, Office of Oil and Gas, Washington, DC USA
Natural Gas Monthly
Apr. 2002; 98p; In English
Report No.(s): PB2002-108610; DOE/EIA/0130(2002/04); No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche
This issue of the Natural Gas Monthly contains estimates of natural gas data through April 2002 for many data series at the national level. National-level natural gas prices are available through December 2001 (electric utilities), January (residential, commercial, and industrial), and March (wellhead). State-level data generally are available through January 2002, although underground storage data are available through February 2002.
NTIS
Natural Gas; Utilities

20020073377 Department of Energy, Washington, DC USA
International Petroleum Monthly
Jun. 2002; 86p
Report No.(s): PB2002-108621; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
The International Petroleum Monthly presents data on international oil production, demand, imports, and stocks. The report has four sections. Section 1 contains time series data on world oil production, and on oil demand and stocks in the Organization for Economic Cooperation and Development (OECD). This section contains annual data beginning in 1990 or 1997, and monthly data for the most recent years. Section 2 presents an oil supply/demand balance for the world. This balance is presented in quarterly intervals for the most recent two years and annually for the three years prior to that. Section 3 presents data on oil imports by OECD countries. This section contains annual data for the most recent year, quarterly data for the most recent two quarters, and monthly data for the most recent twelve months. Section 4 presents annual time series data on world oil production and oil stocks, demand, and trade in OECD countries. World oil production and OECD demand data are for the years 1970 through 2001; OECD stocks from 1973 through 2001; and OECD trade from 1991 through 2001.
NTIS
Production; Inventories; Data Acquisition; Crude Oil; Supplying

20020073444 Energy Information Administration, Washington, DC USA
Natural Gas Monthly
Mar. 2002; 98p; In English
Report No.(s): PB2002-108622; DOE/EIA-0130(2002/03); No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche
The Natural Gas Monthly (NGM) highlights activities, events, and analyses of interest to public and private sector organizations associated with the natural gas industry. Volume and price data are presented each month for natural gas production,

distribution, consumption, and interstate pipeline activities. Producer-related activities and underground storage data are also reported. From time to time, the NGM features articles designed to assist readers in using and interpreting natural gas information. NTIS

Natural Gas; Energy Consumption; Industries; Pipelines; Distributing; Fuel Production

20020073479 Johns Hopkins Univ., Chemical Propulsion Information Agency, Columbia, MD USA

JANNAF 30th Propellant Development and Characterization Subcommittee Meeting, Volume I, ***12 May 2000 - 21 Mar. 2002***

Moore, T. L., Editor, Johns Hopkins Univ., USA; Becker, D. L., Editor, Johns Hopkins Univ., USA; March 2002; 262p; In English, 18-21 Mar. 2002, Colorado Springs, CO, USA; Sponsored by Department of the Army, USA; Also announced as 20020073480 through 20020073498

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

Report No.(s): CPIA-Publ-708-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 compilation of 22 unclassified/unlimited technical papers presented at the Joint Army-Navy-NASA-Air Force (JANNAF) 30th Propellant Development & Characterization Subcommittee Meeting, held on 18-21 March 2002 at the Sheraton Colorado Springs Hotel, Colorado Springs, Colorado. The papers presented herein reflect work performed in the areas of green energetic materials (GEM) development; liquid and gel propellant development; propellant surveillance and aging; and propellant chemistry test methods.

Author

Conferences; Liquid Rocket Propellants; Solid Rocket Propellants; Chemical Analysis; Propellant Chemistry; Propellant Properties; Aging (Materials)

20020073480 Naval Surface Warfare Center, Indian Head, MD USA

Green Energetic Materials (GEM): A Program Overview

Nock, Lori, Naval Surface Warfare Center, USA; Porada, Don, Naval Ordnance Safety and Security Activity, USA; King, Gerald, Booz-Allen and Hamilton, Inc., USA; JANNAF 30th Propellant Development and Characterization Subcommittee Meeting; March 2002; Volume 1, pp. 1-11; In English; Also announced as 20020073479; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

A summary of the Navy Science & Technology Affordability Green Energetic Materials (GEM) program will be presented. This five-year effort has developed green energetic materials and processes to lower total ownership cost of munitions. The program goals were to replace conventional propelling charges, rocket propellants and explosives (submunitions) with green materials for a 5-inch extend range guided munition (ERGM). Demonstrations, in which all performance objectives were met, included: (1) twin screw extrusion, solventless processing of gun and rocket propellants; (2) developing and demonstrating optimized processing parameters for TPE high explosives and hydrolyzable rocket propellants and high explosives; (3) recovery/recycling of ingredients; (4) full-scale component testing; and (5) development of environmental and cost models. Successful full-scale development of green energetic materials for the ERGM has set the stage for development of a TPE-based munition with improved performance and lower life cycle costs (i.e., 15% cost savings over conventional materials). Recycle, recovery, and reuse of the developing green energetic binders could potentially lower the life cycle wastes for the ERGM by more than 80%. This translates into cost savings for energetic system production, acquisition, demilitarization, and disposal.

Author

Rocket Propellants; Weapons Development; Environment Protection; Gun Propellants; Explosives; Waste Management; Materials Recovery; Recycling

20020073482 Chemical Compliance Systems, Inc., Lake Hopatcong, NJ USA

'Green' Munitions Analytical Compliance System (G-MACS)

Thompson, George R., Chemical Compliance Systems, Inc., USA; Nordquist, Tyrone D., Army Defense Ammunition Center, USA; JANNAF 30th Propellant Development and Characterization Subcommittee Meeting; March 2002; Volume 1, pp. 21-22; In English; Also announced as 20020073479

Contract(s)/Grant(s): DACA87-01-F-0102; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Establishment of criteria for 'green' munitions and timely identification of non-environ mentally preferable chemical constituents are presently two significant deterrents to the development of "green" munitions. The availability of prototype criteria, chemical and product databases and analytical software greatly simplifies development of customized capabilities for

automatically analyzing and identifying 'green' munitions. The U.S. Army Defense Ammunition Center (DAC) has initiated several activities to fulfill the intent of these Executive Orders. DAC has successfully enhanced the Munitions Items Disposition Action System (MIDAS) that characterizes munitions into components, parts, materials, and chemical constituents so regulatory compliance and other "green" criteria can be readily applied. DAC has also successfully developed the Munitions Analytical Compliance System (MACS-1) to effectively assure demilitarization site compliance with federal and state compliance requirements. The utility of these DAC accomplishments can be greatly enhanced by the development of a 'Green' Munitions Analytical Compliance System (G-MACS). The objectives for G-MACS are fairly straightforward: (1) accelerate development of 'green' munitions, (2) provide a mechanism to clean up munitions in production, and (3) reduce future demilitarization costs.
Author

Environment Management; Environmental Monitoring; Environmental Cleanup; Applications Programs (Computers); Weapons; Ammunition; Military Technology; Weapon Systems

20020073483 NASA Johnson Space Center, Houston, TX USA

Laboratory Preparation and Characterization of UDMH/NO2 Reaction Products

Dee, Louis A., Honeywell Technology Solutions, Inc., USA; Davidson, Vanessa D., Honeywell Technology Solutions, Inc., USA; Johnson, Harry T., NASA Johnson Space Center, USA; JANNAF 30th Propellant Development and Characterization Subcommittee Meeting; March 2002; Volume 1, pp. 23-28; In English; Also announced as 20020073479; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Laboratory samples of 1, 1-dimethylhydrazine/nitrogen dioxide noncombustion reaction products were prepared using unique permeation tube technology, which allowed accurate mixture ratio control. The composition of the products did not vary widely between fuel-rich, stoichiometric, and oxidizer-rich mixtures but the quantities of some inorganic and organic components formed appeared to be related to the fuel/oxidizer ratio. N-nitrosodimethylamine was a major product included in the numerous other organic compounds that resulted from recombinations of dimethylamine, dimethylhydrazine, and partially oxidized reactants. Most of the reaction products were identified using gas chromatography/mass spectroscopy and ion chromatography. With the exception of dimethylammonium nitrate and nitrite salts, the other organic material was effectively removed by subjecting the crude reaction product mixture to simulated space vacuum.
Author

Dimethylhydrazines; By-Products; Nitrogen Dioxide; Reaction Products; Stoichiometry; Nitrites

20020073484 Army Research Lab., Aberdeen Proving Ground, MD USA

Molecular Modeling for Predicting Bulk Thermophysical Properties of Azide-Functionalized Fuels and Propellants

McQuaid, Michael, Army Research Lab., USA; Sun, Huai, Aeon Technology, Inc., USA; Rigby, David, Accelrys, Inc., USA; JANNAF 30th Propellant Development and Characterization Subcommittee Meeting; March 2002; Volume 1, pp. 29-40; In English; Also announced as 20020073479; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

This paper reports the results of efforts to establish molecular (forcefield-based) modeling capability that will accurately predict bulk thermophysical properties for azide-functionalized fuels and propellants. Until now, such capability has not been generally available because the unique nature of azide atom types requires forcefield parameters developed specifically for them. to address this issue, ARL and Accelrys, Inc. have collaborated to develop and validate forcefield parameters for azide atom types for Accelrys's COMPASS forcefield. The parameterization procedure identified the need to establish 4 new atom types: one for each of the 3 azide nitrogen atoms and one for an sp3 carbon atom bonded to the azide. Molecular dynamics simulations performed with the new parameters yield molecular structures and vibrational frequencies for hydrozoic acid, azidomethane, and the anti and gauche forms of azidoethane that are in good agreement with experimentally determined and/or density functional theory values. In addition, reasonable calculated values for the liquid densities and heats of vaporization were obtained for the 10 training set compounds. The possibility of predicting an azide's density and heat of vaporization via molecular dynamics simulations with its halogen analogs was also investigated. The approach proved to yield reasonable density predictions for the 4 test cases studied, but heats of vaporization were underpredicted. This knowledge may prove valuable to molecular dynamicists who wish to employ a forcefield other than COMPASS.
Author

Thermophysical Properties; Rocket Propellants; Azides (Organic); Hydrocarbon Fuels; Parameter Identification; Field Theory (Physics); Molecular Dynamics; Molecular Structure; Dynamic Models

20020073485 NASA Johnson Space Center, Houston, TX USA

A Review of the Effects of Exposure of EMU Materials to Hypergolic Propellants in Space-Like Vacuum

Davis, Dennis D., Honeywell Technology Solutions, Inc., USA; Baker, David L., NASA Johnson Space Center, USA; JANNAF 30th Propellant Development and Characterization Subcommittee Meeting; March 2002; Volume 1, pp. 41-44; In English; Also announced as 20020073479; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

International Space Station and Shuttle operations have requirements for extra vehicular activities during which the extravehicular mobility unit (EMU) may be exposed to leaking hypergolic propellants. Compatibility testing of EMU materials with hypergolic propellants has been performed at the NASA White Sands Test Facility and other NASA sites to identify the effects of such exposures. This presentation is designed to review the key test results on the compatibility of EMU materials when exposed to hypergolic propellants in a space-like vacuum.

Author

Extravehicular Mobility Units; Hypergolic Rocket Propellants; Space Environment Simulation; Dimethylhydrazines; Destructive Tests; Exposure

20020073486 Army Research Lab., Aberdeen Proving Ground, MD USA

Computational Characterization of 2-Azidocycloalkanamines: Notional Variations on the Hypergol 2-Azido-N,N-Dimethylethanamine (DMAZ)

McQuaid, Michael J., Army Research Lab., USA; JANNAF 30th Propellant Development and Characterization Subcommittee Meeting; March 2002; Volume 1, pp. 45-57; In English; Also announced as 20020073479; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The fuel 2-azido-N,N-dimethylethanamine (DMAZ) has shown considerable promise as a replacement for hydrazine-based fuels in hypergolic propulsion systems, but the ignition delays observed for DMAZ-inhibited red fuming nitric acid (IRFNA) systems are longer than those for monomethythydrazine (MMH)-IRFNA systems. Since this may negatively impact the Army's ability to field DMAZ, other 2-azidoethanamines have been synthesized and tested in an attempt to address this issue. This report proposes an alternate approach, namely, synthesizing and testing 2-azidocycloalkanamines. Such molecules will not only incorporate an energy- and reactivity-enhancing cycloalkane into the fuel, the benefits of which have been demonstrated in the case of 2-azido-N-cyclopropylethanamine (CPAZ); they have two stereochemically distinct isomers, one of which prevents the azide group from 'shielding' the amine lone pair electrons from proton attack, the other promoting such shielding. Since shielding may influence the manner in which nitric acid reacts with the fuel, the ignition delays for the isomers may be different, and it is possible that one of the isomers will yield shorter ignition delays than DMAZ. The 2-azidocyclopropanamines characterized in this paper are cis and trans forms of 2-azido-N,N-dimethylcyclopropanamine (ADMCPA), and, to a lesser extent, cis and trans forms of 2-azido-N-methylcyclobutanamine (AMCBA) and 2-azidocyclopentanamine (ACPA). to support consideration of the synthesis and development of these fuels, equilibrium structures are identified and their gas-phase heats of formations estimated via density functional theory based calculations. In addition, ADMCPA isomer condensed-phase densities and heats of vaporization are estimated via molecular dynamics simulations performed with halogen analogs. Combined and employed to predict ballistic properties, the computational results indicate that the ADMCPA isomers merit further investigation as hypergols. A suggestion for synthesizing cis-ADMCPA is also proffered.

Author

Hypergolic Rocket Propellants; Computerized Simulation; Molecular Dynamics; Ignition; Dimethyl Compounds; Molecular Interactions

20020073487 Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

Hydrocarbon Fuels Optimization

Mills, Jeffrey D., Air Force Research Lab., USA; JANNAF 30th Propellant Development and Characterization Subcommittee Meeting; March 2002; Volume 1, pp. 59-69; In English; Also announced as 20020073479; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Hydrocarbon fuel performance in rockets is systematically considered using standard equilibrium, isentropic, one-dimensional computer codes with a new web-based interface. For reference engine conditions the optimized specific impulse depends only upon the mass-normalized (specific) enthalpy content and the hydrogento-carbon ratio. In this context promising families of strained and unsaturated high-energy hydrocarbon fuels, with special emphasis upon those currently under development by in-house researchers, are insightfully compared and justified. A variety of simple, mission-tailored metrics approximating payload mass gains and the relative importance of fuel density are considered with special application to similar kerosene fuels. In this way it is possible to begin to simply, if approximately, quantify some of the performance trade-offs among

the relevant liquid-fuel physical and chemical properties and to easily screen a great number of possible fuels as a foundation for calculations employing more sophisticated and realistic rocket models.
Author
Hydrocarbon Fuels; Rocket Propellants; Applications Programs (Computers); Computerized Simulation; Enthalpy; Mixing Ratios; Performance Prediction; Tradeoffs

20020073489 Alliant Ammunition and Powder Co., LLC, Radford, VA USA
Material Characterization of Elastomeric and Gel Propellants
Yu, Johnny, Alliant Ammunition and Powder Co., LLC, USA; JANNAF 30th Propellant Development and Characterization Subcommittee Meeting; March 2002; Volume 1, pp. 97-106; In English; Also announced as 20020073479; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

High-energy solid propellant systems, either in elastomeric or gel forms, may contain a significant amount of fillers. The micro voids that exist in such material systems affect the compressibility or the apparent bulk modulus of the material. The insufficient adhesion or dewetting between energetic fillers such as RDX or HMX and polymer binder could also lead to larger voids or crack formation under tension or shearing load. Understanding the material property of propellant at its initial stage is important to the structural integrity and performance of rocket motor, especially when the propellant grain is in a constrained configuration. Determination of bulk modulus or Poisson's ratio, however, is difficult for elastomeric or gel propellants. For example, the Poisson's ratio for HTPB type composite propellants is very close to 0.5. Their volume changes sometimes require highly sensitive apparatus like optical extensometer to detect the slight dimension change. Often, five or more significant digits of Poisson's ratio are needed to calculate reliable bulk modulus data. Here, we propose an indirect method to measure the force transmission within a propellant cylinder under compression so as to determine its Poisson's ratio or the bulk modulus, if the shear modulus is known. Theoretical prediction shows that the pressure attenuation is very sensitive to changes of bulk modulus. In addition, this technique can determine the stress-free temperature of the material system if the propellant is bonded to liner or case. Knowing the stress-free temperature is important in the aspect that the residual stress due to the coefficient of thermal expansion mismatch between propellant and binder plays a crucial role in crack initiation and propagation. Based on the correspondence principle, dynamic measurements can also be used to measure Poisson's ratio or bulk modulus as a function of frequency. Fundamental information on the material property would contribute to the understanding of propellant performance and possibly provide guideline for the synthesis of better energetic materials.
Author
Bulk Modulus; Solid Rocket Propellants; Gelled Propellants; Poisson Ratio; Propellant Binders; Stress Propagation; Internal Friction; Numerical Analysis; Residual Stress; Thermal Expansion; Crack Initiation

20020073490 Alliant Ammunition and Powder Co., LLC, Radford, VA USA
Modeling of Pin Flex in 7-Perf Extrusion Die
Chan, T. W., Alliant Ammunition and Powder Co., LLC, USA; Yu, J., Alliant Ammunition and Powder Co., LLC, USA; JANNAF 30th Propellant Development and Characterization Subcommittee Meeting; March 2002; Volume 1, pp. 107-118; In English; Also announced as 20020073479; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

A flow modeling study was carried out to obtain information for die design and process control improvements. A commercial code based on the finite element method was used to simulate the flow of a triple-base propellant through a 7-perf die. Pin flex was estimated by treating a die pin as a cantilever beam. Modeling results show that between the two die variables considered, pin flex is more sensitive to the length of the die land than to the die approach angle. Pin flex is large and towards the die wall for dies with a long die land. Shortening the die land will reduce pin flex and eventually change the flex direction. Pin flex remains small and relatively unchanged over a wide range of die approach angles, but becomes large and towards the center outside this range. The lower the wall slip the more the pin will flex towards the die wall. With partial slip at the wall, the higher the solvent content the larger the pin flex in the direction of the die wall. The pin flex changes direction as the solvent content is reduced below a certain value. Ram rate control is important as pin flex is very sensitive to ram rate. Pin flex is towards the die wall at high ram rates and reverses direction as the ram rate is lowered. Variations in pin flex are to be expected at start-up and near the end of an extrusion run. Generally the lower the temperature the higher the tendency of the pin to flex towards the center. But temperature has a smaller effect on pin flex than the other variables.
Author
Propellants; Computerized Simulation; Burning Rate; Computational Fluid Dynamics; Numerical Analysis; Dynamic Models; Flow Characteristics

20020073491 Johns Hopkins Univ., Applied Physics Lab., Laurel, MD USA

Nondestructive Monitoring of Composite and Nitrate-Ester Based Tomahawk Propellants by Headspace Vapor Absorption

Hunter, Lawrence W., Johns Hopkins Univ., USA; Costigan, Sharon L., Johns Hopkins Univ., USA; Lawrence, David S., Johns Hopkins Univ., USA; JANNAF 30th Propellant Development and Characterization Subcommittee Meeting; March 2002; Volume 1, pp. 119-127; In English; Also announced as 20020073479

Contract(s)/Grant(s): N00024-98-D-8124; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Progress has continued on the development of nondestructive methods for monitoring solid propellants in motors. Many of the chemical components in solid propellants, including original ingredients and decomposition products resulting from aging, support vapors in the headspace over the propellant inside the motor. Due to their low partial pressures, these vapors are not usually detectable by gas sampling. However, certain polymeric materials are able to absorb and concentrate the vapors for eventual chromatographic detection. We have exposed the absorbents to the headspace above the propellant in two ways. First, the absorbents can be coated on a single small fiber that is left in place preferably overnight (or longer) and later removed for analysis in a chemical laboratory. Second, the absorbent can be coated on a filter through which the headspace gases and vapors are purged. This paper describes application of both approaches to small samples of propellant from a Tomahawk Mk 75 gas generator and a Tomahawk Mk 106 motor. The gas generator propellant is nitroglycerin-based. Propellant stabilizers and one stabilizer daughter product were detected in the vapor samples of the gas generator propellant, as well as nitroglycerin. Results for a series of gas generator propellant samples taken at two different depths from the propellant surface agreed with the known trend that the stabilizers are depleted near the surface. The motor propellant, on the other hand, is composite. Vapor samples of the motor propellant detected a plasticizer and its decomposition product.

Author

Solid Rocket Propellants; Nitrate Esters; Nondestructive Tests; Solid Propellant Rocket Engines; Absorbents; Gas Chromatography; Vapors; Sampling

20020073492 Geo-Centers, Inc., USA

Stabilizer Determination in Solid Propellant Using Near Infrared Spectroscopy

Hardmeyer, E. K., Geo-Centers, Inc., USA; Kansas, L. D., Geo-Centers, Inc., USA; DeAngelis, T. P., Geo-Centers, Inc., USA; Herbst, D. L., Department of the Army, USA; JANNAF 30th Propellant Development and Characterization Subcommittee Meeting; March 2002; Volume 1, pp. 129-135; In English; Also announced as 20020073479

Contract(s)/Grant(s): DAAE30-00-D-1009; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Stabilizer content of single and double base propellant is determined by means of a scanning near-infrared spectrometer in the diffuse reflectance mode. No sample pre-treatment is employed. Calibration models are developed using standard chemometric methods. All results are within 0.20 % (absolute) of the reference HPLC method. Pass/fail thresholds are set. Calibrations models are transferred to multiple instruments, which will be used for screening propellant in the field to identify potential unstable lots.

Author

Solid Propellants; Propellant Chemistry; Infrared Spectrometers; Chemical Analysis; Calibrating; Models

20020073493 Naval Surface Warfare Center, Indian Head, MD USA

Use of an Adjustable-Gap On-Line Rheometer for the Characterization of the Wall Slip and Shear Viscosity Behavior of LOVA EX-99

Prickett, Suzanne E., Naval Surface Warfare Center, USA; Kalyon, Dilhan M., Stevens Inst. of Tech., USA; Brough, John E., Naval Surface Warfare Center, USA; Johnson, Sharperson G., Naval Surface Warfare Center, USA; Murphy, Constance M., Naval Surface Warfare Center, USA; Thomas, G. Wayne, Naval Surface Warfare Center, USA; JANNAF 30th Propellant Development and Characterization Subcommittee Meeting; March 2002; Volume 1, pp. 137-152; In English; Also announced as 20020073479; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

It is difficult to characterize the rheological behavior of structured fluids after removing them from the confines of processing equipment. These fluids include energetic suspensions, dispersions, gels and systems involving solvents. The use of an on-line slit rheometer with an adjustable gap, used in conjunction with the extrusion process, offers very significant advantages. The gap of the rheometer is varied, which changes the wall shear rate. A series of pressure transducers, flush with the wall, are used to determine the pressure drop. Hence, the wall shear stress can be determined over the fully developed flow region. The ability to independently vary the mass flow rate and the gap opening allows one to carryout the wall slip corrections and hence obtain the

wall slip velocity versus the shear stress data. These data can be used as the boundary condition during simulations of die and extrusion flows and also allow the determination of accurate shear viscosity data. NSWC has an on-line slit rheometer with a continuously adjustable gap. This rheometer was used to systematically collect data needed to generate the wall slip velocity as well as the shear viscosity material function of a LOVA formulation. Tests were run varying the deformation rate (gap height), solvent concentration, and temperature. to our knowledge this is the first time that on-line data could be collected to enable the characterization of the wall slip and the shear viscosity material function of an energetic suspension.
Author
Computational Fluid Dynamics; Rheometers; Nonnewtonian Fluids; Viscoplasticity; Shear Stress; Wall Pressure; Flow Characteristics

20020073494 Army Research Lab., USA
Surface Characterization of Energetic Materials Using Point-to-Point Contact FTIR-ATR
Newberry, Joyce, Army Research Lab., USA; Kaste, Pamela J., Army Research Lab., USA; Bunte, Steven W., Army Research Lab., USA; Pesce-Rodriguez, Rose A., Army Research Lab., USA; JANNAF 30th Propellant Development and Characterization Subcommittee Meeting; March 2002; Volume 1, pp. 153-166; In English; Also announced as 20020073479; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Surface characterization of energetic materials and their components has been a useful tool for resolving many research and quality control issues. An important application for gun propulsion is the understanding of plasma-propellant interactions (PPI) in order to exploit plasma ignition, which offers the potential for rapid, controlled ignition of high energy density charges. Towards this end, the surface characterization of double base and composite propellant samples from two configurations of open air plasma, and from interrupted closed bomb experiments, has been undertaken. The surface characterization was performed using three commercially-available FTIR spectroscopy techniques: specular reflectance micro-spectroscopy, diamond attenuated total reflection (ATR) micro-spectroscopy and macro ATR using a Macro-ATR (Thunderdome, Spectra-Tech, Inc.). Each technique offers advantages, depending on the application. For the analysis of JA2 samples exposed to plasma, the spectra obtained using the Macro-ATR attachment most clearly showed the presence of denitrated decomposition products, and suggest that the first site of denitration is a secondary carbon. The denitrated species does not appear to migrate, suggesting that NC (with two secondary carbons) is the component affected. Diethylene glycol dinitrate (which has no secondary carbons) was recovered from denitrated JA2, but showed no evidence of denitration. Nitroglycerin does contain one secondary carbon (and two primary carbons), and would also be a candidate for denitration. However nondegraded NG is known to migrate, and the spectral results indicate that no migration has occurred.
Author
Surface Properties; Gun Propellants; Plasma-Particle Interactions; Infrared Spectroscopy; Ignition; Chemical Analysis

20020073498 Directorate of Aerospace Fuels, Vandenberg AFB, CA USA
2000 Comparison of N2O4 Analyses by Five Laboratories
Wurzbach, Roy, Directorate of Aerospace Fuels, USA; Hunter, Philip, Air Force Center for Environmental Excellence, USA; JANNAF 30th Propellant Development and Characterization Subcommittee Meeting; March 2002; Volume 1, pp. 223-239; In English; Also announced as 20020073479; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Five laboratories participated in an interlaboratory study (ILS) of the variances associated with the measurement of the following attributes found in propellant dinitrogen tetroxide (N2O4): nitric oxide (NO) percent by weight (wt%); assay wt%; and iron content (ppmw). Three separate batches of dinitrogen tetroxide (N2O4) were submitted to the five laboratories. These analyses of propellant N204 are required for specification conformance testing and quality assurance of missile propellants. The paramount purpose of this investigation was to determine the repeatability and reproducibility of reported NO wt% content in N2O4. One laboratory consistently reported lower NO wt% values than the other laboratories. A subsequent publication will describe the statistical analyses of the water, chloride and nonvolatile residue contents found in these samples.
Author
Nitric Oxide; Solid Rocket Propellants; Chemical Analysis; Laboratories; Sampling

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.

20020070802 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Mechanical Cryogenic Cooler for the Hubble Space Telescope
Jedrich, Nicholas, Jackson and Tull, Inc., USA; Zimbelman, Darell, NASA Goddard Space Flight Center, USA; Swift, Walter, Creare X, Inc., USA; Dolan, Francis, Creare X, Inc., USA; [2002]; 8p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper presents a description of the Hubble Space Telescope (HST) Near-Infrared Camera and Multi-Object Spectrometer (NICMOS) Cryo Cooler (NCC), the cutting edge technology involved, its evolution, performance, and future space applications. The NCC is the primary hardware component of the NICMOS Cooling System comprised of the NCC, an Electronics Support Module, a Capillary Pumped Loop/Radiator, and associated interface harnessing. The system will be installed during extravehicular activities on HST during Servicing Mission 3B scheduled for launch in February 2002. The NCC will be used to revive the NICMOS instrument, which experienced a reduced operational lifetime due to an internal thermal short in its dewar structure, and restore HST scientific infrared capability to operational status. The NCC is a state-of-the-art reverse Turbo-Brayton cycle cooler employing gas bearing micro turbo machinery, driven by advanced power conversion electronics, operating at speeds up to 7300 revolutions per second (rps) to remove heat from the NICMOS instrument.
Author
Cameras; Spectrometers; Cryogenic Equipment; Cryogenic Cooling; Hubble Space Telescope

20020072741 NASA Marshall Space Flight Center, Huntsville, AL USA
Space Product Development: NASA Partnering With Industry For Out of This World Results
Nall, Mark E., NASA Marshall Space Flight Center, USA; Casas, Joe, NASA Marshall Space Flight Center, USA; Powers, Blake, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 23rd International Symposium on Space Technology and Science, 26 May - 2 Jun. 2002, Matsue, Japan; No Copyright; Avail: Issuing Activity; Abstract Only

True space commercialization can only be achieved through having the broadest possible industrial participation. Commercial paradigms focused simply on commercial launch operations are not viable since there are limited payload launch opportunities in terms of satellites and similar vehicles, and there are not yet sufficient markets to support large-scale operations and innovation. What is required to expand commercial operations to the point of viability is a broad base of industry that understands the opportunities of commercial space and microgravity operations, and is eager to take advantage of it. Interesting non-aerospace companies in commercial space and microgravity research or operations is a major challenge, since these companies must be educated about the opportunities, introduced into the process in an effective and comfortable manner, and encouraged to continue and expand their work in this area. The NASA Space Product Development Program does this through fifteen Commercial Space Centers located across the USA, each focusing on a different area of interest to industry rather than of interest to NASA. These Centers serve as a consortium of industry, academia, and government, bringing the synergistic effects of membership to the benefit of all. This paper will discuss the guiding philosophies of this program, its organization, the successes obtained by industry in a variety of fields, and the success NASA is experiencing in building the broad base of industry needed to achieve true space commercialization.
Author
Space Commercialization; Aerospace Technology Transfer; NASA Space Programs; Product Development; Industries

20020073093 Johns Hopkins Univ., Chemical Propulsion Information Agency, Columbia, MD USA
26th JANNAF Airbreathing Propulsion Subcommittee Meeting, Volume 1, *Nov. 2000 - Apr. 2002*
Fry, Ronald S., Editor, Johns Hopkins Univ., USA; Gannaway, Mary T., Editor, Johns Hopkins Univ., USA; April 2002; 368p; In English, 8-12 Apr. 2002, Destin, FL, USA; Sponsored by NASA, USA; Also announced as 20020073094 through 20020073121
Contract(s)/Grant(s): SPO700-97-D-4004
Report No.(s): CPIA-Publ-713-Vol-1; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

This volume, the first of four volumes, is a collection of 28 unclassified/unlimited-distribution papers which were presented at the Joint Army-Navy-NASA-Air Force (JANNAF) 26th Airbreathing Propulsion Subcommittee (APS) was held jointly with the 38th Combustion Subcommittee (CS), 20th Propulsion Systems Hazards Subcommittee (PSHS), and 2nd Modeling and

Simulation Subcommittee. The meeting was held 8-12 April 2002 at the Bayside Inn at The Sandestin Golf & Beach Resort and Eglin Air Force Base, Destin, Florida. Topics covered include: scramjet and ramjet R&D program overviews; tactical propulsion; space access; NASA GTX status; PDE technology; actively cooled engine structures; modeling and simulation of complex hydrocarbon fuels and unsteady processes; and component modeling and simulation.
Author
Conferences; Supersonic Combustion Ramjet Engines; Research and Development; Propulsion System Configurations

20020073133 Naval Research Lab., Washington, DC USA
Design, Development, and Testing of a Lightweight Optical Sensor Cover System
Hurley, Mike, Naval Research Lab., USA; Christiansen, Scott, Starsys Research Corp., USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 135-140; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

This paper discusses aspects of the design, development and testing of the sensor cover on the Clementine (DSPSE (Deep Space Program Science Experiment)) spacecraft. Particular attention is given to defining the typically ambiguous issue of cleanliness (i.e. how clean is clean?). to characterize performance with respect to these requirements, a simple and effective method for testing prototype seals was developed. This testing was useful for comparing various types of seals as well as for providing information about achievable cleanliness levels. The results were invaluable input for defining a realistic final cleanliness requirement that satisfied everyone from mechanisms to sensor engineers. Balancing torque margins (reliability) versus cost and/or weight of the system can be significantly influenced by choice of seal type. Several seal types are discussed in terms of both cleanliness and ease of implementation. These design issues influence actuator selection and structural integrity of the door. The cover system designed and fabricated as described above was thoroughly tested both on a component level and on the Clementine system level. Testing included characterization, vibration, pyro-shock, life, and thermal/vacuum. The extensive testing identified problems early enough that they could be resolved prior to integration and launch.
Author
Cleanliness; Optical Measuring Instruments; Seals (Stoppers); Tests; Protectors

20020073134 Lockheed Engineering and Sciences Co., Houston, TX USA
Energy Absorber for the CETA
Wesselski, Clarence J., Lockheed Engineering and Sciences Co., USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 141-145; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The energy absorber that has been developed for the CETA (Crew Equipment and Translation Aid) on Space Station Freedom is a metal on metal frictional type and has a load regulating feature that prevents excessive stroking loads from occurring while in operation. This paper highlights some of the design and operating aspects and the testing of this energy absorber.
Author
Stroking Tests; Energy Absorption; Extravehicular Activity

20020073136 Lockheed Engineering and Sciences Co., Houston, TX USA
Pip Pin Reliability and Design
Skyles, Lane P., Lockheed Engineering and Sciences Co., USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 153-158; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

Pip pins are used in many engineering applications. of particular interest to the aerospace industry is their use in various mechanism designs. Many payloads that fly aboard our nation's Space Shuttle have at least one actuated mechanism. Often these mechanisms incorporate pip pins in their design in order to fasten interfacing parts or joints. Pip pins are most often used when an astronaut will have a direct interface with the mechanism. This interfacing can be done during Space Shuttle mission EVAS (Extra Vehicular Activities). The main reason for incorporating pip pins is convenience and their ability to provide quick release of interfacing parts. However, there are some issues that must be taken into account when using them in a design. These issues include documented failures and quality control problems when using substandard pip pins. A history of pip pins as they relate to the aerospace industry as well as general reliable design features is discussed.
Author
Pins; Reliability; Design; Fabrication

20020073138 Dornier-Werke G.m.b.H., Friedrichshafen, Germany
High Precision Moving Magnet Chopper for Variable Operation Conditions
Aicher, Winfried, Dornier-Werke G.m.b.H., Germany; Schmid, Manfred, Dornier-Werke G.m.b.H., Germany; 28th Aerospace

Mechanisms Symposium; May 1994, pp. 167-181; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

In the frame work of an ESTEC technology contract a Chopping Mechanism was developed and built with FIRST (Far Infrared and Submillimeter Telescope) astronomy mission as a reference. The task of the mechanism is to tilt the subreflector of the telescope with an assumed mass of 2.5 kg about one chopping axis at nominal frequencies of up to 5 Hz and chopping angles of up to +/- 11.25 mrad with high efficiency (minimum time for position change). The chopping axis is required to run through the subreflector vertex. After performing a concept trade-off also considering the low operational temperatures in the 130 K range, a design using moving magnet actuators was found to be the favorite one. In addition, a bearing concept using flexible pivots was chosen to meet the high chopping accuracy required. With this general concept approach a very reliable design could be realized since the actuators work without any mechanical contact between its moving and fixed parts and the only bearings used are two flexible pivots supporting the subreflector mounting interface. The mechanism was completely built in titanium in a lightweight and stiff design, the moving magnet actuators were designed to meet the stringent requirements for minimum risetime (time necessary to move from one angular position to a new one) in the 20 msec range. The angular position and the corresponding chopping frequency as well can be arbitrarily selected by the user.

Author

Subreflectors; Actuators; Adjusting; Pivots

20020073140 California Univ., Space Sciences Lab., Berkeley, CA USA

Design and Performance of the Telescope and Detector Covers on the Extreme Ultraviolet Explorer Satellite

Tom, James L., California Univ., USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 199-209; In English; Also announced as 20020073122

Contract(s)/Grant(s): NAS5-29298; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

Two cover mechanisms were designed and developed for the Extreme Ultraviolet Explorer (EUVE) science payload to keep the EUVE telescope mirrors and detectors sealed from the atmospheric environment until the spacecraft was placed into orbit. There were four telescope front covers and seven motorized detector covers on the EUVE science payload. The EUVE satellite was launched into orbit in June 1992 and all the covers operated successfully after launch. This success can be attributed to high design margins and extensive testing at each level of assembly. This paper describes the design of the telescope front covers and the motorized detector covers. This paper also discusses some of the many design considerations and modifications made as performance and reliability problems became apparent from each phase of testing.

Author

Mirrors; Satellite-Borne Instruments; Protectors

20020073151 TiNi Alloy Co., San Leandro, CA USA

Implementation of Heaters on Thermally Actuated Spacecraft Mechanisms

Busch, John D., TiNi Alloy Co., USA; Bokaie, Michael D., TiNi Alloy Co., USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 379-393; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

This paper presents general insight into the design and implementation of heaters as used in actuating mechanisms for spacecraft. Problems and considerations that were encountered during development of the Deep Space Probe and Science Experiment (DSPSE) solar array release mechanism are discussed. Obstacles included large expected fluctuations in ambient temperature, variations in voltage supply levels, outgassing concerns, heater circuit design, materials selection, and power control options. Successful resolution of these issues helped to establish a methodology which can be applied to many of the heater design challenges found in thermally actuated mechanisms.

Author

Heating Equipment; Actuators; Shape Memory Alloys; Bolts

20020073210 Washington State Transportation Commission, Seattle, WA USA

Effects of Large Overwater Structures on Epibenthic Juvenile Salmon Prey Assemblages in Puget Sound, Washington

Haas, M. E.; Simenstad, C. A.; Cordell, J. R.; Beauchamp, D. A.; Miller, B. S.; Jun. 2002; 126p; In English

Report No.(s): PB2002-108240; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Although large over-water structures alter nearshore habitat in a number of ways, little work has been done to study how docks affect nearshore fauna. In Puget Sound, juvenile chum, pink, and oceantype chinook salmon migrate along the shorelines and feed extensively on shallow water epibenthic invertebrates. As part of an ongoing project on the effects of ferry terminals on juvenile salmon, this study looked at the effects of large overwater structures on juvenile salmon and their prey. The epibenthic assemblage was sampled for juvenile salmon prey with four sampling regimes: monthly-stratified sampling of epibenthic invertebrates at three

terminals, one-time eelgrass patch at a single terminal, onetime high-resolution cross-terminal at a single terminal, and one-time terminal structure sampling at two terminals. The response variables tested included taxa richness and densities of (1) total epibenthos, (2) total juvenile salmon prey, (3) common or abundant salmon prey taxa and (4) common or abundant nonsalmon prey taxa.
NTIS
Habitats; Shorelines; Drydocks

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.

20020073077 NASA Glenn Research Center, Cleveland, OH USA
Folded Coplanar Waveguide Slot Antenna on Silicon Substrates With a Polyimide Interface Layer
Bacon, Andrew, Georgia Inst. of Tech., USA; Ponchak, George E., NASA Glenn Research Center, USA; Papapolymerou, John, Georgia Inst. of Tech., USA; Bushyager, Nathan, Georgia Inst. of Tech., USA; Tentzeris, Manos, Georgia Inst. of Tech., USA; [2002]; 4p; In English; 2002 IEEE International Symposium on Antennas and Propagation, 16-21 Jun. 2002, San Antonio. TX, USA
Contract(s)/Grant(s): NSF 01-96376; NSF 99-89761; RTOP 755-08-0B; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
A novel mm-wave Coplanar Waveguide (CPW) folded slot antenna is characterized on low-resistivity Si substrate (1 omega-cm) and a high resistivity Si substrate with a polyimide interface layer for the first time. The antenna resonates around 30 GHz with a return loss greater than 14.6 dB. Measured radiation patterns indicate the existence of a main lobe, but the radiation pattern is affected by a strong surface wave mode, which is greater in the high resistivity Si wafer.
Author
Waveguide Antennas; Slot Antennas; Antenna Radiation Patterns; Electrical Resistivity

20020073150 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The Galileo High Gain Antenna Deployment Anomaly
Johnson, Michael R., Jet Propulsion Lab., California Inst. of Tech., USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 359-377; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche
On April 11, 1991, the Galileo spacecraft executed a sequence that would open the spacecraft's High Gain Antenna. The antenna's launch restraint had been released just after launch, but the antenna was left undeployed to protect it from the heat of the sun. During the deployment sequence, the antenna, which opens like an umbrella, never reached the fully deployed position. The analyses and tests that followed allowed a conclusive determination of the likely failure mechanism and pointed to some strategies to use for recovery of the high gain antenna.
Author
Galileo Spacecraft; Spacecraft Antennas; Deployment; Failure Analysis

20020073445 NASA Glenn Research Center, Cleveland, OH USA
A Low Cost Traveling Wave Tube for Wireless Communications
Vancil, Bernard Kenneth, FDE Associates, USA; Wintucky, Edwin G., NASA Glenn Research Center, USA; [2002]; 4p; In English; 2002 IEEE MIT-S International Microwave Symposium, 3-7 Jun. 2002, Seattle, WA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): NAS3-01003; RTOP 253-02-99; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
Demand for high data rate wireless communications is pushing up amplifier power, bandwidth and frequency requirements. Some systems are using vacuum electron devices again because solid-state power amplifiers are not able to efficiently meet the new requirements. The traveling wave tube is the VED of choice because of its excellent broadband capability as well as high power efficiency and frequency. But TWTs are very expensive on a per watt basis below about 200 watts of output power. We propose a new traveling wave tube that utilizes cathode ray tube construction technology and electrostatic focusing. We believe

the tube can be built in quantity for under $1,000 each. We discuss several traveling wave tube slow wave circuits that lend themselves to the new construction. We will present modeling results and data on prototype devices.
Author
Wireless Communication; Low Cost; Traveling Wave Tubes; Solid State Devices; Power Amplifiers; Cathode Ray Tubes

20020073448 Ljubljana Univ., Fakulteta za Elektrotehniko, Ljubljana, Slovenia
3-D Image Enhancement in Wavelet Video Coding Systems ***3-D Izboljsva Slik v Sistemih Kodiranja Videa z Valcno Transformacijo***
Skocir, Primoz, Ljubljana Univ., Slovenia; Tasic, Jurij, Ljubljana Univ., Slovenia; Electrotechnical Review; 2002; ISSN 0013-5852; Volume 69, No. 2, pp. 151-156; In Slovene; Copyright; Avail: Issuing Activity

In this paper an enhanced 3-D postprocessing approach to compression artifact reduction is presented. There are two strategies commonly adopted to reduce compression artifacts. For a given decoding algorithm and a bit rate constraint, the quality of reconstructed images can be enhanced by prefiltering techniques [1] that remove unnoticeable details in source images so that less information has to be coded. Postprocessing [2] is adopted to remove compression artifacts without increasing the bit rate or modifying the coding procedure. We propose a scheme for wavelet compressed video postprocessing based on modified Gaussian filtering of similar gray lavel areas. Our method is based on a 3-D postprocessing approach, which we significantly changed to improve performance of postprocessing. Filtering made with the spatial Gaussian function of the pixel location and differences in the pixel gray levels [3] preserve edges and image details and its extension to 3-D improve the results.
Author
Coding; Image Enhancement; Video Compression; Wavelet Analysis; Three Dimensional Models

20020073455 Ljubljana Univ., Fakulteta za Elektrotehniko, Yugoslavia
A New Approach to Three-Dimensional Wavelet Based Video Coding ***Nov Pristop h Kodiranju Videa na Podlagi Tridimenzionalne Valcne Transformacije z Izravnavo Gibanja***
Marusic, Bostjan, Ljubljana Univ., Yugoslavia; Tasic, Jurij, Ljubljana Univ., Yugoslavia; Electrotechnical Review; 2002; ISSN 0013-5852; Volume 69, No. 2, pp. 135-142; In Slovene; Copyright; Avail: Issuing Activity

This paper presents a new approach to video coding that instead of building on the hybrid (transform+prediction) coding paradigm relies upon a three-dimensional transform for the decorrelation of video frames. In order to take into account the specific correlation patterns along the temporal axis that are due to video object movement, motion compensation is intrinsically integrated into the transform computation. The transform is a three-dimensional extension of the wavelet transform, which is in this paper referred to as MC3DWT. Block based motion estimation (halfpixel accurate) is used to obtain motion information needed for transform computation. This results in some cases results in unconnected pixels that need to be preserved in order to guarantee perfect reconstruction of the inverse transform. The unconnected pixels are treated as shown in Figure 2. In order to diminish the computational burden, block motion estimation is performed on fixed-size macroblocks. The coding efficiency gap, which is introduced by the simplified motion estimation, is compensated by the application of effective entropy coding, i.e. context arithmetic coding. Simulation results reported in the paper show that the proposed approach is superior in performance to coders designed according to the hybrid-coding paradigm. The approach is also competitive with state-of-the-art video coders, more specifically it is competitive with the 3D SPIHT coder especially in intensive motion sequences.
Author
Coding; Wavelet Analysis; Three Dimensional Models; Video Communication; Computerized Simulation

20020073824 NASTEC, Inc., Cleveland, OH USA
Design and Testing of an Electromagnetic Coupling
Anderson, William J., NASTEC, Inc., USA; 20th Aerospace Mechanisms Symposium; May 1986, pp. 31-43; In English; Also announced as 20020073821; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Hostile environments such as the hard vacuum of space, and exposure to water or caustic fluids have fostered the development of devices which allow mechanical rotary feed throughs with positive sealing without the use of conventional dynamic seals. One such device is an electromagnetic coupling which transfers motion across a hermetic seal by means of a rotating magnetic field. Static pull-out torque and dynamic heat build-up and pull-out torque tests of a synchronous reluctance homopolar coupling are reported herein. Coupling efficiencies are estimated for a range of speeds and torques.
Author
Electromagnetic Coupling; Hermetic Seals; Magnetic Fields; Torque; Electromechanical Devices

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ELECTRONICS AND ELECTRICAL ENGINEERING

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

20020070917 DYNACS Engineering Co., Inc., Cocoa Beach, FL USA
Signal Conditioning Amplifier and Recorder (SCAmpR)
Medelius, Pedro J., DYNACS Engineering Co., Inc., USA; Jul. 30, 2002; 20p; In English; NASA Advanced Sensors Symposium, 30 Jul. 2002, Baltimore, MD, USA
Contract(s)/Grant(s): NAS10-98001
Report No.(s): KSC-2002-99; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The Signal Conditioning Amplifier and Recorder (SCAmpR) system is presented. The topics include: 1) System Description; 2) Universal Signal Conditioning Amplifier (USCA); 3) Advanced Data Acquisition System (ADAS); and 4) Signal Conditioning Amplifier and Recorder (SCAmpR). This paper is presented in viewgraph form.
CASI
Signal Processing; Amplifiers; Recording Instruments; Systems Engineering

20020072730 NASA Marshall Space Flight Center, Huntsville, AL USA
Simulation Model of A Ferroelectric Field Effect Transistor
MacLeod, Todd C., NASA Marshall Space Flight Center, USA; Ho, Fat Duen, Alabama Univ., USA; Mar. 13, 2002; 1p; In English; International Joint Conference on the Applications of Ferroelectrics 2002, 28 May 2002, Nara, Japan
Contract(s)/Grant(s): RTOP 430-04-00; No Copyright; Avail: Issuing Activity; Abstract Only
An electronic simulation model has been developed of a ferroelectric field effect transistor (FFET). This model can be used in standard electrical circuit simulation programs to simulate the main characteristics of the FFET. The model uses a previously developed algorithm that incorporates partial polarization as a basis for the design. The model has the main characteristics of the FFET, which are the current hysterisis with different gate voltages and decay of the drain current when the gate voltage is off. The drain current has values matching actual FFET's, which were measured experimentally. The input and output resistance in the model is similar to that of the FFET. The model is valid for all frequencies below RF levels. A variety of different ferroelectric material characteristics can be modeled. The model can be used to design circuits using FFET'S with standard electrical simulation packages. The circuit can be used in designing non-volatile memory circuits and logic circuits and is compatible with all SPICE based circuit analysis programs. The model is a drop in library that integrates seamlessly into a SPICE simulation. A comparison is made between the model and experimental data measured from an actual FFET.
Author
Field Effect Transistors; Computerized Simulation; Circuits

20020072844 NASA Glenn Research Center, Cleveland, OH USA
Miniature Reservoir Cathode: An Update
Vancil, Bernard K., FDE Associates, USA; Wintucky, Edwin G., NASA Glenn Research Center, USA; [2002]; 3p; In English; 2002 IEEE International Vacuum Electron Sources Conference (IVESC-2002), 15-19 Jul. 2002, Saratov, Russia; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): NAS3-00008; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
We report on recent work to produce a small low power, low cost reservoir cathode capable of long life (more than 100,000 hours) at high loading (> 5 A/sq cm). Our objective is a highly manufacturable, commercial device costing less than $30. Small highly loaded cathodes are needed, especially for millimeter wave tubes, where focusing becomes difficult when area convergence ratios are too high. We currently have 3 models ranging from .060-inch diameter to. 125-inch diameter. Reservoir type barium dispenser cathodes have a demonstrated capability for simultaneous high emission density and long life. Seven reservoir cathodes continue to operate on the cathode life test facility at NSWC, Crane, Indiana at 2 and 4 amps/sq cm. They have accumulated nearly 100,000 hours with practically no change in emission levels or knee temperature.
Author
Cathodes; Microwave Tubes; Reservoirs; Low Cost; Millimeter Waves

20020072947 National Defence Research Establishment, Div. of Sensor Technology, Linkoeping, Sweden

RCS Measurement Uncertainty in the Large Anechoic Chamber at FOA ***Maetosekerhet vid Radarmalareamaetningar i Stora Maethallen vid FOA***

Loethegard, J.; Mar. 2000; 20p; In Swedish

Report No.(s): PB2002-105112; FOA-R-00-01451-615-SE; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A careful uncertainty analysis must be made in all measurements and when reporting measurement result, in order to maintain a high measuring quality. Measurement uncertainties must be analyzed and presented in a special chapter, when reporting measurement results, according to FOA's instructions. The National Institute of Standards and Technologies (NIST), US, has presented a standardized uncertainty analysis model. The model treats uncertainties in a radar measurement system. An investigation is made in this report with the purpose of seeing if the model can be used when performing radar cross section measurements in the large anechoic chamber in Linkoping. The result of the investigation is that the suggested analysis model forms a good foundation when continuing the work with uncertainty analysis in the large anechoic chamber. More measurements need to be done in order to get on with the analysis and to be able to investigate the importance of the different components of uncertainty.

NTIS

Standardization; Radar Measurement; Anechoic Chambers

20020072974 California Univ., Lawrence Berkeley National Lab., Berkeley, CA USA

Worldwide Review of Standby Power Use in Homes

Meier, A. K.; 2002; 10p; In English

Report No.(s): DE2002-795343; No Copyright; Avail: Department of Energy Information Bridge

Standby power use is the electricity consumed by appliances when they are switched off or not performing their primary purpose. Results from 21 separate field studies of residential standby power use and eight bottom-up national estimates of standby power use in 17 countries were compiled. Average standby power use in the field measurements ranges from about 30 W in China to over 100 W in New Zealand and the USA. The weighted average of the measurements was about 50 W. The bottom-up estimates found that standby power was responsible for 3-12 percent of residential electricity use. There is insufficient information to determine if standby power use is increasing or declining.

NTIS

Electricity; Residential Areas; Housings; Electric Generators

20020073072 FDE Associates, Beaverton, OR USA

A Low Cost Electrostatically Focused TWT

Vancil, Bernard K., FDE Associates, USA; Wintucky, Edwin G., NASA Glenn Research Center, USA; [2002]; 2p; In English; 3rd IEEE International Vacuum Electronics Conference, 23-25 Apr. 2002, Monterey, CA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA; Original contains color illustrations

Contract(s)/Grant(s): NAS3-01003; RTOP 253-02-99; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Ring-loop circuits are well known for their simplicity, low cost, compactness, low mass, high gain and efficiency and absence of backward wave oscillations. Peak powers over 20 kw have been achieved. They also have low harmonic output and excellent phase performance. We have developed a double ring-loop circuit that permits electrostatic focusing of an electron beam to at least 0.4 micro pervs. This eliminates the magnet stack and further lowers cost and weight. It permits glass rod fastening of circuit elements as well as gun and collector assemblies, as is done in cathode ray tubes. Using CRT construction techniques, the TWT can be built on automated equipment.

Author

Traveling Wave Tubes; Circuits; Electron Beams; Low Cost

20020073390 Maribor Univ., Fakulteta za Elektrotehniko, Racunalnistvo in Informatiko, Maribor, Slovenia

Transient Eddy Current Calculation with Finite Element Method ***Tranzientni Izracun AVrtincnih Tokov Z Metodo Koncnih Elementov***

Jesenik, Marko, Maribor Univ., Slovenia; Trlep, Mladen, Maribor Univ., Slovenia; Stumberger, Bojan, Maribor Univ., Slovenia; Hamler, Anton, Maribor Univ., Slovenia; Electrotechnical Review; 2002; ISSN 0013-5852; Volume 69, No. 2, pp. 101-106; In Slovene; Copyright; Avail: Issuing Activity

In the paper a three dimensional eddy current calculation is shown. Three different methods are used for the time integration. They are tested on the same example (TEAM problem No. 4). The calculation is based on the use of the magnetic vector potential A and electric scalar potential V in the conducting area and only magnetic vector potential A in the nonconducting area (A, V -

A formulation [1], [2]). In the conducting area, the differential Equations (1) and (2) are solved. In the nonconducting area, the differential Equation (3) is solved. (mu) is the permeability of the material, sigma is the conductivity of the material, and J is the excitation current density.
Author
Current Density; Eddy Currents; Finite Element Method; Three Dimensional Models; Differential Equations; Surges

20020073391 Ljubljana Univ., Faculty of Computer and Information Science, Ljubljana, Slovenia
Feature Extraction and Shape Representation of Ambulatory Electrocardiogram Using the Karhunen-Loeve Transform ***Izlocanje Znacilk in Predstavljanje Oblik Ambulantnega Elektrokardiograma z Uporabo Transformacije Karhunena in Loeveja***
Jager, Franc, Ljubljana Univ., Slovenia; Electrotechnical Review; 2002; ISSN 0013-5852; Volume 69, No. 2, pp. 83-89; In English; Copyright; Avail: Issuing Activity

We developed a new approach to feature extraction and shape representation of QRS complex and ST segment pattern vectors of ambulatory electrocardiograms using the Karhunen-Loeve transform. We describe applying the Karhunen-Loeve transform to the ambulatory electrocardiogram, derivation of robust covariance matrices using kernel-approximation method and with noisy patterns excluded, a method to estimate sufficient and necessary QRS complex and ST segment Karhunen-Loeve feature-vector dimensionality, and a technique to derive and represent time series of feature vectors.
Author
Electrocardiography; Karhunen-Loeve Expansion; Transformations (Mathematics); Vectors (Mathematics); Shape Functions

20020073393 Ljubljana Univ., Fakulteta za Elektrotehniko, Ljubljana, Slovenia
Improved MESFET Model for Computer Distortion Analysis with Continuous High Order Derivatives ***Izboljsan MESFET Model za Racunalnisko Analizo Popacenj z Zveznimi Odvodi Visjih Redov***
Puhan, Janez, Ljubljana Univ., Slovenia; Fajfar, Iztok, Ljubljana Univ., Slovenia; Burmen, Arpad, Ljubljana Univ., Slovenia; Nussdorfer, Andrej, Ljubljana Univ., Slovenia; Tuma, Tadej, Ljubljana Univ., Slovenia; Electrotechnical Review; 2002; ISSN 0013-5852; Volume 69, No. 2, pp. 113-119; In Slovene; Copyright; Avail: Issuing Activity

The level of harmonic distortion in nonlinear circuits is calculated incorrectly by the Berkeley's Spice3 based circuit analysis programs in several cases. One example is a circuit with a MESFET used as a voltage controlled resistance (Figure 1) at V(sub ds) = 0. An error occurs when Fourier transform is obtained from a previously calculated transient response to a sine input signal. It is caused by unsuitable MESFET model equations. Harmonic distortions generated by weak non-linear two-port networks can be mathematically analysed (equations (1) and (2) for the circuit in Figure 1). An approximate dependency between basic and higher harmonic components can be obtained (3). Thus the second harmonic component amplitude rises with slope two, and the third with slope three, when plotted in log-log scale as a function of the basic component amplitude. This relation is important in high-frequency circuit design to estimate the distortion from the signal level. It is demonstrated that the widely used MESFET model formulation [3] (used also in Spice) violates this relationship (Equations (4) to (11)), which leads to incorrect distortion results (Figure 2). The error is caused by the discontinuity of higher order derivatives in MESFET model equations (Figure 3), and also by the fact that V(sub gs) or V(sub gd) is used depending on the sign of V(sub ds). In this paper, a modification of the MESFET model that eliminates those flaws is proposed. The general MESFET model equations (12) and (13) are transformed into (14). The absolute value function, which causes discontinuities, is replaced with approximation (15). It introduces new model parameters a1 and a2, and initiates a minor shift of threshold voltage deltaV(T) (16). The modified MESFET model degenerates into the original model for a1 (goes to) 0 or a2 (goes to) infinity so the degree of modification can be controlled.
Author
Computer Techniques; Network Analysis; Nonlinearity; Mathematical Models; Harmonics; Distortion; Semiconductor Devices

20020073431 MRJ Technology Solutions, Inc., Moffett Field, CA USA
Simulation of Ultra-Small MOSFETs Using a 2-D Quantum-Corrected Drift-Diffusion Model
Biegel, Bryan A., MRJ Technology Solutions, Inc., USA; Rafferty, Conor S., Lucent Technologies, USA; Yu, Zhiping, Stanford Univ., USA; Dutton, Robert W., Stanford Univ., USA; Ancona, Mario G., Naval Research Lab., USA; [1998]; 12p; In English; 1998 SEC Conference, 28 Sep. 1998, Pullman, WA, USA
Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We describe an electronic transport model and an implementation approach that respond to the challenges of device modeling for gigascale integration. We use the density-gradient (DG) transport model, which adds tunneling and quantum smoothing of carrier density profiles to the drift-diffusion model. We present the current implementation of the DG model in PROPHET, a partial differential equation solver developed by Lucent Technologies. This implementation approach permits rapid development

and enhancement of models, as well as run-time modifications and model switching. We show that even in typical bulk transport devices such as P-N diodes and BJTs, DG quantum effects can significantly modify the I-V characteristics. Quantum effects are shown to be even more significant in small, surface transport devices, such as sub-0.1 micron MOSFETs. In thin-oxide MOS capacitors, we find that quantum effects may reduce gate capacitance by 25% or more. The inclusion of quantum effects in simulations dramatically improves the match between C-V simulations and measurements. Significant quantum corrections also occur in the I-V characteristics of short-channel MOSFETs due to the gate capacitance correction.
Author
Metal Oxide Semiconductors; Field Effect Transistors; Simulation; Diffusion; Diodes; Models

20020073452 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Fishermans Bend, Australia
Effect of Broad-Banding Amplifiers on E-field Probe Measurements in a Reverberant Cavity
Priest, Timothy S., Defence Science and Technology Organisation, Australia; September 2001; 32p; In English
Report No.(s): DSTO-RR-0227; DODA-AR-012-100; Copyright; Avail: Issuing Activity
Broad-band electric-field probes have gained wide-spread acceptance for use in reverberation chambers in recent years, primarily due to their ease of use. However, recent work with AOD has highlighted situations where E-field probes may return ambiguous results. In particular, the SR may be greatly affected by the wide-band frequency reception of an e-field probe when in the presence of multiple frequencies in a reverberant environment Monte-carlo simulations conducted to examine the effects of multiple frequencies on probe measurements in a reverberant cavity were compared with experimental data that was taken by an E-field probe that was in the presence of an amplifier exhibiting distortion in a reverberation chamber. The experimental results indicate that considerable care should be taken to ensure frequency purity in a reverberant environment when making e-field probe measurements.
Author
Broadband; Amplifiers; Cavities; Electrical Measurement; Electric Fields; Remote Sensors

20020073461 NASA Glenn Research Center, Cleveland, OH USA
The Electrostatic Breakdown on Metal-Dielectric Junction Immersed in a Plasma
Vayner, Boris V., Ohio Aerospace Inst., USA; Galofaro, Joel T., NASA Glenn Research Center, USA; Ferguson, Dale C., NASA Glenn Research Center, USA; [2002]; 4p; In English; 20th International Symposium on Discharges, 30 Jun. - 5 Jul. 2002, Tours, France
Contract(s)/Grant(s): RTOP 755-A4-05; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
New results are presented of an experimental study and theoretical analysis of arcing on metal-dielectric junctions immersed in low-density plasmas. Two samples of conventional solar arrays and four different metal-quartz junctions have been used to investigate the effects of arcing within a wide range of neutral gas pressures, ion currents, and electron number densities. The effect of surface conditioning (decrease of arc rate due to outgassing) was clearly demonstrated. Moreover, a considerable increase in arc rate due to absorption of molecules from atmospheric air has been confirmed. It has been proved that the are inception mechanism in plasma is different from one in vacuum.
Author
Electrostatics; Dielectrics; Plasmas (Physics); Joints (Junctions); Solar Arrays

20020073825 Ball Aerospace Systems Div., Boulder, CO USA
Slip Ring Experience in Long Duration Space Applications
Phinney, Damon D., Ball Aerospace Systems Div., USA; 20th Aerospace Mechanisms Symposium; May 1986, pp. 45-54; In English; Also announced as 20020073821; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche
In 1978 SEASAT suffered a disastrous power system failure after three months of successful operation. The probable cause was a short somewhere inside a slip ring assembly. It was also concluded that mistakes had been made in the original slip ring specification (for a project other than SEASAT) and in the way the slip ring was used. The power transfer requirement could easily have been satisfied except for these mistakes. Unfortunately, few in the aerospace community have had an opportunity to read the SEASAT failure report. The widely disseminated news that a satellite was destroyed by a slip ring failure has led to a totally undeserved skepticism of these highly developed and very useful mechanisms. This paper reviews Ball Aerospace System Division (BASD) experience with slip rings in space, presenting design and application experience for several different types. Ball flew the very first slip ring used in space in its first Orbiting Solar Observatory (OSO-1) satellite, launched in 1962. Since then, more than 40 BASD drives using slip ring assemblies for power and signal transfer have been orbited. Continuous operating lifetimes up to eight years at 60 rpm have been demonstrated. We have also specified, purchased, and/or lubricated as many or

more slip rings for other space prime contractors. We have no knowledge of any orbit failure of a Ball-processed slip ring assembly. The cumulative orbit operating lifetime of these units comes to hundreds of years and billions of revolutions.
Author
Aerospace Systems; System Failures; Electric Conductors; Electromechanical Devices

20020073831 California Univ., Santa Barbara, CA USA
Duty Cycle Testing and Performance Evaluation of the SM-229 Teleoperator
Stoughton, Robert S., California Univ., USA; Kuban, Daniel P., Oak Ridge National Lab., USA; 20th Aerospace Mechanisms Symposium; May 1986, pp. 133-148; In English; Also announced as 20020073821
Contract(s)/Grant(s): DE-AC05-84-OR-21400; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche
This paper contains the first known experimental studies and analyses of teleoperator performance for specific duty cycles. The results are presented in two distinct areas as position usage patterns, and as three dimensional power grids. The position usage patterns are a valuable means to assess the available motion range. The power grids are a unique concept for evaluating joint performance. Final conclusions contain recommendations to upgrade the teleoperator for optimum performance.
Author
Performance Tests; Teleoperators; Man Machine Systems; Design Analysis; Joints (Anatomy)

20020073834 Moore Reed and Co. Ltd., Andover, UK
Redundancy for Electric Motors in Spacecraft Applications
Smith, Robert J., Moore Reed and Co. Ltd., UK; Flew, Alastair R., Moore Reed and Co. Ltd., UK; 20th Aerospace Mechanisms Symposium; May 1986, pp. 179-194; In English; Also announced as 20020073821; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche
This paper identifies the parts of electric motors which should be duplicated in order to provide maximum reliability in spacecraft applications. The paper describes various common types of redundancy and gives the advantages and disadvantages of each. The principal types are illustrated by reference to specific examples. For each example, constructional details, basic performance data and failure modes are described, together with a discussion of the suitability of particular redundancy techniques to motor types.
Author
Electric Motors; Redundancy; Aerospace Systems; Mechanical Engineering

20020073835 Hughes Aircraft Co., Space and Communications Group, El Segundo, CA USA
RF Switch Positioner for Communications Satellite Network
Storaasli, A. G., Hughes Aircraft Co., USA; Griesser, H. P., Hughes Aircraft Co., USA; Grant, R. W., Hughes Aircraft Co., USA; 20th Aerospace Mechanisms Symposium; May 1986, pp. 195-203; In English; Also announced as 20020073821; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche
The RF (radio frequency) switch positioner is a simple, lightweight, redundant positioning mechanism used to reconfigure the antenna beam on the INTELSAT VI satellite. It simultaneously rotates approximately 100 squareax waveguide switches through a full 360 degrees.
Author
Intelsat Satellites; Positioning Devices (Machinery); Antenna Radiation Patterns; Satellite Antennas; Radio Antennas

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FLUID MECHANICS AND THERMODYNAMICS

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

20020070795 NASA Ames Research Center, Moffett Field, CA USA
Shear-Sensitive Liquid Crystal Coating Method: Surface-Inclination Effects on Shear Vector Measurements
Reda, Daniel C., NASA Ames Research Center, USA; Wilder, Michael C., MCAT Inst., USA; Nov. 1998; 4p; In English; 18th International Congress on Instrumentation in Aerospace Simulation Facilities, 21-24 Jun. 1999, Toulouse, France; Sponsored by Office National d'Etudes et de Recherches Aerospatiales, France
Contract(s)/Grant(s): NAS2-14109; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The shear-sensitive liquid crystal coating (SSLCC) method is an image-based technique for both visualizing dynamic surface-flow phenomena, such as transition and separation, and for measuring the continuous shear-stress vector distribution acting on an aerodynamic surface. Under proper lighting and viewing conditions (discussed below), the coating changes color in response to an applied aerodynamic shear. This color-change response is continuous and reversible, with a response time of milliseconds, and is a function of both the shear magnitude and the shear vector orientation relative to the observer. The liquid crystal phase of matter is a weakly-ordered, viscous, non-Newtonian fluid state that exists between the nonuniform liquid phase and the ordered solid phase of certain organic compounds. Cholesteric liquid crystal compounds possess a helical molecular arrangement that selectively scatters white light, incident along the helical axis, as a three-dimensional spectrum. This property is linked to the helical pitch length, which is within the range of wavelengths in the visible spectrum. The pitch length, and hence the wavelength of the scattered light, is influenced by shear stress normal to the helical axis. This unique optical property produces a measurable color change in response to an applied shearing force. The full-surface shear stress vector measurement method, developed at NASA-Ames, is schematically illustrated. As with the visualization method, the coated test surface is illuminated from the normal direction with white light and the camera is positioned at an above-plane view angle of approximately 30 deg. Experiments have been initiated at NASA Ames to begin the process of quantifying surface-inclination (surface-curvature) effects on shear vector measurement accuracy. In preliminary experiments, surface-inclination angles theta(sub x), theta(sub y) of 0, +/-5, +/-10, and +/-15 deg were employed. In this arrangement, white-light illumination was positioned normal to the untilted test surface, and the camera above-plane view angle was set at 30 deg relative to the untilted test surface. As can be seen, vector-aligned lambda(sub d) values showed no dependence on theta(sub x) or theta(sub y) for absolute values of these tilt angles is less than or equal to 15 deg. Acquisition and analyses of full-surface color images are presently underway to definitively document the insensitivity limits of the shear vector measurement methodology to surface-slope variations.
Author
Liquid Crystals; Coating; Flow Visualization; Aerodynamics; Stress Measurement; Image Analysis; Vector Analysis; Shear Stress

20020070797 Mississippi Univ., Dept. of Chemical Engineering, University, MS USA
NASA EPSCoR Preparation Grant ***Final Report, 1 Aug. 1999 - 31 Dec. 2001***
Sukanek, Peter C., Mississippi Univ., USA; [2002]; 8p; In English; American Society of Photogrammetry and Remote Sensing, May 2002, Washington, DC, USA; Sponsored by American Society for Photogrammetry and Remote Sensing, USA
Contract(s)/Grant(s): NCC5-405; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The NASA EPSCoR project in Mississippi involved investigations into three areas of interest to NASA by researchers at the four comprehensive universities in the state. These areas involved: (1) Noninvasive Flow Measurement Techniques, (2) Spectroscopic Exhaust Plume Measurements of Hydrocarbon Fueled Rocket Engines and (3) Integration of Remote Sensing and GIS data for Flood Forecasting on the Mississippi Gulf Coast. Each study supported a need at the Stennis Space Center in Mississippi. The first two addressed needs in rocket testing, and the third, in commercial remote sensing. Students from three of the institutions worked with researchers at Stennis Space Center on the projects.
Author
Flow Measurement; Computational Fluid Dynamics; Reusable Launch Vehicles; Systems Health Monitoring; Exhaust Flow Simulation; Flame Spectroscopy; Flood Predictions; Hydrology Models

20020070817 California Univ., Santa Barbara, CA USA
The Dynamics of Miscible Interfaces: Simulations ***Final Report***
Meiburg, Eckart, California Univ., USA; [2002]; 2p; In English
Contract(s)/Grant(s): NAG3-2493; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
The goal of this experimental/computational investigation (joint with Prof Maxworthy at USC) has been to study the dynamics of miscible interfaces, both from a scientific and a practical point of view, and to prepare a related experiment to be flown on the International Space Station. In order to address these effects, we have focused experimental and computational investigations on miscible displacements in cylindrical capillary tubes, as well as in Hele-Shaw cells. Regarding the flow in a capillary tube, the question was addressed as to whether Korteweg stresses and/or divergence effects can potentially account for discrepancies observed between conventional Stokes flow simulations and experiments for miscible flows in capillary tubes. An estimate of the vorticity and streamfunction fields induced by the Kortewegs stresses was derived, which shows these stresses to result in the formation of a vortex ring structure near the tip of the concentration front. Through this mechanism the propagation velocity of the concentration front is reduced, in agreement with the experimental observations. Divergence effects, on the other hand, were seen to be very small, and they have a negligible influence on the tip velocity. As a result, it can be concluded that they are not responsible for the discrepancies between experiments and conventional Stokes simulations. A further part of our investigation focussed on the development of high-accuracy three-dimensional spectral element simulation techniques for

miscible flows in capillary tubes, including the effects of variable density and viscosity. Towards this end, the conservation equations are treated in cylindrical coordinates.
Derived from text
Capillary Tubes; Displacement; Fluid Dynamics; Vortex Rings; Three Dimensional Models

20020072849 NASA Glenn Research Center, Cleveland, OH USA
An Experimental Study of Nonlinear Standing Waves in Resonators with Numerical Comparison
Finkbeiner, Joshua R., Illinois Inst. of Tech., USA; Raman, Ganesh, Illinois Inst. of Tech., USA; Li, Xiaofan, Illinois Inst. of Tech., USA; Steinetz, Bruce M., NASA Glenn Research Center, USA; Daniels, Christopher, Ohio Aerospace Inst., USA; Jun. 04, 2002; 16p; In English
Contract(s)/Grant(s): NCC3-798; NCC3-840; RTOP 708-28-13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Lawrenson et. al. [Journal of the Acoustic Society of America, Nov. 1998] described the generation of shock-free high-amplitude pressure waves in closed cavities using large equipment and resonators to produce the reported effects. An attempt is made to generate shock-free high-amplitude pressure waves using relatively small resonators. Ambient air is used as the working fluid. A small cylindrical resonator is tested resulting in the lack of a shocked waveform while a larger model of the same shape produces shock waves. A small conical resonator produces shock-free pressure waves at resonance, but the amplitude of these waves is small. A larger cone resonator model produces shock-free pressure waves of higher amplitude. A large horn-cone resonator also produces shock-free high amplitude pressure waves, A numerical model is used to compare the experimental results to theoretical results. The effects of structural resonances on the production of shock-free high-amplitude pressure waves are discussed, especially concerning difficulties encountered when these resonances were in the frequency ranges of interest. Identifying features of a structural resonance are presented.
Author
Standing Waves; Resonators; High Pressure; Waveforms; Frequency Ranges

20020072991 NASA Glenn Research Center, Cleveland, OH USA
Glenn-HT: The NASA Glenn Research Center General Multi-Block Navier Stokes Heat Transfer Code
Gaugler, Raymond E., NASA Glenn Research Center, USA; Apr. 25, 2002; 36p; In English; Ohio State University Aerospace Engineering and Spring Seminar Series, 25 Apr. 2002, OH, USA; Sponsored by Ohio State Univ., USA; Original contains color illustrations
Contract(s)/Grant(s): RTOP 708-31-13; RTOP 708-28-13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
For the last several years, Glenn-HT, a three-dimensional (3D) Computational Fluid Dynamics (CFD) computer code for the analysis of gas turbine flow and convective heat transfer has been evolving at the NASA Glenn Research Center. The code is unique in the ability to give a highly detailed representation of the flow field very close to solid surfaces in order to get accurate representation of fluid beat transfer and viscous shear stresses. The code has been validated and used extensively for both internal cooling passage flow and for hot gas path flows, including detailed film cooling calculations and complex tip clearance gap flow and heat transfer. In its current form, this code has a multiblock grid capability and has been validated for a number of turbine configurations. The code has been developed and used primarily as a research tool, but it can be useful for detailed design analysis. In this presentation, the code is described and examples of its validation and use for complex flow calculations are presented, emphasizing the applicability to turbomachinery.
Author
Computational Fluid Dynamics; Heat Transfer; Applications Programs (Computers); Gas Dynamics; Flow Distribution; Navier-Stokes Equation; Three Dimensional Models

20020073073 NASA Glenn Research Center, Cleveland, OH USA
Glenn-HT: The NASA Glenn Research Center General Multi-Block Navier-Stokes Heat Transfer Code
Gaugler, Raymond E., NASA Glenn Research Center, USA; Oct. 01, 2001; 8p; In English; JANNAF CS/APS/PSHS/MSS Joint Meeting, 8-12 Apr. 2002, Destin, FL, USA; Sponsored by Department of the Navy, USA
Contract(s)/Grant(s): RTOP 708-73-43; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
For the last several years, Glenn-HT, a three-dimensional (3D) Computational Fluid Dynamics (CFD) computer code for the analysis of gas turbine flow and convective heat transfer has been evolving at the NASA Glenn Research Center. The code is unique in the ability to give a highly detailed representation of the flow field very close to solid surfaces in order to get accurate representation of fluid heat transfer and viscous shear stresses. The code has been validated and used extensively for both internal cooling passage flow and for hot gas path flows, including detailed film cooling calculations and complex tip clearance gap flow and heat transfer. In its current form, this code has a multiblock grid capability and has been validated for a number of turbine

configurations. The code has been developed and used primarily as a research tool, but it can be useful for detailed design analysis. In this paper, the code is described and examples of its validation and use for complex flow calculations are presented, emphasizing the applicability to turbomachinery for space launch vehicle propulsion systems.
Author
Computational Fluid Dynamics; Computer Programming; Navier-Stokes Equation; Convective Heat Transfer

20020073094 Brown Univ., Div. of Applied Mathematics, Providence, RI USA
Multi-Domain Spectral Simulations of Supersonic Reactive Flows in Recessed Cavity Flame-Holders
Don, Wai-Sun, Brown Univ., USA; Gottlieb, David, Brown Univ., USA; Jung, Jae-Hun, Brown Univ., USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 1-9; In English; Also announced as 20020073093
Contract(s)/Grant(s): F49620-02-1-0113; DE-FG02-96ER-25346; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

This paper reports results of simulations of the two-dimensional supersonic reactive flows in recessed cavities. These results are obtained by using multidomain spectral methods, specially designed for high Mach number flows. Comparisons are made between different configurations and the advantages of each configuration is outlined. The effect of the numerical dissipativity is discussed and an argument is made for the importance of high order accuracy schemes for those type of problems.
Author
Two Dimensional Flow; Supersonic Flow; Spectral Methods

20020073097 NASA Glenn Research Center, Cleveland, OH USA
High Temperature Composite Heat Exchangers
Eckel, Andrew J., NASA Glenn Research Center, USA; Jaskowiak, Martha H., NASA Glenn Research Center, USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 39-42; In English; Also announced as 20020073093; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

High temperature composite heat exchangers are an enabling technology for a number of aeropropulsion applications. They offer the potential for mass reductions of greater than fifty percent over traditional metallics designs and enable vehicle and engine designs. Since they offer the ability to operate at significantly higher operating temperatures, they facilitate operation at reduced coolant flows and make possible temporary uncooled operation in temperature regimes, such as experienced during vehicle reentry, where traditional heat exchangers require coolant flow. This reduction in coolant requirements can translate into enhanced range or system payload. A brief review of the approaches and challengers to exploiting this important technology are presented, along with a status of recent government-funded projects.
Author
High Temperature; Heat Exchangers; Composite Structures

20020073114 NASA Langley Research Center, Hampton, VA USA
A Modified Wall Matching Treatment to Account for Local Solid to Fluid Thermal Coupling
White, Jeffery A., NASA Langley Research Center, USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 259-269; In English; Also announced as 20020073093; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The wall-matching methodology of Wilcox is modified to include a solid-wall, thermal-conduction model. This coupled fluid-thermal-structure model is derived assuming that the wall thermal-structure behavior is locally one-dimensional and that structural deformations, due to thermally induced stresses, are not significant. The one-dimensional coupled fluid-thermal-structure model is derived such that the wall temperature is removed as an independent boundary condition variable. The one-dimensional coupled fluid-thermal-structure model is also derived for the general case of an arbitrary mixture of thermally prefect gases and a wall of arbitrary thickness and conductivity by using a compressible, streamwise-pressure-gradient-corrected, wall-matching function and Fourier's law of heat conduction. The resulting model was implemented in the VULCAN CFD code as a new boundary condition type. VULCAN was then used to simulate a two-dimensional Mach 6 wind tunnel facility nozzle flow to demonstrate/validate the one-dimensional coupled fluid-thermal-structure model. The nozzle internal-wall surface temperature and heat transfer distributions computed using the one-dimensional coupled fluid-thermal-structure model are compared to wall temperature and heat transfer distributions from an iterative multi-dimensional analysis obtained by coupling the VULCAN CFD code and the MSC/NASTRAN-thermal code. The one-dimensional coupled fluid-thermal-structure model analysis is shown to be very robust and in excellent agreement with the

multi-dimensional iteratively coupled analysis. It is also shown that the one-dimensional analysis can be used as an initial guess for the multi-dimensional iteratively coupled analysis.
Author
One Dimensional Flow; Computational Fluid Dynamics; Boundary Conditions; Conductive Heat Transfer; Nozzle Walls; Temperature Effects; Wall Temperature

20020073199 Air Products and Chemicals, Inc., Allentown, PA USA
Engineering Development of Slurry Bubble Column Reactor (SBCR) Technology ***Quarterly Report, 1 Oct. - 31 Dec. 1998***
2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-794298; No Copyright; Avail: National Technical Information Service (NTIS)
The major technical objectives of this program are threefold: (1) to develop the design tools and a fundamental understanding of the fluid dynamics of a slurry bubble column reactor to maximize reactor productivity, (2) to develop the mathematical reactor design models and gain an understanding of the hydrodynamic fundamentals under industrially relevant process conditions, and (3) to develop an understanding of the hydrodynamics and their interaction with the chemistries occurring in the bubble column reactor. Successful completion of these objectives will permit more efficient usage of the reactor column and tighter design criteria, increase overall reactor efficiency, and ensure a design that leads to stable reactor behavior when scaling up to large diameter reactors.
NTIS
Fluid Dynamics; Reactor Technology; Reactor Design; Mathematical Models; Hydrodynamics; Bubble Technique

20020073232 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Inst. fuer Aerodynamik und Stroemungstechnik, Goettingen, Germany
Experimental Investigations on the Laminar-Turbulent Transition of Cylinder Boundary Layer Flow ***Experimentelle Untersuchungen des laminar-turbulenten Ueberganges der Zylindergrenzschichtstroemung***
Goelling, Burkhard, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; [2001]; ISSN 1434-8454; 158p; In German; Original contains color illustrations
Report No.(s): DLR-FB-2001-14; Copyright; Avail: Issuing Activity
The spatio-temporal separation of transitional boundary-layer of the cross-stream cylinder flow is explored in the subcritical up to the transcritical Reynolds number regime, i.e. from Re(sub D) = 0.1x10(exp 6) until Re(sub D) = 5.0x10(exp 6). In order to detect the spatial, i.e. the spanwise evolution of coherent separation structures wall-pressure measurements and oil-flow visualizations are conducted. The instationary separation is recognized by force measurements with a piezo-balance. The result is a detailed description of spatial and temporal scales of shear-flow instabilities and their causes on drag, lift and Strouhal number. The obtained vortical structures due to these instabilities show a different behavior by passive or active-dynamic flow control techniques. In case of passive control the spanwise wavelength of the coherent vortices are determined by the spanwise distribution of the stationary disturbances, but no drag decrease is realizable. A significant drag reduction, especially in the subcritical Reynolds number regime, is obtained by introduction of combined spanwise and temporally periodic disturbances in the separating boundary-layer.
Author
Laminar Boundary Layer; Turbulent Boundary Layer; Boundary Layer Flow; Flow Visualization

20020073233 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Inst. fuer Aerodynamik und Stroemungstechnik, Goettingen, Germany
Experimental Investigation of Transitional Unsteady Separated Vortex Flows ***Experimentelle Untersuchung Transitioneller Instationaerer Abgeloester Wirbelstroemungen***
Bao, Feng, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; August 2001; ISSN 1434-8454; 116p; In English
Report No.(s): DLR-FB-2001-20; Copyright; Avail: Issuing Activity
Experimental results on transitional separated flows along a rounded backward facing step are reported in the present thesis. Experiments are carried out in a water towing tank using hydrogen bubbles and laser light sheet flow visualizations. Results are given for a Reynolds number range between 8.4x10(exp 3) and 1.01x10(exp 5). Velocity-field measurements are obtained with video-based digital particle image velocimetry (DPIV). Flow visualizations and quantitative measurements reveal that the topological structure and dynamics of transitional separated flows are complex and dominated by large-scale flow unsteadiness with travelling vortices, with intense interaction between these flow structures, and with inclined separated shear layers. Vortex shedding appears out and downstream of a mean-flow separation bubble. While laminar flow separation appears stationary and two-dimensional a pronounced three-dimensionality of the flow appears in the region of turbulent flow reattachment. The

development of the initially two-dimensional vortex-flow structures into Lambda-formed three-dimensional flow structures is visualized. An interpretation of the dynamics of an unsteady vortex flow being the basis of a mean-flow transitional separation bubble is given.
Author
Separated Flow; Backward Facing Steps; Water Flow; Flow Visualization; Laminar Flow; Vortices

20020073235 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Inst. fuer Aerodynamik und Stroemungstechnik, Goettingen, Germany
Measurement of a Swirling Pipe and Combustion Chamber Flow by Means of Multicomponent Laser-Doppler-Velocimetry ***Mehrkomponenten-Laser-Doppler-Anemometer-Messungen in einer drallbehafteten Rohrund Brennkammerstroemung***
Wiedemann, Andreas, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; 2001; ISSN 1434-8454; 96p; In German
Report No.(s): DLR-FB-2001-02; Copyright; Avail: Issuing Activity
Swirl flows, i.e. axisymmetric jet flows with a non zero circumferential velocity, are important in technology as well as in nature. If the strength of swirl is greater than a certain critical value, the forces due to the induced pressure gradients exceed the forward kinetic forces. The flow reverses its direction on the axis of symmetry and the central toroidal recirculation zone is generated, that plays an important role in flame stabilization. Neither a complete theoretical description nor a numerical prediction of swirl flows has been found due to the complex structure of swirl flows. In this work investigation on a swirl generator, which was geometrically strongly simplified, are conducted by means of Laser-Doppler-Velocimetry (LDV). It was possible to separate the periodic fluctuations due to the precessing vortex core from the non-periodic 'pure-turbulent' part. The integral length scale was determined at different positions in the shear layer of the nozzle by two point correlation measurement.
Author
Flow Measurement; Vortices; Combustion Chambers

20020073236 NASA Ames Research Center, Moffett Field, CA USA
Turbomachinery Airfoil Design Optimization Using Differential Evolution
Madavan, Nateri K., NASA Ames Research Center, USA; [2002]; 12p; In English; 2nd International Conference on Computational Fluid Dynamics, 15-19 Jul. 2002, Sydney, Australia
Contract(s)/Grant(s): RTOP 704-40-21; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
An aerodynamic design optimization procedure that is based on a evolutionary algorithm known at Differential Evolution is described. Differential Evolution is a simple, fast, and robust evolutionary strategy that has been proven effective in determining the global optimum for several difficult optimization problems, including highly nonlinear systems with discontinuities and multiple local optima. The method is combined with a Navier-Stokes solver that evaluates the various intermediate designs and provides inputs to the optimization procedure. An efficient constraint handling mechanism is also incorporated. Results are presented for the inverse design of a turbine airfoil from a modern jet engine. The capability of the method to search large design spaces and obtain the optimal airfoils in an automatic fashion is demonstrated. Substantial reductions in the overall computing time requirements are achieved by using the algorithm in conjunction with neural networks.
Author
Turbomachinery; Airfoils; Design Optimization; Algorithms

20020073237 NASA Glenn Research Center, Cleveland, OH USA
Experimental Study of the Richtmyer-Meshkov Instability of Incompressible Fluids
Niederhaus, Charles, Arizona Univ., USA; Jacobs, Jeffrey W., Arizona Univ., USA; Jun. 07, 2002; 58p; In English
Contract(s)/Grant(s): NAG3-2375; RTOP 101-13-0C; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The Richtmyer-Meshkov instability of a low Atwood number, miscible, two-liquid system is investigated experimentally. The initially stratified fluids are contained within a rectangular tank mounted to a sled that rides on a vertical set of rails. The instability is generated by dropping the sled onto a coil spring, producing a nearly impulsive upward acceleration. The subsequent freefall that occurs as the container travels upward and then downward on the rails allows the instability to evolve in the absence of gravity. The interface separating the two liquids initially has a well-defined, sinusoidal perturbation that quickly inverts and then grows in amplitude after undergoing the impulsive acceleration. Disturbance amplitudes are measured and compared to theoretical predictions. Linear stability theory gives excellent agreement with the measured initial growth rate, a(sub 0), for single-mode perturbations with the predicted amplitudes differing by less than 10% from experimental measurements up to a nondimensional time ka(sub 0)t = 0.7, where k is the wavenumber. Linear stability theory also provides excellent agreement for the individual mode amplitudes of multi-mode initial perturbations up until the interface becomes multi-valued. Comparison with

previously published weakly nonlinear single-mode models shows good agreement up to ka(sub 0)t = 3, while published nonlinear single-mode models provide good agreement up to ka(sub 0)t = 30. The effects of Reynolds number on the vortex core evolution and overall growth rate of the interface are also investigated. Measurements of the overall amplitude are found to be unaffected by the Reynolds number for the range of values studied here. However, experiments carried out at lower values of Reynolds numbers were found to have decreased vortex core rotation rates. In addition, an instability in the vortex cores is observed.
Author
Incompressible Fluids; Liquids; Reynolds Number; Stability; Mixing Layers (Fluids)

20020073795 Brown Univ., Div. of Applied Mathematics, Providence, RI USA
Multi-Domain Spectral Simulations of Supersonic Reactive Flows In Recessed Cavity Flame-Holders
Don, Wai-Sun, Brown Univ., USA; Gottlieb, David, Brown Univ., USA; Jung, Jae-Hun, Brown Univ., USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 1-9; In English; Also announced as 20020073794
Contract(s)/Grant(s): F49620-02-1-0113; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

This paper reports results of simulations of the two-dimensional supersonic reactive flows in recessed cavities. These results are obtained by using multidomain spectral methods, specially designed for high Mach number flows. Comparisons are made between different configurations and the advantages of each configuration is outlined. The effect of the numerical dissipativity is discussed and an argument is made for the importance of high order accuracy schemes for those type of problems.
Author
Reacting Flow; Supersonic Flow; Flame Holders

20020073796 Wayne State Univ., Dept. of Mechanical Engineering, Detroit, MI USA
Direct Calculation of High-Speed Cavity Flows In A Scramjet Engine by the CESE Method
Yu, S.-T. John, Wayne State Univ., USA; Kim, C.-K., Wayne State Univ., USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 11-19; In English; Also announced as 20020073794
Contract(s)/Grant(s): F49620-01-1-0051; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

In this paper we report the application of the Space-Time CESE (Conservation Element and Solution Element) method to simulate supersonic flows over open cavities. In the setting of a dual-mode scramjet engine, flow features of cavity flows with and without an upstream injection are studied for mixing enhancement and flame holding. Without upstream injection, the present numerical results compared favorably with the experimental data for dominant frequencies and time-averaged pressure coefficients inside the cavities. The role of cavity-generated acoustic waves in fuel/air mixing enhancement is illustrated. With an upstream inject on, the flow oscillations are drastically suppressed. The present results show that the CESE method provides high-fidelity numerical results of unsteady flows relevant to advanced scramjet engine concepts.
Author
Space-Time Ce/Se Method; Cavities; Supersonic Combustion Ramjet Engines

20020073813 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
An All-Pressure Fluid-Drop Model: Validation and Species System Dependency
Bellan, J., Jet Propulsion Lab., California Inst. of Tech., USA; Harstad, K., Jet Propulsion Lab., California Inst. of Tech., USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 279-292; In English; Also announced as 20020073794; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

A fundamental and very general model of fluid drop behavior at all pressures is presented and is shown to reproduce microgravity experimental data for heptane drops in nitrogen. In the model, the existence of a drop surface (i.e. phase discontinuity) is not necessarily assumed. The optical drop diameter is defined as the location of the maximum density-gradient magnitude. An examination of the drop-diameter-squared variation with time for the heptane/nitrogen system shows that it is approximately linear only at atmospheric pressure and has a negative curvature at higher pressures. As the pressure increases, the slope of the diameter squared becomes an increasing function of time and progressively increases with pressure at subcritical far-field temperatures, however, at supercritical temperatures a maximum is reached. A similar investigation conducted for oxygen drops in hydrogen reveals that at higher then atmospheric pressure the slope of the diameter squared versus time has a positive curvature. Given that the drop diameter squared versus time exhibits different behavior with pressure for the two species systems, it is concluded that high-pressure behavior should not be extrapolated from one species system to another. The results also show that, independent of the species system, at locations arbitrarily near the boundary, the drop does not reach the mixture critical point within the range of conditions investigated. An examination of the relaxation time at the drop boundary shows that

quasi-steadiness of the mass transfer prevails even for relatively small drops. On an appropriate scale, the slope of the diameter squared versus time is shown to be independent of the drop size at all pressures.
Author
Drops (Liquids); Microgravity; Models; Drop Size; Time Dependence

20020073814 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Aspects of Supercritical Turbulence: Direct Numerical Simulation of O2/H2 and C7H16/N2 Temporal Mixing Layers
Bellan, J., Jet Propulsion Lab., California Inst. of Tech., USA; Okong'o, N. A., Jet Propulsion Lab., California Inst. of Tech., USA; Harstad, K. G., Jet Propulsion Lab., California Inst. of Tech., USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 293-302; In English; Also announced as 20020073794; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Results from Direct Numerical Simulations of temporal, supercritical mixing layers for two species systems are analyzed to elucidate species-specific turbulence aspects. The two species systems, O2/H2 and C7H16 (heptane)/N2, have different thermodynamic characteristics; thus, although the simulations are performed at similar reduced pressure (ratio of the pressure to the critical pressure), the former system is close to mixture ideality and has a relatively high solubility with respect to the latter, which exhibits strong departures from mixture ideality. Due to the specified, smaller initial density stratification, the C7H16/N2 layers display higher growth and increased global molecular mixing as well as larger turbulence levels. However, smaller density gradients at the transitional state for the O2/H2 system indicate that on a local basis, the layer exhibits an enhanced mixing, this being attributed to the increased solubility and to mixture ideality. These thermodynamic features are shown to affect the irreversible entropy production (i.e. the dissipation), which is larger for the O2/H2 layer and is primarily concentrated in high density-gradient magnitude regions that are distortions of the initial density stratification boundary. In contrast, the regions of largest dissipation in the C7H16/N2 layer are located in high density-gradient magnitude regions resulting from the mixing of the two fluids.
Author
Turbulence; Direct Numerical Simulation; Mixing Layers (Fluids)

20020073816 NASA Langley Research Center, Hampton, VA USA
A Modified Wall Matching Treatment to Account for Local Solid to Fluid Thermal Coupling
White, Jeffery A., NASA Langley Research Center, USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 319-327; In English; Also announced as 20020073794; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The wall-matching methodology of Wilcox is modified to include a solid-wall, thermal-conduction model. This coupled fluid-thermal-structure model is derived assuming that the wall thermal-structure behavior is locally one-dimensional and that structural deformations, due to thermally induced stresses, are not significant. The one-dimensional coupled fluid-thermal-structure model is derived such that the wall temperature is removed as an independent boundary condition variable. The one-dimensional coupled fluid-thermal-structure model is also derived for the general case of an arbitrary mixture of thermally prefect gases and a wall of arbitrary thickness and conductivity by using a compressible, streamwise-pressure-gradient-corrected, wall-matching function and Fourier's law of heat conduction. The resulting model was implemented in the VULCAN CFD (Computational Fluid Dynamics) code as a new boundary condition type. VULCAN was then used to simulate a two-dimensional Mach 6 wind tunnel facility nozzle flow to demonstrate/validate the one-dimensional coupled fluid-thermal-structure model. The nozzle internal-wall surface temperature and heat transfer distributions computed using the one-dimensional coupled fluid-thermal-structure model are compared to wall temperature and heat transfer distributions from an iterative multi-dimensional analysis obtained by coupling the VULCAN CFD code and the MSC/NASTRAN-thermal code. The one-dimensional coupled fluid-thermal-structure model analysis is shown to be very robust and in excellent agreement with the multi-dimensional iteratively coupled analysis. It is also shown that the one-dimensional analysis can be used as an initial guess for the multi-dimensional iteratively coupled analysis.
Author
Thermodynamic Coupling; Boundary Conditions; Walls; Wall Temperature; Fourier Law; Exhaust Flow Simulation

20020073820 Sandia National Labs., Combustion Research Facility, Livermore, CA USA
Large Eddy Simulation of Cryogenic Injection Processes at Supercritical Pressure
Oefelein, Joseph C., Sandia National Labs., USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 267-277; In English; Also announced as 20020073794

Contract(s)/Grant(s): NASA Order H-33477-D; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

This paper highlights results from the first of a series of hierarchical simulations aimed at assessing the modeling requirements for application of the large eddy simulation technique to cryogenic injection and combustion processes in liquid rocket engines. The focus is on liquid-oxygen-hydrogen coaxial injectors at a condition where the liquid-oxygen is injected at a subcritical temperature into a supercritical environment. For this situation a diffusion dominated mode of combustion occurs in the presence of exceedingly large thermophysical property gradients. Though continuous, these gradients approach the behavior of a contact discontinuity. Significant real gas effects and transport anomalies coexist locally in colder regions of the flow, with ideal gas and transport characteristics occurring within the flame zone. The current focal point is on the interfacial region between the liquid-oxygen core and the coaxial hydrogen jet where the flame anchors itself.

Author

Large Eddy Simulation; Cryogenic Rocket Propellants; Supercritical Pressures; Fuel Injection; Gas Jets; Real Gases

20020073867 MRJ Technology Solutions, Inc., Moffett Field, CA USA

Automatic Data Distribution for CFD Applications on Structured Grids

Frumkin, Michael, NASA Ames Research Center, USA; Yan, Jerry, MRJ Technology Solutions, Inc., USA; [1999]; 2p; In English; 3rd Annual HPF User Group Meeting, USA

Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: Issuing Activity; Abstract Only

Development of HPF versions of NPB and ARC3D showed that HPF has potential to be a high level language for parallelization of CFD applications. The use of HPF requires an intimate knowledge of the applications and a detailed analysis of data affinity, data movement and data granularity. Since HPF hides data movement from the user even with this knowledge it is easy to overlook pieces of the code causing low performance of the application. In order to simplify and accelerate the task of developing HPF versions of existing CFD applications we have designed and partially implemented ADAPT (Automatic Data Distribution and Placement Tool). The ADAPT analyzes a CFD application working on a single structured grid and generates HPF TEMPLATE, (RE)DISTRIBUTION, ALIGNMENT and INDEPENDENT directives. The directives can be generated on the nest level, subroutine level, application level or inter application level. ADAPT is designed to annotate existing CFD FORTRAN application performing computations on single or multiple grids. On each grid the application can considered as a sequence of operators each applied to a set of variables defined in a particular grid domain. The operators can be classified as implicit, having data dependences, and explicit, without data dependences. In order to parallelize an explicit operator it is sufficient to create a template for the domain of the operator, align arrays used in the operator with the template, distribute the template, and declare the loops over the distributed dimensions as INDEPENDENT. In order to parallelize an implicit operator, the distribution of the operator's domain should be consistent with the operator's dependences. Any dependence between sections distributed on different processors would preclude parallelization if compiler does not have an ability to pipeline computations. If a data distribution is "orthogonal" to the dependences of an implicit operator then the loop which implements the operator can be declared as INDEPENDENT.

Author

Computational Fluid Dynamics; Structured Grids (Mathematics); Autonomy; Applications Programs (Computers); Computerized Simulation; High Level Languages

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.

20020070811 NASA Kennedy Space Center, Cocoa Beach, FL USA

Pressure Transducer Remote Calibration/Health Check

Deyoe, Richard, NASA Kennedy Space Center, USA; [2002]; 12p; In English; NASA Advanced Sensors Symposium, 30 Jul. 2002, Baltimore, MD, USA

Contract(s)/Grant(s): NAS10-98001

Report No.(s): KSC-2002-101; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This presentation reports on efforts to develop an in-situ pressure transducer calibration system for extension of calibration lifecycle and transducer health determination. This system aims to: (1) provide a long term solution to determining the calibration

of pressure transducers for gas applications, (2) provide a method of isolating problems in remote measurements, and (3) reduce costs and resources by extending the length of time a transducer may be left in a system without a repeat laboratory calibration. Topic covers include: design requirements, design assumptions and design approach.
Author
Pressure Sensors; Transducers; Calibrating; Systems Health Monitoring; Design Analysis

20020070812 NASA Kennedy Space Center, Cocoa Beach, FL USA
Valve Health Monitor (VHM)
Perotti, Jose M., NASA Kennedy Space Center, USA; [2002]; 17p; In English; NASA Advanced Sensor Symposium, 30 Jul. 2002, Baltimore, MD, USA
Contract(s)/Grant(s): NAS10-98001
Report No.(s): KSC-2002-100; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This presentation reports on progress being made on developing a Valve Health Monitor (VHM) Smart Current Signature Sensor. Topics cover include: design needs, target valves, current signatures, VHM design approach and VHM status/conclusions.
Author
Valves; Systems Health Monitoring; Sensors; Smart Materials; Design Analysis

20020070819 NASA Kennedy Space Center, Cocoa Beach, FL USA
Sensors and Data Acquisition Development Efforts at KSC
Perotti, Jose M., NASA Kennedy Space Center, USA; [2002]; 25p; In English; 2nd Generation NASA Sensors Working Group Workshop, 15-18 Jul. 2002, Cleveland, OH, USA; Sponsored by NASA Kennedy Space Center, USA
Report No.(s): KSC-2002-097; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This viewgraph presentation describes efforts at Kennedy Space Center (KSC) to develop spacecraft sensors and instruments which meet the expected needs of potential clients on a budget. Sensors are profiled, and the topics covered include systems health monitoring, smart structures, software algorithms, and testing.
CASI
Systems Health Monitoring; Sensors; Research and Development; Smart Structures; Spacecraft Instruments

20020070820 NASA Glenn Research Center, Cleveland, OH USA
Advanced Measurement Systems Available to PIWG Members
Anderson, Robert, NASA Glenn Research Center, USA; [2002]; 1p; In English; PIWG Road Show, GEAE, 25 May 2000, Cleveland, OH, USA
Contract(s)/Grant(s): RTOP 704-20-13; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
It was developed advanced measurement technologies to meet NASA goals: reduce design cycle time, reduce emission, reduce testing time, increase safety. The technology are saving money. This technology are available now for technology transfer: optical diagnostics, the film technology and MEMS devices.
CASI
Measuring Instruments; Optical Materials; Technology Assessment

20020070828 NASA Glenn Research Center, Cleveland, OH USA
Interferometer Control of Optical Tweezers
Decker, Arthur J., NASA Glenn Research Center, USA; June 2002; 13p; In English; 47th Annual Meeting: International Symposium on Optical Science and Technology, 7-11 Jul. 2002, Seattle, WA, USA; Sponsored by International Society for Optical Engineering, USA
Contract(s)/Grant(s): RTOP 708-90-53
Report No.(s): NASA/TM-2002-211586; E-13371; NAS 1.15:211586; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This paper discusses progress in using spatial light modulators and interferometry to control the beam profile of an optical tweezers. The approach being developed is to use a spatial light modulator (SLM) to control the phase profile of the tweezers beam and to use a combination of the SLM and interferometry to control the intensity profile. The objective is to perform fine and calculable control of the moments and forces on a tip or tool to be used to manipulate and interrogate nanostructures. The performance of the SLM in generating multiple and independently controllable tweezers beams is also reported. Concurrent

supporting research projects are mentioned and include tweezers beam scattering and neural-net processing of the interference patterns for control of the tweezers beams.
Author
Interferometers; Light Modulators; Optical Control; Beamforming

20020070863 NASA Glenn Research Center, Cleveland, OH USA
Development and Design of a Zero-G Liquid Quantity Gauge for a Solar Thermal Vehicle
Dodge, Franklin T., Southwest Research Inst., USA; Green, Steven T., Southwest Research Inst., USA; Petullo, Steven P., Southwest Research Inst., USA; VanDresar, Neil T., NASA Glenn Research Center, USA; Feb. 01, 2002; 8p; In English; Space Technology and Applications International Forum (STAIF), 3-7 Feb. 2002, Albuquerque, NM, USA
Contract(s)/Grant(s): NAS3-99152; RTOP 721-26-CF; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The development and design of a cryogenic liquid quantity gauge for zero-g applications is described. The gauge, named the Compression Mass Gauge (CMG), operates on the principle of slightly changing the volume of the tank by an oscillating bellows. The resulting pressure change is measured and used to predict the volume of vapor in the tank, from which the volume of liquid is computed. For each gauging instance, pressures are measured for several different bellows frequencies to enable minor real-gas effects to be quantified and thereby to obtain a gauging accuracy of +/- 1% of tank volume. Southwest Research Institute (Tm) and NASA-GRC (Glenn Research Center) have developed several previous breadboard and engineering development gauges and tested them in cryogenic hydrogen and nitrogen to establish the gauge capabilities, to resolve several design issues, and to formulate data processing algorithms. The CMG has been selected by NASA's Future X program for a flight demonstration on the USAF (USA Air Force) / Boeing Solar Thermal Vehicle Space Experiment (SOTVSE). This paper reviews the design trade studies needed to satisfy the SOTVSE limitations on CMG power, volume, and mass, and describes the mechanical design of the CMG.
Author
Measuring Instruments; Weightlessness; Cryogenic Fluids; Storage Tanks

20020070916 DYNACS Engineering Co., Inc., Cocoa Beach, FL USA
Multi Sensor Array
Immer, Christopher, DYNACS Engineering Co., Inc., USA; [2002]; 18p; In English; NASA Advanced Sensors Symposium, 30 Jul. 2002, Baltimore, MD, USA
Contract(s)/Grant(s): NAS10-98001
Report No.(s): KSC-2002-98; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This paper presents viewgraphs on the Multi Sensor Array. The topics include: 1) MSA Algorithm; 2) Types of Sensors for the MSA; 3) How to test the MSA; 4) Monte Carlo Simulation; and 5) Accelerated Life Tests.
CASI
Arrays; Multisensor Applications; Pressure Sensors; Systems Engineering

20020071038 NASA Goddard Space Flight Center, Greenbelt, MD USA
Design and Fabrication of a Two-Dimensional Superconducting Bolometer Array
Benford, Dominic, NASA Goddard Space Flight Center, USA; Voellmer, George M., NASA Goddard Space Flight Center, USA; Chervenak, Jay, NASA Goddard Space Flight Center, USA; Irwin, Kent, National Inst. of Standards and Technology, USA; Moseley, S. Harvey, NASA Goddard Space Flight Center, USA; Shafer, Rick, NASA Goddard Space Flight Center, USA; Stacey, Gordon, Cornell Univ., USA; Staguhn, J., Science Systems and Applications, Inc., USA; [2002]; 2p; In English; SPIE Workshop, 22-28 Aug. 2002, Waikoloa, HI, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only
Large format, two dimensional arrays of close-packed bolometers will enable submillimeter cameras and spectrometers to obtain images and spectra orders of magnitude faster than present instruments. The South Pole Imaging Fabry-Perot Interferometer (SPIFI) for the AST/RO observatory and the Submillimeter and Far-InfraRed Experiment (SAFIRE) on the SOFIA airborne observatory will employ a large-format, two-dimensional, closepacked bolometer arrays. Both these instruments are imaging Fabry-Perot spectrometers operating at wavelengths between 100 micron and 700 micron. The array format is 16x32 pixels, using a 32-element multiplexer developed in part for this purpose. The low backgrounds achieved in spectroscopy require very sensitive detectors with NEPs of order 5x10(exp 18) W/square root of Hz. Superconducting detectors can be close-packed using the Pop-Up Detector (PUD) format, and SQUID multiplexers operating at the detector bas temperature can be intimately

coupled to them. We have fabricated an engineering model array with this technology which features a very compact, modular approach for large format arrays.
Author
Bolometers; Wavelength Division Multiplexing; Product Development; Equipment Specifications

20020071044 NASA Goddard Space Flight Center, Greenbelt, MD USA
Superconducting Bolometer Array Architectures
Benford, Dominic, NASA Goddard Space Flight Center, USA; Chervenak, Jay, NASA Goddard Space Flight Center, USA; Irwin, Kent, National Inst. of Standards and Technology, USA; Moseley, S. Harvey, NASA Goddard Space Flight Center, USA; Shafer, Rick, NASA Goddard Space Flight Center, USA; Staguhn, Johannes, Science Systems and Applications, Inc., USA; Wollack, Ed, NASA Goddard Space Flight Center, USA; [2002]; 2p; In English; SPIE Meeting, 22-28 Aug. 2002, Waikoloa, HI, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The next generation of far-infrared and submillimeter instruments require large arrays of detectors containing thousands of elements. These arrays will necessarily be multiplexed, and superconducting bolometer arrays are the most promising present prospect for these detectors. We discuss our current research into superconducting bolometer array technologies, which has recently resulted in the first multiplexed detections of submillimeter light and the first multiplexed astronomical observations. Prototype arrays containing 512 pixels are in production using the Pop-Up Detector (PUD) architecture, which can be extended easily to 1000 pixel arrays. Planar arrays of close-packed bolometers are being developed for the GBT (Green Bank Telescope) and for future space missions. For certain applications, such as a slewed far-infrared sky survey, feedhorncoupling of a large sparsely-filled array of bolometers is desirable, and is being developed using photolithographic feedhorn arrays. Individual detectors have achieved a Noise Equivalent Power (NEP) of -10(exp 17) W/square root of Hz at 300mK, but several orders of magnitude improvement are required and can be reached with existing technology. The testing of such ultralow-background detectors will prove difficult, as this requires optical loading of below IfW. Antenna-coupled bolometer designs have advantages for large format array designs at low powers due to their mode selectivity.
Author
Bolometers; Antenna Arrays; Antenna Design; Infrared Detectors

20020071066 NASA Goddard Space Flight Center, Greenbelt, MD USA
Antenna-Coupled Superconducting Tunnel Junctions with Single-Electron Transistor Readout for Detection of Sub-mm Radiation
Stevenson, T. R., NASA Goddard Space Flight Center, USA; Hsieh, W.-T., NASA Goddard Space Flight Center, USA; Li, M. J., NASA Goddard Space Flight Center, USA; Stahle, C. M., NASA Goddard Space Flight Center, USA; Wollack, E. J., NASA Goddard Space Flight Center, USA; Schoelkopf, R. J., Yale Univ., USA; Teufel, J., Yale Univ., USA; [2002]; 1p; In English; Far-IR, Sub-mm and MM Detector Technology Workshop, 1-3 Apr. 2002, Monterey, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Antenna-coupled superconducting tunnel junction detectors have the potential for photon-counting sensitivity at sub-mm wavelengths. The device consists of an antenna structure to couple radiation into a small superconducting volume and cause quasiparticle excitations, and a single-electron transistor to measure currents through tunnel junction contacts to the absorber volume. We will describe optimization of device parameters, and recent results on fabrication techniques for producing devices with high yield for detector arrays. We will also present modeling of expected saturation power levels, antenna coupling, and rf multiplexing schemes.
Author
Tunnel Junctions; Antenna Couplers; Transistors; Wavelength Division Multiplexing; Submillimeter Waves; Stellar Spectrophotometry

20020072721 NASA Marshall Space Flight Center, Huntsville, AL USA
Ball Aerospace AMSD Progress Update
Blair, Mark, NASA Marshall Space Flight Center, USA; Brown, Robert, NASA Marshall Space Flight Center, USA; Chaney, David, NASA Marshall Space Flight Center, USA; Lightsey, Paul, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA
Contract(s)/Grant(s): NAS8-00146; No Copyright; Avail: Issuing Activity; Abstract Only

The current status of the Advanced Mirror System Demonstrator program being performed by Ball Aerospace is presented. The hexagonal low-areal density Beryllium mirror blank has been fabricated and undergoing polishing at the time of this presentation.
Author
Mirrors; Tests

20020072725 NASA Marshall Space Flight Center, Huntsville, AL USA
Ball Aerospace SBMD Coating Test Results
Brown, Robert, NASA Marshall Space Flight Center, USA; Lightsey, Paul, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only
The Sub-scale Beryllium Mirror Demonstrator that was successfully tested to demonstrate cryogenic figuring of a bare mirror has been coated with a protected gold reflective surface and retested at cryogenic temperatures. Results showing less than 9 nm rms surface distortion attributable to the added coating are presented.
Author
Mirrors; Cryogenics; Tests

20020072728 NASA Marshall Space Flight Center, Huntsville, AL USA
Ball Aerospace AMSD Ambient and Cryogenic Test Plans
Blair, Mark, NASA Marshall Space Flight Center, USA; Brown, Robert, NASA Marshall Space Flight Center, USA; Chaney, David, NASA Marshall Space Flight Center, USA; Lightsey, Paul, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA
Contract(s)/Grant(s): NAS8-00146; No Copyright; Avail: Issuing Activity; Abstract Only
The planned testing of the Advanced Mirror System Demonstrator program being performed by Ball Aerospace are presented.
Author
Mirrors; Tests

20020073059 NASA Glenn Research Center, Cleveland, OH USA
Spiral Orbit Tribometry I: Description of the Tribometer
Pepper, Stephen V., NASA Glenn Research Center, USA; Kingsbury, Edward P., Interesting Rolling Contact, USA; [2002]; 17p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A new rolling contact tribometer based on a planar thrust bearing geometry is described. The bearing 'races' are flat plates that drive a ball into a near-circular, spiral path. The spiraling ball is returned to its initial radius each revolution around the race by a 'guide plate' backed by a force transducer. The motions of the ball are analyzed and the force exerted by the ball on the guide plate is related to the friction coefficient of the system. The experimental characteristics of the system are presented and the system is shown to exhibit the behavior expected for a tribometer.
Author
Bearings; Tribology; Lubrication; Angular Velocity; Coefficient of Friction; Geometry; Flat Plates

20020073149 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Lessons Learned from Selecting and Testing Spaceflight Potentiometers
Iskenderian, T., Jet Propulsion Lab., California Inst. of Tech., USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 339-358; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche
A solar array drive (SAD) was designed for operation on the TOPEX/POSEIDON spacecraft that was launched in August, 1992. The experience gained in selecting, specifying, testing to failure, and redesigning its position sensor produced valuable lessons for future component selection and qualification. Issues of spaceflight heritage, cost/benefit/risk assessment, and component specification are addressed. It was found that costly schedule and budget overruns may have been avoided if the capability of the candidate sensors to meet requirements had been more critically examined prior to freezing the design. The use of engineering models and early qualification tests is also recommended.
Author
Potentiometers (Resistors); Assessments; Cost Analysis; Cost Effectiveness

20020073535 NASA Ames Research Center, Moffett Field, CA USA

Active Wireless Temperature Sensors for Aerospace Thermal Protection Systems

Milos, Frank S., NASA Ames Research Center, USA; Karunaratne, K., Korteks, USA; Jul. 10, 2002; 1p; In English; SPIE 8th Annual International Symposium on NDE for Health Monitoring and Diagnostics, 2-6 Mar. 2003, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Health diagnostics is an area where major improvements have been identified for potential implementation into the design of new reusable launch vehicles in order to reduce life-cycle costs, to increase safety margins, and to improve mission reliability. NASA Ames is leading the effort to advance inspection and health management technologies for thermal protection systems. This paper summarizes a joint project between NASA Ames and Korteks to develop active wireless sensors that can be embedded in the thermal protection system to monitor sub-surface temperature histories. These devices are thermocouples integrated with radio-frequency identification circuitry to enable acquisition and non-contact communication of temperature data through aerospace thermal protection materials. Two generations of prototype sensors are discussed. The advanced prototype collects data from three type-k thermocouples attached to a 2.54-cm square integrated circuit.

Author

Systems Health Monitoring; Temperature Sensors; Temperature 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.

20020070782 Illinois Univ., Gear Research Center, Chicago, IL USA

Design and Stress Analysis of Low-Noise Adjusted Bearing Contact Spiral Bevel Gears

Fuentes, A., Polytechnic Univ. of Cartagena, Spain; Litvin, F. L., Illinois Univ., USA; Mullins, B. R., Bell Helicopter Co., USA; Woods, R., Bell Helicopter Co., USA; Handschuh, R. F., Army Research Lab., USA; Lewicki, David G., Army Research Lab., USA; Mar. 01, 2002; 14p; In English; International Conference on Gears, 13-15 Mar. 2002, Munich, Germany

Contract(s)/Grant(s): RTOP 708-90-13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An integrated computerized approach for design and stress analysis of low-noise spiral bevel gear drives with adjusted bearing contact is proposed. The procedure of computations is an iterative process that requires four separate procedures and provide: (a) a parabolic function of transmission errors that is able to reduce the effect of errors of alignment on noise and vibration, and (b) reduction of the shift of bearing contact caused by misalignment. Application of finite element analysis enables us to determine the contact and bending stresses and investigate the formation of the bearing contact. The design of finite element models and boundary conditions is automated and does not require intermediate CAD computer programs for application of general purpose computer program for finite element analysis.

Author

Design Analysis; Stress Analysis; Spiral Bevel Gears; Mechanical Drives; Gears; Finite Element Method

20020070783 Boeing Co., Mesa, AZ USA

Torque Splitting by a Concentric Face Gear Transmission

Filler, Robert R., Boeing Co., USA; Heath, Gregory F., Boeing Co., USA; Slaughter, Stephen C., Boeing Co., USA; Lewicki, David G., Army Research Lab., USA; Jun. 01, 2002; 17p; In English; American Helicopter Society 58th Annual Forum, 11-13 Jun. 2002, Montreal, Canada; Sponsored by American Helicopter Society, Inc., USA

Contract(s)/Grant(s): NCC3-356; RTOP 708-90-13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Tests of a 167 Kilowatt (224 Horsepower) split torque face gearbox were performed by the Boeing Company in Mesa, Arizona, while working under a Defense Advanced Research Projects Agency (DARPA) Technology Reinvestment Program (TRP). This paper provides a summary of these cooperative tests, which were jointly funded by Boeing and DARPA. Design, manufacture and testing of the scaled-power TRP proof-of-concept (POC) split torque gearbox followed preliminary evaluations of the concept performed early in the program. The split torque tests were run using 200 N-m (1767 in-lbs) torque input to each side of the transmission. During tests, two input pinions were slow rolled while in mesh with the two face gears. Two idler gears were also used in the configuration to recombine torque near the output. Resistance was applied at the output face gear to create the required loading conditions in the gear teeth. A system of weights, pulleys and cables were used in the test rig to provide both the input and output loading. Strain gages applied in the tooth root fillets provided strain indication used to determine torque

splitting conditions at the input pinions. The final two pinion-two idler tests indicated 52% to 48% average torque split capabilities for the two pinions. During the same tests, a 57% to 43% average distribution of the torque being recombined to the upper face gear from the lower face gear was measured between the two idlers. The POC split torque tests demonstrated that face gears can be applied effectively in split torque rotorcraft transmissions, yielding good potential for significant weight, cost and reliability improvements over existing equipment using spiral bevel gearing.
Author
Gear Teeth; Spiral Bevel Gears; Torque; Transmissions (Machine Elements); Strain Measurement

20020070865 Massachusetts Univ., Dept. of Mechanical and Industrial Engineering, Amherst, MA USA
Condition Monitoring of Helicopter Gearboxes by Embedded Sensors
Suryavanashi, Abhijit, Massachusetts Univ., USA; Wang, Shengda, Massachusetts Univ., USA; Gao, Robert, Massachusetts Univ., USA; Danai, Kourosh, Massachusetts Univ., USA; Lewicki, David G., Army Research Lab., USA; Jun. 01, 2002; 10p; In English; American Helicopter Society 58th Annual Forum, 11-13 Jun. 2002, Montreal, Canada; Sponsored by American Helicopter Society, Inc., USA
Contract(s)/Grant(s): NAG3-2452; RTOP 708-90-13; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Health of helicopter gearboxes is commonly assessed by monitoring the housing vibration, thus it is challenged by poor signal-to-noise ratio of the signal measured away from the source. It is hypothesized that vibration measurements from sensors placed inside the gearbox will be much clearer indicators of faults and will eliminate many of the difficulties faced by present condition monitoring systems. This paper outlines our approach to devising such a monitoring system. Several tasks have been outlined toward this objective and the strategy to address each has been described. Among the tasks are wireless sensor design, antenna design, and selection of sensor locations.
Author
Helicopters; Transmissions (Machine Elements); Sensors; Vibration Measurement; Signal Processing; Wireless Communication; Systems Health Monitoring

20020072719 Army Research Lab., Vehicle Technology Directorate, Cleveland, OH USA
Testing of Face-Milled Spiral Bevel Gears at High-Speed and Load
Handschuch, Robert F., Army Research Lab., USA; International Journal of Gearing and Transmissions; [2002]; ISSN 1335-518X, No. 3, pp. 36-45; In English
Contract(s)/Grant(s): RTOP 722-90-06; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Spiral bevel gears are important drive system components of rotorcraft (helicopters) currently in use. In this application the spiral bevel gears are required to transmit very high torque at high rotational speed. Available experimental data on the operational characteristics for thermal and structural behavior is relatively small in comparison to that found for parallel axis gears. An ongoing test program has been in place at NASA Glenn Research Center over the last ten years to investigate their operational behavior at operating conditions found in aerospace applications. This paper will summarize the results of the tests conducted on face-milled spiral bevel gears. The data from the pinion member (temperature and stress) were taken at conditions from slow-roll to 14400 rpm and up to 537 kW (720 hp). The results have shown that operating temperature is affected by the location of the lubricating jet with respect to the point it is injected and the operating conditions that are imposed. Also the stress measured from slow-roll to very high rotational speed, at various torque levels, indicated little dynamic affect over the rotational speeds tested.
Author
Spiral Bevel Gears; Temperature Effects; Mechanical Drives; Loads (Forces); Aerospace Engineering

20020072742 NASA Marshall Space Flight Center, Huntsville, AL USA
Thermal Stir Welding: A New Solid State Welding Process
Ding, R. Jeffery, NASA Marshall Space Flight Center, USA; Apr. 16, 2002; 1p; In English; NASA Advanced Materials Symposium, 28-30 May 2002, Cleveland, OH, USA; No Copyright; Avail: Issuing Activity; Abstract Only
Thermal Stir Shielding is a revolutionary new welding process developed at NASA's Marshall Space Flight Center in Huntsville, AL. Thermal stir welding is similar to friction stir welding in that it joins similar or dissimilar materials without melting the parent material. However, unlike friction stir welding, the heating and stirring functions are independent allowing more degrees of freedom for greater process control. This paper introduces the mechanics of the thermal stir welding process. In addition, weld mechanical property data is presented for selected alloys as well as metallurgical analysis.
Author
Mechanical Properties; Welding; Stirring

20020072842 NASA Glenn Research Center, Cleveland, OH USA

A Comparison Study of Magnetic Bearing Controllers for a Fully Suspended Dynamic Spin Rig

Choi, Benjamin, NASA Glenn Research Center, USA; Johnson, Dexter, NASA Glenn Research Center, USA; Morrison, Carlos, NASA Glenn Research Center, USA; Mehmed, Oral, NASA Glenn Research Center, USA; Jun. 18, 2002; 6p; In English; 8th International Symposium on Magnetic Bearings, 26-28 Aug. 2002, Mito, Japan; Sponsored by American Society of Mechanical Engineers, USA

Contract(s)/Grant(s): RTOP 708-28-13

Report No.(s): ISMB-8-Paper-0160; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

NASA Glenn Research Center (GRC) has developed a fully suspended magnetic bearing system for the Dynamic Spin Rig (DSR) that is used to perform vibration tests of turbomachinery blades and components under spinning conditions in a vacuum. Two heteropolar radial magnetic bearings and a thrust bearing and the associated control system were integrated into the DSR to provide noncontact magnetic suspension and mechanical excitation of the 35 lb vertical rotor with blades to induce turbomachinery blade vibration. A simple proportional-integral-derivative (PID) controller with a special feature for multidirectional radial excitation worked very well to both support and shake the shaft with blades. However, more advanced controllers were developed and successfully tested to determine the optimal controller in terms of sensor and processing noise reduction, smaller rotor orbits, and energy savings for the system. The test results of a variety of controllers we demonstrated up to the rig's maximum allowable speed of 10,000 rpm are shown.

Author

Magnetic Bearings; Turbomachinery; Vibration Tests; Magnetic Suspension; Noise Reduction

20020073131 Lockheed Missiles and Space Co., Sunnyvale, CA USA

Space Station Freedom Solar Array Tension Mechanism Development

Allmon, Curtis, Lockheed Missiles and Space Co., USA; Haugen, Bert, Lockheed Missiles and Space Co., USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 123-128; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

The tension mechanism is used to apply a tension force to the Space Station Freedom Solar Array Blanket. This tension is necessary to meet the deployed frequency requirement of the array as well as maintain flatness of the flexible substrate solar cell blanket. The mechanism underwent a series of design iterations before arriving at the final design. This paper discusses the design and testing of the mechanism.

Author

Tensile Stress; Solar Cells; Solar Arrays

20020073139 Space Systems/Loral, Palo Alto, CA USA

Two-Axis Antenna Positioning Mechanism

Herald, Michelle, Space Systems/Loral, USA; Wai, Leilani C., International Telecommunications Satellite Organization, USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 183-197; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

The Two-Axis Antenna Positioning Mechanism (TAAPM) is used to position three Ku- and one C-band spot antennas on the INTELSAT VII (I-VII) spacecraft, which is a commercial telecommunications satellite purchased and operated by INTELSAT, an international consortium. The first I-VII was successfully launched on 22 October 1993 from French Guiana on an Ariane launch vehicle. All TAAPMs on the first I-VII satellite successfully completed their in-orbit functional testing. The TAAPM was an entirely new design for Space Systems/ Loral. This paper will describe the spacecraft/ system requirements and application of the TAAPM, and present the technical findings of TAAPM qualification and protoflight testing.

Author

Microwave Antennas; C Band; Performance Tests; Positioning

20020073141 MATRA Marconi Space, Automatic Control Systems and Propulsion Div., Toulouse, France

Pointing and Tracking Space Mechanism for Laser Communication

Brunschvig, A., MATRA Marconi Space, France; deBoisanger, M., MATRA Marconi Space, France; 28th Aerospace Mechanisms Symposium; May 1994, pp. 211-228; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

Space optical communication is considered a promising technology regarding its high data rate and confidentiality capabilities. However, it requires today complex satellite systems involving highly accurate mechanisms. This paper aims to highlight the stringent requirements which had to be fulfilled for such a mechanism, the way an existing design has been adapted

to meet these requirements and the main technical difficulties which have been overcome thanks to extensive development tests throughout the C/D phase initiated in 1991. The expected on-orbit performance of this mechanism is also presented.
Author
Optical Communication; Space Communication; Spaceborne Lasers; Tracking (Position)

20020073142 European Space Tribology Lab., Risley, UK
A Comparison of the Performance of Solid and Liquid Lubricants in Oscillating Spacecraft Ball Bearings
Gill, Steve, European Space Tribology Lab., UK; 28th Aerospace Mechanisms Symposium; May 1994, pp. 229-244; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

The European Space Tribology Laboratory (ESTL) has been engaged in a program to compare the performance of oscillating ball bearings when lubricated by a number of space lubricants, both liquid and solid. The results have shown that mean torque levels are increased by up to a factor of five above the normal running torque, and that often torque peaks of even greater magnitudes are present at the ends of travel. It is believed that these effects are caused by a build-up of compacted debris in the contact zone, thus reducing the ball/race conformity ratio.
Author
Ball Bearings; Lubrication; Oscillations

20020073143 European Space Tribology Lab., Risley, UK
Development of Long-Life, Low-Noise Linear Bearings for Atmospheric Interferometry
Roberts, E. W., European Space Tribology Lab., UK; Watters, R. B., European Space Tribology Lab., UK; Gill, S., European Space Tribology Lab., UK; Birner, R., Deutsche Aerospace A.G., Germany; Lange, G., Deutsche Aerospace A.G., Germany; Posselt, W., Deutsche Aerospace A.G., Germany; 28th Aerospace Mechanisms Symposium; May 1994, pp. 245-264; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

This paper describes the development of dry-lubricated linear bearings for use on the Michelson Interferometer for Passive Atmospheric Sounding (MIPAS). Two candidate bearing systems were developed and tested. In the first, use was made of linear roller (needle) bearings equipped with a pulley-and-cable arrangement to prevent cage drift and to minimize roller slip. The second design was of a roller-guided bearing system in which guidance was provided by ball bearings rolling along guide rods. The paper focuses on the development of these linear bearing systems and describes the approach taken in terms of bearing design, lubrication methods, screening programs and thermal vacuum testing. Development difficulties are highlighted and the solutions ultimately adopted are described.
Author
Solid Lubricants; Needle Bearings; Ball Bearings

20020073145 Draper (Charles Stark) Lab., Inc., Cambridge, MA USA
Design of a High-Speed Reliable Ball Bearing
Singer, Herbert B., Draper (Charles Stark) Lab., Inc., USA; Gelotte, Erik, Draper (Charles Stark) Lab., Inc., USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 279-283; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

A high-speed, reliable ball bearing has been designed for at least fifteen years of operation in space effectors, MWAs, and RWAs. Advance bearing concepts have been used in this design, such as: no ball retainer, which eliminates all retainer-related problems; an external lubricating system that will supply the lubricant at a specified flow rate; and a cartridge assembly that will allow the instrument user to purchase a ready-to-use bearing assembly, with lubricator. Currently, two assemblies are on life test at 12,000 RPM and have accumulated over 20,000 hours, each, with consistent low-torque losses. The paper will describe each of the salient features.
Author
Ball Bearings; Lubrication

20020073146 Lockheed Missiles and Space Co., Sunnyvale, CA USA
MSAT Boom Joint Testing and Load Absorber Design
Klinker, D. H., Lockheed Missiles and Space Co., USA; Shuey, K., Lockheed Missiles and Space Co., USA; St.Clair, D. R., Lockheed Missiles and Space Co., USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 285-302; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

Through a series of component and system-level tests, the torque margin for the MSAT (Mobile Satellite) booms is being determined. The verification process has yielded a number of results and lessons that can be applied to many other types of

deployable spacecraft mechanisms. The MSAT Load Absorber has proven to be an effective way to provide high energy dissipation using crushable honeycomb. Using two stages of crushable honeycomb and a fusible link, a complex crush load profile has been designed and implemented. The design features of the Load Absorber lend themselves to use in other spacecraft applications.
Author
MSAT; Energy Dissipation; Honeycomb Structures; Loads (Forces); Torque; Booms (Equipment)

20020073147 Lockheed Missiles and Space Co., Sunnyvale, CA USA
Special Test Equipment and Fixturing for MSAT Reflector Assembly Alignment
Young, Jeffrey A., Lockheed Missiles and Space Co., USA; Zinn, Michael R., Lockheed Missiles and Space Co., USA; McCarten, David R., Lockheed Missiles and Space Co., USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 303-322; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

The MSAT Reflector Assembly is a state of the art subsystem for Mobile Satellite (MSAT), a geosynchronous-based commercial mobile telecommunication satellite program serving North America. The Reflector Assembly consisted of a deployable, three-hinge, folding-segment Boom, deployable 5.7 x 5.3-meter 16-rib Wrap-Rib (trademark) Reflector, and a Reflector Pointing Mechanism (RPM). The MSAT spacecraft was based on a Hughes HS601 spacecraft bus carrying two Reflector Assemblies independently dedicated for L-band transmit and receive operations. Lockheed Missiles and Space Company (LMSC) designed and built the Reflector Assembly for MSAT under contract to SPAR Aerospace Ltd. Two MSAT satellites were built jointly by SPAR Aerospace Ltd. and Hughes Space and Communications Co. for this program, the first scheduled for launch in 1994. When scaled for wavelength, the assembly and alignment requirements for the Reflector Assembly were in many instances equivalent to or exceeded that of a diffraction-limited visible light optical system. Combined with logistical constraints inherent to large, compliant, lightweight structures; 'bolt-on' alignment; and remote, indirect spacecraft access; the technical challenges were formidable. This document describes the alignment methods, the special test equipment, and fixturing for Reflector Assembly assembly and alignment.
Author
MSAT; Reflectors; Alignment; Booms (Equipment)

20020073148 Astro Aerospace Corp., Carpinteria, CA USA
Deployable and Retractable Telescoping Tubular Structure Development
Thomson, M. W., Astro Aerospace Corp., USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 323-338; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

A new deployable and retractable telescopic boom capable of high deployed stiffness and strength is described. Deployment and retraction functions are controlled by simple, reliable, and fail-safe latches between the tubular segments. The latch and a BI-STEM Storable Tubular Extendible Member) actuator work together to eliminate the need for the segments to overlap when deployed. This yields an unusually lightweight boom and compact launch configuration. An aluminum space-flight prototype with three joints displays zero structural deadband, low hysteresis, and high damping. The development approach and difficulties are discussed. Test results provide a joint model for sizing flight booms of any diameter and length.
Author
Booms (Equipment); Retractable Equipment; Folding Structures

20020073152 G and H Technology, Inc., Camarillo, CA USA
Payload Holddown and Release Mechanism
Chaput, Dale, G and H Technology, Inc., USA; Visconti, Mark, G and H Technology, Inc., USA; Edwards, Michael, G and H Technology, Inc., USA; Moran, Tom, G and H Technology, Inc., USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 395-411; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

A payload holddown and release mechanism, designated the Model 1172, was designed and built at G and H Technology during the winter of 1992/1993. The mechanism is able to restrain and release a 45-pound payload with minimal tipoff. The payload is held in place by a stainless steel band and released using electrically triggered nonexplosive actuators. These actuators provide reliable operation with negligible shock and no special handling requirements. The performance of the mechanism was demonstrated in two flight tests. Data showed pitch and yaw tipoff rates of less than 0.07 radian (4 degree) per second. The Model 1172 design is an efficient replacement for conventional payload deployment devices, especially where low transmitted shock is required.
Author
Payloads; Deployment

20020073153 Naval Research Lab., Washington, DC USA

Advanced Release Technologies Program

Purdy, Bill, Naval Research Lab., USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 413-427; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

The objective of the ARTS (Advanced Release Technologies) program was to develop lighter and less expensive spacecraft ordnance and release systems that answer to the requirements of a wide variety of spacecraft applications. These improvements were to be evaluated at the spacecraft system level, as it was determined that there were substantial system-level costs associated with the present ordnance and release subsystems. New, better devices were to be developed, then flight qualified, then integrated into a flight experiment in order to prove the reliability required for their subsequent use on high-reliability spacecraft. The secondary goal of the program was to quantify the system-level benefits of these new subsystems based upon the development program results. Three non-explosive release mechanisms and one laser-diode-based ordnance system were qualified under the program. The release devices being developed were required to release high preloads because it is easier to scale down a release mechanism than to scale it up. The laser initiator developed was required to be a direct replacement for NASA Standard Initiators, since these are the most common initiator in use presently. The program began in October, 1991, with completion of the flight experiment scheduled for February, 1994. This paper will: 1) provide an overview of the ARTS program, 2) discuss the benefits of using the ARTS components, 3) introduce the new components, 4) compare them with conventional systems and each other, and 5) provide recommendations on how best to implement them.

Author

Payloads; Deployment; Assessments

20020073154 NASA Johnson Space Center, Houston, TX USA

Load-Limiting Landing Gear Footpad Energy Absorption System

Hansen, Chris, NASA Johnson Space Center, USA; Tsai, Ted, NASA Johnson Space Center, USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 429-441; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

As a precursor to future manned missions to the moon, an inexpensive, unmanned vehicle that could carry small, scientific payloads to the lunar surface was studied by NASA. The vehicle, called the Common Lunar Lander, required extremely optimized structural systems to increase the potential payload mass. A lightweight energy-absorbing system (LAGFEAS), which also acts as a landing load-limiter was designed to help achieve this optimized structure. Since the versatile and easily tailored system is a load-limiter, it allowed for the structure to be designed independently of the ever-changing landing energy predictions. This paper describes the LAGFEAS system and preliminary verification testing performed at NASA's Johnson Space Center for the Common Lunar Lander program.

Author

Energy Absorption; Landing Gear; Lunar Landing Modules; Unmanned Spacecraft; Design Optimization

20020073163 NASA Ames Research Center, Moffett Field, CA USA

Computational Approach for Developing Blood Pump

Kwak, Dochan, NASA Ames Research Center, USA; Jul. 08, 2002; 28p; In English, 23 Jul. 2002, Auckland, Canterbury, New Zealand, New Zealand; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This viewgraph presentation provides an overview of the computational approach to developing a ventricular assist device (VAD) which utilizes NASA aerospace technology. The VAD is used as a temporary support to sick ventricles for those who suffer from late stage congestive heart failure (CHF). The need for donor hearts is much greater than their availability, and the VAD is seen as a bridge-to-transplant. The computational issues confronting the design of a more advanced, reliable VAD include the modelling of viscous incompressible flow. A computational approach provides the possibility of quantifying the flow characteristics, which is especially valuable for analyzing compact design with highly sensitive operating conditions. Computational fluid dynamics (CFD) and rocket engine technology has been applied to modify the design of a VAD which enabled human transplantation. The computing requirement for this project is still large, however, and the unsteady analysis of the entire system from natural heart to aorta involves several hundred revolutions of the impeller. Further study is needed to assess the impact of mechanical VADs on the human body

CASI

Blood Pumps; Computational Fluid Dynamics; Heart; Heart Diseases; Pulmonary Circulation; Aerospace Technology Transfer

20020073382 NASA Glenn Research Center, Cleveland, OH USA

Two- and Three-Dimensional Numerical Experiments Representing Two Limiting Cases of an In-Line Pair of Finger Seal Components

Braun, M. J., Akron Univ., USA; Steinetz, B. M., NASA Glenn Research Center, USA; Kudriavtsev, V. V., CFD Canada, Canada; Proctor, M. P., NASA Glenn Research Center, USA; Jan. 01, 2002; 11p; In English; 9th International Symposium on Transport Phenomena and Dynamics of Rotating Machinery, 10-14 Feb. 2002, Honolulu, HI, USA; Sponsored by Pacific Centre of Thermal Fluids Engineering, Unknown

Contract(s)/Grant(s): RTOP 708-28-13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The work presented here concerns the numerical development and simulation of the flow, pressure patterns and motion of a pair of fingers arranged behind each other and axially aligned in-line. The fingers represent the basic elemental component of a Finger Seal (FS) and form a tight seal around the rotor. Yet their flexibility allows compliance with rotor motion and in a passive-adaptive mode complies also with the hydrodynamic forces induced by the flowing fluid. While the paper does not treat the actual staggered configuration of a finger seal, the inline arrangement represents a first step towards that final goal. The numerical 2-D (axial-radial) and 3-D results presented herein were obtained using a commercial package (CFD-ACE+). Both models use an integrated numerical approach, which couples the hydrodynamic fluid model (Navier-Stokes based) to the solid mechanics code that models the compliance of the fingers.

Author

Computational Fluid Dynamics; Rotors; Solid Mechanics; Seals (Stoppers)

20020073798 NASA Marshall Space Flight Center, Huntsville, AL USA

Thermo-Mechanical Turbopump Design and Analysis Tools

Platt, Michael J., Concepts ETI, Inc., USA; Cook, Conan, Concepts ETI, Inc., USA; Marsh, Matthew, NASA Marshall Space Flight Center, USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 39-48; In English; Also announced as 20020073794; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The design and analysis tools developed in this project improve the turbopump design process through data synthesis of component models, encompassing information from pump and turbine designs, in addition to shafts, bearings, seals, and internal flows. The combined toolset provides the ability to address static, quasi-static, and transient thermo-mechanical requirements sooner in the design process, improving the design cycle time and overall life and reliability of the turbopump system.

Author

Design Analysis; Turbine Pumps; Design Optimization; Thermodynamics; Computer Programs

20020073799 Concepts ETI, Inc., White River Jct, VT USA

Overview of Industrial Pump Inducer Design

Japikse, D., Concepts ETI, Inc., USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 59-76; In English; Also announced as 20020073794; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

High performance inducers for commercial low suction pressure pumps have been designed frequently during the past century. Some design lore has evolved to guide this design process; additionally, some detailed flow observations have been made which shed light on the basic flow process. Design methods have been recommended during the past decades to guide inducer design. This paper reviews some of the design methods, some of the flow observations, and some of the design practice which is used for inducer design. The purpose of this review is to bring together a good portion of prior art and focus it from a modern designer's perspective. Some suggestions for future improvements are provided. A useful overview of current design practice is given which should provide guidance to current inducer pump design.

Author

Pumps; Design

20020073817 Georgia Inst. of Tech., Aerospace Systems Design Lab., Atlanta, GA USA

Propulsion System Modeling and Simulation

Tai, Jimmy C. M., Georgia Inst. of Tech., USA; McClure, Erin K., Georgia Inst. of Tech., USA; Mavris, Dimitri N., Georgia Inst. of Tech., USA; Burg, Cecile, Georgia Inst. of Tech., USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 49-58; In English; Also announced as 20020073794

Contract(s)/Grant(s): NAS3-00179; N00014-97-1-0783; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The Aerospace Systems Design Laboratory at the School of Aerospace Engineering in Georgia Institute of Technology has developed a core competency that enables propulsion technology managers to make technology investment decisions substantiated by propulsion and airframe technology system studies. This method assists the designer/manager in selecting appropriate technology concepts while accounting for the presence of risk and uncertainty as well as interactions between disciplines. This capability is incorporated into a single design simulation system that is described in this paper. This propulsion system design environment is created with a commercially available software called iSIGHT, which is a generic computational framework, and with analysis programs for engine cycle, engine flowpath, mission, and economic analyses. iSIGHT is used to integrate these analysis tools within a single computer platform and facilitate information transfer amongst the various codes. The resulting modeling and simulation (M&S) environment in conjunction with the response surface method provides the designer/decision-maker an analytical means to examine the entire design space from either a subsystem and/or system perspective. The results of this paper will enable managers to analytically play what-if games to gain insight in to the benefits (and/or degradation) of changing engine cycle design parameters. Furthermore, the propulsion design space will be explored probabilistically to show the feasibility and viability of the propulsion system integrated with a vehicle.
Author
Engine Design; Propulsion System Configurations; Propulsion System Performance; Design Analysis; Decision Making

20020073821 NASA Lewis Research Center, Cleveland, OH USA
20th Aerospace Mechanisms Symposium
20th Aerospace Mechanisms Symposium; May 1986; 322p; In English; 20th Aerospace Mechanisms Symposium, 7-9 May 1986, Cleveland, OH, USA; Sponsored by NASA Lewis Research Center, USA; Also announced as 20020073822 through 20020073843
Report No.(s): NASA-CP-2423-Rev; E-2904-Rev; NAS 1.55:2423-Rev; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche
The proceedings of the 20th Aerospace Mechanisms Symposium, hosted by the NASA Lewis Research Center, Cleveland, Ohio, on May 7-9, 1986, is documented herein. During the 3 days, 23 technical papers were presented by experts from the USA and Western Europe. A panel discussion by an International group of experts on future directions In mechanisms was also presented; this discussion, however, is not documented herein. The technical topics addressed included deployable structures, electromagnetic devices, tribology, thermal/mechanical/hydraulic actuators, latching devices, positioning mechanisms, robotic manipulators, and computerized mechanisms synthesis.
Author
Conferences; Mechanical Devices; Mechanics (Physics); Tribology

20020073822 Messerschmitt-Boelkow-Blohm G.m.b.H., Space Systems Group, Bremen, Germany
Design and Development of a Telescopic Axial Boom
Felkai, Roland, Messerschmitt-Boelkow-Blohm G.m.b.H., Germany; 20th Aerospace Mechanisms Symposium; May 1986, pp. 1-12; In English; Also announced as 20020073821; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche
A special telescopic boom has been design-optimized, developed and qualified to carry an S-band Antenna for the DFS-Deutscher Fernmelde Satellit (German Telecommunication Satellite) - KOPERNIKUS. This paper describes the ”design driver” requirements, the alternatives investigated and the final technical solution, the tests performed, and identifies the special problem areas encountered during its development.
Author
Booms (Equipment); Design Optimization; Design Analysis; Functional Design Specifications; Folding Structures

20020073823 Dornier System G.m.b.H., Friedrichshaften, Germany
Extendable Retractable Telescopic Mast for Deployable Structures
Schmid, M., Dornier System G.m.b.H., Germany; Aguirre, M., European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; 20th Aerospace Mechanisms Symposium; May 1986, pp. 13-29; In English; Also announced as 20020073821; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche
The Extendable and Retractable Mast (ERM) which is presently developed by DORNIER in the frame of an ESA (European Space Agency) contract, will be used to deploy and retract large foldable structures. The design is based on a telescopic carbon fiber structure with high stiffness, strength and pointing accuracy. to verify the chosen design, a breadboard model of an ERM was built and tested under thermal vacuum (TV) conditions. It is planned as a follow-on development to manufacture and test an

Engineering Model Mast. The Engineering Model will be used to establish the basis for an ERM family covering a wide range of requirements.
Author
Beams (Supports); Retractable Equipment; Folding Structures; Space Erectable Structures; Spacecraft Structures

20020073826 NASA Marshall Space Flight Center, Huntsville, AL USA
Design and Analysis of a Keel Latch for Use on the Hubble Space Telescope
Calvert, John, NASA Marshall Space Flight Center, USA; Stinson, Melanie, NASA Marshall Space Flight Center, USA; 20th Aerospace Mechanisms Symposium; May 1986, pp. 55-71; In English; Also announced as 20020073821; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper will be divided into two parts. The first part will deal with the mechanical design of the keel latch. The second part will be the stress analysis of the keel latch. The first part will present: (1) background information; (2) mechanical design requirements; (3) some of the initial design considerations; (4) the design considerations that led to the selection of the final design; (5) the mechanics of the final design; (6) testing that has been and will be accomplished to verify that design requirements have been met; and (7) future tests.
Author
Design Analysis; Stress Analysis; Latches; Hubble Space Telescope

20020073827 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Mirror Transport Mechanism for Use at Cryogenic Temperatures
Stark, Kenneth W., NASA Goddard Space Flight Center, USA; Wilson, Meredith, NASA Goddard Space Flight Center, USA; 20th Aerospace Mechanisms Symposium; May 1986, pp. 73-95; In English; Also announced as 20020073821; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This report describes the Mirror Transport Mechanism (MTM), which supports a pair of dihedral mirrors and moves them in a very smooth and uniform scanning motion normal to a beamsplitter. Each scan is followed by a quick flyback and repeat. Included in the report will be material selection, design, and testing of all major components of the MTM in order to meet the stringent performance requirements under cryogenic conditions and survive the launch environment of the shuttle. Areas to be discussed in detail will be those in which failures or performance anomalies occurred and their solutions. Typically, this will include (but not to be limited to) flex pivot failures during vibration testing, excessive dihedral platform sag under one ”g” operation, electronic and fiber optic characteristics, and tolerancing considerations. As of this writing, development of the mechanism has reached the final phase of thermal and vibration qualification. Environmental testing of the complete FIRAS (Far Infrared Absolute Spectrophotometer) experiment is just beginning.
Author
Cryogenic Temperature; Mirrors; Vibration Tests; Temperature Effects; Infrared Spectrophotometers; Mechanical Engineering; Mechanical Devices

20020073828 NASA Goddard Space Flight Center, Greenbelt, MD USA
Shutter Mechanism for Calibration of the Cryogenic Diffused Infrared Background Experiment (DIRBE) Instrument
Tyler, Allen, NASA Goddard Space Flight Center, USA; 20th Aerospace Mechanisms Symposium; May 1986, pp. 97-102; In English; Also announced as 20020073821; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper describes the design requirements, the design, the assembly and alignment, and the test program for a shutter mechanism which must operate at cryogenic temperature and draw less than 1.0 milliwatt. The design solution to meet these requirements is a device that positions a mirror with repeated accuracy, has no wearing surfaces and operates at 2.0 K. The unique feature of this device is the simplicity of the mechanism, thus obtaining high reliability.
Author
Cryogenic Temperature; Mirrors; Shutters; Mechanical Engineering; Aerospace Environments; Mechanical Devices; Infrared Detectors

20020073830 Battelle Columbus Labs., OH USA
Rolling Element Bearings in Space
Kannel, J. W., Battelle Columbus Labs., USA; Dufrane, K. F., Battelle Columbus Labs., USA; 20th Aerospace Mechanisms Symposium; May 1986, pp. 121-132; In English; Also announced as 20020073821; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The paper discusses some of the advances in tribology that have been associated with aerospace mechanisms. The needs of aerospace have been the dominant forces leading to improvements in understanding and applying tribology technology. In the past two decades improvements in understanding bearing torque, elastohydrodynamic lubrication, lubricant distribution, cage stability, and transfer film lubricants have been made. It is anticipated that further developments will be made in response to future aerospace requirements.
Author
Tribology; Aerospace Engineering; Aerospace Environments; Roller Bearings; Mechanical Engineering

20020073833 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
Dual Wound DC Brush Motor Gearhead
Henson, Barrie W., European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; 20th Aerospace Mechanisms Symposium; May 1986, pp. 165-178; In English; Also announced as 20020073821; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche
This paper describes the design requirements, the design, development tests and problems, the qualification and life test and the findings of the strip examination of a dual wound DC brushed motor gearhead. At the time of writing it is the only space qualified dual wound DC brushed motor gearhead in Europe.
Author
Brushes (Electrical Contacts); Electric Motors; Mechanical Drives; Performance Tests; Design Analysis

20020073836 NASA Lewis Research Center, Cleveland, OH USA
Evaluation of a High-Torque Backlash-Free Roller Actuator
Steinetz, Bruce M., NASA Lewis Research Center, USA; Rohn, Douglas A., NASA Lewis Research Center, USA; Anderson, William, NASTEC, Inc., USA; 20th Aerospace Mechanisms Symposium; May 1986, pp. 205-230; In English; Also announced as 20020073821; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche
The results are presented herein of a test program that evaluated the stiffness, accuracy, torque ripple, frictional losses, and torque holding capability of a 16:1 ratio, 430 N-m (320 ft-lb) planetary roller drive for a potential space vehicle actuator application. The drive's planet roller supporting structure and bearings were found to be the largest contributors to overall drive compliance, accounting for more than half of the total. In comparison, the traction roller contacts themselves contributed only nine percent of the drive's compliance based on an experimentally verified stiffness model. The drive exhibited no backlash although 8 arc sec of hysteresis deflection were recorded due to microcreep within the contact under torque load. Because of these load-dependent displacements, some form of feedback control would be required for arc second positioning applications. Torque ripple tests showed the drive to be extremely smooth, actually providing some damping of input torsional oscillations. The drive also demonstrated the ability to hold static torque with drifts of 7 arc sec or less over a 24 hr period at 35 percent of full load.
Author
Rollers; Torque; Mechanical Drives; Traction; Actuators

20020073837 NASA Langley Research Center, Hampton, VA USA
A Precision, Thermally-Activated Driver for Space Application
Murray, Robert C., PRC Kentron, Inc., USA; Walsh, Robert F., PRC Kentron, Inc., USA; Kinard, William H., NASA Langley Research Center, USA; 20th Aerospace Mechanisms Symposium; May 1986, pp. 231-239; In English; Also announced as 20020073821; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche
This paper describes a space qualified, precision, large force, thermally activated driver that has been developed jointly by the NASA Langley Research Center and PRC Kentron. The driver consists of a sealed hydraulic cylinder containing a metal bellows, a bellows plug, a coil spring, a spring retainer, an output shaft, a shaft guide, and a quantity of silicone oil. Temperature changes cause the silicone oil to expand or contract thus contracting or expanding the bellows/spring assembly thereby extending or retracting the output shaft.
Author
Thermometers; Temperature Measurement; Space Weathering; Environmental Monitoring; Spacecraft Instruments

20020073838 Sperry Corp., Aerospace and Marine Group, Phoenix, AZ USA
Space Station Rotary Joint Mechanisms
Driskill, Glen W., Sperry Corp., USA; 20th Aerospace Mechanisms Symposium; May 1986, pp. 241-251; In English; Also announced as 20020073821; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper describes the mechanism which will be used on the Space Station to position the solar arrays and radiator panels for sun pointing and sun avoidance, respectively. The unique design features will be demonstrated on advanced development models of two of the joints being fabricated under contract to NASA-MSFC (Marshall Space Flight Center).
Author
Space Stations; Positioning Devices (Machinery); Mechanical Drives; Joints (Junctions)

20020073839 Boeing Aerospace Co., Seattle, WA USA
Hydraulic Mechanism to Limit Torsional Loads Between the IUS and Space Transportation System Orbiter
Farmer, James R., Boeing Aerospace Co., USA; 20th Aerospace Mechanisms Symposium; May 1986, pp. 253-263; In English; Also announced as 20020073821; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche
The Inertial Upper Stage (IUS) is a two stage booster used by NASA and the Defense Department to insert payloads into geosynchronous orbit from low Earth orbit. The hydraulic mechanism discussed in this paper was designed to perform a specific dynamic and static interface function within the Space Transportation System's Orbiter. This paper discusses requirements, configuration, and application of the hydraulic mechanism with emphasis on performance and methods of achieving zero external hydraulic leakage.
Author
Torsion; Hydraulic Equipment; Aerospace Environments; Leakage; Inertial Upper Stage

20020073840 S and Q Corp., Morgan Hill, CA USA
Design and Development of a Large Diameter, High Pressure, Fast Acting Propulsion Valve and Valve Actuator
Srinivasan, K. V., S and Q Corp., USA; 20th Aerospace Mechanisms Symposium; May 1986, pp. 265-276; In English; Also announced as 20020073821; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche
This paper describes the design and development of a large diameter high pressure quick acting propulsion valve and valve actuator. The valve is the heart of a major test facility dedicated to conducting full scale performance tests of aircraft landing gear systems. The valve opens in less than 300 milliseconds releasing a 46 cm (18 in) diameter water jet and closes in 300 milliseconds. The four main components of the valve, i.e., valve body, safety shutter, high speed shutter, and pneumatic-hydraulic actuator, are discussed. This valve is unique and may have other aerospace and industrial applications.
Author
Actuators; High Pressure; High Speed; Hydraulic Jets; Propulsion; Valves; Diameters; Test Facilities; Flow Characteristics

20020073841 Lockheed Missiles and Space Co., Sunnyvale, CA USA
Discrete Mechanism Damping Effects in the Solar Array Flight Experiment
Pinson, E. D., Lockheed Missiles and Space Co., USA; 20th Aerospace Mechanisms Symposium; May 1986, pp. 277-289; In English; Also announced as 20020073821; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche
Accelerometer data were collected during on-orbit structural dynamic testing of the Solar Array Flight Experiment aboard the Space Shuttle, and were analyzed at Lockheed Missiles and Space Co. to determine the amount of damping present in the structure. The results of this analysis indicated that the damping present in the fundamental in-plane mode of the structure substantially exceeded that of the fundamental out-of-plane mode. In an effort to determine the source of the higher in-plane damping, a test was performed involving a small device known as a constant-force spring motor or constant-torque mechanism. Results from this test indicate that this discrete device is at least partially responsible for the increased in-plane modal damping of the Solar Array Flight Experiment structure.
Author
Dynamic Structural Analysis; Oscillation Dampers; Spacecraft Structures; Structural Vibration

20020073842 Akron Univ., Akron, OH USA
A Mechanism for Precise Linear and Angular Adjustment Utilizing Flexures
Ellis, J. R., Akron Univ., USA; 20th Aerospace Mechanisms Symposium; May 1986, pp. 291-302; In English; Also announced as 20020073821
Contract(s)/Grant(s): N-7405-eng-26; NAG3-379; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche
This paper describes the design and development of a mechanism for precise linear and angular adjustment. This work was in support of the development of a mechanical extensometer for biaxial strain measurement. A compact mechanism was required which would allow angular adjustments about perpendicular axes with better than 10(exp -3) degree resolution. The approach adopted was first to develop a means of precise linear adjustment. to this end, a mechanism based on the toggle principle was built with inexpensive and easily manufactured parts. A detailed evaluation showed that the resolution of the mechanism was better

than 1 micron and that adjustments made by using the device were repeatable. In the second stage of this work, the linear adjustment mechanisms were used in conjunction with a simple arrangement of flexural pivots and attachment blocks to provide the required angular adjustments. A series of experiments conducted with an autocollimator showed that the resolution of the mechanisms was better than 10(exp -3) degrees. Also, the mechanism met all requirements regarding size, weight, and mechanical simplicity. Attempts to use the mechanism in conjunction with the biaxial extensometer under development proved unsuccessful. Any form of in situ adjustment was found to cause erratic changes in instrument output. These changes were due to problems with the suspension system. However, the subject mechanism performed well in its own right and appeared to have potential for use in other applications. One important advantage of flexure based mechanisms is that they can be designed to operate independently of screw threads. This raises the possibility that they can be used for precise linear and angular adjustment in a space environment.
Author
Extensometers; Structural Strain; Strain Measurement; Positioning Devices (Machinery); Positioning; Precision

20020073843 Itek Corp., Measurement Systems Div., Newton, MA USA
Weight and Power Savings Shaft Encoder Interfacing Techniques for Aerospace Applications
Breslow, Donald H., Itek Corp., USA; 20th Aerospace Mechanisms Symposium; May 1986, pp. 303-311; In English; Also announced as 20020073821; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Many aerospace applications for shaft angle digitizers such as optical shaft encoders require special features that are not usually required on commercial products. Among the most important user considerations are the lowest possible weight and power consumption. This paper will describe a variety of mechanical and electrical interface techniques that have large potential weight and power savings. The principles to be presented apply to a wide variety of encoders, ranging from 16 to 22 bit resolution and with diameters from 152 to 380 mm (6 to 15 in).
Author
Shafts (Machine Elements); Coders; Mechanical Devices; Mechanical Engineering; Electrical Engineering; Aerospace Engineering

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QUALITY ASSURANCE AND RELIABILITY

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

20020073169 NASA Ames Research Center, Moffett Field, CA USA
Failure Mode Identification Through Clustering Analysis
Arunajadai, Srikesh G., Missouri Univ., USA; Stone, Robert B., Missouri Univ., USA; Tumer, Irem Y., NASA Ames Research Center, USA; [2002]; 17p; In English
Contract(s)/Grant(s): NCC2-5423; NSF DMI-99-88817; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Research has shown that nearly 80% of the costs and problems are created in product development and that cost and quality are essentially designed into products in the conceptual stage. Currently, failure identification procedures (such as FMEA (Failure Modes and Effects Analysis), FMECA (Failure Modes, Effects and Criticality Analysis) and FTA (Fault Tree Analysis)) and design of experiments are being used for quality control and for the detection of potential failure modes during the detail design stage or post-product launch. Though all of these methods have their own advantages, they do not give information as to what are the predominant failures that a designer should focus on while designing a product. This work uses a functional approach to identify failure modes, which hypothesizes that similarities exist between different failure modes based on the functionality of the product/component. In this paper, a statistical clustering procedure is proposed to retrieve information on the set of predominant failures that a function experiences. The various stages of the methodology are illustrated using a hypothetical design example.
Author
Product Development; Quality Control; Statistical Analysis; Failure

20020073218 Mine Safety and Health Administration, Arlington, VA USA
Arcing Faults on Direct Current Trolley Systems
Hall, P. M.; Myers, K.; Vilcheck, W. S.; 2002; 24p; In English
Report No.(s): PB2002-108419; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper discusses tests that have been conducted to evaluate arcing short circuit faults on direct current trolley systems. Arcing faults supplied by single and multiple power sources and limited by various impedances were studied. Data were recorded

to compare various system behavior during arching faults. The instrumentation, test procedures, electrode material and other factors affecting arcing faults are described. The results are systematically evaluated and are compared to present Federal Regulations. Areas of further study and research are also presented.
NTIS
Short Circuits; Direct Current; Electric Arcs

20020073219 Mine Safety and Health Administration, Pittsburgh, PA USA
Autotransformers for Supplying Portable Mining Equipment
Checca, E. L.; 2002; 18p; In English
Report No.(s): PB2002-108420; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Power center manufacturers are using autotransformers to provide second utilization voltages and to derive system neutrals on the secondaries of ungrounded two winding transformers. The neutral is high resistance grounded and is intended to provide system grounding for all connected loads. A laboratory model for the different circuit configurations was used to determine if ground fault protection was provided. These configurations were analyzed and evaluated to determine if a safety problem existed. This paper discusses limitations on the use of autotransformers for establishing system grounding and the inherent hazards associated with their application.
NTIS
Electrical Grounding; Transformers; Portable Equipment; Electric Potential; Mining

20020073231 Defence Science and Technology Organisation, Airframes and Engines Div., Fishermans Bend, Australia
Principal Component Thermography
Rajic, N., Defence Science and Technology Organisation, Australia; April 2002; 36p; In English
Report No.(s): DSTO-TR-1298; DODA-AR-012-294; Copyright; Avail: Issuing Activity
This report describes a robust computational framework for the qualitative enhancement and quantitative interpretation of active thermographic inspection data. Singular Value Decomposition is used to reduce an appropriately constructed matrix of raw pixel values to a set of orthogonal functions that compactly describe the key spatial and temporal variations relating to underlying structural anomalies. Tests against synthetic and experimental data are described that underscore the practical efficacy of the methodology, and demonstrate significant advantages compared to more traditional methods of processing.
Author
Thermography; Matrices (Mathematics); Orthogonal Functions; Spatial Distribution; Temporal Distribution

20020073392 Nuklearni Inst. Jozef Stefan, Odsek za Racunalnisko Avtomatizacijo in Regulacije, Ljubljana, Yugoslavia
Comparison of Approximate Reasoning Approaches for Fault Isolation: A Simulation Study ***Primerjava Metod Aproksimativenega Sklepanja Pri Izolaciji Napak: Simulacijska Studija***
Rakar, Andrej, Nuklearni Inst. Jozef Stefan, Yugoslavia; Juricic, Dani, Nuklearni Inst. Jozef Stefan, Yugoslavia; Electrotechnical Review; 2002; ISSN 0013-5852; Volume 69, No. 2, pp. 120-127; In Slovene; Copyright; Avail: Issuing Activity
Tough competition on the market is putting pressure on companies to steadily increase their product quality while reducing production costs and adhering to environmental constraints. to accomplish this, modern model-based diagnostic systems should be designed, From available process data they first infer about the presence of a fault in the system (detection) and then they try to determine the type and location of a fault (isolation). Fault isolation is performed on the basis of symptoms' evaluation and their mutual dependencies by means of logical reasoning. The traditional Boolean reasoning seems to be unsuitable for practical applications [1] due to the problems with diagnostic instability. to overcome this problem, approximate reasoning approaches have been suggested. Bayesian reasoning [2] fuzzy logic [3], confirmation theory [4] and its derivatives DMP (Diagnostic Model Processor) [5] and DMA (Deep Model Algorithm) [6] belong to this track. A step further represents TBM (Transferable Belief Model) [7], which originates from the Dempster-Shafer's mathematical theory of evidence [8]. The paper focuses on a comparison of various reasoning approaches that have been suggested by different engineering communities. For this purpose, a benchmark case study of a three tank system is chosen. Several different faults were simulated and the following conclusions summarize the results. Results obtained with the DMP approach are often misleading and unreliable. In spite of considering different sensitivities of residuals, many faults exhibit similar failure likelihoods that make the isolation impossible. Similar holds for the DMA approach where there is also an obvious problem with the diagnostic instability. This is mainly due to the fact that the approach does not properly handle the signal noise, the size of which is usually independent and thus unrelated to the sensitivity of residuals to faults. Fuzzy logic and TBM approach give similar diagnostic results that are the best compared to the previous methods. All faults are successfully isolated, while diagnostic results are accurate, stable and reliable with some inconsistencies during the

transient periods. TBM successfully handles this case with high strength of conflict (SC) during these periods, thus correctly indicating lower reliability of diagnostic results during this time.
Author
Algorithms; Mathematical Models; Data Processing; Fault Detection; Logic Circuits; Fuzzy Systems

20020073413 Oregon Dept. of Transportation, Research Unit, Salem, OR USA
Strain Monitoring for Horsetail Falls and Sylvan Bridges ***Final Report***
Soltesz, S.; May 2002; 64p; In English
Report No.(s): PB2002-107270; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
Fiber optic sensors were installed on two reinforced concrete bridges that had been strengthened with fiber reinforced polymer composites. The primary objective for one of the bridges was to provide strain data to verify a computer model for the bridge developed under a separate project. A second objective was to evaluate the effect of fiber reinforced polymer composite reinforcement on bridge response. Unfortunately, usable strain data were not acquired prior to retrofit for either bridge to meet the second objective. This report summarizes the procedures used to install and monitor the sensors and the strain results after the composite retrofit.
NTIS
Bridges (Structures); Strain Gages; Data Acquisition; Computerized Simulation; Monitors

20020073812 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
BEAM: Technology for Autonomous Vehicle Health Monitoring
Park, Han, Jet Propulsion Lab., California Inst. of Tech., USA; Mackey, Ryan, Jet Propulsion Lab., California Inst. of Tech., USA; James, Mark, Jet Propulsion Lab., California Inst. of Tech., USA; Michail, Zak, Jet Propulsion Lab., California Inst. of Tech., USA; Baroth, Edmund, Jet Propulsion Lab., California Inst. of Tech., USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 243-254; In English; Also announced as 20020073794; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC
BEAM (Beacon-based Exception Analysis for Multimissions) is an end-to-end method of data analysis intended for real-time fault detection and characterization. It provides a generic signal-level system analysis capability for potential application to deep space probes and other highly automated systems. This paper describes in brief the architecture and applications of BEAM. BEAM provides a generalized formalism for diagnostics and prognostics in many instrumented systems. It can operate with all standard forms of data, both time-varying (sensor or extracted feature) quantities and discrete measurements, through its embedded physical and symbolic models. This approach can be adapted to on-board or ground-based implementations with no change to the basic operating theory. The approach is very synergistic with higher-level diagnostic systems such as Model-based Reasoners (MBAs) and can be easily integrated with other autonomy-enabling components such as planners and schedulers. The approach will be illustrated with an overview of application types, past validations, and ongoing efforts, including application to propulsion systems such as the Space Shuttle Main Engine.
Author
Systems Health Monitoring; Automatic Control; Autonomy; Real Time Operation; Fault Detection

20020073819 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Novel Model-Based Diagnosis Approaches for Advanced IVHM Systems
Fijany, Amir, Jet Propulsion Lab., California Inst. of Tech., USA; Vatan, Farokh, Jet Propulsion Lab., California Inst. of Tech., USA; Baroth, Ed, Jet Propulsion Lab., California Inst. of Tech., USA; Barrett, Anthony, Jet Propulsion Lab., California Inst. of Tech., USA; Mackey, Ryan, Jet Propulsion Lab., California Inst. of Tech., USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 255-265; In English; Also announced as 20020073794; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC
Over the past decade, the number of Earth orbiters and deep space probes has grown dramatically and is expected to continue growing in the future as miniaturization technologies drive spacecraft to become more numerous and more complex. This rate of growth has brought a new focus on autonomous and self-preserving systems that depend on fault diagnosis. The current manned systems, also heavily rely on Integrated Vehicle Health Management (IVHM) systems to increase reliability and reduce cost of operation. In this paper, we propose a two-fold approach to overcome these two limitations and to develop a new and powerful diagnosis engine. First, we propose a novel and compact reconstruction of General Diagnosis Engine (GDE), as one of the most fundamental approaches to model-based diagnosis. We then present a novel algorithmic approach for calculation of minimal diagnosis set. Using a powerful yet simple representation of the calculation of minimal diagnosis set, we map the problem onto two well-known problems, that is, the Boolean Satisfiability and 0/1 Integer Programming problems. The mapping onto Boolean

Satisfiability enables the use of very efficient algorithms with a super-polynomial rather than an exponential complexity for the problem. The mapping onto 0/1 Integer Programming problem enables the use of variety of algorithms that can efficiently solve the problem for up to several thousand components. These new algorithms significantly improve over the existing ones, enabling efficient diagnosis of large complex systems. In addition. the latter mapping allows, for the first time, to determine the bound on the solution, i.e., the minimum number of faulty components, before solving the problem. This is a powerful insight that can be exploited to develop yet more efficient algorithms for the problem.
Author
Systems Health Monitoring; Error Analysis; Autonomy; Algorithms

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STRUCTURAL MECHANICS

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

20020073162 Adoptech, Inc., Blacksburg, VA USA
Design and Manufacture of Elastically Tailored Tow Placed Plates
Tatting, Brain F., Adoptech, Inc., USA; Guerdal, Zafer, Virginia Polytechnic Inst. and State Univ., USA; August 2002; 34p; In English
Contract(s)/Grant(s): NAS1-00135; RTOP 706-21-21-01
Report No.(s): NASA/CR-2002-211919; NAS 1.26:211919; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Elastic stiffness tailoring of laminated composite panels by allowing the fibers to curve within the plane of the laminate is a relatively novel design concept that has been demonstrated to be both beneficial and practical. In particular, for structures with highly non-uniform stress states, such as the case of a flat panel with a central hole subjected to in-plane loading, the concept is likely to provide substantial improvements in load carrying capability. The objective of the present study is to determine the effectiveness of stiffness tailoring through the use of curvilinear fibers to reduce stress concentrations around the hole and improve the load carrying capability of panels with holes. In this study software was created that translates standard finite element models with traditional laminate definitions into ones that possess stacking sequences with curvilinear fiber paths that are directly manufacturable using an advanced tow placement machine. Preliminary designs for the manufacturing and testing phase were determined through rudimentary design studies for flat plates without holes under axial compression. These candidate designs were then analyzed using finite element models that accurately reflect the test conditions and geometries in order to select final designs for testing. A total of six large panels, measuring three feet by six feet, each of which are used to produce four specimens with or without holes, were fabricated and delivered to NASA for machining and testing.
Author
Flat Plates; Laminates; Manufacturing; Panels; Stiffness; Fiber Orientation; Elastic Properties; Compression Loads; Graphite-Epoxy Composites; Fiber Composites

20020073230 Defence Science and Technology Organisation, Airframes and Engines Div., Fishermans Bend, Australia
A Strain-Based Cohesive Zone Model for a Crack in a Power-Law Material Under Grossly Plastic Conditions
Chen, G. X., Defence Science and Technology Organisation, Australia; Wang, C. H., Defence Science and Technology Organisation, Australia; Rose, L. R. F., Defence Science and Technology Organisation, Australia; April 2002; 30p; In English
Report No.(s): DSTO-RR-0235; DODA-AR-012-297; Copyright; Avail: Issuing Activity
To develop an analytical method for quantifying the growth behavior of short cracks embedded in notch plastic zones for power law strain hardening materials, a strain-based cohesive zone model is proposed in which the conventional equilibrium equation in the stress-based model is replaced by strain compatibility. A comparison with finite element results shows that this strain-based model provides accurate values of the crack-tip-opening displacement for applied strains up to four times the yield strain under general yielding conditions. Furthermore, it is shown that the cohesive stress determined by a method proposed in this work gives better results than the existing method, which are appropriate only for small-scale yielding conditions.
Author
Crack Propagation; Strain Hardening; Cohesion; Equilibrium Equations

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GEOSCIENCES (GENERAL)

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see categories 41 through 48.

20020071145 Maryland Univ. Baltimore County, Goddard Earth Sciences and Technology Center, Catonsville, MD USA
Goddard Earth Sciences and Technology Center (GEST) ***Quarterly Report, 1 Jan. - 31 Mar. 2002***
[2002]; 24p; In English
Contract(s)/Grant(s): NCC5-494; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This document summarizes the activities of the Goddard Earth Sciences and Technology Center (GEST), a consortium of scientists and engineers led by the University of Maryland, Baltimore County (UMBC), during the contract reporting period. Topics covered include: new programs, eligibility and selection criteria, Goddard Coastal Research Graduate Fellowship Program and staffing changes.
CASI
Students; Education; Universities; Earth Sciences

20020072068 Geological Survey, Water Resources Div., Bismarck, ND USA
Simulation of Streamflow and Wetland Storage, Starkweather Coulee Subbasin, North Dakota, Water Years 1981-1998 ***Final Report***
Vining, K. C.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM; Coordinated in part by the North Dakota State Water Commission, Bismarck
Report No.(s): PB2002-108558; USGS-02-4113; No Copyright; Avail: National Technical Information Service (NTIS)
A study was conducted to simulate streamflow and wetland storage within a part of the Starkweather Coulee subbasin. Information on streamflow and wetland storage in Starkweather Coulee subbasin may help with the management of water issues in the Devils Lake Basin. Information from a digital elevation model and geographic-information-system analyses of the study area was used to develop the Devils Lake Basin wetlands model. Digital elevation model data and other climatic and topographic data were used as inputs to the model. Within the study area, the average wetland depth was about 2.21 feet, the total maximum wetland area was about 30,890 acres at the overflow elevation, and the total maximum wetland volume was about 68,270 acre-feet. Model runs were made for water years 1981-98 to calibrate the model to observed streamflows that were obtained from the Starkweather Coulee gaging station.
NTIS
Computerized Simulation; Wetlands; Simulation; Water Management; Water Flow; Climatology

20020072218 Geological Survey, Water Resources Div., Cheyenne, WY USA
Water Quality and Environmental Isotopic Analyses of Ground-Water Samples Collected from the Wasatch and Fort Union Formations in Areas of Coalbed Methane Development. Implications to Recharge and Ground-Water Flow, Eastern Powder River Basin, WY
Bartos, T. T.; Ogle, K. M.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-108557; USGS/WRI-02-4045; No Copyright; Avail: National Technical Information Service (NTIS)
Chemical analyses of ground-water samples were evaluated as part of an investigation of lower Tertiary aquifers in the eastern Powder River Basin where coalbed methane is being developed. Ground-water samples were collected from two springs discharging from clinker, eight monitoring wells completed in the Wasatch aquifer, and 13 monitoring or coalbed methane production wells completed in coalbed aquifers. The groundwater samples were analyzed for major ions and environmental isotopes (tritium and stable isotopes of hydrogen and oxygen) to characterize the composition of waters in these aquifers, to relate these characteristics to geochemical processes, and to evaluate recharge and ground-water flow within and between these aquifers. This investigation was conducted in cooperation with the Wyoming State Engineer's Office and the Bureau of Land Management.
NTIS
Water Quality; Ground Water; Chemical Analysis; Isotope Ratios

20020072219 Geological Survey, Denver, CO USA

Composition, Age, and Petrogenesis of Late Cretaceous Intrusive Rocks in the Central Big Belt Mountains, Broadwater and Meagher Counties, Montana

du Bray, E. A.; Snee, L. W.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): PB2002-108548; USGS-PP-1657; ISBN: 0-607-98231-4; No Copyright; Avail: National Technical Information Service (NTIS)

The central Big Belt Mountains in western Montana contain two Late Cretaceous intrusions that are satellitic to the Boulder batholith. New 40Ar/39Ar data demonstrate that these intrusions, their hydrothermally altered margins, and small peripheral metal deposits are temporally related, which indicates a genetic link among their causative magmato-hydrothermal processes. These deposits and associated altered rocks are similar to other recently described, globally dispersed intrusion-related gold systems. As such, rocks in the central Big Belt Mountains help better de.ne the physical and genetic characteristics of these deposits and establish the petrogenesis of their host granitoid intrusions.

NTIS

Batholiths; Intrusion; Geological Surveys; Cretaceous Period

20020072230 NASA Goddard Space Flight Center, Greenbelt, MD USA

Visions 2025 and Linkage to NEXT

Wiscombe, W., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; ESTO Technology Strategy Team Meeting, 23 Apr. 2002, Cleveland, OH, USA; No Copyright; Avail: Issuing Activity; Abstract Only

This talk will describe the progress to date on creating a science-driven vision for the NASA Earth Science Enterprise (ESE) in the post-2010 period. This effort began in the Fall of 2001 by organizing five science workgroups with representatives from NASA, academia and other agencies: Long-Term Climate, Medium-Term Climate, Extreme Weather, Biosphere & Ecosystems, and Solid Earth, Ice Sheets, & Sea Level. Each workgroup was directed to scope out one Big Question, including not just the science but the observational and modeling requirements, the information system requirements, and the applications and benefits to society. This first set of five Big Questions is now in hand and has been presented to the ESE Director. It includes: water resources, intraseasonal predictability, tropical cyclogenesis, invasive species, and sea level. Each of these topics will be discussed briefly. How this effort fits into the NEXT vision exercise and into Administrator O'Keefe's new vision for NASA will also be discussed.

Author

Water Resources; Intraseasonal Variations; Cyclogenesis; Sea Level

20020072939 Geological Survey, Water Resources Div., Honolulu, HI USA

Surface Water Quality-Assurance Plan for the Hawaii District of the U.S. Geological Survey

Fontaine, R.; 2001; 44p; In English

Report No.(s): PB2002-108631; USGS/OFR-01-75; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The District Surface Water Quality-Assurance Plan documents the standards, policies, and procedures used by the Hawaii District for activities related to the collection, processing, storage, analysis, and publication of surface-water data.

NTIS

Data Management; Surface Water; Water Quality; Hawaii; Geological Surveys

20020072943 Geological Survey, Water Resources Div., Honolulu, HI USA

Statistical Summary of Hydrologic and Water-Quality Data from the Halawa, Haiku, and Kaneohe Drainage Basins Before, During, and After H-3 Highway Construction, Oahu, Hawaii, 1983-99

Wong, M. F.; Young, S. T. M.; 2001; 80p; In English

Report No.(s): PB2002-108630; USGS/OFR-01-64; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report provides statistical summaries of rainfall, streamflow, suspended-sediment, and water-quality data collected in the Halawa, Haiku, and Kaneohe drainage basins before, during, and after construction of the H-3 Highway on the island of Oahu, Hawaii. Methods of data collection also are described. Data collected during water years 1983 through 1999 at eight streamflow and six stream water-quality gaging-stations, and two water-quality stations located in Waimaluhia Reservoir are included. Physiographic data for all basins contributing to the 14 stream stations as well as brief land-use descriptions of the Halawa, Haiku, and Kaneohe drainage basins are provided.

NTIS

Water Quality; Statistical Analysis; Data Acquisition; Hydrology; Construction; Drainage; Structural Basins

20020073180 North Central Forest Experiment Station, Saint Paul, MN USA
21st Session of the International Poplar Commission (IPC 2000). Poplar and Willow Culture: Meeting the Needs of Society and the Environment
Isebrands, J. G.; Richardson, J.; 2002; 230p; In English
Report No.(s): PB2002-108588; FSGTR-NC-215; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche
The International Poplar Commission (IPC), founded in 1947, is part of the Food and Agricultural Organization (FAO) of the United Nations. The functions of the IPC are to study the scientific, technical, social, and economic aspects of poplar and willow cultivation, to promote the exchange of ideas and material among research workers, producers, and users, to arrange joint research programs, to stimulate the organization of congresses and study tours, to report and make recommendations to the FAO, and to make recommendations to National Poplar Commissions. At present there are 36 member countries of the IPC, of which 14 are developing countries and five are countries with economies in transition. The IPC meets in Session every 4 years. The last meeting was in Budapest, Hungary, in 1996. Five Working Parties reflect the main issues concerning the cultivation and utilization of the Salicaceae (Poplar and Willow Breeding; Diseases; Insects and Other Animal Pests; Production Systems; and Logging and Utilization). There is also a Sub-committee on poplar and willow nomenclature.
NTIS
Breeding (Reproduction); Agriculture; Developing Nations; Conferences

20020073183 Geological Survey, Water Resources Div., Mounds View, MN USA
Water Resources Data for Minnesota, Water Year 2001 ***Annual Report, 1 Oct. 2000 - 30 Sep. 2001***
Mitton, G. B.; Guttormson, K. G.; Stratton, G. W.; Wakeman, E. S.; Apr. 2002; 402p; In English
Report No.(s): PB2002-106375; USGS/WDR/MN-01-1; No Copyright; Avail: CASI; A18, Hardcopy; A04, Microfiche
Water resources data for the 2001 water year for Minnesota consist of records of stage, discharge, and water quality of streams; stage of lakes and reservoirs; ground-water quality; and water quality in wells. This report contains discharge records for 100 stream-gaging stations; stage for 13 lakes and reservoirs water quality for 24 stream-gaging stations; peak flow data for 88 high-flow partial-record stations, and water levels for 4 groundwater observation wells. Additional water data were collected at various sites that are not part of the systematic data collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey for cooperating State and Federal agencies in Minnesota.
NTIS
Ground Water; Information Flow; Data Systems; Geological Surveys

20020073186 Geological Survey, Water Resources Div., Sacramento, CA USA
Water Resources Data California, Water Year 2001. Volume 4. Northern Central Valley Basins and the Great Basin from Honey Lake Basin to the Oregon State Line ***Annual Report, (Annual) 1 Oct. 00 - 30 Sep.t. 01***
Rockwell, G. L.; Smithson, J. R.; Friebel, M. F.; Webster, M. D.; Apr. 2002; 486p
Report No.(s): PB2002-107984; USGS-WDR-CA-01-4; No Copyright; Avail: CASI; A21, Hardcopy; A04, Microfiche
Water-resources data for the 2001 water year for California consist of records of stage, discharge, and water quality of streams, stage and contents in lakes and reservoirs, and water levels and water quality in wells. Volume 4 contains discharge records for 191 gaging stations, stage and contents for 53 lake and reservoirs, gage-height records for 1 station, and water quality for 18 stations. Also included are 3 miscellaneous partial-record sites, and 3 partial-record water-quality stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in California.
NTIS
Surface Water; Hydrology; Geological Surveys; Data Systems

20020073188 Geological Survey, Water Resources Div., Lakewood, CO USA
Water Resources Data for Colorado, Water Year 2001, Volume 1, Missouri River Basin, Arkansas River Basin, and Rio Grande Basin ***Annual Report, 1 Oct. - 30 Sep. 2001***
Crowfoot, R. M.; Steger, R. D.; Payne, W. F.; ONeill, G. B.; 2001; 558p; In English
Report No.(s): PB2002-106378; USGS/WDR/CO-01-Vol-1; No Copyright; Avail: CASI; A24, Hardcopy; A04, Microfiche
Water-resources data for Colorado for the 2001 water year consist of records of stage, discharge, and water quality of streams; stage, contents, and water-quality of lakes and reservoirs; meteorological data; and water levels and water quality of wells and springs. This report (Volumes 1 and 2) contains discharge records for 313 gaging stations, stage and contents of 16 lakes and reservoirs, discharge measurements for 1 partial-record low-flow station and 1 miscellaneous site, peak flow information for 22

crest-stage partial-record stations; water-quality for 125 gaging stations and for 10 lakes and reservoirs, supplemental water-quality for 181 gaged sites; water-quality for 77 miscellaneous sites and 14 observation wells; water levels for 3 observation wells, and meteorological data for 55 sites. Three pertinent stations operated by bordering states also are included in this report. The records were collected and computed by the Water Resources Division of the U.S. Geological Survey under the direction of W.F. Horak, District Chief. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies.
NTIS
Surface Water; Ground Water; Meteorological Parameters; Geological Surveys; Data Systems

20020073204 Geological Survey, Water Resources Div., Rolla, MO USA
Water Resources Data for Missouri, Water Year 2001 ***Annual Report, (Annual) 1 Oct. 00 - 30 Sep. 01***
Hauck, H. S.; Nagel, C. D.; Mar. 2002; 528p; In English
Report No.(s): PB2002-106377; USGS/WDR/MO-01-1; No Copyright; Avail: CASI; A23, Hardcopy; A04, Microfiche
The U.S. Geological Survey, Water Resources Division, in cooperation with local, State, and Federal agencies and organizations, obtains a large quantity of data pertaining to the water resources of Missouri each water year (October 1 to September 30). These data, accumulated during the water years, constitute a valuable data base for developing an improved understanding of the water resources of Missouri. Water-resources data for the 2001 water year for Missouri consist of records of stage, discharge, and water quality of streams; elevation at 12 lakes and reservoirs; water quality at 112 sampling stations (including 2 lakes); and data for 39 crest-stage stations.
NTIS
Surface Water; Ground Water; Geological Surveys; Water Resources; Missouri

20020073205 Forest Service, Pacific Northwest Research Station, Portland, OR USA
Recent Publications of the Pacific Northwest Research Station, Second Quarter 2002
2002; 44p
Report No.(s): PB2002-108020; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This list of recent publications and other products of the Pacific Northwest (PNW) Research Station is published four times a year. The first section shows items published by the PNW Research Station. The second section shows publications available elsewhere. In each section, items are grouped alphabetically by author within categories.
NTIS
Research Projects; Documents

20020073216 Forest Service, Washington, DC USA
Blueprint for Forest Inventory and Analysis Research and Vision for the Future. Program Aid No. 1512
2002; 26p; In English
Report No.(s): PB2002-108585; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The purpose of this blueprint is to chart a course for the Forest Inventory and Analysis program that will serve as a guide throughout the 1990's. It contains the basis for our varied activities, covers our relationships with our clients and cooperators, and contains our vision of where we are and where we are going. We are proud to be part of the USDA-Forest Service whose stated mission is to care for the land and to serve the people. We have an important role to play in achieving this overall mission. Our forest inventories provide the necessary foundation for building a program of land stewardship. and we serve the people by providing unbiased, accurate, current, and relevant forest resources information that meets their diverse needs.
NTIS
Forests; Blueprints; Charts

20020073386 Maryland Univ. Baltimore County, Goddard Earth Sciences and Technology Center, Catonsville, MD USA
The Goddard Earth Sciences and Technology Center (GEST Center) ***Quarterly Report, 1 Oct. - 31 Dec. 2001***
[2002]; 20p; In English
Contract(s)/Grant(s): NCC5-494; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The following is a technical report of the progress made under Cooperative Agreement NCC5494, the Goddard Earth Sciences and Technology Center (GEST). The period covered by this report is October 1, 2001 through December 31, 2001. GEST is a consortium of scientists and engineers, led by the University of Maryland, Baltimore County (UMBC), to conduct scientific research in Earth and information sciences and related technologies in collaboration with the NASA Goddard Space Flight Center

(GSFC). GEST was established through a cooperative agreement signed May 11, 2000, following a competitive procurement process initiated by GSFC.
Author
Earth Sciences; NASA Programs; Education

20020073439 NASA Johnson Space Center, Houston, TX USA
Major Element Analysis of the Target Rocks at Meteor Crater, Arizona
See, Thomas H., Lockheed Martin Space Operations, USA; Hoerz, Friedrich, NASA Johnson Space Center, USA; Mittlefehldt, David W., NASA Johnson Space Center, USA; Varley, Laura, Lunar and Planetary Inst., USA; Mertzman, Stan, Franklin and Marshall Coll., USA; Roddy, David, Geological Survey, USA; August 2002; 32p; In English
Report No.(s): NASA/TM-2002-210787; NAS 1.15:210787; S-897; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We collected approximately 400 rock chips in continuous vertical profile at Meteor Crater, Arizona, representing, from bottom to top, the Coconino, Toroweap, Kaibab, and Moenkopi Formations to support ongoing compositional analyses of the impact melts and their stratigraphic source depth(s) and other studies at Meteor Crater that depend on the composition of the target rocks. These rock chips were subsequently pooled into 23 samples for compositional analysis by XRF (x ray fluorescence) methods, each sample reflecting a specific stratigraphic ”subsection” approximately 5-10 in thick. We determined the modal abundance of quartz, dolomite, and calcite for the entire Kaibab Formation at vertical resolutions of 1-2 meters. The Coconino Formation composes the lower half of the crater cavity. It is an exceptionally pure sandstone. The Toroweap is only two inches thick and compositionally similar to Coconino, therefore, it is not a good compositional marker horizon. The Kaibab Formation is approximately 80 in thick. XRD (x ray diffraction) studies show that the Kaibab Formation is dominated by dolomite and quartz, albeit in highly variable proportions; calcite is a minor phase at best. The Kaibab at Meteor Crater is therefore a sandy dolomite rather than a limestone, consistent with pronounced facies changes in the Permian of SE Arizona over short vertical and horizontal distances. The Moenkopi forms the 12 in thick cap rock and has the highest Al2O3 and FeO concentrations of all target rocks. With several examples, we illustrate how this systematic compositional and modal characterization of the target ideologies may contribute to an understanding of Meteor Crater, such as the depth of its melt zone, and to impact cratering in general, such as the liberation of CO2 from shocked carbonates.
Author
Craters; Impact Melts; Meteorite Craters; Rocks; Composition (Property); Fragments; Arizona

20020073507 NASA Ames Research Center, Moffett Field, CA USA
Incorporation of Solar Noble Gases from a Nebula-Derived Atmosphere During Magma Ocean Cooling
Woolum, D. S., NASA Ames Research Center, USA; Cassen, P., NASA Ames Research Center, USA; Wasserburg, G. J., California Inst. of Tech., USA; Porcelli, D., California Inst. of Tech., USA; [1998]; 1p; In English; Origin of the Earth and Moon Conference, 1-3 Dec. 1998, Monterey, CA, USA; Copyright; Avail: Issuing Activity; Abstract Only

The presence of solar noble gases in the deep interior of the Earth is inferred from the Ne isotopic compositions of MORB (Mid-ocean Ridge Basalts) and OIB (Oceanic Island Basalt); Ar data may also consistent with a solar component in the deep mantle. Models of the transport and distribution of noble gases in the earth’s mantle allow for the presence of solar Ar/Ne and Xe/Ne ratios and permit the calculation of lower mantle noble gas concentrations. These mantle data and models also indicate that the Earth suffered early (0.7 to 2 x 10(exp 8) yr) and large (greater than 99 percent) losses of noble gases from the interior, a result previously concluded for atmospheric Xe. We have pursued the suggestion that solar noble gases were incorporated in the forming Earth from a massive, nebula-derived atmosphere which promoted large-scale melting, so that gases from this atmosphere dissolved in the magma ocean and were mixed downward. Models of a primitive atmosphere captured from the solar nebula and supported by accretion luminosity indicate that pressures at the Earth’s surface were adequate (and largely more than the required 100 Atm) to dissolve sufficient gases. We have calculated the coupled evolution of the magma ocean and the overlying atmosphere under conditions corresponding to the cessation (or severe attenuation) of the sustaining accretion luminosity, prior to the complete removal of the solar nebula. Such a condition was likely to obtain, for instance, when most of the unaccumulated mass resided in large bodies which were only sporadically accreted. The luminosity supporting the atmosphere is then that provided by the cooling Earth, consideration of which sets a lower limit to the time required to solidify the mantle and terminate the incorporation of atmospheric gases within it. In our initial calculations, we have fixed the nebula temperature at to = 300K, a value likely to be appropriate for nebular temperatures at lAU in the early planet-building epoch. We treated the background

(nebula) pressure as an adjustable, time-dependent parameter. Additional information is contained within the original extended abstract.
Author (revised)
Earth Mantle; Magma; Rare Gases; Planetary Composition; Gas Transport

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EARTH RESOURCES AND REMOTE SENSING

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

20020070805 Colorado Univ., Boulder, CO USA
Integrating Microwave and Hyperspectral Remote Sensing for Estimating Vegetation Structure and Biomass ***Final Report***
Asner, Gregory P., Colorado Univ., USA; [2002]; 8p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The objective of this project is to demonstrate a novel approach to estimating three-dimensional vegetation structure and biomass by combining the information in microwave interferometric and polarimetric (AIRSAR) and hyperspectral optical (AVIRIS) data. This project addresses a central issue in remote sensing for the Terrestrial Ecology Program: Forests are sufficiently complicated targets that a single remote-sensing technique is typically incapable of accurately characterizing the structural attributes needed to determine biomass and carbon dynamics. This work proposes and demonstrates a new paradigm, in which a combination of microwave (C-band) and hyperspectral techniques optimally derives the key vegetation characteristic of leaf area density (LAD). In the first year of the project, microwave, hyperspectral, and field data were acquired over Central Oregon and subjected to a series of calibration steps and integrity tests. An intensive field campaign was carried out near in time to AIRSAR and AVIRIS overflights, yielding data needed to develop ground-based LAD profiles and biomass. In the second year, data from 3 of the 20 acquired stands were analyzed and submitted for publication. In this third and final year, biomass was estimated from the 3 published LAD profiles plus profiles from 8 additional stands. This is the first demonstration of combining microwave and hyperspectral data to estimate biomass, and the first demonstration of microwave-structure -based biomass determination. Current biomass errors from this approach are in the range of 20-40 tons/ha (hectare), meeting or exceeding the performance of any optical or microwave techniques known to date. These results also suggest that interferometric C-band profiles, when coupled with hyperspectral leaf area indices, exhibit virtually no saturation characteristics in biomass determination up to 300 tons/ha. This result is in remarked contrast to the more than 100-tons/ha saturation usually attributed to C-band radar (non-interferometric) power.
Author
Microwaves; Remote Sensing; Data Integration; Biomass; Environment Models; Forests; Carbon; Statistical Analysis

20020070835 Colorado Univ., Boulder, CO USA
Land and Land-use Change in the Climate Sensitive High Plains: An Automated Approach with LANDSAT ***Final Report***
Goetz, Alexander F., Colorado Univ., USA; [2002]; 4p; In English
Contract(s)/Grant(s): NAG5-3437; RTOP 229-02-10-01; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
The High Plains is an economically important and climatologically sensitive region of the USA and Canada. The High Plains contain 100,000 sq km of Holocene sand dunes and sand sheets that are currently stabilized by natural vegetation. Droughts and the larger threat of global warming are climate phenomena that could cause depletion of natural vegetation and make this region susceptible to sand dune reactivation. The original proposal was directed toward the use of LANDSAT TM data to establish the state and ongoing changes of the surface in the 1.2 million sq. km, semi-arid High Plains region of the central US, A key objective was to develop a model to predict the reactivation of the 100,000 sq. km of Holocene dunes found on the High Plains during an extended drought. At least one LANDSAT 5 image per year for 1985, 1988 and 1996 was obtained for 32 scenes on the High Plains to coincide with wet and dry years. Additional LANDSAT 7 data were acquired for 1999 and 2000 primarily for Colorado and Nebraska. As luck would have it, there was no severe drought during the study period 1985-2000. Attention was focused on developing methods for mapping dry vs. green vegetation on sparsely vegetated rangelands in sandy soils, since these were the areas most susceptible to surface reactivation during a drought.
Author
Rangelands; Land Use; Change Detection; Dunes; Remote Sensing; LANDSAT Satellites; Environment Models; Satellite Imagery

20020070892 NASA Goddard Space Flight Center, Greenbelt, MD USA

Lidar Remote Sensing

McGill, Matthew J., NASA Goddard Space Flight Center, USA; [2002]; 40p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The laser radar, or lidar (for light detection and ranging) is an important tool for atmospheric studies. Lidar provides a unique and powerful method for unobtrusively profiling aerosols, wind, water vapor, temperature, and other atmospheric parameters. This brief overview of lidar remote sensing is focused on atmospheric applications involving pulsed lasers. The level of technical detail is aimed at the educated non-lidar expert and references are provided for further investigation of specific topics. The article is divided into three main sections. The first describes atmospheric scattering processes and the physics behind laser-atmosphere interactions. The second section highlights some of the primary lidar applications, with brief descriptions of each measurement capability. The third section describes the practical aspects of lidar operation, including the governing equation and operational considerations.

Author

Optical Radar; Pulsed Lasers; Remote Sensing; Atmospheric Scattering; Atmospheric Physics

20020071068 NASA Goddard Space Flight Center, Greenbelt, MD USA

Land Product Validation

Morisette, Jeffrey, NASA Goddard Space Flight Center, USA; [2002]; 2p; In English; Forest Cover Characteristics and Changes, 11-13 Feb. 2002, Toulouse, France; No Copyright; Avail: Issuing Activity; Abstract Only

The ”Land Product Validation” (LPV) subgroup of the Committee on Earth Observing Satellites Working on Group on Calibration and Validation was formed in 2000. Goals of the LPV subgroup are: (1)to increase the quality and economy of global satellite product validation via developing and promoting international standards and protocols for field sampling, scaling, error budgeting, data exchange and product evaluation, and (2) to advocate mission-long validation programs for current and future earth observing satellites. First-round LPV activities will compliment the research themes of the Global Observation of Forest Cover (GOFC) program, which are: biophysical products, fire/burn scar detection, and land cover mapping. Meetings in June and July of 2001 focused on the first two themes. The GOFC ”Forest Cover Characteristics and Changes” meeting provides a forum to initiate LPV activities related to Land Cover. The presentation will start with a summary of the LPV subgroup and its current activities. This will be followed by an overview of areas for potential coordination between the LPV and the GOFC Land Cover Theme.

Author

Satellite Observation; Remote Sensing; Standardization; International Cooperation; Proving

20020072228 Colorado Univ., Dept. of Geological Sciences, Boulder, CO USA

Low-Cost Evaluation of EO-1 Hyperion and ALI for Detection and Biophysical Characterization of Forest Logging in Amazonia (NCC5-481) ***Final Report***

Asner, Gregory P., Colorado Univ., USA; Keller, Michael M., New Hampshire Univ., USA; Silva, Jose Natalino, Empresa Brasileira de Pesquisa Agropecuaria, Brazil; Zweede, Johan C., Servicos Tecnicos Florestais e Planejamento (STF&P), Brazil; Pereira, Rodrigo, Jr., Servicos Tecnicos Florestais e Planejamento (STF&P), Brazil; [2002]; 5p; In English

Contract(s)/Grant(s): NCC5-481; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Major uncertainties exist regarding the rate and intensity of logging in tropical forests worldwide: these uncertainties severely limit economic, ecological, and biogeochemical analyses of these regions. Recent sawmill surveys in the Amazon region of Brazil show that the area logged is nearly equal to total area deforested annually, but conversion of survey data to forest area, forest structural damage, and biomass estimates requires multiple assumptions about logging practices. Remote sensing could provide an independent means to monitor logging activity and to estimate the biophysical consequences of this land use. Previous studies have demonstrated that the detection of logging in Amazon forests is difficult and no studies have developed either the quantitative physical basis or remote sensing approaches needed to estimate the effects of various logging regimes on forest structure. A major reason for these limitations has been a lack of sufficient, well-calibrated optical satellite data, which in turn, has impeded the development and use of physically-based, quantitative approaches for detection and structural characterization of forest logging regimes. We propose to use data from the EO-1 Hyperion imaging spectrometer to greatly increase our ability to estimate the presence and structural attributes of selective logging in the Amazon Basin. Our approach is based on four ”biogeophysical indicators” not yet derived simultaneously from any satellite sensor: 1) green canopy leaf area index; 2) degree of shadowing; 3) presence of exposed soil and; 4) non-photosynthetic vegetation material. Airborne, field and modeling studies have shown that the optical reflectance continuum (400-2500 nm) contains sufficient information to derive estimates of each of these indicators. Our ongoing studies in the eastern Amazon basin also suggest that these four indicators are sensitive to logging intensity.

Satellite-based estimates of these indicators should provide a means to quantify both the presence and degree of structural disturbance caused by various logging regimes. Our quantitative assessment of Hyperion hyperspectral and ALI multi-spectral data for the detection and structural characterization of selective logging in Amazonia will benefit from data collected through an ongoing project run by the Tropical Forest Foundation, within which we have developed a study of the canopy and landscape biophysics of conventional and reduced-impact logging. We will add to our base of forest structural information in concert with an EO-1 overpass. Using a photon transport model inversion technique that accounts for non-linear mixing of the four biogeophysical indicators, we will estimate these parameters across a gradient of selective logging intensity provided by conventional and reduced impact logging sites. We will also compare our physical ly-based approach to both conventional (e.g., NDVI) and novel (e.g., SWIR-channel) vegetation indices as well as to linear mixture modeling methods. We will cross-compare these approaches using Hyperion and ALI imagers to determine the strengths and limitations of these two sensors for applications of forest biophysics. This effort will yield the first physical ly-based, quantitative analysis of the detection and intensity of selective logging in Amazonia, comparing hyperspectral and improved multi-spectral approaches as well as inverse modeling, linear mixture modeling, and vegetation index techniques.
Author
Logging (Industry); Deforestation; Biophysics; Economic Analysis; Remote Sensing; Forests

20020072734 NASA Goddard Space Flight Center, Greenbelt, MD USA
Satellites as Shared Resources for Caribbean Climate and Health Studies
Maynard, Nancy G., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; Conference and Workshop on Climate Variability and Change and Health Effects in the Caribbean, 21-25 May 2002, Bridgetown, Barbados; No Copyright; Avail: Issuing Activity; Abstract Only

Remotely-sensed data and observations are providing powerful new tools for addressing climate and environment-related human health problems through increased capabilities for monitoring, risk mapping, and surveillance of parameters useful to such problems as vector-borne and infectious diseases, air and water quality, harmful algal blooms, UV (ultraviolet) radiation, contaminant and pathogen transport in air and water, and thermal stress. Remote sensing, geographic information systems (GIS), global positioning systems (GPS), improved computational capabilities, and interdisciplinary research between the Earth and health science communities are being combined in rich collaborative efforts resulting in more rapid problem-solving, early warning, and prevention in global health issues. Collaborative efforts among scientists from health and Earth sciences together with local decision-makers are enabling increased understanding of the relationships between changes in temperature, rainfall, wind, soil moisture, solar radiation, vegetation, and the patterns of extreme weather events and the occurrence and patterns of diseases (especially, infectious and vector-borne diseases) and other health problems. This increased understanding through improved information and data sharing, in turn, empowers local health and environmental officials to better predict health problems, take preventive measure, and improve response actions. This paper summarizes the remote sensing systems most useful for climate, environment and health studies of the Caribbean region and provides several examples of interdisciplinary research projects in the Caribbean currently using remote sensing technologies. These summaries include the use of remote sensing of algal blooms, pollution transport, coral reef monitoring, vectorborne disease studies, and potential health effects of African dust on Trinidad and Barbados.
Author
Remote Sensing; Caribbean Region; Climatology; Public Health; Climate Change; Satellite Observation

20020072735 NASA Goddard Space Flight Center, Greenbelt, MD USA
Changes in Earth 360 380 nm Reflectivity: 1980-2000
Herman, J. R., NASA Goddard Space Flight Center, USA; Weatherhead, B., NASA Goddard Space Flight Center, USA; Chubarova, N., NASA Goddard Space Flight Center, USA; Ziemke, G., NASA Goddard Space Flight Center, USA; Hsu, C., NASA Goddard Space Flight Center, USA; Larki, D., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; Ultraviolet Workshop, 8-12 Apr. 2002, Saariselka, Finland; No Copyright; Avail: Issuing Activity; Abstract Only

The TOMS (Total Ozone Mapping Spectrometer) reflectively time series 1980 to 1992 and 1997 to 2000 have been combined to estimate change that have occurred over a 21 year period. The relative calibration of the two TOMS (Nimbus-7, N7 and Earth-Probe, EP) has been validated using the measured reflectivity R over Hudson Bay, Canada and found to be within 1 RU (R=0.01). Some of the local trend features seen in the N7 time series (1980 to 1992) have been continued in the combined time series, but the overall zonal average and global trends have changed. The UV (ultraviolet) reflectivity data are compared with changes in the AVHRR outgoing long-wavelength radiation (OLR) and show an expected anti-correlation with cloud-cover

changes over the same period for many, but not all, features. The key results include a continuing decrease in cloud cover over Europe and North America and an increase in reflectivity near Antarctica.
Author
Reflectance; Stellar Spectrophotometry; Total Ozone Mapping Spectrometer; Ozone Depletion; Time Series Analysis; Climate Change

20020072736 NASA Goddard Space Flight Center, Greenbelt, MD USA
Visions of our Planet's Atmosphere, Land and Oceans: NASA/NOAA Electronic Theater 2002
Haser, Fritz, NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; Visions of our Planet's Atmosphere, Land and Oceans: NASA/NOAA Electronic Theater 2002, 22-25 May 2002, Boulder, CO, USA; Sponsored by NASA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The NASA/NOAA Electronic Theater presents Earth science observations and visualizations in a historical perspective. Fly in from outer space to the 2002 Winter Olympic Stadium Site of the Olympic Opening and Closing Ceremonies in Salt Lake City. Fly in and through Olympic Alpine Venues using 1 m IKONOS "Spy Satellite" data. Go back to the early weather satellite images from the 1960s and see them contrasted with the latest US and international global satellite weather movies including hurricanes and "tornadoes". See the latest visualizations of spectacular images from NASA/NOAA remote sensing missions like Terra, GOES, TRMM, SeaWiFS, LANDSAT 7 including new 1 - min GOES rapid scan image sequences of Nov 9th 2001 Midwest tornadic thunderstorms and have them explained. See how High-Definition Television (HDTV) is revolutionizing the way we communicate science. (In cooperation with the American Museum of Natural History in NYC) See dust storms in Africa and smoke plumes from fires in Mexico. See visualizations featured on the covers of Newsweek, TIME, National Geographic, Popular Science and on National and International Network TV. New computer software tools allow us to roam and zoom through massive global images e.g. LANDSAT tours of the US, and Africa, showing desert and mountain geology as well as seasonal changes in vegetation. See animations of the polar ice packs and the motion of gigantic Antarctic Icebergs from SeaWinds. data. Spectacular new visualizations of the global atmosphere and oceans are shown. See vortexes and currents in the global oceans that bring up the nutrients to feed tiny algae and draw the fish, whales and fisherman. See the how the ocean blooms in response to these currents and El Nino/La Nina climate changes. See the city lights, fishing fleets, gas flares and bio-mass burning of the Earth at night observed by the "night-vision" DMSP military satellite.
Author
Remote Sensing; Satellite Observation; Applications Programs (Computers); Multimedia; Earth Atmosphere

20020072737 NASA Goddard Space Flight Center, Greenbelt, MD USA
NASA Remote Sensing Data for Epidemiological Studies
Maynard, Nancy G., NASA Goddard Space Flight Center, USA; Vicente, G. A., George Mason Univ., USA; [2002]; 2p; In English; International Conference on Emerging Infectious Diseases, 24-27 Mar. 2002, Atlanta, GA, USA; Sponsored by American Society for Microbiology, USA; No Copyright; Avail: Issuing Activity; Abstract Only

In response to the need for improved observations of environmental factors to better understand the links between human health and the environment, NASA has established a new program to significantly improve the utilization of NASA's diverse array of data, information, and observations of the Earth for health applications. This initiative, lead by Goddard Space Flight Center (GSFC) has the following goals: (1) to encourage interdisciplinary research on the relationships between environmental parameters (e.g., rainfall, vegetation) and health, (2) Develop practical early warning systems, (3) Create a unique system for the exchange of Earth science and health data, (4) Provide an investigator field support system for customers and partners, (5) Facilitate a system for observation, identification, and surveillance of parameters relevant to environment and health issues. The NASA Environment and Health Program is conducting several interdisciplinary projects to examine applications of remote sensing data and information to a variety of health issues, including studies on malaria, Rift Valley Fever, St. Louis Encephalitis, Dengue Fever, Ebola, African Dust and health, meningitis, asthma, and filariasis. In addition, the NASA program is creating a user-friendly data system to help provide the public health community with easy and timely access to space-based environmental data for epidemiological studies. This NASA data system is being designed to bring land, atmosphere, water and ocean satellite data/products to users not familiar with satellite data/products, but who are knowledgeable in the Geographic Information Systems (GIS) environment. This paper discusses the most recent results of the interdisciplinary environment-health research projects and provides an analysis of the usefulness of the satellite data to epidemiological studies. In addition, there will be a summary of presently-available NASA Earth science data and a description of how it may be obtained.
Author
Remote Sensing; Geographic Information Systems; Data Systems; Information Dissemination; Epidemiology

20020072738 NASA Goddard Inst. for Space Studies, New York, NY USA

Observed Climate Properties of Tropical Precipitating Convection

DelGenio, Anthony, NASA Goddard Inst. for Space Studies, USA; [2002]; 1p; In English; Seminar: Observed Climatic Properties of Tropical Precipitating Convection, 21 Mar. 2002, Princeton, NJ, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Conflicting theories about the contribution of convective systems to cloud feedback highlight the need for observational constraints on the properties of these storms. The NASA Tropical Rainfall Measuring Mission (TRMM) satellite provides unprecedented information on the hydrological properties and energetics of tropical convection. We present an analysis of almost 9,000 TRMM storms, focusing on how convection strength affects storm cloud properties and rainfall, and what this implies for the opposing ”adaptive iris” and ”thermostat” hypotheses.

Author

Remote Sensing; Satellite Observation; Trmm Satellite; Convection; Tropical Regions

20020072964 Geological Survey, Water Resources Div., Charleston, WV USA

Water Resources Data for West Virginia, Water Year 2001 ***Annual Report, 1 Oct. 2000 - 30 Sep. 2001***

Ward, S. M.; Taylor, B. C.; Crosby, G. R.; Mar. 2002; 288p; In English

Report No.(s): PB2002-106376; USGS/WDR-WV-01-1; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

Water-resources data for the 2001 water year for West Virginia consist of records of discharge and water quality of streams and water levels of observing wells. This report contains discharge records for 65 streamflow-gaging stations; discharge records provided by adjacent states for 7 streamflow-gaging stations; annual maximum discharge at 18 crest-stage partial-record stations; water-quality records for 4 stations; and water-level records for 10 observation wells. Locations of these sites are shown on figures 4 and 5. Additional water data were collected at various sites, not involved in the systematic data collection program, and are published as miscellaneous sites. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in West Virginia.

NTIS

Water Resources; Data Acquisition; Geological Surveys; Hydrology

20020073078 Colorado Univ., Dept. of Geological Sciences and Environmental Studies Program, Boulder, CO USA

Remote Sensing of Selective Logging in Amazonia Assessing Limitations based on Detailed Field Observations, LANDSAT ETM+, and Textural Analysis

Asner, Gregory P., Colorado Univ., USA; Keller, Michael, New Hampshire Univ., USA; Pereira, Rodrigo, Fundacao Floresta Tropical, Brazil; Zweede, Johan C., Fundacao Floresta Tropical, Brazil; Remote Sensing of Environment; [2002]; ISSN 0034-4257; Volume 80, pp. 483-496; In English; Copyright; Avail: Issuing Activity; Abstract Only

We combined a detailed field study of forest canopy damage with calibrated LANDSAT 7 Enhanced Thematic Mapper Plus (ETM+) reflectance data and texture analysis to assess the sensitivity of basic broadband optical remote sensing to selective logging in Amazonia. Our field study encompassed measurements of ground damage and canopy gap fractions along a chronosequence of postharvest regrowth of 0.5 - 3.5 years. We found that canopy damage and regrowth rates varied according to the logging method used, either conventional logging or reduced impact logging. Areas used to stage felled trees prior to transport, log decks, had the largest gap fractions immediately following cutting. Log decks were quickly colonized by early successional plant species, resulting in significant gap fraction decreases within 1.5 years after site abandonment. Although log decks were the most obvious damage areas on the ground and in satellite imagery, they accounted for only 1 -2% of the total harvested area of the blocks studied. Other forest damage features such as tree-fall gaps, skid trails, and roads were difficult to recognize in LANDSAT reflectance data or through textural analysis. These landscape features could be only crudely resolved in the most intensively logged forests and within about 0.5 years following harvest. We found that forest damage within any of the landscape strata (decks, roads, skids, tree falls) could not be resolved with LANDSAT reflectance or texture data when the canopy gap fraction was is less than 50%. The basic LANDSAT ETM+ imagery lacks the resolution of forest structural features required for quantitative studies of logging damage. LANDSAT textural analyses may be useful for broad delineation of logged forests, but detailed ecological and biogeochemical studies will probably need to rely on other remote sensing approaches. Until spatial gradients of canopy damage and regrowth resulting from selective logging operations in tropical forests in the Amazon region are resolved, the impacts of this land use on a continental scale will remain poorly understood.

Author

Biogeochemistry; Canopies (Vegetation); Forests; Remote Sensing; Satellite Imagery; Topography

20020073176 Carnegie Institution of Washington, Dept. of Global Ecology, Stanford, CA USA

Canopy Damage and Recovery Following Selective Logging in an Amazon Forest: Integrating Field and Satellite Studies

Asner, Gregory P., Carnegie Institution of Washington, USA; Keller, Michael, New Hampshire Univ., USA; Pereira, Rodrigo, Jr., Fundacao Floresta Tropical, Brazil; Zweede, Johan C., Fundacao Floresta Tropical, Brazil; Silva, Jose N. M., Empresa Brasileira de Pesquisa Agropecuaria, Brazil; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

We combined a detailed field study of canopy gap fraction with spectral mixture analyses of LANDSAT 7 ETM+ satellite imagery to assess landscape and regional dynamics of canopy damage following selective logging in an Eastern Amazon forest. Our field studies encompassed measurements of ground damage and canopy gap fractions along multi-temporal sequences of post-harvest regrowth of 0.5-3.5 years. Areas used to stage harvested logs prior to transport, called log decks, had the largest forest gap fractions, but their contribution to the landscape-level gap dynamics was minor. Tree falls were spatially the most extensive form of canopy damage following selective logging, but the canopy gap fractions resulting from them were small. Reduced-impact logging resulted in consistently less damage to the forest canopy than did conventional logging practices. This was true at the level of individual landscape strata such as roads, skids and tree falls as well as at the area-integrated scale. A probabilistic spectral mixture model was employed that utilizes bundles of field and image spectral reflectance measurements with Monte Carlo analysis to estimate sub-pixel cover of forest canopies, exposed non-photosynthetic vegetation and soils in the LANDSAT ETM+ imagery. The method proved highly useful for quantifying forest canopy cover fraction in log decks, roads, skids, tree-fall, and intact forest areas. The information derived from this approach allowed tracking of forest canopy damage up to 3.5 years post-harvest. Forest canopy cover fractions derived from the satellite observations were highly and inversely correlated with field-based canopy gap fraction. Subsequent regional-scale estimates of forest gap fraction were derived from the combination of field- and satellite-based measurements. A preliminary 440 sq km study of gap fraction showed that approximately one-half of the canopy opening caused by logging is closed within one year of regrowth following timber harvests. This is the first regional-scale study utilizing field measurements, satellite observations and models to quantify forest canopy damage and recovery following selective logging in the Amazon.

Author

Amazon Region (South America); Canopies (Vegetation); Forests; Environmental Monitoring; Spectral Mixture Analysis; Deforestation

20020073228 NASA Goddard Space Flight Center, Greenbelt, MD USA

Combined use of Satellite and Surface Observations to Infer the Imaginary Part of Refractive Index of Saharan Dust

Sinyuk, Alexander, Maryland Univ. Baltimore County, USA; Torres, Omar, Maryland Univ. Baltimore County, USA; Dubovik, Oleg, Maryland Univ. Baltimore County, USA; [2002]; 1p; In English; 2002 Spring AGU, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We present a method for retrieval of imaginary part of refractive index of desert dust aerosol in UV part of spectrum along with aerosol layer height above the ground. The method uses Total Ozone Mapping Spectrometer' (TOMS) measurements of the top of atmosphere radiances (331 nm, 360 nm) and aerosol optical depth provided by Aerosol Robotic Network (AERONET) (440 nm). Obtained values of imaginary part of refractive index retrieved for Saharan dust aerosol at 360 nm are significantly lower than previously reported values. The average retrieved values vary between 0.0054 and 0.0066 for different geographical locations. Our findings are in good agreement with the results of several recent investigations. The time variability of retrieved values for aerosol layer height is consistent with the predictions of dust transport model.

Author

Aerosols; Optical Thickness; Dust; Satellite Observation; Refractivity

20020073379 NASA Ames Research Center, Moffett Field, CA USA

A Modeling Approach to Global Land Surface Monitoring with Low Resolution Satellite Imaging

Hlavka, Christine A., NASA Ames Research Center, USA; Dungan, Jennifer, NASA Ames Research Center, USA; Livingston, Gerry P., Vermont Univ., USA; Dec. 09, 1998; 2p; In English

Contract(s)/Grant(s): RTOP 274-52-81-19; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The effects of changing land use/land cover on global climate and ecosystems due to greenhouse gas emissions and changing energy and nutrient exchange rates are being addressed by federal programs such as NASA's Mission to Planet Earth (MTPE) and by international efforts such as the International Geosphere-Biosphere Program (IGBP). The quantification of these effects depends on accurate estimates of the global extent of critical land cover types such as fire scars in tropical savannas and ponds in Arctic tundra. to address the requirement for accurate areal estimates, methods for producing regional to global maps with satellite imagery are being developed. The only practical way to produce maps over large regions of the globe is with data of coarse spatial resolution, such as Advanced Very High Resolution Radiometer (AVHRR) weather satellite imagery at 1.1 km resolution

or European Remote-Sensing Satellite (ERS) radar imagery at 100 m resolution. The accuracy of pixel counts as areal estimates is in doubt, especially for highly fragmented cover types such as fire scars and ponds. Efforts to improve areal estimates from coarse resolution maps have involved regression of apparent area from coarse data versus that from fine resolution in sample areas, but it has proven difficult to acquire sufficient fine scale data to develop the regression. A method for computing accurate estimates from coarse resolution maps using little or no fine data is therefore needed.
Author
Advanced Very High Resolution Radiometer; International Geosphere-Biosphere Program; Mission to Planet Earth; Greenhouse Effect; Land Use

20020073399 NASA Goddard Space Flight Center, Greenbelt, MD USA
GCM Simulation of the Large-Scale North American Monsoon Including Water Vapor Tracer Diagnostics
Bosilovich, Michael G., NASA Goddard Space Flight Center, USA; Walker, Gregory, NASA Goddard Space Flight Center, USA; Schubert, Siegfried D., NASA Goddard Space Flight Center, USA; Sud, Yogesh, NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; 13th Conference on Hydrology, 13-17 Jan. 2002, Orlando, FL, USA; Sponsored by American Meteorological Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The geographic sources of water for the large scale North American monsoon in a GCM (General Circulation Model) are diagnosed using passive constituent tracers of regional water sources (Water Vapor Tracers, WVT). The NASA Data Assimilation Office Finite Volume (FV) GCM was used to produce a 10-year simulation (1984 through 1993) including observed sea surface temperature. Regional and global WVT sources were defined to delineate the surface origin of water for precipitation in and around the North American Monsoon. The evolution of the mean annual cycle and the interannual variations of the monsoonal circulation will be discussed. of special concern are the relative contributions of the local source (precipitation recycling) and remote sources of water vapor to the annual cycle and the interannual variation of monsoonal precipitation. The relationships between soil water, surface evaporation, precipitation and precipitation recycling will be evaluated.
Author
Monsoons; Water Vapor; Atmospheric General Circulation Models; Atmospheric Moisture

20020073415 Geological Survey, Hartford, CT USA
Integrated Geophysical and Hydraulic Investigation to Characterize a Fractured-Rock Aquifer, Norwalk, Connecticut
Lane, J. W.; Williams, J. H.; Johnson, C. D.; Savino, D. M.; Haeni, F. P.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-106823; USGS/WRI-001-4133; No Copyright; Avail: National Technical Information Service (NTIS)

This report presents results of an integrated geophysical and hydraulic investigation to characterize a contaminated fractured-bedrock aquifer site in Norwalk, Connecticut. The USGS conducted the investigation as part of a Cooperative Research and Development Agreement with United Technologies Corporation (UTC) to develop and test geophysical methods to investigate bedrock hydrogeology and to monitor active and innovative remediation measures. The purpose of this geophysical and hydraulic investigation was to characterize the bedrock lithology and structure at the site and to identify the orientation, distribution, and hydraulic characteristics of fractures and transmissive zones in the fractured-bedrock aquifer. This work supported ongoing efforts to develop a conceptual site model of ground-water flow and solute transport and to design a discrete-zone monitoring (DZM) and sampling network.
NTIS
Aquifers; Hydrogeology; Fractures (Materials); Sampling; Bedrock

20020073416 Geological Survey, Water Resources Div., Storrs, CT USA
Integrated Surface-Geophysical Investigation of the University of Connecticut Landfill, Storrs, Connecticut: 2000
Johnson, C. D.; Dawson, C. B.; Belaval, M.; Lane, J. W.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-106821; USGS/WRI-02-4008; No Copyright; Avail: National Technical Information Service (NTIS)

A surface-geophysical investigation to characterize the hydrogeology and contaminant distribution of the former landfill area at the University of Connecticut in Storrs, Connecticut, was conducted in 2000 to supplement the preliminary hydrogeologic assessment of the contamination of soil, surface water, and ground water at the site. A geophysical toolbox approach was used to characterize the hydrogeology and contaminant distribution of the former landfill. Two-dimensional direct-current resistivity, inductive terrain-conductivity, and seismic-refraction surface-geophysical data were collected and interpreted in an iterative manner with exploratory drilling, borehole geophysics, and hydraulic testing. In this investigation, a geophysical-toolbox approach was used to (1) further define identified conductive anomalies and leachate plumes; (2) identify additional leachate

plumes, possible fracture zones, and (or) conductive lithologic layers in the bedrock; and (3) delineate bedrock-surface topography in the drainage valleys north and south of the landfill. Resistivity and terrain-conductivity surveys were used to further delineate previously identified geophysical anomalies to the north and southwest of the landfill. A conductive anomaly identified in the terrain-conductivity survey to the north of the landfill in 2000 had a similar location and magnitude as an anomaly identified in terrain-conductivity surveys conducted in 1998 and 1999. Collectively, these surveys indicated that the magnitude of the conductive anomaly decreased with depth and with distance from the landfill. The anomalies indicated landfill leachate in the overburden and shallow bedrock.
NTIS
Connecticut; Geophysics; Hydrogeology; Contamination; Soils; Sanitation

20020073417 Geological Survey, Water Resources Div., Sacramento, CA USA
Water Resources Data California Water Year 2001. Volume 3. Southern Central Valley Basins and the Great Basin from Walker River to Truckee River
Smithson, J. R.; Freeman, L. A.; Rockwell, G. L.; Anderson, S. W.; Pope, G. L.; May 2001; 638p; In English
Report No.(s): PB2002-107983; USGS-WDR-CA-01-3; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche
Water-resources data for the 2001 water year for California consist of records of stage, discharge, and water quality of streams, stage and contents in lakes and reservoirs, and water levels and water quality in wells. Volume 3 contains discharge records for 180 gaging stations, stage and contents for 44 lakes and reservoirs, and water quality for 44 stations. Also included are 1 crest-stage partial-record station, 1 miscellaneous partial-record sites, and 6 miscellaneous-measurement stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in California.
NTIS
Water Resources; California; Data Acquisition; Hydrology

20020073418 Geological Survey, Water Resources Div., Sacramento, CA USA
Water Resources Data California Water Year 2001. Volume 1. Southern Great Basin from Mexican Border to Mono Lake Basin, and Pacific Slope Basins from Tijuana River to Santa Maria River
Agajanian, J.; Rockwell, G. L.; Anderson, S. W.; Pope, G. L.; May 2002; 520p; In English
Report No.(s): PB2002-107982; USGS-WDR-CA-01-1; No Copyright; Avail: CASI; A22, Hardcopy; A04, Microfiche
Water-resources data for the 2001 water year for California consist of records of stage, discharge, and water quality of streams, stage and contents in lakes and reservoirs, and water levels and water quality in wells. Volume 1 contains discharge records for 180 gaging stations and 13 crest-stage partial-record stations, stage and contents for 20 lakes and reservoirs, gage-height records for 2 stations, water quality for 37 streamflow-gaging stations and 2 partial-record stations, and precipitation data for 3 stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in California.
NTIS
Water Resources; Data Acquisition; Hydrology; Shallow Water

20020073426 Arizona Univ., Tucson, AZ USA
Accuracy Assessment of 1992 LANDSAT-MSS Derived Land Cover for the Upper San Pedro Watershed (US/Mexico)
Maingi, J. K.; Kepner, S. E.; Edmonds, W. G.; Jun. 2002; 44p; In English; Sponsored by Environmental Protection Agency, Las Vegas, NV. National Exposure Research Lab
Report No.(s): PB2002-107521; NERL-LV-ESD-02-062; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The utility of Digital Orthophoto Quads (DQQS) in assessing the classification accuracy of land cover derived from LANDSAT MSS data was investigated. Initially, the suitability of DOQs in distinguishing between different land cover classes was assessed using high-resolution airborne color video data. A cross-tabulation of the analyst's DOQ labels and the reference video label was produced and had an overall accuracy of 92%. This indicated that the DOQ data could be used to identify and distinguish between the different land cover classes. A 1992 land cover map for the upper San Pedro Watershed was available for accuracy assessment. The map was interpreted and generated by Instituto del Medio Ambiente y el Desarrollo Sustentable del Estado de Sonora (B4ADES), Hermosillo, Sonora. The Environmental Protection Agency (EPA) supplied Arizona Remote Sensing Center (ARSC) with approximately 60 DOQs for 1992. Most of the land cover classes were fairly well represented in the DOQs and covered between 24% and 41% in eight out of ten land cover classes. Only the Barren and Agriculture classes were poorly represented in the available DOQs covering 5.3% and 14.2% of the map area, respectively. A total of 457 sample points was used for the accuracy assessment. Allocation of sample points to land cover classes was through stratified (by land cover class

area) random sampling, with a 20-sample minimum for the smallest classes. Map labels for the sample points were compared with reference DOQ labels and an error matrix generated. An overall classification accuracy of about 75% was obtained.
NTIS
LANDSAT Satellites; Image Analysis; Accuracy; Data Acquisition; Data Processing

20020073427 Forest Service, Pacific Northwest Research Station, Portland, OR USA
Understanding the Compatibility of Multiple Uses on Forest Land: A Survey of Multiresource Research with Application to the Pacific Northwest
Stevens, J. A.; Montgomery, C. A.; Jun. 2002; 54p; In English
Report No.(s): PB2002-108703; FSGTR-PNW-539; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
In this report, multiresource research is described as it has coevolved with forest policy objectives-from managing for single or dominant uses, to managing for compatible multiple forest uses, to sustaining ecosystem health on the forest. The evolution of analytical methods for multiresource research is traced from impact analysis to multiresource modeling, and examples of true joint production of forest products, goods, and services are given. Empirical results from studies related to wood compatibility in the Pacific Northwest (PNW) are compiled. The authors found that: In most cases, joint production research has been too specific or too theoretical to be directly applicable by land managers. Meta-analysis may prove useful for generating general management guidelines; Compatibility studies generally demonstrate compatibility between wood production and other uses. This result depends on geographic scale of analysis; Increasing sophistication in modeling method and the dramatic increase in data describing interactions among forest uses will likely make future tradeoff analysis more realistic and useful. Current work in modeling timber-wildlife tradeoffs shows promise; Compatibility analysis can be useful for policy analysis by establishing standards of efficiency against which to evaluate policy alternatives.
NTIS
Forest Management; Land Use; Forests; Tradeoffs; Alternatives

20020073428 Forest Service, Pacific Northwest Research Station, Portland, OR USA
Comparisons of Estimated Standard Error a Ratio-of-Means Estimator for a Mapped-Plot Sample Design in Southeast Alaska
van Hees, W. S.; Jun. 2002; 16p
Report No.(s): PB2002-108702; FSRN-PNW-532; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Comparisons of estimated standard error for a ratio-of-means (ROM) estimator are presented for forest resource inventories conducted in southeast Alaska between 1995 and 2000. Estimated standard errors for the ROM were generated by using a traditional variance estimator and also approximate by bootstrap methods. Estimates of standard error generated by both traditional and bootstrap methods were similar. Percentage differences between the traditional and bootstrap estimates of standard error for productive forest acres and for gross cubic-foot growth were generally greater than respective differences for non-productive forest acres, net cubic volume, or nonforest acres.
NTIS
Estimates; Approximation; Forests; Errors

20020073429 Forest Service, Pacific Northwest Research Station, Portland, OR USA
Thinning Stock and Response to Fertilizer Less than Expected in Young Douglas-Fir Stand at Wind River Experimental Forest
DeBell, D. S.; Harrington, C. A.; Shumway, J.; Jun. 2002; 30p
Report No.(s): PB2002-108701; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Three thinning treatments (thinned to 3.7 by 3.7 m, thinned to 4.3 by 4.3 m, and an unthinned control treatment with nominal spacing averaging 2.6 by 2.6 m) were installed in a 10-year-old Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco) plantation growing on a low-quality site at the Wind River Experimental Forest in southwest Washington. Two years after thinning, two fertilizer treatments were superimposed on the design (0 and 224 kg per ha of nitrogen applied as ammonium nitrate). Diameter growth increased with increasing spacing throughout the 6-year study period, and it was also increased by fertilizer in both the thinned and unthinned (control) treatments. Thinning shock, a reduction in height growth after thinning, was expected at this study site because severe shock had been documented in earlier nearby trials. Height growth was initially reduced slightly by thinning, but by the third 2-year period after thinning, height growth in thinned, unfertilized treatments was equal to or greater than height growth in the unthinned, unfertilized treatment. Fertilizer application increased height growth on average by 13 percent in the first 2 years after fertilization. In the third and fourth years after feritilization, however, fertilizer increased average height growth by 9 percent, but the increase was substantial (16 percent) only in the unthinned control treatment. The mild, ephemeral nature of

thinning shock in the author's study was in contrast to the severe, long-lasting shock in earlier studies at Wind River. The milder shock in the author's study could be related to one or more of the following: (1) thinning was done at an early age, (2) impacts of fire (natural or prescribed) preceding planting were minor, and (3) seed source of the planted stock was appropriate for the location. Based on comparisons with other studies at Wind River and elsewhere, the authors suspect that use of nonlocal, maladapted seed sources in the earlier studies may have predisposed those trees to thinning shock. Furthermore, the authors suspect that the much higher responses to fertilizer application reported in the earlier studies may be associated with intense natural fires prior to planting, and the reduced nutritional status of those sites may have been further exacerbated by the use of maladapted seed sources.
NTIS
Forests; Ammonium Nitrates; Conifers; Nitrogen

20020073430 Forest Service, Pacific Northwest Research Station, Cordova, AK USA
Economics Research Supporting Water Resource Stewardship in the Pacific Northwest
Houston, L. L.; Kline, J. D.; Alig, R. J.; Jul. 2002; 84p; In English
Report No.(s): PB2002-108676; PNW-GTR-550; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
The use of water increasingly involves complex tradeoffs among biophysical, economic, ecological, and societal values. Knowledge about the value of water to different users and methods with which to evaluate biophysical, economic, ecological, and social tradeoffs associated with allocating limited water resources among competing uses is vital to devising appropriate and effective water resource policies. A review and synthesis of water resource economics research can contribute to a foundation on which to plan and conduct interdisciplinary research evaluating tradeoffs regarding water. It also can assist in setting research priorities for developing analytical processes and tools with which to evaluate tradeoffs, as well as develop water resource management strategies that are ecologically sound, economically efficient, and socially acceptable. Intended primarily for noneconomists, this report reviews existing water resource economics literature concerning the economic value of water in different uses in the Pacific Northwest, the evaluation of tradeoffs among uses, and the use of economic incentives for water conservation and protection or enhancement of water quality. The synthesis of water economics literature culminates in the identification of priority research topics relevant to the Pacific Northwest. An annotated bibliography of a sampling of water resource economics research is provided in an appendix.
NTIS
Economic Analysis; Resources Management; Water Management

20020073433 Geological Survey, Water Resources Div., Middleton, WI USA
Hydrology and Water Quality of Geneva Lake, Walworth County, Wisconsin
Robertson, D. M.; Goddard, G. L.; Mergener, E. A.; Rose, W. J.; Garrison, P. J.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-106822; USGS/WRI-02-4039; No Copyright; Avail: National Technical Information Service (NTIS)
As part of continuing efforts to improve the water quality of Geneva Lake, a collaborative effort between the U.S. Geological Survey, the Wisconsin Department of Natural Resources, and the Geneva Lake Environmental Agency was initiated in 1997 to document the present quality of the lake and its sediments, compute detailed hydrologic and nutrient (primarily phosphorus) budgets for the lake, estimate how changes in nutrient loading may affect water quality, and describe changes in the lake over the past 170 years by comparing water quality measured in this study with historical measurements and sediment-core information. This report presents the results of this collaborative study.
NTIS
Water Quality; Hydrology; Lakes; Phosphorus; Water Pollution

20020073434 Geological Survey, Water Resources Div., Honolulu, HI USA
Streamflow and Erosion Response to Prolonged Intense Rainfall of November 1-2, 2000, Island of Hawaii, Hawaii *Final Report*
Fontaine, R. A.; Hill, B. R.; 2002; 42p; In English
Report No.(s): PB2002-108670; USGS-02-4117; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A combination of several meteorologic and topographic factors produced extreme rainfall over the eastern part of the island of Hawaii on November 1-2, 2000. Storm rainfall was concentrated in two distinct areas, the Waiakea and Kapapala areas, where maximum rainfall totals of 32.47 and 38.97 inches were recorded. Resultant flooding caused damages in excess of 70 million dollars, among the highest totals associated with flooding in the State's history. Storm rainfall had recurrence intervals that ranged from 10 years or less for maximum 1-hour totals to 100 years or more for maximum 24-hour totals. As part of this study, peak

flow and/or erosion data were collected at 41 sites. Analyses of these data indicated that peak discharges of record occurred at 6 of 12 sites where historic data were available. Peak flows with estimated recurrence intervals from 50 to over 100 years were recorded at 4 of 11 sites. Peak flows were poorly correlated with total storm rainfall. Critical rainfall durations associated with peak flows ranged from 1 to 12 hours and were about 3 hours at most sites. Rainfall- runoff computations and field observations indicated that infiltration-excess overland flow alone was not sufficient to have caused the observed flood peaks and therefore saturation excess overland flow and subsurface flow probably contributed to peak flows at most sites.
NTIS
Watersheds; Erosion; Rainstorms; Damage; Flow Characteristics

20020073438 Tropical Forest Foundation, Belem, Brazil
Forest Canopy Damage and Recovery in Reduced-Impact and Conventional Selective Logging in Eastern Para, Brazil
Rodgrio, Pereira, Jr., Tropical Forest Foundation, Brazil; Zweede, Johan, Tropical Forest Foundation, Brazil; Asner, Gregory P., Colorado Univ., USA; Keller, Michael, New Hampshire Univ., USA; Forest Ecology and Management; 2001; ISSN 0378-1127; Volume 5778, pp. 1-13; In English; Copyright Waived; Avail: Issuing Activity; Abstract Only

We investigated ground and canopy damage and recovery following conventional logging and reduced-impact logging (RIL) of moist tropical forest in the eastern Amazon of Brazil. Paired conventional and RIL blocks were selectively logged with a harvest intensity of approximately 23 cu m/ha (geometric volume) in the dry seasons (July-December) of 1996 and 1998. Ground damage (roads + skid trails + log decks) in the conventional logging treatments occupied 8.9-11.2% of total operational area. In contrast, ground damage in RIL treatments ranged from 4.6 to 4.8% of the total area. Forest canopy damage was assessed using gap fraction measurements collected with an automated optical canopy analyzer (LAI-2000; Licor Inc.) in March 1999. Canopy opening varied by time since logging. The recently logged (1998) blocks had integrated canopy gap fractions of 21.6 and 10.9% of total area for conventional and RIL blocks, respectively. The blocks logged in 1996 had more closed canopies with 16.5 and 4.9% gap fraction for conventional and RIL blocks, respectively. For comparison, undisturbed forest had a canopy gap fraction of 3.1%. Measurements of ground disturbance and gap fraction using the Licor LAI-2000 generally agree with other field evaluations of RIL and conventional logging. Detailed understanding of canopy structural changes resulting from different logging intensities are critical to the prospect of logging damage estimation using current and future remote sensing products.
Author
Amazon Region (South America); Canopies (Vegetation); Forests; Logging (Industry); Deforestation

20020073456 Colorado Univ., Dept. of Geological Sciences and Environmental Studies Program, Boulder, CO USA
Cloud Cover in LANDSAT Observations of the Brazilian Amazon
Asner, G. P., Colorado Univ., USA; International Journal of Remote Sensing; [2001]; ISSN 0143-1161; Volume 22, No. 18, pp. 3855-3862; In English; Copyright Waived; Avail: Issuing Activity; Abstract Only

High spatial resolution LANDSAT imagery is employed in efforts to understand the impact of human activities on ecological, biogeochemical and atmospheric processes in the Amazon basin. The utility of LANDSAT multi-spectral data depends both on the degree to which surface properties can be estimated from the radiometric measurements and on the ability to observe the surface through the atmosphere. Clouds are a major obstacle to optical remote sensing of humid tropical regions, therefore cloud cover probability analysis is a fundamental prerequisite to land-cover change and Earth system process studies in these regions. This paper reports the results of a spatially explicit analysis of cloud cover in the LANDSAT archive of Brazilian Amazonia from 1984 to 1997. Monthly observations of any part of the basin are highly improbable using LANDSAT-like optical imagers. Annual observations are possible for most of the basin, but are improbable in northern parts of the region. These results quantify the limitations imposed by cloud cover to current Amazon land-cover change assessments using LANDSAT data. They emphasize the need for improved radar and alternative optical data fusion techniques to provide time-series analyses of biogeophysical properties for regional modelling efforts.
Author
Amazon Region (South America); Satellite Imagery; Cloud Cover; Time Series Analysis

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.

20020070891 NASA Glenn Research Center, Cleveland, OH USA
Fuel Cell Activities at the NASA Glenn Research Center
Kohout, Lisa L., NASA Glenn Research Center, USA; [2002]; 27p; In English; Ohio Technical College, 10 Jul. 2002, Cleveland, OH, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Fuel cells have a long history in space applications and may have potential application in aeronautics as well. A fuel cell is an electrochemical energy conversion device that directly transforms the chemical energy of a fuel and oxidant into electrical energy. Alkaline fuel cells have been the mainstay of the U.S. space program, providing power for the Apollo missions and the Space Shuttle. However, Proton Exchange Membrane (PEM) fuel cells offer potential benefits over alkaline systems and are currently under development for the next generation Reusable Launch Vehicle (RLV). Furthermore, primary and regenerative systems utilizing PEM technology are also being considered for future space applications such as surface power and planetary aircraft. In addition to these applications, the NASA Glenn Research Center is currently studying the feasibility of the use of both PEM and solid oxide fuel cells for low- or zero-emission electric aircraft propulsion. These types of systems have potential applications for high altitude environmental aircraft, general aviation and commercial aircraft, and high attitude airships. NASA Glenn has a unique set of capabilities and expertise essential to the successful development of advanced fuel cell power systems for space and aeronautics applications. NASA Glenn's role in past fuel cell development programs as well as current activities to meet these new challenges will be presented
Author
Aircraft Engines; Fuel Cells; Research and Development; Spacecraft Power Supplies; Energy Conversion Efficiency; Aerospace Systems

20020072223 NASA Glenn Research Center, Cleveland, OH USA
Fuel Cell Research at NASA GRC
Perez-Davis, Marla E., NASA Glenn Research Center, USA; [2002]; 29p; In English; Oak Ridge National Laboratories Meeting, 21 Mar. 2002, Oak Ridge, TN, USA; Sponsored by Oak Ridge National Lab., USA
Contract(s)/Grant(s): RTOP 755-1A-06; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An overview of NASA GRC (Glenn Research Center) initiatives and challenges in fuel cell technology. The research and development of fuel cells and regenerative fuel cell systems for a wide variety of applications, including earth-based and planetary aircraft, spacecraft, planetary surface power, and terrestrial use are discussed.
Author
Fuel Cells; Research and Development; Space Exploration

20020072936 National Renewable Energy Lab., Golden, CO USA
What Future Car MPG Levels and Technology Will Be Necessary
Patterson, P.; Steiner, E.; Singh, M.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-42333; No Copyright; Avail: National Technical Information Service (NTIS)

The potential peaking of world conventional oil production and the possible imperative to reduce carbon emissions will put great pressure on vehicle manufacturers to produce more efficient vehicles, on vehicle buyers to seek them out in the marketplace, and on energy suppliers to develop new fuels and delivery systems. Four cases for stabilizing or reducing light vehicle fuel use, oil use, and/or carbon emissions over the next 50 years are presented. Case 1 - Improve mpg so that the fuel use in 2020 is stabilized for the next 30 years. Case 2 - Improve mpg so that by 2030 the fuel use is reduced to the 2000 level and is reduced further in subsequent years. Case 3 - Case 1 plus 50% ethanol use and 50% low-carbon fuel cell vehicles by 2050. Case 4 - Case 2 plus 50% ethanol use and 50% low-carbon fuel cell vehicles by 2050. The mpg targets for new cars and light trucks require that significant advances be made in developing cost-effective and very efficient vehicle technologies. With the use of alternative fuels that are low in carbon, oil use and carbon emissions can be reduced even further.
NTIS
Fuel Consumption; Motor Vehicles; Carbon; Reduction (Chemistry); Emission

20020072946 ARCADIS Geraghty and Miller, Inc., Durham, NC USA

Advantage of Illinois Coal for FGD Removal of Mercury

Ghorishi, S. B.; Jozewicz, W. S.; Gullett, B. K.; May 2002; 18p; In English

Report No.(s): PB2002-107514; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The paper gives results of an investigation conducted to characterize and modify mercury speciation in Illinois coal combustion flue gas so that a mercury control strategy can be implemented in conventional flue gas desulfurization (FGD) units. Mercury, in trace concentration in coal, is readily volatilized during coal combustion and leaves the high-temperature zone as gas-phase elemental mercury (Hgo). Previous results have shown that, as the flue gas is cooled, a portion of the HgO is converted, primarily to mercuric chloride (HgC12), in the presence of catalytically active surfaces such as certain fly ashes. Unlike Hgo, HgC12 is highly soluble in water and has a high affinity for alkaline sorbents; it can, therefore, be easily removed in wet scrubbers and spray dryers (FGD units). This two-task study examined the effect of injecting Illinois coal combustion residues (ICCRs) on the conversion of Hgo to HgC12 in coal combustion flue gases. Task I studied HgO oxidation using a fixed-bed, bench-scale reactor in a simulated Illinois coal combustion environment.

NTIS

Air Pollution; Coal; Mercury (Metal); Pollution Control; Coal Derived Gases

20020072983 PDVSA Gas, Caracas, Venezuela

Reforming Petroleum Based Fuels for Fuel Cell Vehicles: Composition-Performance Relationships

Devlin, P.; Pacheco, M.; Jun. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-41466; No Copyright; Avail: National Technical Information Service (NTIS)

Onboard reforming of petroleum-based fuels, such as gasoline, may help ease the introduction of fuel cell vehicles to the marketplace. Although gasoline can be reformed, it is optimized to meet the demands of internal combustion engines (ICEs). This optimization includes blending to increase the octane number and addition of oxygenates and detergents to control emissions. The requirements for a fuel for onboard reforming to hydrogen are quite different than those for combustion. Factors such as octane number and flame speed are not important; however, factors such as hydrogen density, catalyst-fuel interactions, and possible catalyst poisoning become paramount. In order to identify what factors are important in a hydrocarbon fuel for reforming to hydrogen and what factors are detrimental, we have begun a program to test various components of gasoline and blends of components under autothermal reforming conditions. The results indicate that fuel composition can have a large effect on reforming behavior.

NTIS

Gasoline; Fuel Cells; Crude Oil; Automobiles

20020072990 NASA Glenn Research Center, Cleveland, OH USA

Space Environmental Testing of Dye-Sensitized Solar Cells

Harris, Jerry D., Cleveland State Univ., USA; Anglin, Emily J., NASA Glenn Research Center, USA; Hepp, Aloysius F., NASA Glenn Research Center, USA; Bailey, Sheila G., NASA Glenn Research Center, USA; Scheiman, David A., Ohio Aerospace Inst., USA; Castro, Stephenie L., Ohio Aerospace Inst., USA; [2002]; 4p; In English; Sixth European Space Power Conference, 6-10 May 2002, Porto, Portugal

Contract(s)/Grant(s): NCC3-817; NCC3-869; RTOP 755-A4-01; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Recent advances in nanocrystalline dye-sensitized solar cells has lead NASA to investigate the potential of these devices for space power generation, Reported here is the first space environment characterization of these type of photovoltaic devices. Cells containing liquid electrolytes were exposed to simulated low-earth orbit conditions and their performance evaluated. All cells were characterized under simulated air mass zero (AMO) illumination. Complete cells were exposed to pressures less than 1 x 10(exp -7) torr for over a month, with no sign of sealant failure or electrolyte leakage. Cells from Solaronix SA were rapid thermal cycled under simulated low-earth orbit conditions. The cells were cycled 100 times from -80 C to 80 C, which is equivalent to 6 days in orbit. The best cell had a 4.6% loss in efficiency as a result of the thermal cycling,

Author

Solar Cells; Space Environment Simulation; Thermal Cycling Tests; Energy Storage; Solar Generators; Electrolytes; Leakage; Nanocrystals

20020073123 Lockheed Missiles and Space Co., Sunnyvale, CA USA

Space Station Freedom Solar Array Containment Box Mechanisms

Johnson, Mark E., Lockheed Missiles and Space Co., USA; Haugen, Bert, Lockheed Missiles and Space Co., USA; Anderson, Grant, Lockheed Missiles and Space Co., USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 1-16; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

Space Station Freedom will feature six large solar arrays, called solar array wings, built by Lockheed Missiles & Space Company under contract to Rockwell International, Rocketdyne Division. Solar cells are mounted on flexible substrate panels which are hinged together to form a 'blanket.' Each wing is comprised of two blankets supported by a central mast, producing approximately 32 kW of power at beginning-of-life. During launch, the blankets are fan-folded and compressed to 1.57% of their deployed length into containment boxes. This paper describes the main containment box mechanisms designed to protect, deploy, and retract the solar array blankets: the latch, blanket restraint, tension, and guidewire mechanisms.

Author

Space Station Freedom; Solar Blankets; Solar Cells; Boxes (Containers); Conferences; Equipment Specifications; Spacecraft Equipment

20020073196 Department of Energy, Washington, DC USA

Preparation of a Plan for the Enhanced Geothermal System Development of the AmeriCulture Leasehold in the Animas Valley

May 2002; 8p

Report No.(s): DE2002-794068; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Working under the grant with AmeriCulture, Inc., and its team of geothermal experts, assembled a plan to apply enhanced geothermal systems (EGS) techniques to increase both the temperature and flow rate of the geothermal waters on its leasehold. AmeriCulture operates a commercial aquaculture facility that will benefit from the larger quantities of thermal energy and low cost electric power that EGS technology can provide. The project brought together a team of specialists that, as a group, provided the full range of expertise required to successfully develop and implement the project.

NTIS

New Mexico; Aquiculture; Geothermal Energy Utilization

20020073200 Electrotek Concepts, Inc., Arlington, VA USA

Integrated Field Testing of Fuel Cells and Micro-Turbines

Feb. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-794297; No Copyright; Avail: National Technical Information Service (NTIS)

This is a report of the Phase I effort for this project, which is to conduct a technical and economic evaluation of the prospects for the deployment of DG on Long Beach Island. The work in this phase consists of five tasks: (1) Circuit data compilation and model development, (2) Development of the base case, (3) Development of the alternative cases, (4) Technical evaluations through a comprehensive power flow analysis, and (5) Economic analysis of the various cases over a 10-year planning horizon. Each of these tasks has been completed and the results are presented in this report along with pertinent details of some of the key analysis.

NTIS

Fuel Cell Power Plants; Fuel Cells; Turbines; Field Tests

20020073202 Community Power Corp., Littleton, CO USA

Demonstration of a Small Modular BioPower System Using Poultry Litter *Final Report*

Reardon, J. P.; Lilley, A.; Browne, K.; Beard, K.; Avens, J.; Feb. 25, 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-794292; No Copyright; Avail: National Technical Information Service (NTIS)

The purpose of this project was to assess poultry grower residue, or litter (manure plus absorbent biomass), as a fuel source for Community Power Corporations Small Modular Biopower System (SMB). A second objective was to assess the poultry industry to identify potential onsite applications of the SMB system using poultry litter residue as a fuel source, and to adapt CPCs existing SMB to generate electricity and heat from the poultry litter fuel biomass. Benchscale testing and pilot testing were used to gain design information for the SMB retrofit. A system design for a phase II application of the SMB system was a goal of the

Phase I testing. Cost estimates for an onsite poultry litter SMB were prepared. Finally, a market estimate was prepared for implementation of the SMB.
NTIS
Gasification; Waste Utilization; Agriculture; Organic Wastes (Fuel Conversion); Biomass; Manures

20020073214 California Energy Commission, Sacramento, CA USA
Wind Project Performance, 1995 Summary, Staff Report
Jun. 1997; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-108559; P500-97-003; No Copyright; Avail: National Technical Information Service (NTIS)
The WPRS Annual Report includes the following information for all wind projects in California rated at 100 kilowatts (kW) or more that sell electricity to a power purchaser: turbine manufacturers, model numbers, rotor diameters and kW ratings; the number of cumulative and new turbines installed; the projected output per turbine; the output for each turbine model; and the output for the entire project. The WPRS Annual Report is compiled from quarterly reports submitted by project operators and public utilities. Commission staff use this WPRS data to analyze wind project performance and industry production and capacity trends. The Annual Report also contains data summary tables reflecting performance statewide and by resource area; turbine size, type and origin; manufacturer; and project operator.
NTIS
Wind Turbines; Diameters; Turbines; Ratings; Electricity

20020073458 Oak Ridge National Lab., TN USA
Estimating Externalities of the Hydro Fuel Cycles, Report 6
Kroodsma, R. L.; Lee, R.; Shriner, D. S.; Tolbert, V. R.; Turner, R. S.; Dec. 01, 1994; 220p; In English
Report No.(s): DE20-02757384; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
There are three major objectives of this hydropower study: (1) to implement the methodological concepts that were developed in the background document (ORNL/RFF 1992) as a means of estimating the external costs and benefits of fuel cycles and, by so doing, to demonstrate their application to the hydroelectric fuel cycle (different fuel cycles have unique characteristics that need to be addressed in different ways); (2) to develop, given the time and resources, the best range of estimates of externalities associated with hydroelectric projects, using two benchmark projects at two reference sites in the US; and (3) to assess the state of the information that is available to support the estimation of externalities associated with the hydroelectric fuel cycle and, by so doing, to assist in identifying gaps in knowledge and in setting future research agendas. The main consideration in defining these objectives was a desire to have more information about externalities and a better method for estimating them. As set forth in the agreement between the US and the EC, the study is explicitly and intentionally not directed at any one audience. This study is about a methodology for estimating externalities. It is not about how to use estimates of externalities in a particular policy context.
NTIS
Power Plants; Hydroelectricity; Cost Analysis

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ENVIRONMENT POLLUTION

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

20020070822 NASA Goddard Space Flight Center, Greenbelt, MD USA
Climatology, Natural Cycles, and Modes of Interannual Variability of the Great Plains Low-Level Jet as Assimilated by the GEOS-1 Data Analysis System
Helfand, H. M., NASA Goddard Space Flight Center, USA; Schubert, S. D., NASA Goddard Space Flight Center, USA; [2002]; 53p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
Despite the fact that the low-level jet of the southern Great Plains (the GPLLJ) of the U.S. is primarily a nocturnal phenomenon that virtually vanishes during the daylight hours, it is one of the most persistent and stable features of the low-level continental flow during the warm-season months, May through August. We have first used significant-level data to validate the skill of the GEOS-1 Data Assimilation System (DAS) in realistically detecting this jet and inferring its structure and evolution. We have then carried out a 15-year reanalysis with the GEOS-1 DAS to determine and validate its climatology and mean diurnal cycle and to study its interannual variability. Interannual variability of the GPLLJ is much smaller than mean diurnal and random intraseasonal variability and comparable in magnitude, but not location, to mean seasonal variability. There are three maxima of

interannual low-level meridional flow variability of the GPLLJ over the upper Great Plains, southeastern Texas, and the western Gulf of Mexico. Cross-sectional profiles of mean southerly wind through the Texas maximum remain relatively stable and recognizable from year to year with only its eastward flank showing significant variability. This variability, however, exhibits a distinct, biennial oscillation during the first six years of the reanalysis period and only then. Each of the three variability maxima corresponds to a spatially coherent, jet-like pattern of low-level flow interannual variability. There are three prominent modes of interannual. variability. These include the intermittent biennial oscillation (IBO), local to the Texas maximum. Its signal is evident in surface pressure, surface temperature, ground wetness and upper air flow, as well. A larger-scale continental convergence pattern (CCP) of covariance, exhibiting strong anti-correlation between the flow near the Texas and the upper Great Plains variability maxima, is revealed only when the IBO is removed from the interannual time series. A third, subtropical mode of covariance is associated with the Gulf of Mexico variability maximum. Significant interannual anti-correlations of the southeasterly flow over the Arizona/New Mexico region with the CCP and the subtropical mode are enhanced when restricted to the month of July. These anti-correlations may relate to an observed out-of-phase precipitation relationship between the Great Plains and the southwestern U.S.. The typical duration of interannual low-level meridional wind anomalies within a given season increases over the continent with decreasing latitude from two to three weeks over the upper Great Plains to six to seven weeks over eastern Texas.
Author
Jet Streams (Meteorology); Meridional Flow; Annual Variations; Diurnal Variations

20020070844 NASA Goddard Space Flight Center, Greenbelt, MD USA
Interseasonal Variations in the Middle Atmosphere Forced by Gravity Waves
Mayr, H. G., NASA Goddard Space Flight Center, USA; Mengel, J. G., Science Systems and Applications, Inc., USA; Drob, D. P., Naval Research Lab., USA; Porter, H. S., Furman Univ., USA; Chan, K. L., Hong Kong Univ. of Science and Technology, Hong Kong; April 2002; 30p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
In our Numerical Spectral Model (NSM), which incorporates Hines' Doppler Spread Parameterization, gravity waves (GW) propagating in the east/west direction can generate the essential features of the observed equatorial oscillations in the zonal circulation and in particular the QBO (quasi-biennial oscillation) extending from the stratosphere into the upper mesosphere. We report here that the NSM also produces inter-seasonal variations in the zonally symmetric (m = 0) meridional circulation. A distinct but variable meridional wind oscillation (MWO) is generated, which appears to be the counterpart to the QBO. With a vertical grid-point resolution of about 0.5 km, the NSM produces the MWO through momentum deposition of GWs propagating in the north/south direction. The resulting momentum source represents a third (generally odd) order non-linear function of the meridional winds, and this enables the oscillation, as in the case of the QBO for the zonal winds. Since the meridional winds are relatively small compared to the zonal winds, however, the vertical wavelength that maintains the MWO is much smaller, i.e., only about 10 km instead of 40 km for the QBO. Consistent with the associated increase of the viscous stress, the period of the MWO is then short compared with that of the QBO, i.e., only about two to four months. Depending on the strength of the GW forcing, the computed amplitudes of the MWO are typically 4 m/s in the upper stratosphere and mesosphere, and the associated temperature amplitudes are between about 2 and 3 K. These amplitudes may be observable with the instruments on the TIMED spacecraft. Extended computer simulations with the NSM in 2D (two-dimensional) and 3D (three-dimensional) reveal that the MWO is modulated by and in turn influences the QBO.
Author
Gravity Waves; Quasi-Biennial Oscillation; Middle Atmosphere; Meridional Flow; Numerical Analysis; Atmospheric Models

20020071036 Texas Univ., Center for Transportation Research, Austin, TX USA
Immediately Applicable Methods for Evaluating Environmental Impacts of Intelligent Transportation Systems (ITS)(Revised)
Mehta, T.; Mahmassani, H. S.; Bhat, C.; Dec. 2001; 62p; In English
Report No.(s): PB2002-107958; RR-4197-2; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This report provides an overview of the various methodologies for assessing the impacts of Intelligent Transportation Systems (ITS) on the environment. The report also discusses the general ITS evaluation framework and the issues that are important in assessing environmental impacts of ITS. The report particularly focuses on Immediately Applicable (IA) methods. A description of the structure and the assessment methodologies of two of the most widely used IA tools is presented along with the limitations of these tools.
NTIS
Transportation; Highways

20020071071 NASA Goddard Space Flight Center, Greenbelt, MD USA

Fabry-Perot Interferometer for Column CO2

Heaps, William S., NASA Goddard Space Flight Center, USA; Kawa, S. Randolph, NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Global atmospheric CO2 measurements are essential to resolving significant discrepancies in our understanding of the global carbon budget and, hence, humankind's role in global climate change. The science measurement requirements for CO2 are extremely demanding (precision is less than .3%). No atmospheric chemical species has ever been measured from space with this precision. We are developing a novel application of a Fabry-Perot interferometer to detect spectral absorption of reflected sunlight by CO2 and O2 in the atmosphere. Preliminary design studies indicate that the method will be able to achieve the sensitivity and signal-to-noise detection required to measure column CO2 at the target specification. The objective of this program is to construct a prototype instrument for deployment on an aircraft to test the instrument performance and our ability to retrieve the data in the real atmosphere. to date we have assembled a laboratory bench system to begin testing the optical and electronic components. We are also undertaking some measurements of signal and noise levels for actual sunlight reflecting from the ground in order to evaluate the potential of some components to meet the exacting requirements of this measurement.

Author

Fabry-Perot Interferometers; Carbon Dioxide; Prototypes; Design Analysis; Absorption Spectra; Atmospheric Composition

20020072723 NASA Marshall Space Flight Center, Huntsville, AL USA

Soil Moisture and Snow Cover: Active or Passive Elements of Climate

Oglesby, Robert J., NASA Marshall Space Flight Center, USA; Marshall, Susan, North Carolina Univ., USA; Erickson, David J., III, Oak Ridge National Lab., USA; Robertson, Franklin R., NASA Marshall Space Flight Center, USA; Roads, John O., California Univ., USA; [2002]; 1p; In English; International Enviornmental Modeling and Software Society, 24-27 Jun. 2002, Lugano, Switzerland; No Copyright; Avail: Issuing Activity; Abstract Only

A key question is the extent to which surface effects such as soil moisture and snow cover are simply passive elements or whether they can affect the evolution of climate on seasonal and longer time scales. We have constructed ensembles of predictability studies using the NCAR CCM3 in which we compared the relative roles of initial surface and atmospheric conditions over the central and western U.S. in determining the subsequent evolution of soil moisture and of snow cover. Results from simulations with realistic soil moisture anomalies indicate that internal climate variability may be the strongest factor, with some indication that the initial atmospheric state is also important. Model runs with exaggerated soil moisture reductions (near-desert conditions) showed a much larger effect, with warmer surface temperatures, reduced precipitation, and lower surface pressures; the latter indicating a response of the atmospheric circulation. These results suggest the possibility of a threshold effect in soil moisture, whereby an anomaly must be of a sufficient size before it can have a significant impact on the atmospheric circulation and climate. Results from simulations with realistic snow cover anomalies indicate that the time of year can be crucial. When introduced in late winter, these anomalies strongly affected the subsequent evolution of snow cover. When introduced in early winter, however, little or no effect is seen on the subsequent snow cover. Runs with greatly exaggerated initial snow cover indicate that the high reflectivity of snow is the most important process by which snow cover can impact climate, through lower surface temperatures and increased surface pressures. The results to date were obtained for model runs with present-day conditions. We are currently analyzing runs made with projected forcings for the 21st century to see if these results are modified in any way under likely scenarios of future climate change. An intriguing new statistical technique involving 'clustering' is developed to assist in this analysis.

Author

Soil Moisture; Snow Cover; Surface Properties; Periodic Variations; Climate Models; Computerized Simulation; Meteorology; Climate Change

20020072937 Argonne National Lab., IL USA

Estimation of Environmental Noise Impacts within Architectural Spaces

Chang, Y. S.; Liebich, R. E.; Chun, K. C.; 2002; 20p; In English

Report No.(s): DE2002-42935; ANL-02-43547; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Public Law 91-596, 'Occupational Safety and Health Act of 1970,' Dec. 29, 1970, stimulated interest in modeling the impacts of interior noise on employees, as well as the intelligibility of interior public-address and other speech intra-communication systems. The classical literature on this topic has primarily featured a statistical uniform diffuse-field model. This was pioneered by Leo L. Beranek in the 1950s, based on energy-density formulations at the former Bell Telephone (AT&T) Laboratories in the years from 1930 to 1950. This paper compares the classical prediction approach to the most recent statistical methods. Such

models were developed in the late 1970s and included innovations such as consideration of irregularly shaped (e.g., L-shaped) interior room spaces and coupled spaces.
NTIS
Noise Pollution; Public Law; Statistical Analysis; Telecommunication

20020072959 NASA Ames Research Center, Moffett Field, CA USA
Airborne Sunphotometer Measurements of Aerosol Optical Depth and Water Vapor in ACE-Asia and Their Comparisons to Correlative Measurements
Schmid, B., Bay Area Environmental Research Inst., USA; Redemann, J., Bay Area Environmental Research Inst., USA; Livingston, J., SRI International Corp., USA; Russell, P., NASA Ames Research Center, USA; Hegg, D., Washington Univ., USA; Wang, J., California Inst. of Tech., USA; Kahn, R., Jet Propulsion Lab., California Inst. of Tech., USA; Hsu, C., NASA Goddard Space Flight Center, USA; Masonis, S., Washington Univ., USA; Murayama, T., Tokyo Univ. of Mercantile Marine, Japan; [2002]; 1p; In English; AGU Western Pacific Geophysics Meeting, 9-12 Jul. 2002, New Zealand; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

In the Spring 2001 phase of the Asian Pacific Regional Aerosol Characterization Experiment (ACE-Asia), the 6-channel NASA Ames Airborne Tracking Sunphotometer (AATS-6) operated on 15 of the 19 research flights of the NCAR C-130, while its 14-channel counterpart (AATS-14) flew successfully on all 19 research flights of the CIRPAS Twin Otter. ACE-Asia studied aerosol outflow from the Asian continent to the Pacific basin. It was designed to integrate suborbital and satellite measurements and models to reduce the uncertainty in calculations of the climate forcing due to aerosols. AATS-6 and AATS-14 measured solar beam transmission at six and 14 wavelengths (380-1021 and 354-1558 nm, respectively), yielding aerosol optical depth (AOD) spectra and columnar water vapor (CWV). Vertical differentiation in profiles yielded aerosol extinction spectra and water vapor concentration. In this paper, we plan to present examples of the following, preliminary findings that are based in part on our airborne sunphotometer measurements: (1) The wavelength dependence of sunphotometer-derived AOD and extinction indicates that supermicron dust was often a major component of the aerosol, frequently extending to high altitudes. The percentage of full-column AOD (525 nm) that Jay above 3 km was typically 34+/-13%. In contrast, the analogous percentage of columnar water vapor was only 10+/-4%; (2) Initial comparison studies between AOD data obtained by AATS-6 and AATS-14 during coordinated low-level flight legs show agreement well within the instruments' error bars; (3) Aerosol extinction has been derived from airborne in situ measurements of scattering (nephelometers) and absorption (particle soot/ absorption photometer, PSAP) or calculated from particle size distribution measurements (mobility analyzers and aerodynamic particle sizers). Comparison with corresponding extinction values derived from the Ames airborne sunphotometer measurements shows good agreement for the vertical distribution of aerosol layers. However, the level of agreement in absolute magnitude of the derived aerosol extinction/optical depth varied among the aerosol layers sampled; (4) Initial comparisons of sunphotometer and satellite-derived AOD using SeaWiFS, MISR and AVHRR show promising results. We also plan to include comparisons with MODIS and TOMS: (5) Initial comparisons of sunphotometer-derived AOD and aerosol extinction profiles with lidars in Tokyo and on a ship show reasonable agreement.
Author
Optical Thickness; Aerosols; Water Vapor; Photometers; Asia; Numerical Analysis

20020072971 Oak Ridge National Lab., TN USA
New and Emerging Technologies for Real-Time Air and Surface Beryllium Monitoring
Phifer, B. E.; Churnetski, E. L.; Cooke, L. E.; Reed, J. J.; Howell, M. L.; Sep. 2001; 40p; In English
Report No.(s): DE2002-794063; No Copyright; Avail: Department of Energy Information Bridge

In this study, five emerging technologies were identified for real-time monitoring of airborne beryllium: Microwave-Induced Plasma Spectroscopy (MIPS), Aerosol Beam-Focused Laser-Induced Plasma Spectroscopy (ABFLIPS), Laser-Induced Breakdown Spectroscopy (LIBS), Surfaced-Enhanced Raman Scattering (SERS) Spectroscopy, and Micro-Calorimetric Spectroscopy (CalSpec). Desired features of real-time air beryllium monitoring instrumentation were developed from the Y-12 CBDPP. These features were used as guidelines for the identification of potential technologies as well as their unique demonstrated capability to provide real-time monitoring of similar materials. However, best available technologies were considered, regardless of their ability to comply with the desired features. None of the five technologies have the capability to measure the particle size of airborne beryllium. Although reducing the total concentration of airborne beryllium is important, current literature suggests that reducing or eliminating the concentration of respirable beryllium is critical for worker health protection. Eight emerging technologies were identified for surface monitoring of beryllium. CalSpec, MIPS, SERS, LIBS, Laser Ablation, Absorptive Stripping Voltametry (ASV), Modified Inductively Coupled Plasma (ICP) Spectroscopy, and Gamma BeAST. Desired features of real-time surface beryllium monitoring were developed from the Y-12 CBDPP. These features were used as guidelines for the

identification of potential technologies. However, the best available technologies were considered regardless of their ability to comply with the desired features.
NTIS
Beryllium; Environmental Monitoring; Microwave Spectra; Raman Spectra; Air Quality; Aerosols

20020073045 State Univ. of New York, Albany, NY USA
Final Technical Report on Atmospheric Ozone as a Climate Gas
Wang, W. C.; Feb. 01, 2002; 10p; In English
Report No.(s): DE2002-792078; No Copyright; Avail: Department of Energy Information Bridge
This report summarizes the major research accomplishments of the project 'Atmospheric Ozone as a Climate Gas' for the period Apri1 1, 1998-September 30, 2001. The objectives of the project were: (1) to investigate the physical, chemical and dynamical processes that affect midlatitude O3 in the lower stratosphere and free troposphere; and (2) to study climate-chemistry interaction concerning O3 changes in these regions and their influence on (and response to) future climate change due to increasing greenhouse gases CO2, N2O, CH4 and the CFCs, and changes of O3 precursor gases. The research team included a subaward with the University of Oslo with Professor Ivar Isaksen as project director.
NTIS
Greenhouse Effect; Climate Change; Ozone; Atmospheric Composition; Chemical Reactions; Chlorofluorocarbons

20020073046 National Oceanic and Atmospheric Administration, Environmental Research Labs., Boulder, CO USA
Climatic Change at High Elevation Sites *Final Report*
Diaz, H. F.; 2002; 10p; In English
Report No.(s): DE2002-765722; DOE/ER/62058; No Copyright; Avail: Department of Energy Information Bridge
A Workshop on climatic change at high elevation sites was held September 11-15, 1995 in Wengen, Switzerland. The meeting was sponsored by both U.S. (Department of Energy, National Science Foundation and National Oceanic & Atmospheric Administration) and European (Swiss National Science Foundation, European Science Foundation, Swiss Federal Institute of Technology) agencies. The goals of the workshop were to (1) focus the attention of the world climate community on the existence of unique high elevation geophysical records around the world, (2) highlight the value of these observing sites for climate change detection efforts and to help insure the continued support of governments and of relevant institutions in the maintenance of these high elevation data gathering efforts, (3) discuss and evaluate climatic trends that may be present in these records, and to compare the information with available paleoenvironmental records of glaciers, tree-rings and varved sediments from the alpine zones, and (4) discuss and evaluate information about elevational differences in current and projected greenhouse-gas induced climatic changes in coupled General Circulation Models.
NTIS
Atmospheric Physics; Atmospheric Chemistry; Climatology; Climate Change; Elevation

20020073067 NASA Ames Research Center, Moffett Field, CA USA
Airborne Sunphotometer Measurements of Aerosol Optical Depth and Columnar Water Vapor During the Puerto Rico Dust Experiment, and Comparison with Land, Aircraft, and Satellite Measurements
Livingston, John M., SRI International Corp., USA; Russell, Philip B., NASA Ames Research Center, USA; Reid, Jeffrey, Space and Naval Warfare Systems Command, USA; Redemann, Jens, Bay Area Environmental Research Inst., USA; Schmid, Beat, Bay Area Environmental Research Inst., USA; Allen, Duane A., NASA Ames Research Center, USA; Torres, Omar, Maryland Univ. Baltimore County, USA; Levy, Robert C., Science Systems and Applications, Inc., USA; Remer, Lorraine A., NASA Goddard Space Flight Center, USA; Holben, Brent N., NASA Goddard Space Flight Center, USA; [2002]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only
Analyses of aerosol optical depth (AOD) and columnar water vapor (CWV) measurements obtained with the six-channel NASA Ames Airborne Tracking Sunphotometer (AATS-6) mounted on a twin-engine aircraft during the summer 2000 Puerto Rico Dust Experiment are presented. In general, aerosol extinction values calculated from AATS-6 AOD measurements acquired during aircraft profiles up to 5 km ASL reproduce the vertical structure measured by coincident aircraft in-situ measurements of total aerosol number and surface area concentration. Calculations show that the spectral dependence of AOD was small (mean Angstrom wavelength exponents of approximately 0.20) within three atmospheric layers defined as the total column beneath the top of each aircraft profile, the region beneath the trade wind inversion, and the region within the Saharan Air Layer (SAL) above the trade inversion. This spectral behavior is consistent with attenuation of incoming solar radiation by large dust particles or by dust plus sea salt. Values of CWV calculated from profile measurements by AATS-6 at 941.9 nm and from aircraft in-situ measurements by a chilled mirror dewpoint hygrometer agree to within approximately 4% (0.13 g/sq cm). AATS-6 AOD values

measured on the ground at Roosevelt Roads Naval Air Station and during low altitude aircraft runs over the adjacent Cabras Island aerosol/radiation ground site agree to within 0.004 to 0.030 with coincident data obtained with an AERONET Sun/sky Cimel radiometer located at Cabras Island. For the same observation times, AERONET retrievals of CWV exceed AATS-6 values by a mean of 0.74 g/sq cm (approximately 21 %) for the 2.9-3.9 g/sq cm measured by AATS-6. Comparison of AATS-6 aerosol extinction values obtained during four aircraft ascents over Cabras Island with corresponding values calculated from coincident aerosol backscatter measurements by a ground-based micro-pulse lidar (MPL-Net) located at Cabras yields a similar vertical structure above the trade inversion. Finally, AATS-6 AOD values measured during low altitude aircraft traverses over the ocean are compared with corresponding AOD values retrieved over water from upwelling radiance measurements by the MODIS, TOMS, and GOES-8 Imager satellite sensors, with mixed results. These exercises highlight the need for continued satellite sensor comparison/validation studies to improve satellite AOD retrieval algorithms, and the usefulness of airborne sunphotometer measurements in the validation process.
Author
Aerosols; Optical Thickness; Water Vapor; Photometers; Optical Measurement; Airborne Equipment; Satellite Observation

20020073071 NASA Ames Research Center, Moffett Field, CA USA
Effects of Interannual Climate Variability on Water Availability and Productivity in Capoeira and Crops Under Traditional and Alternative Shifting Cultivation
Guild, Liane S., NASA Ames Research Center, USA; Sa, Tatiana D. A., Empresa Brasileira de Pesquisa Agropecuaria, Brazil; Carvalho, Claudio J. R., Empresa Brasileira de Pesquisa Agropecuaria, Brazil; Potter, Christopher S., NASA Ames Research Center, USA; Wickel, Albert J., Bonn Univ., Germany; Brienza, Silvio, Jr., Empresa Brasileira de Pesquisa Agropecuaria, Brazil; Kato, Maria doSocorro A., Empresa Brasileira de Pesquisa Agropecuaria, Brazil; Kato, Osvaldo, Empresa Brasileira de Pesquisa Agropecuaria, Brazil; Apr. 22, 2002; 1p; In English; Large-Scale Biosphere Atmosphere Experiment in Amazonia Science Meeting, 7-11 Jul. 2002, Manaus, Amazonas, Brazil; No Copyright; Avail: Issuing Activity; Abstract Only
Regenerating forests play an important role in long-term carbon sequestration and sustainable landuse as they act as potentially important carbon and nutrient sinks during the shifting agriculture fallow period. The long-term functioning of capoeira. is increasingly threatened by a shortening fallow period during shifting cultivation due to demographic pressures and associated increased vulnerability to severe climatic events. Declining productivity and functioning of fallow forests of shifting cultivation combined with progressive loss of nutrients by successive burning and cropping activities has resulted in declining agricultural productivity. In addition to the effects of intense land use practices, droughts associated with El Nino events are becoming more frequent and severe in moist tropical forests and negative effects on capoeira productivity could be considerable. In Igarape-Acu (near Belem, Para), we hypothesize that experimental alternative landuse/clearing practices (mulching and fallow vegetation improvement by planting with fast-growing leguminous tree species) may make capoeira and agriculture more resilient to the effects of agricultural pressures and drought through (1) increased biomass, soil organic matter and associated increase in soil water storage, and nutrient retention and (2) greater rooting depth of trees planted for fallow improvement. This experimental practice (moto mechanized chop-and-mulch with fallow improvement) has resulted increased soil moisture during the cropping phase, reduced loss of nutrients and organic matter, and higher rates of secondary-forest biomass accumulation. We present preliminary data on water relations during the dry season of 2001 in capoeira and crops for both traditional slash-and-burn and alternative chop-and-mulch practices. These data will be used to test IKONOS data for the detection of moisture status differences. The principal goal of the research is to determine the extent to which capoeira and agricultural fields are susceptible to extreme climate events (drought) under contrasting landuse/clearing practices.
Author
Annual Variations; Drought; Crop Growth; Farm Crops; Cultivation; Rural Land Use

20020073181 Department of Energy, Office of Environmental Management, Washington, DC USA
Innovative Technology Summary Report. In-Well Vapor Stripping Technology: Subsurface Contaminants Focus Area
Mar. 2002; 54p; In English
Report No.(s): DE2002-794979; DOE/EM-0626; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
In-Well Vapor Stripping extracts volatile organic compounds (VOCs) dissolved in groundwater, and removes these contaminants as a vapor. The technology is based on a well within a well design. Groundwater is recirculated by air injected through the central well. VOCs dissolved in groundwater are vaporized and transferred to the flowing air bubbles. The outer well is kept under vacuum where VOC vapors are extracted in the offgas stream. The outer well delivers the offgas stream to the surface for treatment.
NTIS
Volatile Organic Compounds; Ground Water; Wells; Technology Assessment; Vapors

20020073206 National Inst. for Occupational Safety and Health, Cincinnati, OH USA
Health Hazard Evaluation Report: HETA 99-0084-2807, Haverhill High School, Haverhill, Massachusetts
Sylvain, D. C.; Sep. 2002; 24p
Report No.(s): PB2002-108039; HETA-99-0084-2807; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

On January 27, 1999, the National Institute for Occupational Safety and Health (NIOSH) received a confidential request from staff at Haverhill High School in Haverhill, Massachusetts, for an evaluation of exposures to crystalline silica and other compounds in ceramics. The request indicated that employees were concerned about developing emphysema, silicosis, and/or asthma due to exposure to ceramics materials. In addition, the request indicated that staff were concerned about exposures to various to various materials used in five art room, and the woodworking shop. On April 27, 1999, an initial site visit was conducted which included an opening conference, informal discussions with teachers, and a walk-through inspection of the art rooms and woodworking shop. During the walk-through, activities were identified in ceramics and woodworking classrooms which could result in exposure to crystalline silica, metals and wood dust. On May 4, 1999, a second site visit was conducted where environmental monitoring was conducted for airborne crystalline silica in the ceramics classroom, and wood dust in the woodworking shop. Surface wipe sampling for metals was conducted in ceramics.
NTIS
Environmental Surveys; Environmental Monitoring; Metal Crystals; Silicon Dioxide

20020073207 National Inst. for Occupational Safety and Health, Cincinnati, OH USA
Health Hazard Evaluation Report: University of Kentucky College of Pharmacy, Lexington, Kentucky
Cook, C. K.; Daftarian, H.; Mortimer, V.; Nov. 2000; 28p
Report No.(s): PB2002-108038; HETA-99-0250-2815; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In June 1999, the National Institute for Occupational Safety and Health (NIOSH) received a request from management at the University of Kentucky Medical Center to conduct a health hazard evaluation (HHE) at the College of Pharmacy building. The request stated that two College of Pharmacy faculty personnel had been diagnosed with chronic neurological conditions (multiple sclerosis (MS) and amyotrophic lateral sclerosis (ALS)), and that there were concerns that the development of these conditions may be work-related. Since the building was first occupied in 1985, faculty personnel often reported smelling chemical odors from research labs on the 4th floor. NIOSH investigators reviewed the facility's Chemical Hygiene Plan, chemical inventory lists, ventilation blueprints, and floor plans. A tracer gas evaluation of the building's ventilation system was conducted to evaluate potential pollutant pathways and airflow patterns on the 4th floor. The tracer gas study demonstrated how chemical odors generated in labs can enter each floor's common return-air plenum, then disperse to other areas in the building, and how air contaminants released from fume hood exhaust stacks and a plumbing vent could re-enter the building's ventilation system. Some research labs were under positive pressure, which may allow chemical odors to disperse to areas outside the lab.
NTIS
Environmental Surveys; Air Pollution; Pharmacology; Flow Distribution; Chronic Conditions; Contaminants

20020073208 National Inst. for Occupational Safety and Health, Cincinnati, OH USA
Health Hazard Evaluation Report: HETA 99-0137-2810, World Color Press, Effingham, Illinois
Cook, C. K.; Page, E. H.; Sep. 2000; 32p
Report No.(s): PB2002-108037; HETA-99-0137-2810; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

On March 16, 1999, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Graphic Communications Local No. 391-C union to conduct a health hazard evaluation (HHE) at World Color Press located in Effingham, Illinois. Employees reportedly had unspecified respiratory problems and skin rashes that they believed were caused by occupational exposures to solvents and inks during printing and binding processes. On June 23-24, 1999, a walk-through survey was conducted to review the printing and bindery processes, conduct air sampling for potential air contaminants, and interview employees. A follow-up industrial hygiene survey was conducted on September 8-9, 1999, to measure workers' exposures to petroleum naphthas, 2-butoxyethanol, aldehydes, and resin acids (specifically abietic and dehydroabietic acids). Full-shift personal breathing-zone (PBZ) air samples collected for petroleum naphthas on press operators and press cleaners revealed time-weighed average (TWA) exposures of 48 and 98 milligrams per cubic meter (mg/cu.m3), respectively. These exposures were below both the NIOSH recommended exposure limit (REL) of 350 mg/cu.m3 for up to a 10-hour workday, 40-hour workweek, and the Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) of 2000 mg/cu.m3. Full-shift 2-butoxyethanol exposures ranged up to 1.9 mg/cu.m3, below both the NIOSH REL of 24 mg/cu.m3 as a 10-hour TWA and the OSHA PEL of 240 mg/cu.m3 as an 8-hour TWA.
NTIS
Environmental Surveys; Printing; Industrial Safety; Air Pollution; Organic Compounds

20020073209 National Inst. for Occupational Safety and Health, Cincinnati, OH USA

Health Hazard Evaluation Report: HETA 2001-0034-2843, USAirways Aircraft Support Center, Charlotte, North Carolina

Kiefer, M.; Weber, A.; May 2001; 32p

Report No.(s): PB2002-108243; HETA-2001-0034-2843; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

On October 23, 2000, the National Institute for Occupational Safety and Health (NIOSH) received a management request for a health evaluation (HHE) at the US Airways aircraft support center in Charlotte, North Carolina. The request asked NIOSH to determine if exposures resulting from a process change involving an industrial cleaner presented a health hazard to workers. Specific areas of concern included the aircraft wheel and brake maintenance departments where the primary industrial cleaner used in these areas had been replaced with a new product. No health complaints were reported in the HHE request, however subsequent information indicated that some employees had reportedly experienced health problems such as irritation and nose bleeds when the cleaner was first introduced. On February 5, 2001, NIOSH researchers conducted a site visit at the US Airways facility. During the site visit, integrated personal air sampling was conducted to evaluate employee exposures to total particulate and sodium metasilicate, the primary active ingredient in the industrial cleaner, and two glycol ethers (dipropylene glycol butyl ether (DPGBE), and tripropylene glycol methyl ether (TPGME)) that were also a component of the cleaner. Samples were collected from workers in the wheel pre-wash, bearing wash, wheel tear down, brake tear down, and the brake cleaning sinks.

NTIS

Environmental Surveys; Methyl Compounds; Aircraft Brakes; Cleaners

20020073211 National Inst. for Occupational Safety and Health, Cincinnati, OH USA

Health Hazard Evaluation Report: HETA 2000-0408-2825, Federal Aviation Administration, Burlington, Massachusetts

Tubbs, R. L.; Feb. 2001; 20p

Report No.(s): PB2002-108270; HETA-2000-0408-2825; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Hazard Evaluations and Technical Assistance Branch (HETAB) of the National Institute for Occupational Safety and Health (NIOSH) received a request for assistance from the Federal Aviation Administration's (FAA) New England Regional Occupational Health and Safety Office in August 2000, to evaluate noise exposures that aviation safety inspectors encounter during their employment. A previous investigation at Boston's Logan International Airport recommended that the inspectors be included in the agency's hearing conservation program. The FAA wanted to determine if other inspectors within the region should also be included in some level of a hearing conservation program.

NTIS

Environmental Surveys; Noise (Sound); Aircraft Safety

20020073221 NASA Goddard Space Flight Center, Greenbelt, MD USA

Interseasonal Variations in the Middle Atmosphere Forced by Gravity Waves

Mayr, H. G., NASA Goddard Space Flight Center, USA; Mengel, J. G., Science Systems and Applications, Inc., USA; Drob, D. P., Naval Research Lab., USA; Porter, H. S., Furman Univ., USA; [2002]; 1p; In English; 2002 Spring AGU, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

In our Numerical Spectral Model (NSM), which incorporates Hines' Doppler Spread Parameterization, gravity waves (GW) propagating in the east/west direction can generate the essential features of the observed equatorial oscillations of the zonal circulation and in particular the QBO (quasi-biennial oscillation) extending from the stratosphere into the upper mesosphere. We report here that the NSM also produces inter-seasonal variations in the zonally symmetric meridional circulation. A distinct meridional oscillation (MO) is generated, which appears to be the counterpart to the QBO. With a vertical grid-point resolution of about 0.5 km, the NSM produces the MO through momentum deposition of GW's propagating in the north/south direction. This process is inherently non-linear, of third (odd) order, which enables the oscillation. Since the meridional winds are relatively small compared to the zonal winds, the vertical wavelength required to maintain the MO is also smaller, i.e., only about 10 km instead of the 30 km for the QBO. The corresponding viscous stress is then larger, and the period of the MO is thus short compared with that of the QBO, i.e., only about 3 to 4 months. Depending on the strength of the GW forcing, the computed amplitudes of the meridional wind oscillation are typically 5 m/s in the upper stratosphere and mesosphere, and the associated temperature amplitudes are between about 2 and 3 K. These amplitudes may be observable with the instruments on the TIMED spacecraft. Extended computer simulations with the NSM in 2D and 3D reveal that the MO at low latitudes is modulated by the QBO and in turn can influence it to produce a hemispherically asymmetric component. The annual circulation from the summer to the winter hemisphere is likely to play an important role.

Author

Annual Variations; Mathematical Models; Middle Atmosphere; Gravity Waves; Zonal Flow (Meteorology)

20020073222 NASA Goddard Space Flight Center, Greenbelt, MD USA

Tropospheric Ozone during the TRACE-P Mission: Comparison between TOMS Satellite Retrievals and Aircraft Lidar Data, March 2001

Frolov, A. D., Maryland Univ., USA; Thompson, A. M., NASA Goddard Space Flight Center, USA; Hudson, R. D., Maryland Univ., USA; Browell, E. V., NASA Langley Research Center, USA; Oltmans, S. J., National Oceanic and Atmospheric Administration, USA; Witte, J. C., Science Systems and Applications, Inc., USA; [2002]; 1p; In English; 2002 Spring AGU: Validation and Satellite Data, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Over the past several years, we have developed two new tropospheric ozone retrievals from the TOMS (Total Ozone Mapping Spectrometer) satellite instrument that are of sufficient resolution to follow pollution episodes. The modified-residual technique uses v. 7 TOMS total ozone and is applicable to tropical regimes in which the wave-one pattern in total ozone is observed. The TOMS-direct method ('TDOT' = TOMS Direct Ozone in the Troposphere) represents a new algorithm that uses TOMS radiances directly to extract tropospheric ozone in regions of constant stratospheric ozone. It is not geographically restricted, using meteorological regimes as the basis for classifying TOMS radiances and for selecting appropriate comparison data. TDOT is useful where tropospheric ozone displays high mixing ratios and variability characteristic of pollution. Some of these episodes were observed downwind of Asian biomass burning during the TRACE-P (Transport and Atmospheric Chemical Evolution-Pacific) field experiment in March 2001. This paper features comparisons among TDOT tropospheric ozone column depth, integrated uv-DIAL measurements made from NASA's DC-8, and ozonesonde data.

Author

Total Ozone Mapping Spectrometer; Satellite Imagery; Ozone; Troposphere; Data Retrieval

20020073226 NASA Goddard Space Flight Center, Greenbelt, MD USA

Tropospheric Ozone from the TOMS TDOT (TOMS-Direct-Ozone-in-Troposphere) Technique During SAFARI-2000

Stone, J. B., Maryland Univ., USA; Thompson, A. M., NASA Goddard Space Flight Center, USA; Frolov, A. D., Maryland Univ., USA; Hudson, R. D., Maryland Univ., USA; [2002]; 1p; In English; 2002 Spring AGU: Validation and Satellite Data, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

There are a number of published residual-type methods for deriving tropospheric ozone from TOMS (Total Ozone Mapping Spectrometer). The basic concept of these methods is that within a zone of constant stratospheric ozone, the tropospheric ozone column can be computed by subtracting stratospheric ozone from the TOMS Level 2 total ozone column, We used the modified-residual method for retrieving tropospheric ozone during SAFARI-2000 and found disagreements with in-situ ozone data over Africa in September 2000. Using the newly developed TDOT (TOMS-Direct-Ozone-in-Troposphere) method that uses TOMS radiances and a modified lookup table based on actual profiles during high ozone pollution periods, new maps were prepared and found to compare better to soundings over Lusaka, Zambia (15.5 S, 28 E), Nairobi and several African cities where MOZAIC aircraft operated in September 2000. The TDOT technique and comparisons are described in detail.

Author

Ozone; Troposphere; Total Ozone Mapping Spectrometer; Mapping

20020073227 NASA Goddard Space Flight Center, Greenbelt, MD USA

Variability in Ozone in the Tropical Tropopause Region from the 1998-2000 SHADOZ (Southern Hemisphere ADditional OZonesondes) Data

Thompson, Anne M., NASA Goddard Space Flight Center, USA; Witte, J. C., Science Systems and Applications, Inc., USA; Oltmans, S. J., National Oceanic and Atmospheric Administration, USA; Schmidlin, F. J., NASA Wallops Flight Facility, USA; [2002]; 1p; In English; 2002 Spring AGU: Tropical Tropopause Layer, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The first view of stratospheric and tropospheric ozone variability in the southern hemisphere tropics is provided by a 3-year, 10-site record of ozone soundings from the Southern Hemisphere ADditional OZonesondes (SHADOZ) network. Observations covering 1998-2000 were made over Ascension Island; Nairobi, Kenya; Irene, South Africa; Reunion Island; Watukosek, Java; Fiji; Tahiti; American Samoa; San Cristobal, Galapagos; Natal, Brazil. Taking the TTL (tropical tropopause layer) as the region between 12 and 17 km, we examine ozone variability in this region on a week-to-week and seasonal basis. The TTL layer is lower in September-October-November than in March-April-May, when ozone is a minimum at most SHADOZ stations. A zonal wave-one pattern is apparent in column-integrated TTL ozone because ozone mixing ratios are greater over the Atlantic and adjacent continents than over the Pacific and eastern Indian Ocean. The wave-one persists all year with varying magnitude and appears to be due to general circulation - with subsidence over the Atlantic and frequent deep convection over the Pacific and

Indian Ocean. The variability of deep convection - most prominent at Java, Fiji, Samoa and Natal - is explored in time-vs-altitude ozone curtains. Stratospheric incursions into the troposphere are most prominent in soundings at Irene and Reunion Island. Author

Tropical Regions; Tropopause; Ozone; Atmospheric Composition; Satellite Observation; Statistical Analysis

20020073381 NASA Ames Research Center, Moffett Field, CA USA

Effects of Aircraft On Aerosol Abundance in the Upper Troposphere

Ferry, G. V., NASA Ames Research Center, USA; Pueschel, R. F., NASA Ames Research Center, USA; Strawa, A. W., NASA Ames Research Center, USA; Howard, S. D., Symtech Corp., USA; Verma, S., Science and Technology Corp., USA; Mahoney, M. J., Jet Propulsion Lab., California Inst. of Tech., USA; Bui, T. P., NASA Ames Research Center, USA; Hannan, J. R., Florida State Univ., USA; Fuelberg, H. E., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 11p; In English

Contract(s)/Grant(s): RTOP 538-08-12-14; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A significant increase in sulfuric acid aerosol concentration was detected above 10 km pressure altitude during a cross-corridor flight out of Shannon on October 23, 1997. The source of this aerosol is ascribed to commercial aircraft operations in flight corridors above 10 km, because (1) a stable atmosphere prevented vertical air mass exchanges and thus eliminated surface sources, (2) air mass back trajectories documented the absence of remote continental sources, and (3) temperature profiler data showed the tropopause at least one kilometers above flight altitude throughout the flight. Particle volatility identified 70% H2SO4, 20% (NH4)2SO4 and 10% nonvolatile aerosol in the proximity of flight corridors, and (10-30)% H2SO4, up to 50% (NH4)2SO4, and (40-60)% nonvolatile aerosols in air that was not affected by aircraft operations below 10 km. Only a very small fraction of the nonvolatile particles (determined with a condensation nucleus counter) could be morphologically identified as soot aerosol (validated by scanning electron microscopy of wire impactor samples). The newly formed H2SO4 particles did not measurably affect surface area and volume of the background aerosol due to their small size, hence did not affect radiative transfer directly. Author

Aerosols; Flight Altitude; Troposphere; Commercial Aircraft; Sulfuric Acid

20020073425 Research Triangle Inst., Research Triangle Park, NC USA

Factors Relating to the Release of Stachybotrys Chartarum Spores from Contaminated Sources

Foarde, K. K.; Menetrez, M. Y.; 2002; 10p; In English

Report No.(s): PB2002-107525; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The paper describes preliminary results of a research project to determine the factors that control the release of S. chartarum spores from a contaminated source and test ways to reduce spore release and thus exposure. As anticipated, S. chartarum spore emissions from gypsum board at low flow are directly proportional to airflow and indirectly proportional to relative humidity and support the authors' previous observations with penicillium and Aspergillus. The relationship between the cultural colony-forming units and total spores varied over time and needs further investigation, but suggests one reason that correlation between airborne field measurements (usually only of cultural organisms) and possible exposure is so difficult. (NOTE: Although traditionally, fungi as building contaminants have primarily been viewed as allergens, adverse health effects resulting from inhalation of fungal spores are likely due to multiple factors. One factor is the mycotoxins produced by some fungi.)

NTIS

Aerosols; Spores; Pollution Control; Data Acquisition; Aspergillus; Contaminants; Organisms

20020073440 NASA Goddard Space Flight Center, Greenbelt, MD USA

Insights into Tropical Tropospheric Ozone from the 1998-2000 SHADOZ (Southern Hemisphere Additional Ozonesondes) Data Record

Thompson, Anne M., NASA Goddard Space Flight Center, USA; Witte, Jacquelyn C., Science Systems and Applications, Inc., USA; Oltmans, Samuel J., National Oceanic and Atmospheric Administration, USA; Schmidlin, Francis J., NASA Wallops Flight Center, USA; Volker, W., Instituto de Pesquisas Espaciais, Brazil; Kirchhoff, J. H., Instituto de Pesquisas Espaciais, Brazil; Posny, Franaoise, Universite de La Reunion, Reunion; Gert, J., South African Weather Bureau, South Africa; Coetzee, R., South African Weather Bureau, South Africa; Hoegger, Bruno, Aerological Observatory, Switzerland; [2002]; 1p; In English; European Geophysical Society 2002 Meeting, 21-26 Apr. 2002, Nice, France; No Copyright; Avail: Issuing Activity; Abstract Only

We describe the first overview of total, stratospheric and tropospheric ozone in the southern hemisphere tropics based on a three year, ten site record of ozone soundings from the Southern Hemisphere Additional Ozonesondes (SHADOZ) network. Observations covering 1998-2000 were made over Ascension Island; Nairobi, Kenya; Irene, South Africa; Reunion Island; Watukosek, Java; Fiji; Tahiti; American Samoa; San Cristobal, Galapagos; Natal, Brazil. The ozone data, with simultaneous temperature profiles to approximately 7 hPa and relative humidity to approximately 200 hPa, are at an archive: http://code9l6.

gsfc.nasa.gov/Data_services/shadoz. Prominent features are highly variable tropospheric ozone, a zonal wave-one pattern in total (and tropospheric) column ozone, and signatures of the Quasi-Biennial Oscillation (QBO) in stratospheric ozone. Total, stratospheric and tropospheric column ozone amounts usually peak between August and November and are lowest in the first half of the year. Tropospheric ozone variability over the Indian and Pacific Ocean displays influences of the waning 1997-1998 Indian Ocean Dipole and ENSO (El Nino / Southern Oscillation), seasonal convection and pollution transport from Africa. Tropospheric ozone over the Atlantic Basin reflects regional subsidence and recirculation as well as pollution ozone from biomass burning.
Author
Ozone; Tropical Regions; Troposphere; Stratosphere

20020073441 Smithsonian Astrophysical Observatory, Cambridge, MA USA
Participation in the TOMS Science Team ***Final Report, 1 Jun. 1998 - 31 May 2002***
Chance, Kelly, Smithsonian Astrophysical Observatory, USA; September 2002; 8p; In English
Contract(s)/Grant(s): NAG5-7489; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Because of the nominal funding provided by this grant, some of the relevant research is partially funded by other sources. Research performed for this funding period included the following items: We have investigated errors in TOMS ozone measurements caused by the uncertainty in wavelength calibration, coupled with the ozone cross sections in the Huggins bands and their temperature dependence. Preliminary results show that 0.1 nm uncertainty in TOMS wavelength calibration at the ozone active wavelengths corresponds to approx. 1% systematic error in O3, and thus potential 1% biases among ozone trends from the various TOMS instruments. This conclusion will be revised for absolute O3 Measurements as cross sections are further investigated for inclusion in the HITRAN database at the SAO, but the potential for relative errors remains. In order to aid further comparisons among TOMS and GOME ozone measurements, we have implemented our method of direct fitting of GOME radiances (BOAS) for O3, and now obtain the best fitting precision to date for GOME O3 Columns. This will aid in future comparisons of the actual quantities measured and fitted for the two instrument types. We have made comparisons between GOME ICFA cloud fraction and cloud fraction determined from GOME data using the Ring effect in the Ca II lines. There is a strong correlation, as expected, but there are substantial systematic biases between the determinations. This study will be refined in the near future using the recently-developed GOME Cloud Retrieval Algorithm (GOMECAT). We have improved the SAO Ring effect determination to include better convolution with instrument transfer functions and inclusion of interferences by atmospheric absorbers (e.g., O3). This has been made available to the general community.
Author
Total Ozone Mapping Spectrometer; Astrophysics; Transfer Functions; Systematic Errors; Calibrating

20020073447 NASA Goddard Space Flight Center, Greenbelt, MD USA
Atmospheric Chemistry Insights from the SHADOZ Data: An IGAC Paradigm
Thompson, Anne M., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; IGAC Meeting, 19-26 Mar. 2002, Skukuza, South Africa; No Copyright; Avail: Issuing Activity; Abstract Only

The first climatological overview of total, stratospheric and tropospheric ozone in the southern hemisphere tropical and subtropics is based on ozone sounding data from ten sites comprising the Southern Hemisphere Additional Ozonesondes (SHADOZ) network. The period covered is 1998-2000. Observations were made over: Ascension Island; Nairobi, Kenya; Irene, South Africa; Reunion Island; Watukosek, Java; Fiji; Tahiti; American Samoa; San Cristobal, Galapagos; Natal, Brazil. Campaign data were collected on a Trans-Atlantic oceanographic cruise and during SAFARI-2000 in Zambia. The ozone data, with simultaneous temperature profiles to approx. 7 hPa and relative humidity to approx. 200 hPa, reside at: http://code9l6.gsfc.nasa.gov/ Data-services/shadoz. SHADOZ ozone time-series and profiles give a perspective on tropical total, stratospheric and tropospheric ozone in 1998-2000. Prominent features are highly variable tropospheric ozone, a zonal wave-one pattern in total (and tropospheric) column ozone, and signatures of the Quasi-Biennial Oscillation (QBO) in stratospheric ozone. Total, stratospheric and tropospheric column ozone amounts peak between August and November and are lowest between March and May. Tropospheric ozone variability over the Indian and Pacific Ocean displays influences of the Indian Ocean Dipole, and convective mixing. Pollution transport from Africa, South American and the Maritime Continent is a seasonal feature. Tropospheric ozone seasonality over the Atlantic Basin shows effects of regional subsidence and recirculation as well as biomass burning. Dynamical and chemical influences appear to be of comparable magnitude though model studies are needed to quantify this.
Author
Atmospheric Chemistry; Atmospheric Composition; Ozone; Stratosphere; Tropical Regions; Troposphere

20020073460 Arizona Univ., Dept. of Chemical and Environmental Engineering, Tucson, AZ USA

NO(x), Fine Particle and Toxic Metal Emissions from the Combustion of Sewage Sludge/Coal Mixtures: A Systematic Assessment ***Progress Report***

Wendt, J. O. L.; Feb. 05, 2002; 16p; In English

Report No.(s): DE2002-795263; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This research project focuses on pollutants from the combustion of mixtures of dried municipal sewage sludge (MSS) and coal. The objective is to determine the relationship between (1) fraction sludge in the sludge/coal mixture, and (2) combustion conditions on NOx concentrations in the exhaust, the size segregated fine and ultra-fine particle composition in the exhaust, and the partitioning of toxic metals between vapor and condenses phases, within the process. to this end work is progress using an existing 17kW downflow laboratory combustor, available with coal and sludge feed capabilities. The proposed study will be conducted in concert with an existing ongoing research on toxic metal partitioning mechanisms for very well characterized pulverized coals alone. Both high NOx and low NOx combustion conditions will be investigated (unstaged and staged combustion).

NTIS

Coal; Sewage; Sludge; Combustion Chambers; Metal Combustion

20020073861 NASA Ames Research Center, Moffett Field, CA USA

Methanol Uptake by Low Temperature Aqueous Sulfuric Acid Solutions

Iraci, Laura T., NASA Ames Research Center, USA; Essin, Andrew M., NASA Ames Research Center, USA; Golden, David M., NASA Ames Research Center, USA; [2001]; 1p; In English; Gordon Conference on Atmospheric Chemistry, 17-22 Jun. 2001, Newport, RI, USA; Sponsored by Gordon Research Conferences, Inc., USA; No Copyright; Avail: Issuing Activity; Abstract Only

To evaluate the role of upper tropospheric and lower stratospheric aerosols in the global budget of methanol, the solubility and reactivity of CH3OH in aqueous sulfuric acid solutions are under investigation. Using standard uptake techniques in a Knudsen cell reactor, we have measured the effective Henry's law coefficient, H(*), for methanol dissolution into 45 to 70 percent by weight H2SO4. We find that methanol solubility ranges from 10(exp 5) to 10(exp 8) M/atm and increases with decreasing temperature and with increasing sulfuric acid content. These solubility measurements include uptake due to physical solvation and all rapid equilibria which are established in solution. Our data indicate that simple uptake by aqueous sulfuric acid particles will not be a significant sink for methanol in the UT/LS. These results differ from those recently reported in the literature, and an explanation of this disparity will be presented. In addition to solvation, reaction between primary alcohols and sulfuric acid does occur, leading to the production of alkyl sulfates. Literature values for the rate of this reaction suggest that formation of CH3OSO3H may proceed in the atmosphere but is not significant under our experimental conditions. Results obtained using a complementary equilibrium measurement technique confirm this directly. In addition, the extent of methanol sequestration via formation of mono- and dimethylsulfate will be evaluated under several atmospheric conditions.

Author

Methyl Alcohol; Aerosols; Solubility; Reactivity; Sulfuric Acid

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GEOPHYSICS

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

20020070808 NASA Goddard Space Flight Center, Greenbelt, MD USA

The 1998-2000 SHADOZ (Southern Hemisphere ADditional OZonesondes) Tropical Ozone Climatology, 2, Stratospheric and Tropospheric Ozone Variability and the Zonal Wave-One

Thompson, Anne M., NASA Goddard Space Flight Center, USA; Witte, Jacquelyn C., NASA Goddard Space Flight Center, USA; Oltmans, Samuel J., National Oceanic and Atmospheric Administration, USA; Schmidlin, Francis J., NASA Wallops Flight Center, USA; Logan, Jennifer A., Harvard Univ., USA; Fujiwara, Masatomo, Kyoto Univ., Japan; Kirchhoff, Volker W. J. H., Instituto Nacional de Pesquisas Espacias, Brazil; Posny, Francoise, Universite de La Reunion, Reunion; Coetzee, Gert J. R., South African Weather Bureau, South Africa; Hoegger, Bruno, Swiss Aerological Observatory, Switzerland; [2002]; 59p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This is the second 'reference' or 'archival' paper for the SHADOZ (Southern Hemisphere Additional Ozonesondes) network and is a follow-on to the recently accepted paper with similar first part of title. The latter paper compared SHADOZ total ozone

with satellite and ground-based instruments and showed that the equatorial wave-one in total ozone is in the troposphere. The current paper presents details of the wave-one structure and the first overview of tropospheric ozone variability over the southern Atlantic, Pacific and Indian Ocean basins. The principal new result is that signals of climate effects, convection and offsets between biomass burning seasonality and tropospheric ozone maxima suggest that dynamical factors are perhaps more important than pollution in determining the tropical distribution of tropospheric ozone. The SHADOZ data at (is less than http://code9l6.gsfc.nasa.gov/Data_services/shadoz>) are setting records in website visits and are the first time that the zonal view of tropical ozone structure has been recorded - thanks to the distribution of the 10 sites that make up this validation network.
Author
Ozone; Troposphere; Tropical Regions; Southern Hemisphere

20020070810 Carnegie Institution of Washington, Dept. of Terrestrial Magnetism, Washington, DC USA
Transients in Pacific/North American Plate Boundary Deformation: Synthesis and Modeling of GPS and Borehole Strain Observations ***Final Report, 1 Jun. 1997 - 14 Sep. 2001***
Solomon, Sean C., Carnegie Institution of Washington, USA; Aug. 30, 2002; 6p; In English
Contract(s)/Grant(s): NAG5-6159; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
This is the Final Technical Report on research conducted between 1 June 1997 and 14 September 2001 entitled ”Transients in Pacific/North American plate boundary deformation: Synthesis and modeling of GPS and borehole strain observations.” As the project title implies, our effort involved a geodetic study of strain transients, i.e., temporal variations in deformation rates, that occur within plate boundary zones and their relationship to earthquakes and plate motions. Important transients occur during and following large earthquakes, and there are also strain transients not apparently associated with earthquakes. A particularly intriguing class of transients, for which there is a modest but growing list of examples, are preseismic anomalies. Such earthquake precursors, if further documented and understood, would have obvious importance for earthquake hazard mitigation. Because the timescales for these diverse transients range over at least 6 orders of magnitude (minutes to years), no single geodetic technique is optimum. We therefore undertook a systematic synthesis of Global Positioning Satellite (GPS) and borehole strainmeter data in three areas in California where there are adequate numbers of both types of instruments (or their equivalent): the San Francisco Bay region (within the Bay Area Regional Deformation network), southern California (within the Southern California Integrated GPS Network), and Parkfield (where a two-color laser system provides a proxy for continuous GPS measurements). An integral component of our study was the elucidation of the physical mechanisms by which such transients occur and propagate. We therefore initiated the development of multiple forward models, using two independent approaches. In the first, we explored the response to specified earthquake slip in viscoelastic models that incorporated failure criteria and the geometry of major faults in California. In the second approach, we examined the dynamical response of a complex rheological medium to the application of a far-field stress imposed by plate motions. The forward models were used both to gain insight into the range of strain transients to be expected under different assumed mechanical conditions and to develop representations for strain fields that allow GPS, borehole, and other strain data to be combined in a self-consistent, yet well-determined, manner. The models also provided a basis for hypothesis testing, by which data from a strain transient well characterized by GPS and borehole observations were utilized to distinguish among competing candidates for the causative physical mechanism and the governing physical characteristics. During the three years of this project, continued to a fourth year through a no-cost extension of the grant, we published 14 papers and presented or co-authored 37 papers at national scientific meetings.
Derived from text
Deformation; Geodesy; Global Positioning System; Strain Measurement; Boreholes; Surges; Plates (Tectonics); Mathematical Models

20020071067 NASA Goddard Space Flight Center, Greenbelt, MD USA
Observations of Overshooting Convective Tops and Dynamical Implications
Heymsfield, Gerald M., NASA Goddard Space Flight Center, USA; Halverson, Jeffrey, NASA Goddard Space Flight Center, USA; Fitzgerald, Mike, NASA Goddard Space Flight Center, USA; Dominquez, Rose, NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; American Geophysical Union Spring Meeting, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only
Convective tops overshooting the tropopause have been suggested in the literature to play an important role in modifying the tropical tropopause. The structure of thunderstorm tops overshooting the tropopause have been difficult to measure due to the intensity of the convection and aircraft safety. This paper presents remote observations of overshooting convective tops with the high-altitude ER-2 aircraft during several of the Tropical Rain Measuring Mission (TRMM) and (Convection and Moisture Experiment) CAMEX campaigns. The ER-2 was instrumented with the down-looking ER-2 Doppler Radar (EDOP), a new dropsonde system (ER-2 High Altitude Dropsonde, EHAD), and an IR radiometer (Modis Airborne Simulator, MAS).

Measurements were collected in Florida and Amazonia (Brazil). In this study, we utilize the radar cloud top information and cloud top infrared temperatures to document the amount of overshoot and temperature difference relative to the soundings provided by dropsondes and conventional upsondes. The radar measurements provide the details of the updraft structure near cloud top, and it is found that tops of stronger convective cells can overshoot by 1-2 km and with temperatures 5C colder than the tropopause minimum temperature. The negatively buoyant cloud tops are also evidenced in the Doppler measurements by strong subsiding flow along the sides of the convective tops . These findings support some of the conceptual and modeling studies of deep convection penetrating the tropopause.
Author
Cloud Height Indicators; Thunderstorms; Convection Cells; Tropopause; Remote Sensing; Radar Measurement

20020072962 Royal Netherlands Meteorological Inst., De Bilt, Netherlands
Rainfall Generator for the Rhine Basin. Nearest-Neighbour Resampling of Daily Circulation Indices and Conditional Generation of Weather Variables
Beersma, J. J.; Buishand, T. A.; 1999; 44p; In English
Report No.(s): PB2002-105678; KNMI-186-111; Copyright; Avail: National Technical Information Service (NTIS)
The KNMI rainfall generator is a non-parametric stochastic weather generator based on nearest neighbor resampling of historical data. The weather generator produces daily values of precipitation and temperature. The latter is needed for the calculation of evaporation and snowmelt. Precipitation is generated for about 200 subcatchments. Temperature is simultaneously generated for 34 stations in the basin. With this weather generator, it is possible to generate very long time series (1000 years and more). Since new combinations of historical events are generated (resampling), much higher multi-day rainfall events occur in such long simulations than in the highest historical events. In the Netherlands, this characteristic of the weather generator will be used to determine the design discharge of the Rhine for flood protection, i.e. the discharge with a mean recurrence time of 1250 years at the point where the river enters the Netherlands.
NTIS
Temperature; Precipitation (Meteorology); Rivers; Drainage; Time Series Analysis

20020073164 California Univ., Santa Barbara, CA USA
Paleoclimate and Glaciological Reconstruction in Central Asia Through the Collection and Analysis of Ice Cores and Instrumental Data from the Tien Shan *Final Report*
Aizen, V.; Kreutz, K.; May 30, 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-794067; No Copyright; Avail: National Technical Information Service (NTIS)
The main objectives of our paleoclimate research in the Tien Shan mountains of middle Asia combine the development of detailed paleoenvironmental records via the physical and chemical analysis of ice cores with the analysis of modern meteorological and hydrological data. The first step in this research, work that was funded jointly by DOE (this grant) and the National Science Foundation - Paleoclimate Program, was the collection of ice cores from the accumulation zone of the Inylchek Glacier and the collection of meteorological data from a variety of stations throughout the Tien Shan. The research effort described in this report was part of a collaborative effort with the United States Geological Survey's (USGS) Global Environmental Research Program which began studying radionuclide deposition in mid-latitude glaciers in 1995.
NTIS
Glaciology; Paleoclimatology; Geological Surveys; Asia; Data Acquisition

20020073166 California Univ., San Diego, Dept. of Chemistry, La Jolla, CA USA
Models of Geothermal Brine Chemistry *Final Report, 30 Jun. 1993 - 29 Jun. 1998*
Moller, N.; Weare, J. H.; 2002; 28p; In English
Report No.(s): DE2002-793353; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Many significant expenses encountered by the geothermal energy industry are related to chemical effects. When the composition, temperature of pressure of the fluids in the geological formation are changed, during reservoir evolution, well production, energy extraction or injection processes, the fluids that were originally at equilibrium with the formation minerals come to a new equilibrium composition, temperature and pressure. As a result, solid material can be precipitated, dissolved gases released and/or heat lost. Most geothermal energy operations experience these phenomena. For some resources, they create only minor problems. For others, they can have serious results, such as major scaling or corrosion of wells and plant equipment, reservoir permeability losses and toxic gas emission, that can significantly increase the costs of energy production and sometimes

lead to site abandonment. In future operations that exploit deep heat sources and low permeability reservoirs, new chemical problems involving very high T, P rock/water interactions and unknown injection effects will arise.
NTIS
Brines; Models; Chemical Effects; Geochemistry

20020073396 NASA Goddard Space Flight Center, Greenbelt, MD USA
CHAMP Tracking and Accelerometer Data Analysis Results
Lemoine, Frank G., NASA Goddard Space Flight Center, USA; Luthcke, S. B., NASA Goddard Space Flight Center, USA; Rowlands, D. D., NASA Goddard Space Flight Center, USA; Pavlis, D. E., Raytheon Information Technology and Scientific Services, USA; Colombo, O. L., Maryland Univ. Baltimore County, USA; Ray, Richard D., NASA Goddard Space Flight Center, USA; Thompson, B., Colorado Univ., USA; Nerem, R. S., Colorado Univ., USA; Williams, Teresa A., Raytheon Information Technology and Scientific Services, USA; [2002]; 1p; In English; 1st CHAMP Science Meeting, 22-25 Jan. 2002, Potsdam, Germany; No Copyright; Avail: Issuing Activity; Abstract Only

The CHAMP (Challenging Minisatellite Payload) mission's unique combination of sensors and orbit configuration will enable unprecedented improvements in modeling and understanding the Earth's static gravity field and its temporal variations. CHAMP is the first of two missions (GRACE (Gravity Recovery and Climate Experiment) to be launched in the later part of '01) that combine a new generation of GPS (Global Positioning System) receivers, a high precision three axis accelerometer, and star cameras for the precision attitude determination. In order to isolate the gravity signal for science investigations, it is necessary to perform a detailed reduction and analysis of the GPS and SLR tracking data in conjunction with the accelerometer and attitude data. Precision orbit determination based on the GPS and SLR (Satellite Laser Ranging) tracking data will isolate the orbit perturbations, while the accelerometer data will be used to distinguish the surface forces from those due to the geopotential (static, and time varying). In preparation for the CHAMP and GRACE missions, extensive modifications have been made to NASA/GSFC's GEODYN orbit determination software to enable the simultaneous reduction of spacecraft tracking (e.g. GPS and SLR), three axis accelerometer and precise attitude data. Several weeks of CHAMP tracking and accelerometer data have been analyzed and the results will be presented. Precision orbit determination analysis based on tracking data alone in addition to results based on the simultaneous reduction of tracking and accelerometer data will be discussed. Results from a calibration of the accelerometer will be presented along with the results from various orbit determination strategies. Gravity field modeling status and plans will be discussed.
Author
Accelerometers; Earth Gravitation; Global Positioning System; Orbit Determination; Satellite Tracking; Small Scientific Satellites

20020073402 NASA Goddard Space Flight Center, Greenbelt, MD USA
Gravity Estimation from a Simulated GRACE Mission: Short vs. Long Arcs
Rowlands, David D., NASA Goddard Space Flight Center, USA; Ray, Richard D., NASA Goddard Space Flight Center, USA; Chinn, D. S., NASA Goddard Space Flight Center, USA; Lemoine, F. G., NASA Goddard Space Flight Center, USA; [2001]; 1p; In English; American Geophysical Union 2001, 10-14 Dec. 2001, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We present simulations of gravity estimation from a GRACE-like satellite mission: low-low intersatellite tracking with a precision of order 1 micron s(exp -1) yielding gravity fields of degree and order 120. We employ a unique parameterization of the intersatellite baseline vector which allows the gravity estimation to be performed (relatively) independently of the GPS (global positioning system) tracking data once sufficiently accurate orbits are obtained. This considerably simplifies data processing during the gravity estimation. During that process only certain components of the baseline parameterization need be adjusted; other components are uncorrelated with gravity and may be adopted unchanged from the initial GPS orbits. The technique is also amenable to very short arcs of data. We present comparisons of gravity estimation from 30 days of observations with arcs of length 15 minutes vs. arcs of one day. Our 'truth' field is the EGM96 (Earth Gravitational Model) model; our prior field is a degree-70 clone of EGM96, perturbed from it by amounts comparable to the standard errors of EGM96 (and identically zero for degrees 71-120). For a high inclination orbit, the short-arc analysis recovers low order gravity coefficients remarkably well, although higher order terms, especially sectorial terms, are understandably less accurate. The simulations suggest that either long or short arcs of GRACE data are likely to improve parts of the geopotential spectrum by several orders of magnitude. This is especially so for low order coefficients, which are markedly improved for all degrees through 120.
Author
Gravitational Fields; Earth Gravitation; Satellite-to-Satellite Tracking

20020073410 NASA Ames Research Center, Moffett Field, CA USA

Absolute Rovibrational Intensities for the Chi(sup 1)Sigma(sup +) v=3 <#0106>- 0 Band of (12)C(16)O Obtained with Kitt Peak and BOMEM FTS Instruments

Chackerian, Charles, Jr., NASA Ames Research Center, USA; Kshirsagar, R. J., NASA Ames Research Center, USA; Giver, L. P., NASA Ames Research Center, USA; Brown, L. R., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 3p; In English Contract(s)/Grant(s): RTOP 622-67-67-10; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This work was initiated to compare absolute line intensities retrieved with the Kitt Peak FTS (Fourier Transform Spectrometer) and Ames BOMEM FTS. Since thermal contaminations can be a problem using the BOMEM instrument if proper precautions are not taken it was thought that measurements done at 6300 per cm would more easily result in satisfactory intercomparisons. Very recent measurements of the CO 3 <#0106>- 0 band fine intensities confirms results reported here that the intensities listed in HITRAN (High Resolution Molecular Absorption Database) for this band are on the order of six to seven percent too low. All of the infrared intensities in the current HITRAN tabulation are based on the electric dipole moment function reported fifteen years ago. The latter in turn was partly based on intensities for the 3 <#0106>- 0 band reported thirty years ago. We have, therefore, redetermined the electric dipole moment function of ground electronic state CO.

Author

Fourier Transformation; Infrared Astronomy; Electric Dipoles; Dipole Moments; Astronomical Spectroscopy; Ground State

20020073544 NASA Ames Research Center, Moffett Field, CA USA

Heterogeneous Uptake and Conversion of HOBr on H2SO4 at Upper Tropospheric and Stratospheric Temperatures (255 - 210 K)

Iraci, Laura T., NASA Ames Research Center, USA; Ashbourn, Samantha F. M., NASA Ames Research Center, USA; Rammer, Thomas A., NASA Ames Research Center, USA; Golden, David M., NASA Ames Research Center, USA; [2001]; 1p; In English; Workshop on Laboratory Studies of UT/LS Processes, 22-27 Jul. 2001, Breckenridge, CO, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Halogen species are known to catalytically destroy ozone in several different regions of the atmosphere. In addition to directly destroying ozone, bromine compounds can indirectly enhance ozone loss through coupling to other radical families. Hypobromous acid (HOBr), a key species in the linkage of BrOx to ClOx and HOx, is produced by the hydrolysis of BrONO2 on sulfate aerosols, and thus the heterogeneous behavior of HOBr must be understood. We have measured the solubility of HOBr in 45 to 70 percent by weight sulfuric acid solutions. Over the temperature range 208 to 255 K, HOBr is very soluble in sulfuric acid, H(*) = 10(exp 4) to 10(exp 8) M/atm. The solubility is temperature dependent, and our results agree well with those of Waschewsky and Abbott for 60 percent by weight H2SO4. HOBr is nearly as soluble as HBr, indicating that equilibrium concentrations of HOBr could approach those of HBr in sulfuric acid aerosols. Despite the high solubility of HOBr, stratospheric aerosol volumes are not large enough to sequester a significant fraction of inorganic bromine from the gas phase. Uptake of HOBr was nearly always accompanied by reaction, producing Br2O and possibly Br2. The effect of this bromine conversion pathway on the HOx and ClOx families, particularly at temperatures as warm as 255 K, will be considered.

Author

Bromine Compounds; Sulfuric Acid; Radicals; Catalytic Activity; Ozone Depletion; Solubility; Aerosols

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METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification

20020070801 NASA Goddard Space Flight Center, Greenbelt, MD USA

The GEOS Retrospective Data Assimilation System: The 6-hour lag case

Zhu, Yan-Qiu, NASA Goddard Space Flight Center, USA; Todling, Ricardo, NASA Goddard Space Flight Center, USA; Guo, Jing, NASA Goddard Space Flight Center, USA; Cohn, Stephen E., NASA Goddard Space Flight Center, USA; Navon, I. Michael, Florida State Univ., USA; Yang, Yan, Florida State Univ., USA; [2002]; 56p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The fixed-lag Kalman smoother (FLKS) has been proposed as a framework to construct data assimilation procedures capable of producing high-quality climate research datasets. Fixed-lag Kalman smoother-based systems, referred to as retrospective data assimilation systems, are an extension to three-dimensional filtering procedures with the added capability of incorporating observations not only in the past and present time of the estimate, but also at future times. A variety of simplifications are necessary to render retrospective assimilation procedures practical. In this article, we present an FLKS-based retrospective data assimilation

system implementation for the Goddard Earth Observing System (GOES) Data Assimilation System (DAS). The practicality of this implementation comes from the practicality of its underlying (filter) analysis system, i.e., the physical-space statistical analysis system (PSAS). The behavior of two schemes is studied here. The first retrospective analysis (RA) scheme is designed simply to update the regular PSAS analyses with observations available at times ahead of the regular analysis times. Although our GEOS DAS implementation is general, results are only presented for when observations 6-hours ahead of the analysis time are used to update the PSAS analyses and thereby to calculate the so-called lag-1 retrospective analyses. Consistency tests for this RA scheme show that the lag-1 retrospective analyses indeed have better 6-hour predictive skills than the predictions from the regular analyses. This motivates the introduction of the second retrospective analysis scheme which, at each analysis time, uses the 6-hour retrospective analysis to replace the first-guess normally used in the PSAS analysis, and therefore allows the calculation of a revised (filter) PSAS analysis. Since in this scheme the lag-1 retrospective analyses influence the filter results, this procedure is referred to as the retrospective-based iterative analysis (RIA) scheme. Results from the RIA scheme indicate its potential for improving the overall quality of the assimilation.
Author
Earth Observing System (EOS); Statistical Analysis; Iteration

20020070823 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Evolution of El Nino-Precipitation Relationships from Satellites and Gauges
Curtis, Scott, Maryland Univ. Baltimore County, USA; Adler, Robert F., NASA Goddard Space Flight Center, USA; Apr. 16, 2002; 42p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This study uses a twenty-three year (1979-2001) satellite-gauge merged community data set to further describe the relationship between El Nino Southern Oscillation (ENSO) and precipitation. The globally complete precipitation fields reveal coherent bands of anomalies that extend from the tropics to the polar regions. Also, ENSO-precipitation relationships were analyzed during the six strongest El Ninos from 1979 to 2001. Seasons of evolution, Pre-onset, Onset, Peak, Decay, and Post-decay, were identified based on the strength of the El Nino. Then two simple and independent models, first order harmonic and linear, were fit to the monthly time series of normalized precipitation anomalies for each grid block. The sinusoidal model represents a three-phase evolution of precipitation, either dry-wet-dry or wet-dry-wet. This model is also highly correlated with the evolution of sea surface temperatures in the equatorial Pacific. The linear model represents a two-phase evolution of precipitation, either dry-wet or wet-dry. These models combine to account for over 50% of the precipitation variability for over half the globe during El Nino. Most regions, especially away from the Equator, favor the linear model. Areas that show the largest trend from dry to wet are southeastern Australia, eastern Indian Ocean, southern Japan, and off the coast of Peru. The northern tropical Pacific and Southeast Asia show the opposite trend.
Author
El Nino; Time Series Analysis; Precipitation (Meteorology); Southern Oscillation

20020071027 NASA Goddard Space Flight Center, Greenbelt, MD USA
Convective Systems Over the South China Sea: Cloud-Resolving Model Simulations
Tao, Wei-Kuo, NASA Goddard Space Flight Center, USA; Shie, C.-L., NASA Goddard Space Flight Center, USA; Johnson, D., NASA Goddard Space Flight Center, USA; Simpson, J., NASA Goddard Space Flight Center, USA; Braun, S., NASA Goddard Space Flight Center, USA; Johnson, R., Colorado State Univ., USA; Ciesielski, P. E., Colorado State Univ., USA; May 2002; 69p; In English; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The South China Sea Monsoon Experiment (SCSMEX) was conducted in May-June 1998. One of its major objectives is to better understand the key physical processes for the onset and evolution of the summer monsoon over Southeast Asia and southern China. Multiple observation platforms (e.g., upper-air soundings, Doppler radar, ships, wind profilers, radiometers, etc.) during SCSMEX provided a first attempt at investigating the detailed characteristics of convective storms and air pattern changes associated with monsoons over the South China Sea region. SCSMEX also provided rainfall estimates which allows for comparisons with those obtained from the Tropical Rainfall Measuring Mission (TRMM), a low earth orbit satellite designed to measure rainfall from space. The Goddard Cumulus Ensemble (GCE) model (with 1-km grid size) is used to understand and quantify the precipitation processes associated with the summer monsoon over the South China Sea. This is the first (loud-resolving model used to simulate precipitation processes in this particular region. The GCE-model results captured many of the observed precipitation characteristics because it used a fine grid size. For example, the temporal variation of the simulated rainfall compares quite well to the sounding-estimated rainfall variation. The time and domain-averaged temperature (heating/cooling) and water vapor (drying/ moistening) budgets are in good agreement with observations. The GCE-model-simulated rainfall amount also agrees well with TRMM rainfall data. The results show there is more evaporation from the ocean surface prior to the onset of the monsoon than after the on-~et of monsoon when rainfall increases. Forcing due to net

radiation (solar heating minus longwave cooling) is responsible for about 25% of the precipitation in SCSMEX The transfer of heat from the ocean into the atmosphere does not contribute significantly to the rainfall in SCSMEX. Model sensitivity tests indicated that total rain production is reduced 17-18% in runs neglecting the ice phase. The SCSMEX results are compared to other GCE-model-simulated weather systems that developed during other field campaigns (i.e., west Pacific warm pool region, eastern Atlantic region and central USA). Large-scale forcing vie temperature and water vapor tendency, is the major energy source for net condensation in the tropical cases. The effects of large-scale cooling exceed that of large-scale moistening in the west pacific warm pool region and eastern Atlantic region. For SCSMEX, however, the effects of large-scale moistening predominate. Net radiation and sensible and latent hc,it fluxes play a much more important role in the central USA.
Derived from text
China; Clouds (Meteorology); Convective Heat Transfer; Southeast Asia; Atmospheric Models; Monsoons; Computerized Simulation

20020071041 NASA Goddard Space Flight Center, Greenbelt, MD USA
Interaction Between Surface Heat Budgets, Sea Surface Temperature and Deep Convection in the Tropical Western Pacific
Chou, Shu-Hsien, NASA Goddard Space Flight Center, USA; Chou, Ming-Dah, NASA Goddard Space Flight Center, USA; Lin, Po-Hsiung, National Taiwan Univ., Taiwan, Province of China; [2002]; 1p; In English; 25th Conference on Hurricanes and Tropical Meteorology, 29 Apr. 3 May 2002, San Diego, CA, USA; Sponsored by American Meteorological Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The surface heat budgets, sea surface temperature (SST), clouds and winds in the tropical western Pacific are analyzed and compared for the periods April-June 1998 and 1999. The spring of 1998 is in the later phase of a strong El Nino, whereas the spring of 1999 is in a period of a La Nina. The surface shortwave (SW) and longwave (LW) radiative fluxes are retrieved from Japanese Geostationary Meteorological Satellite radiance measurements, while the surface turbulent fluxes (latent and sensible heat) are derived from SSM/I-Inferred surface air humidity and winds. The SST and sea-air temperature differences are taken from NCEP/NCAR reanalysis. Deep convection is inferred from the outgoing longwave radiation of NOAA's polar-orbiting satellites. The longitudinal shift in maximum SST, deep convection and winds during El Nino and La Nina have a large impact on the spatial distribution of surface heating. Changes in clouds between these two periods have a large impact on the monthly-mean radiative heating, exceeding 60 W m(exp -2) over large oceanic regions. Similarly, the differences in wind speeds and SST have a large impact on the latent cooling, exceeding 40 W m(exp -2) over large oceanic areas. However, the maximum impacts on radiative and latent heat fluxes occur in different regions. The regions of maximum impact on radiative fluxes coincide with the regions of maximum change in clouds, whereas regions of maximum impact on turbulent heat fluxes coincide with the regions of maximum change in trade winds. The time-evolution of SST in relation to that of surface heat fluxes and winds are investigated and compared between the two El Nino and La Nina periods. In regions where wind speeds (or wind stresses) are large, the change in SST agrees well with the change in the net surface heating, indicating a deep ocean mixed layer associated with strong trade winds. On the other hand, in regions where radiative fluxes are large, the change in SST does not agree well with the change in the net surface heating, indicating the importance of solar radiation penetrating through the bottom of the shadow ocean mixed layer.
Author
Sea Surface Temperature; Pacific Ocean; Heat Transfer; Convection; Satellite Observation; Radiant Flux Density

20020071069 NASA Goddard Space Flight Center, Greenbelt, MD USA
Evaluation of the DAO Retrospective Data Assimilation System
Zhu, Yanqiu, Science Applications International Corp., USA; Todling, R., Science Applications International Corp., USA; Guo, J., Science Applications International Corp., USA; Cohn, S. E., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; Advances in Numerical Weather Prediction Data Assimilation, Regional and Global Models, Ensembles, and Operational Methods at European Geophysical Society XXVII General Assembly, 21-26 Apr. 2002, Nice, France; No Copyright; Avail: Issuing Activity; Abstract Only

We have developed and implemented a retrospective data assimilation system (RDAS) as an upgrade to the operational DAO/Terra data assimilation system. This formulation aims at improving analysis over filter analysis by the dynamically consistent incorporation of observation information past a given analysis time. The current implementation of the RDAS uses the adjoint of the tangent linear model of a simplified version of the Terra general circulation model and extensions to the physical-space statistical analysis system to propagate observation information back in time. The RDAS adopts the same assumptions of the regular data assimilation system, particularly, no explicit propagation of error covariances are involved therefore rendering a procedure that is computationally affordable. In this study, we show results of experiments conducted to

investigate the performance of the 6-hour (lag-1) RDAS. Statistical results obtained over one month during a winter season indicate that the RDAS represents considerable improvement over the regular assimilation. Plans for implementation of the RDAS capability in our new finite-volume data assimilation system will also be presented at the time of the conference.
Author
Data Acquisition; Statistical Analysis; Data Retrieval; Data Mining; Kalman Filters

20020072727 NASA Marshall Space Flight Center, Huntsville, AL USA
Using TRMM Data to Understand Interannual Variations In the Tropical Water Balance
Robertson, Franklin R., NASA Marshall Space Flight Center, USA; Fitzjarrald, Dan, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; First TRMM International Science Conference, 22-26 Jul. 2002, Honolulu, HI, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A significant element of the science rationale for TRMM centered on assembling rainfall data needed to validate climate models-- climatological estimates of precipitation, its spatial and temporal variability, and vertical modes of latent heat release. Since the launch of TRMM, a great interest in the science community has emerged for quantifying interannual variability (IAV) of precipitation and its relationship to sea-surface temperature (SST) changes. The fact that TRMM has sampled one strong warm/cold ENSO couplet, together with the prospect for a mission lifetime approaching ten years, has bolstered this interest in these longer time scales. Variability on a regional basis as well as for the tropics as a whole is of concern. Our analysis of TRMM results so far has shown surprising lack of concordance between various algorithms in quantifying IAV of precipitation. The first objective of this talk is to quantify the sensitivity of tropical precipitation to changes in SSTs. We analyze performance of the 3A11, 3A25, and 3B31 algorithms and investigate their relationship to scattering-- based algorithms constructed from SSM/I and TRMM 85 kHz data. The physical basis for the differences (and similarities) in depicting tropical oceanic and land rainfall will be discussed. We argue that scattering-based estimates of variability constitute a useful upper bound for precipitation variations. These results lead to the second question addressed in this talk-- How do TRMM precipitation / SST sensitivities compare to estimates of oceanic evaporation and what are the implications of these uncertainties in determining interannual changes in large-scale moisture transport? We summarize results of an analysis performed using COADS data supplemented by SSM/I estimates of near-surface variables to assess evaporation sensitivity to SST. The response of near 5 W sq m/K is compared to various TRMM precipitation sensitivities. Implied moisture convergence over the tropics and its sensitivity to errors of these algorithms is discussed.
Author (revised)
Trmm Satellite; Annual Variations; Tropical Regions; Water Balance; Sea Surface Temperature; Rain; Numerical Analysis; Algorithms

20020073068 NASA Ames Research Center, Moffett Field, CA USA
Assimilation of TES Water Vapor Observations
Houben, Howard, Bay Area Environmental Research Inst., USA; May 08, 2002; 1p; In English; Committee on Space Research (COSPAR) 2002, 10-19 Oct. 2002, Houston, TX, USA
Contract(s)/Grant(s): RTOP 344-33-21-01; No Copyright; Avail: Issuing Activity; Abstract Only

The Thermal Emission Spectrometer (TES) on the Mars Global Surveyor has made extensive observations of the Martian atmospheric water vapor column since the beginning of its mapping mission in early 1999. The results show broad agreement with the earlier Viking Mars Atmospheric Water Detector (MAWD) results (though column amounts in southern summer are higher, perhaps due to dust obscuration during the Viking mission). General circulation model (GCM) simulations of the annual Martian water cycle also show broad agreement with the TES observations. Details of the simulations depend on cloud and boundary layer parameterizations and on the adsorbing properties of the regolith. In order to make quantitative assessments of this agreement and to obtain observational values for the required physical parameters, a tracer transport data assimilation model has been developed. Model winds are derived from both tracer measurements and retrieved atmospheric temperature structures, providing a useful check of the underlying dynamical core of the GCM. by allowing detailed intercomparison between spacecraft and ground-based observations of Martian water vapor, the model should also contribute significantly to our understanding of the diurnal water cycle.
Author
Mars (Planet); Mars Atmosphere; Atmospheric Moisture; Mars Global Surveyor; Water Vapor; Atmospheric General Circulation Models; Hydrological Cycle

20020073069 NASA Ames Research Center, Moffett Field, CA USA

Sensitivity of Stratocumulus Optical Depths to Droplet Concentrations: Satellite Observations and Large-Eddy Simulations

Ackerman, A. S., NASA Ames Research Center, USA; Stevens, D. E., Lawrence Livermore National Lab., USA; Toon, O. B., Colorado Univ., USA; Coakley, J. A., Jr., Oregon State Univ., USA; [2002]; 1p; In English; 11th Conference on Cloud Physics, 3-7 Jun. 2002, Ogden, UT, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A number of observations and simulations have shown that increased droplet concentrations in ship tracks increase their total cross-sectional area, thereby enhancing cloud albedo and providing a negative (cooling) radiative forcing at the surface and the top of the atmosphere. In some cases cloud water has been found to be enhanced in ship tracks, which has been attributed to suppression of drizzle and implies an enhanced susceptibility of cloud albedo to droplet concentrations. However, observations from aircraft and satellite indicate that on average cloud water is instead reduced in daytime ship tracks. Such a reduction in liquid water may be attributable to cloud-burning caused by solar heating by soot within the ship exhaust, or by increased precipitation resulting from giant nuclei in the ship exhaust. We will summarize the observational evidence and present results from large-eddy simulations that evaluate these mechanisms. Along the way we will present our insights into the interpretation of satellite retrievals of cloud microphysical properties.

Author

Optical Thickness; Drop Size; Precipitation Particle Measurement; Large Eddy Simulation; Atmospheric Models; Satellite Observation

20020073184 Stockholm Univ., Meteorologiska Inst., Sweden

Determination of Atmospheric Wind Statistics

Hakansson, M.; 2001; 30p; In English

Report No.(s): PB2002-105887; DM-87; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In order to be able to specify the requirements on accuracy and resolution for the ADM (Atmospheric Dynamics Mission) Doppler-shift lidar an investigation on atmospheric wind characteristics has been performed. The method used in the investigation is based on analysis of direct wind observations as given by rawin-soundings retrieved from the operational archives at the ECMFW (European Center for Medium-range Weather Forecasting). The wind observations are further complemented by analysis fields in order to improve global coverage. The analysis fields also provide information on horizontal variability and are used to pinpoint possible extreme velocities missed because of the heterogeneous distribution of the observation sites.

NTIS

Wind (Meteorology); Optical Radar; Atmospheric Physics; Doppler Effect

20020073224 NASA Goddard Space Flight Center, Greenbelt, MD USA

Tropical Convection's Roles in Tropical Tropopause Cirrus

Boehm, Matthew T., National Academy of Sciences - National Research Council, USA; Starr, David OC., NASA Goddard Space Flight Center, USA; Verlinde, Johannes, Pennsylvania State Univ., USA; Lee, Sukyoung, Pennsylvania State Univ., USA; [2002]; 1p; In English; 2002 Spring AGU: Physics and Chemistry Near the Tropical Tropopause, 28-31 May 2002, Washington, DC, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Remote sensing observations reveal the frequent occurrence of tropopause cirrus, thin cirrus layers located near the tropical cold-point tropopause. Here, we present a theory in which tropical convection plays several important roles in tropopause cirrus formation. First, tropical convection is the primary means by which the moisture required for tropopause cirrus formation is transported into the upper troposphere. However, previous studies suggest that this convection rarely penetrates to the altitudes at which tropopause cirrus layers are observed, suggesting that additional vertical moisture transport is required to explain tropopause cirrus formation. We propose a mechanism for explaining this transport in which tropical convection plays the key role. According to this hypothesis, the transport is accomplished by meridional circulations that develop within the tropopause transition layer (TTL) in response to momentum transport by Rossby waves generated by tropical convection. Results of a series of global scale model runs designed to test this hypothesis will be presented. In addition, reanalyses vertical velocity data will be examined for evidence of the expected correlation between large-scale rising motion within the TTL and tropical convection. Once moisture is present near the cold-point tropopause, large-scale cooling is required to initiate tropopause cirrus formation. One source of this cooling is stratospheric tropical waves induced by tropical convection, as we will show using a time series of radiosonde temperature data superimposed with data on cloud occurrence from the DOE ARM Nauru99 field experiment. Observations of the global characteristics of these waves from a longer time series of reanalysis data will also be presented.

Author

Remote Sensing; Tropical Regions; Tropopause; Convection; Atmospheric Composition; Atmospheric Models

20020073225 NASA Goddard Space Flight Center, Greenbelt, MD USA

Precipitation Recycling and the Vertical Distribution of Local and Remote Sources of Water for Precipitation

Bosilovich, Michael G., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; 2002 Spring AGU, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Precipitation recycling is defined as the amount of water that evaporates from a region that precipitates within the same region. This is also interpreted as the local source of water for precipitation. In this study, the local and remote sources of water for precipitation have been diagnosed through the use of passive constituent tracers that represent regional evaporative sources along with their transport and precipitation. We will discuss the differences between this method and the simpler bulk diagnostic approach to precipitation recycling. A summer seasonal simulation has been analyzed for the regional sources of the USA Great Plains precipitation. While the tropical Atlantic Ocean (including the Gulf of Mexico) and the local continental sources of precipitation are most dominant, the vertically integrated column of water contains substantial water content originating from the Northern Pacific Ocean, which is not precipitated. The vertical profiles of regional water sources indicate that local Great Plains source of water dominates the lower troposphere, predominantly in the PBL. However, the Pacific Ocean source is dominant over a large portion of the middle to upper troposphere. The influence of the tropical Atlantic Ocean is reasonably uniform throughout the column. While the results are not unexpected given the formulation of the model's convective parameterization, the analysis provides a quantitative assessment of the impact of local evaporation on the occurrence of convective precipitation in the GCM. Further, these results suggest that local source of water is not well mixed throughout the vertical column.

Author

Evaporation; Precipitation (Meteorology); Remote Sensing; Atmospheric Boundary Layer; Atmospheric Models; Atmospheric Moisture

20020073389 Desert Research Inst., Reno, NV USA

Microphysics and Radiative Properties of Cirrus: Instrumentation and Analysis ***Final Report, 4 May 1998 - 3 Aug. 2002***

Hallett, John, Desert Research Inst., USA; Aug. 21, 2002; 6p; In English

Contract(s)/Grant(s): NAG1-2046; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Work under this grant has involved further development of a new aircraft instrument (the cloudscope) for real time characterization of atmospheric particulates together with field observations of such particulates, both in the form of ice and also as nuclei responsible for nucleation of both ice and water cloud particles. Part of the work involving assessment of the frequency of ice crystal shapes has been carried out in collaboration with the Meteorological Service of Canada; part of the work in a field program with the NCAR C-130. Part of the work has been interpreted in terms of laboratory simulation of ice crystal growth under a wide variety of conditions carried out under a grant from Physical Meteorology Program, National Science Foundation.

Author

Aircraft Instruments; Ice Clouds; Particulates; Crystal Growth; Meteorology

20020073398 NASA Goddard Space Flight Center, Greenbelt, MD USA

SPECIAL SESSION: (H21) on Global Precipitation Mission for Hydrology and Hydrometeorology. Sampling-Error Considerations for GPM-Era Rainfall Products

Bell, Thomas L., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; 2002 American Geophysical Union Spring Meeting, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The proposed Global Precipitation Mission (GPM) builds on the success of the Tropical Rainfall Measuring Mission (TRMM), offering a constellation of microwave-sensor-equipped smaller satellites in addition to a larger, multiply-instrumented "mother" satellite that will include an improved precipitation radar system to which the precipitation estimates of the smaller satellites can be tuned. Coverage by the satellites will be nearly global rather than being confined as TRMM was to lower latitudes. It is hoped that the satellite constellation can provide observations at most places on the earth at least once every three hours, though practical considerations may force some compromises. The GPM system offers the possibility of providing precipitation maps with much better time resolution than the monthly averages around which TRMM was planned, and therefore opens up new possibilities for hydrology and data assimilation into models. In this talk, methods that were developed for estimating sampling error in the rainfall averages that TRMM is providing will be used to estimate sampling error levels for GPM-era configurations. Possible impacts on GPM products of compromises in the sampling frequency will be discussed.

Author

Errors; Precipitation (Meteorology); Data Sampling; Meteorological Satellites; Satellite Observation

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OCEANOGRAPHY

Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics, and marine resources. For related information see also 43 Earth Resources and Remote Sensing.

20020070914 Woods Hole Oceanographic Inst., MA USA
Models of Small-Scale Patchiness
McGillicuddy, D. J., Woods Hole Oceanographic Inst., USA; [2001]; 1p; In English
Contract(s)/Grant(s): NAG5-6455; Copyright; Avail: Issuing Activity; Abstract Only

Patchiness is perhaps the most salient characteristic of plankton populations in the ocean. The scale of this heterogeneity spans many orders of magnitude in its spatial extent, ranging from planetary down to microscale. It has been argued that patchiness plays a fundamental role in the functioning of marine ecosystems, insofar as the mean conditions may not reflect the environment to which organisms are adapted. Understanding the nature of this patchiness is thus one of the major challenges of oceanographic ecology. The patchiness problem is fundamentally one of physical-biological-chemical interactions. This interconnection arises from three basic sources: (1) ocean currents continually redistribute dissolved and suspended constituents by advection; (2) space-time fluctuations in the flows themselves impact biological and chemical processes, and (3) organisms are capable of directed motion through the water. This tripartite linkage poses a difficult challenge to understanding oceanic ecosystems: differentiation between the three sources of variability requires accurate assessment of property distributions in space and time, in addition to detailed knowledge of organismal repertoires and the processes by which ambient conditions control the rates of biological and chemical reactions. Various methods of observing the ocean tend to lie parallel to the axes of the space/time domain in which these physical-biological-chemical interactions take place. Given that a purely observational approach to the patchiness problem is not tractable with finite resources, the coupling of models with observations offers an alternative which provides a context for synthesis of sparse data with articulations of fundamental principles assumed to govern functionality of the system. In a sense, models can be used to fill the gaps in the space/time domain, yielding a framework for exploring the controls on spatially and temporally intermittent processes. The following discussion highlights only a few of the multitude of models which have yielded insight into the dynamics of plankton patchiness. In addition, this particular collection of examples is intended to furnish some exposure to the diversity of modeling approaches which can be brought to bear on the problem. These approaches range from abstract theoretical models intended to elucidate specific processes, to complex numerical formulations which can be used to actually simulate observed distributions in detail.
Author
Ocean Models; Marine Environments; Plankton; Populations

20020071028 Centre National de la Recherche Scientifique, Toulouse, France
The Role of Mesoscale Variability on Plankton Dynamics in the North Atlantic
Garcon, Veronique, C., Centre National de la Recherche Scientifique, France; Oschlies, Andreas, Kiel Univ., Germany; Doney, Scott C., National Center for Atmospheric Research, USA; Mcgillicuddy, Dennis, Woods Hole Oceanographic Inst., USA; Deep-Sea Research II; [2001]; Volume 48, pp. 2199-2226; In English
Contract(s)/Grant(s): NAG5-6455; Copyright; Avail: Issuing Activity; Abstract Only

The intensive field observational phase of JGOFS in the North Atlantic Ocean has shown the importance of oceanic mesoscale variability on biogeochemical cycles and on the strength of the ocean biological pump. Mesoscale physical dynamics govern the major time/space scales of bulk biological variability (biomass, production and export). Mesoscale eddies seem to have a strong impact on the ecosystem structure and functioning, but observational evidence is rather limited. For the signature of the mesoscale features to exist in the ecosystem, the comparison of temporal scales of formation and evolution of mesoscale features and reaction of the ecosystem is a key factor. Biological patterns are driven by active changes in biological source and sink terms rather than simply by passive turbulent mixing. A first modelling assessment of the regional balances between horizontal and vertical eddy-induced nutrient supplies in the euphotic zone shows that the horizontal transport predominates over the vertical route in the subtropical gyre, whereas the reverse holds true for the other biogeochemical provinces of the North Atlantic. Presently. despite some difference in numbers, the net impact of modelled eddies yields an enhancement of the biological productivity in most provinces of the North Atlantic Ocean. Key issues remaining include variation on the mesoscale of subsurface particle and dissolved organic matter remineralization, improved knowledge of the ecological response to patterns of variability, synopticity in mesoscale surveys along with refining measures of biogeochemical time/space variability. Eventual success of assimilation of in situ and satellite data, still in its infancy in coupled physical/biogeochemical models, will be crucial to achieve JGOFS synthesis in answering which data are most informative, standing stocks or rates, and which ones are relevant. Depending on which end of the spectrum quantification of the effect of mesoscale features on production and community structure is required,

complementary strategies are offered. Either one may choose to increase resolution of models up to the very fine mesoscale features scale (a few kms) for the high end, or to include a parametric representation of eddies for the low end.
Author
Plankton; Atlantic Ocean; Mesoscale Phenomena; Biogeochemistry

20020071029 California Univ., Ocean Physics Lab., Santa Barbara, CA USA
New Chemical, Bio-Optical and Physical Observations of Upper Ocean Response to the Passage of a Mesoscale Eddy off Bermuda
McNeil, J. D., University of Southern California, USA; Jannasch, H. W., Woods Hole Oceanographic Inst., USA; Dickey, T., University of Southern California, USA; McGillicuddy, D., Woods Hole Oceanographic Inst., USA; Brzekinski, M., California Univ., USA; Sakamoto, C. M., Woods Hole Oceanographic Inst., USA; Journal of Geophysical Research; Jul. 15, 1999; Volume 104, No. C7, pp. 15537-15548; In English
Contract(s)/Grant(s): NAG5-6455; Copyright; Avail: Issuing Activity; Abstract Only
A mesoscale eddy advected across the Bermuda Testbed Mooring site over a 30-day period centered on July 14, 1995. Temperature and current measurements along with biogeochemical measurements were used to characterize the biological response of the upper ocean associated with the introduction of nitrate into the euphoric layer due to the doming of isotherms associated with the eddy. Complementary shipboard data showed an anomalous water mass, which extended from a depth of approximately 50 to 1000 m, manifesting as a cold surface expression and warm anomaly at depth. Although mesoscale eddies are frequently observed in the Sargasso Sea, the present observations are particularly unique because of the high-temporal-resolution measurements of the new instrumentation deployed on the mooring. Analyzers that measure nitrate plus nitrite were placed at depths of 80 and 200 m and bio-optical sensors were located at depths of 20, 35, 45, 71, and 86 m. Peak nitrate values of nearly 3.0 microns at 80 m and chlorophyll alpha values of 1.4 mg/cu m at 71 m were observed, as well as a 25- to 30-meter shoaling of the 1% light level depth. A Doppler shift from the inertial period (22.8 hours) to 25.2 hours was observed in several time series records due to the movement of the eddy across the mooring. Inertial pumping brought cold, nutrient-rich waters farther into the euphotic zone than would occur solely by isothermal lifting. Silicic acid was depleted to undetectable levels owing to the growth of diatoms within the eddy. The chlorophyll alpha values associated with the eddy appear to be the largest recorded during the 8 years of the ongoing U.S. JGOFS Bermuda Atlantic Time Series Study (BATS) program.
Author
Mesoscale Phenomena; Ocean Surface; Ocean Dynamics; Biogeochemistry

20020071030 Woods Hole Oceanographic Inst., MA USA
Mesoscale Variations of Biogeochemical Properties in the Sargasso Sea
McGillicuddy, D. J., Woods Hole Oceanographic Inst., USA; Johnson, R., Bermuda Biological Station for Research, Inc., Bermuda; Siegel, D. A., California Univ., USA; Michaels, A. F., University of Southern California, USA; Bates, N. R., Bermuda Biological Station for Research, Inc., Bermuda; Knap, A. H., Bermuda Biological Station for Research, Inc., Bermuda; Journal of Geophysical Research; Jun. 15, 1999; Volume 104, No. C6, pp. 13381-13394; In English
Contract(s)/Grant(s): NAG5-6455; Copyright; Avail: Issuing Activity; Abstract Only
A mesoscale resolution biogeochemical survey was carried out in the vicinity of the U.S. Joint Global Ocean Flux Study Bermuda Atlantic Time-series Study (BATS) site during the summer of 1996. Real-time nowcasting and forecasting of the flow field facilitated adaptive sampling of several eddy features in the area. Variations in upper ocean nutrient and pigment distributions were largely controlled by vertical isopycnal displacements associated with the mesoscale field. Shoaling density surfaces tended to introduce cold, nutrient-rich water into the euphotic zone, while deepening isopycnals displaced nutrient-depleted water downward. Chlorophyll concentration was generally enhanced in the former case and reduced in the latter. Eddy-induced upwelling at the base of the euphotic zone was affected by features of two different types captured in this survey-, (1) a typical mid-ocean cyclone in which doming of the main thermocline raised the near-surface stratification upward and (2) a mode water eddy composed of a thick lens of 18C water, which pushed up the seasonal thermocline and depressed the main thermocline. Model hindcasts using all available data provide a four-dimensional context in which to interpret temporal trends at the BATS site and two other locations during the 2 weeks subsequent to the survey. Observed changes in near-surface structure at the BATS site included shoaling isopycnals, increased nutrient availability at the base of the euphotic zone, and enhanced chlorophyll concentration within the cuphotic zone. These trends are explicable in terms of a newly formed cyclone that impinged upon the site during this time period. These observations reveal that eddy upwelling has a demonstrable impact on the way in which the nitrate-density relationship changes with depth from the aphotic zone into the euphotic zone. A similar transition is present in the BATS record, suggesting that eddy-driven upwelling events are present in the time series of upper ocean biogeochemical

properties. The variability in main thermocline temperature and nitrate in this synoptic spatial survey spans the range observed in these quantities in the 10-year time series available at BATS to date (1988-1998).
Author
Mesoscale Phenomena; Ocean Surface; Biogeochemistry; Sargasso Sea; Nutrients; Production; Upwelling Water

20020071031 Massachusetts Inst. of Tech., Boston, MA USA
Monthly Variability in Upper Ocean Biogeochemistry due to Mesoscale Eddy Activity in the Sargasso Sea
Sweeney, Erin N.; May 2001; 1p; In English
Contract(s)/Grant(s): NAG5-6455; No Copyright; Avail: Issuing Activity; Abstract Only

A comparison of monthly biogeochemical measurements made from 1993 to 1995, combined with hydrography and satellite altimetry, was used to observe the impacts of nine eddy events on primary productivity and particle flux in the Sargasso Sea. Measurements of primary production, thorium-234 flux, nitrate+nitrite, and photosynthetic pigments made at the US JGOFS Bermuda Atlantic Time-series Study (BATS) site were used. During the three years of this study, four out of six high thorium-234 flux events over 1000 dpm/sq m/d occurred during the passage of an eddy. Primary production nearly as high as the spring bloom maximum was observed in two modewater eddies (May 1993 and July 1995). The 1994 spring bloom at BATS was suppressed by the passage of an anticyclone. Distinct phytoplankton community shifts were observed in mode-water eddies, which had an increased percentage diatoms and dinoflagelletes, and in cyclones, which had an increased percentage cyanobacteria (excluding Prochlorococcus). The difference in the observations of mode-water eddies and cyclones may result from the age of the eddy, which was very important to the biological response. In general, eddies that were one to two months old elicited a large biological response; eddies that were three months old may show a biological response and were accompanied by high thorium flux measurements, eddies that were four months old or older did not show a biological response or high thorium flux. Our conceptual model depicting the importance of temporal changes during eddy upwelling and decay fit the observations well in all 7 upwelling eddies. Additional information is needed to determine the importance of deeper mixed layers and winter mixing to the magnitude of the eddy impacts. Also, sampling generally captured only the beginning, end, and /or edge of an eddy due to the monthly to semi-monthly frequency of the measurements made at BATS. Lagrangian studies, higher resolution time-series, and/or more spatial coverage is needed to provide additional information for improved C and N budgets in the Sargasso Sea and to complete our understanding of the temporal changes that occur in an eddy.
Author
Annual Variations; Biogeochemistry; Ocean Surface; Sargasso Sea; Biological Effects; Atmospheric Models

20020071032 Woods Hole Oceanographic Inst., Dept. of Applied Ocean Physics and Engineering, MA USA
Dynamical Interpolation of Mesoscale Flows in the TOPEX/ Poseidon Diamond Surrounding the U.S. Joint Global Ocean Flux Study Bermuda Atlantic Time-Series Study Site
McGillicuddy, D. J., Woods Hole Oceanographic Inst., USA; Kosnyrev, V. K., Woods Hole Oceanographic Inst., USA; Journal of Geophysical Research; Aug. 15, 2001; Volume 106, No. C8, pp. 16641-16656; In English
Contract(s)/Grant(s): NAG5-6455; Copyright; Avail: Issuing Activity; Abstract Only

An open boundary ocean model is configured in a domain bounded by the four TOPEX/Poseidon (TIP) ground tracks surrounding the U.S. Joint Global Ocean Flux Study Bermuda Atlantic Time-series Study (BATS) site. This implementation facilitates prescription of model boundary conditions directly from altimetric measurements (both TIP and ERS-2). The expected error characteristics for a domain of this size with periodically updated boundary conditions are established with idealized numerical experiments using simulated data. A hindcast simulation is then constructed using actual altimetric observations during the period October 1992 through September 1998. Quantitative evaluation of the simulation suggests significant skill. The correlation coefficient between predicted sea level anomaly and ERS observations in the model interior is 0.89; that for predicted versus observed dynamic height anomaly based on hydrography at the BATS site is 0.73. Comparison with the idealized experiments suggests that the main source of error in the hindcast is temporal undersampling of the boundary conditions. The hindcast simulation described herein provides a basis for retrospective analysis of BATS observations in the context of the mesoscale eddy field.
Author
Data Simulation; Ocean Models; Ocean Dynamics; Sea Level

20020071033 Woods Hole Oceanographic Inst., Dept. of Applied Ocean Physics and Engineering, MA USA

Covariation of Mesoscale Ocean Color and Sea-Surface Temperature Patterns in the Sargasso Sea

McGillicuddy, D. J., Woods Hole Oceanographic Inst., USA; Kosnyrev, V. K., Woods Hole Oceanographic Inst., USA; Ryan, J. P., Monterey Bay Aquarium Research Inst., USA; Yoder, J. A., Rhode Island Univ., USA; Deep-Sea Research II; [2001]; Volume 48, pp. 1823-1836; In English

Contract(s)/Grant(s): NAG5-6455; Copyright; Avail: Issuing Activity; Abstract Only

During the lifetime of the Coastal Zone Color Scanner, there were 21 instances in which both satellite-derived ocean color and sea-surface temperature are simultaneously available over large areas of the Sargasso Sea. These images reveal close correspondence between mesoscale structures observed in temperature and pigment fields. In general, higher (lower) pigment biomass occurs in mesoscale features consisting of cold (warm) temperature anomalies. This relationship is consistent with the idea that upward displacement of isopycnals at the base of the euphotic zone by mesoscale eddies is an important mechanism of nutrient supply in the region.

Author

Sargasso Sea; Satellite Imagery; Sea Surface Temperature; Water Color; Coastal Zone Color Scanner

20020071034 Woods Hole Oceanographic Inst., Dept. of Applied Ocean Physics and Engineering, MA USA

Influence of Mesoscale Eddies on New Production in the Sargasso Sea

McGillicuddy, D. J., Jr., Woods Hole Oceanographic Inst., USA; Robinson, A. R., Harvard Univ., USA; Siegel, D. A., California Univ., USA; Jannasch, H. W., Monterey Bay Aquarium Research Inst., USA; Johnson, R., Bermuda Biological Station for Research, Inc., Bermuda; Dickey, T. D., Monterey Bay Aquarium Research Inst., USA; McNeil, J., Monterey Bay Aquarium Research Inst., USA; Michaels, A. F., University of Southern California, USA; Knap, A. H., Bermuda Biological Station for Research, Inc., Bermuda; Nature; Jul. 16, 1998; Volume 394, pp. 263; In English

Contract(s)/Grant(s): NAG5-6455; Copyright; Avail: Issuing Activity; Abstract Only

It is problematic that geochemical estimates of new production, that fraction of total primary production in surface waters fueled by externally supplied nutrients, in oligotrophic waters of the open ocean surpass that which can be sustained by the traditionally accepted mechanisms of nutrient supply. In the cam of the Sargasso Sea, for example, these mechanisms account for less than half of the annual nutrient requirement indicated by new production estimates based on three independent transient-tracer techniques. Specifically, approximately one-quarter to one-third of the annual nutrient requirement can be supplied by entrainment into the mixed layer during wintertime convection, with minor contributions from mixing in the thermocline and wind-driven transport (the potentially important role of nitrogen fixation- for which estimates vary by an order of magnitude in this region- is excluded from this budget). Here we present four lines of evidence-eddy-resolving model simulations, high-resolution observations from moored instrumentation, shipboard surveys and satellite data-which suggest that the vertical flux of nutrients induced by the dynamics of mesoscale eddies is sufficient to balance the nutrient budget in the Sargasso Sea.

Author

Mesoscale Phenomena; Sargasso Sea; Nutrients; Production; Ocean Surface

20020071048 California Univ., Institute for Computational Earth System Science, Santa Barbara, CA USA

Mesoscale Eddies, Satellite Altimetry, and New Production in the Sargasso Sea

Siegel, David A., California Univ., USA; McGillicuddy, Dennis J., Jr., Woods Hole Oceanographic Inst., USA; Fields, Erik A., California Univ., USA; Journal of Geophysical Research; Jun. 15, 1999; Volume 104, No. C6, pp. 13359-13379; In English

Contract(s)/Grant(s): NAG5-6455; Copyright; Avail: Issuing Activity; Abstract Only

Satellite altimetry and hydrographic observations are used to characterize the mesoscale eddy field in the Sargasso Sea near Bermuda and to address the role of physical processes on the supply of new nutrients to the euphotic zone. The observed sea level anomaly (SLA) field is dominated by the occurrence of westward propagating features with SLA signatures as large as 25 cm, Eulerian temporal scales of roughly a month, lifetimes of several months, spatial scales of approximately 200 km, and a propagation of approximately 5 cm/s . Hydrographic estimates of dynamic height anomaly (referenced to 4000 dbar) are well correlated with satellite SLA (r(sup 2) = 0.65), and at least 85% of the observed dynamic height variability is associated with the first baroclinic mode of motion. This allows us to apply the satellite observations to remotely estimate isopycnal displacements and the flux of nutrients into the euphotic zone due to eddy pumping. Eddy pumping is the process by which mesoscale eddies induce isopycnal displacements that lift nutrient- replete waters into the euphotic zone, driving new primary production. A kinematic approach to the estimation of the eddy pumping results in a flux of 0.24+/-0.1 mol N/sq m/yr (including a scale estimate for the small contribution due to 18 deg water eddies). This flux is more than an order of magnitude larger than the diapycnal diffusive flux as well as scale estimates for the vertical transport due to isopycnal mixing along sloping isopycnal surfaces. Eddy pumping and wintertime convection are the two dominant mechanisms transporting new nutrients into the euphotic zone, and the

sum of all physical new nutrient supply fluxes effectively balances previous geochemical estimates of annual new production for this site. However, if biological transports (e.g., nitrogen fixation, etc.) are significant, the new nitrogen supply budget will be in excess of geochemical new production estimates. This suggests that the various physical and biological transport fluxes, as well as geochemical inferences of new production, still need to be reconciled and many outstanding questions remain.
Author
Satellite Altimetry; Mesoscale Phenomena; Sargasso Sea; Activity (Biology)

20020073187 National Health and Ecological Effects Research Lab., Western Ecology Div., Newport, OR USA
Seagrass Stress Response Model: The Importance of Light, Temperature, Sedimentaion, and Geochemistry
Eldridge, P. M.; Kaldy, J. E.; Burd, A. B.; 2002; 30p; In English
Report No.(s): PB2002-106745; EPA/600/A-02/066; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The objective of our modeling was to better understand the relationship between seagrass and water-column and sediment stressors (i.e., light, organic and particle sedimentation, sediment nutrients and sulfides). The model was developed and optimized for sediments in Thalassia testudinum seagrass beds of Lower Laguna Madre, Texas, USA and is composed of a plant sub-model and a sediment diagenetic sub-model. Simulations were developed for a natural stressor (harmful algal bloom) and an anthropogenic stressor (dredging event). The harmful algal bloom (HAB) was of limited duration and the simulations showed no effect of the algal bloom on biomass trends but did suggest that sediment sulfides could inhibit growth in the bloom duration and intensity were greater. The dredging event resulted in sedimentation of a layer of organically rich material and reduction of canopy light for a period of months. The simulations suggested that the seagrass could have recovered from the effects of light but residual effects of high sulfides in the sediments would make the region uninhabitable for seagrasses for up to 2.5 years. These modeling exercises point out the importance of using a geochemical model to evaluate the impact of reduced light and enhanced organic loading from both natural and anthropogenic stressors to seagrass.
NTIS
Sea Grasses; Sediments; Biomass; Geochemistry

20020073397 NASA Goddard Space Flight Center, Greenbelt, MD USA
Polar Motion Constraints on Models of the Fortnightly Tide
Ray, Richard D., NASA Goddard Space Flight Center, USA; Egbert, G. D., Oregon State Univ., USA; [2002]; 1p; In English; American Geophysical Union 2001, 10-14 Dec. 2001, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only
Estimates of the near-fortnightly Mf ocean tide from TOPEX/Poseidon satellite altimetry and from numerical solutions to the shallow water equations agree reasonably well, at least in their basin-scale features. For example, both show that the Pacific Ocean tide lags the Atlantic tide by roughly 30 degrees. There are hints of finer scale agreements in the elevation fields, but noise levels are high. In contrast, estimates of Mf currents are only weakly constrained by the TP data, because high-wavenumber Rossby waves (with intense currents) are associated with relatively small perturbations in surface elevation. As a result, a wide range of Mf current fields are consistent with both the TP data and the hydrodynamic equations within a priori plausible misfit bounds. We find that a useful constraint on the Mf currents is provided by independent estimates of the Earth's polar motion. At the Mf period polar motion shows a weak signal (both prograde and retrograde) which must be almost entirely caused by the ocean tide. We have estimated this signal from the SPACE2000 time series, after applying a broad-band correction for atmospheric angular momentum. Although the polar motion estimates have relatively large uncertainties, they are sufficiently precise to fix optimum data weights in a global ocean inverse model of Mf. These weights control the tradeoff between fitting a prior hydrodynamic model of Mf and fitting the relatively noisy T/P measurements of Mf. The predicted polar motion from the final inverse model agrees remarkably well with the Mf polar motion observations. The preferred model is also consistent with noise levels suggested by island gauges, and it is marginally consistent with differences observed by subsetting the altimetry (to the small extent that this is possible). In turn, this new model of the Mf ocean tide allows the ocean component to be removed from Mf estimates of length of day, thus yielding estimates of complex Love numbers less contaminated by oceanic effects than has hitherto been possible.
Author
Estimates; Ocean Models; Planetary Waves; Polar Wandering (Geology); Earth Tides

20020073400 NASA Goddard Space Flight Center, Greenbelt, MD USA
Hawaii Ocean Mixing Experiment: Program Summary
Ray, Richard D., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English, 18-19 Feb. 2002, Honolulu, HI, USA; No Copyright; Avail: Issuing Activity; Abstract Only

It is becoming apparent that insufficient mixing occurs in the pelagic ocean to maintain the large scale thermohaline circulation. Observed mixing rates fall a factor of ten short of classical indices such as Munk's "Abyssal Recipe." The growing suspicion is that most of the mixing in the sea occurs near topography. Exciting recent observations by Polzin et al., among others, fuel this speculation. If topographic mixing is indeed important, it must be acknowledged that its geographic distribution, both laterally and vertically, is presently unknown. The vertical distribution of mixing plays a critical role in the Stommel Arons model of the ocean interior circulation. In recent numerical studies, Samelson demonstrates the extreme sensitivity of flow in the abyssal ocean to the spatial distribution of mixing. We propose to study the topographic mixing problem through an integrated program of modeling and observation. We focus on tidally forced mixing as the global energetics of this process have received (and are receiving) considerable study. Also, the well defined frequency of the forcing and the unique geometry of tidal scattering serve to focus the experiment design. The Hawaiian Ridge is selected as a study site. Strong interaction between the barotropic tide and the Ridge is known to take place. The goals of the Hawaiian Ocean Mixing Experiment (HOME) are to quantify the rate of tidal energy loss to mixing at the Ridge and to identify the mechanisms by which energy is lost and mixing generated. We are challenged to develop a sufficiently comprehensive picture that results can be generalized from Hawaii to the global ocean. to achieve these goals, investigators from five institutions have designed HOME, a program of historic data analysis, modeling and field observation. The Analysis and Modeling efforts support the design of the field experiments. As the program progresses, a global model of the barotropic (depth independent) tide, and two models of the baroclinic (depth varying) tide, all validated with near-Ridge data, will be applied, to reveal the mechanisms of tidal energy conversion along the Ridge, and allow spatial and temporal integration of the rate of conversion. Field experiments include a survey to identify "hot spots" of enhanced mixing and barotropic to baroclinic conversion, a Nearfield study identifying the dominant mechanisms responsible for topographic mixing, and a Farfield program which quantifies the barotropic energy flux convergence at the Ridge and the flux divergence associated with low mode baroclinic waves radiation. The difference is a measure of the tidal power available for mixing at the Ridge. Field work is planned from years 2000 through 2002, with analysis and modeling efforts extending through early 2006. If successful, HOME will yield an understanding of the dominant topographic mixing processes applicable throughout the global ocean. It will advance understanding of two central problems in ocean science, the maintenance of the abyssal stratification, and the dissipation of the tides. HOME data will be used to improve the parameterization of dissipation in models which presently assimilate TOPEX-POSEIDON observations. The improved understanding of the dynamics and spatial distribution of mixing processes will benefit future long-term programs such as CLIVAR.

Author

Baroclinic Waves; Barotropism; Ocean Currents; Ocean Models; Oceans; Tides; Tidal Waves; Mixing

20020073401 NASA Goddard Space Flight Center, Greenbelt, MD USA

Improved Estimates of Temporally Coherent Internal Tides and Energy Fluxes from Satellite Altimetry

Ray, Richard D., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; 2002 Ocean Sciences Meeting of the American Geophysical Union, 11-15 Feb. 2002, Honolulu, HI, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Satellite altimetry has opened a surprising new avenue to observing internal tides in the open ocean. The tidal surface signatures are very small, a few cm at most, but in many areas they are robust, owing to averaging over many years. by employing a simplified two dimensional wave fitting to the surface elevations in combination with climatological hydrography to define the relation between the surface height and the current and pressure at depth, we may obtain rough estimates of internal tide energy fluxes. Initial results near Hawaii with TOPEX/Poseidon (T/P) data show good agreement with detailed 3D (three dimensional) numerical models, but the altimeter picture is somewhat blurred owing to the widely spaced T/P tracks. The resolution may be enhanced somewhat by using data from the ERS-1 (ESA (European Space Agency) Remote Sensing) and ERS-2 satellite altimeters. The ERS satellite tracks are much more closely spaced (0.72 deg longitude vs. 2.83 deg for T/P), but the tidal estimates are less accurate than those for T/P. All altimeter estimates are also severely affected by noise in regions of high mesoscale variability, and we have obtained some success in reducing this contamination by employing a prior correction for mesoscale variability based on ten day detailed sea surface height maps developed by Le Traon and colleagues. These improvements allow us to more clearly define the internal tide surface field and the corresponding energy fluxes. Results from throughout the global ocean will be presented.

Author

Internal Energy; Ocean Surface; Satellite Altimetry; Tides; Satellite Observation; Tidal Waves

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.

20020070821 Yale Univ. School of Medicine, Dept. of Neurology, New Haven, CT USA
Mechanisms of Gravity-Evoked Neuronal Plasticity, ***1 Oct. 2001 - 30 Jun. 2002***
Kalb, Robert; [2002]; 3p; In English
Contract(s)/Grant(s): NAG2-1504; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The grant focuses on a gene we identified called, serum and glucocorticoid- induced kinase (SGK), during a previously funded NASA project. The abundance of SGK messenger RNA (mRNA) and protein is increased in CNS tissues from animals reared in microgravity in comparison with 1G reared animals. In the funded proposal we had three aims: 1) characterize the distribution of SGK mRNA in the developing and adult rat CNS, 2) determine if expression of enzymatically active or inactive forms of SGK in cells influenced cell morphology (neurite growth), and 2) determine if SGK is a CREB kinase - that is, a protein kinase that adds phosphate groups to the transcription factor CREB. Over the past year we have made strong progress in the two most difficult parts of the project, namely specific aims 2 and 3. In specific aim #2 we planned to express a dominant negative or a constitutively active form of SGK in PC12 cells and assay the effects on neurite growth. Several methods are available for examining the effects of a transgene on PC12 neurite growth. Relevant variables include the performance of the assay +/- serum, +/- NGF, substratum for growth, timing between transfection and assay. Over the past 8 months we have customized the assay to enable us to most readily determine the effects of transgene expression on neurite growth. We have also compared the relative utility of transfecting DNA as opposed to protein itself. We are now well positioned to study the effects of SGK on neurite growth. We have also made progress in parallel studies in primary neurons. We have made constructs which will lead to transgene expression in cultures of spinal cord neurons. Co-transfection of a reporter and the SGK constructs can now be performed.
Author
Microgravity; Ribonucleic Acids; Glucocorticoids; Neurons

20020070827 Michigan Univ., Center for Biologic Nanotechnology, Ann Arbor, MI USA
Biosensors for Real-Time Monitoring of Radiation-Induced Biologic Effects in Space ***Monthly Report, 26 Jul. - 25 Aug. 2002***
Baker, James R., Michigan Univ., USA; Balogh, Lajos, Michigan Univ., USA; Majoros, Istvan, Michigan Univ., USA; Keszler, Balazs, Michigan Univ., USA; Myc, Andrzej, Michigan Univ., USA; Kukowska-Latallo, Jolanta, Michigan Univ., USA; Norris, Theodore, Michigan Univ., USA; delaiglesia, Felix, Michigan Univ., USA; Beeson, Nicholas W., Compiler, Michigan Univ., USA; August 2002; 16p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS2-02069
Report No.(s): NAS2-02069-4; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This work seeks to develop cellular biosensors based on dendritic polymers. Nanoscale polymer structures less than 20 nm in diameter will be used as the basis of the biosensors. The structures will be designed to target into specific cells of an astronaut and be able to monitor health issues such as exposure to radiation. Multiple components can be assembled on the polymers including target directors, analytical devices (such as molecular probes), and reporting agents. The reporting will be accomplished through fluorescence signal monitoring, with the use of multispectral analysis for signal interpretation. These nanosensors could facilitate the success and increase the safety of extended space flight. The design and assembly of these devices has been pioneered at the Center for Biologic Nanotechnology in the University of Michigan. This period, synthesis of the test-bed biosensors continued. Studies were performed on the candidate fluorescent dyes to determine which might be suitable for the biosensor under development. Development continued on producing an artificial capillary bed as a tool for the use in the production of the fluorescence signal monitor. Work was also done on the in vitro multispectral analysis system, which uses the robotic microscope.
Author
Bioinstrumentation; Nanostructures (Devices); Radiation Measuring Instruments; Biological Effects; Polymers

20020071121 Children's Hospital, Boston, MA USA
Mechanotransduction through Cytoskeleton ***Final Report, 1 Jun. 1997 - 31 May 2002***
Ingber, Donald, Children's Hospital, USA; [2002]; 6p; In English
Contract(s)/Grant(s): NAG5-4839; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The goal of this project was to characterize the molecular mechanism by which cells recognize and respond to physical forces in their local environment. The project was based on the working hypothesis that cells sense mechanical stresses, such as those due to gravity, through their cell surface adhesion receptors (e.g., integrins) and that they respond as a result of structural arrangements with their internal cytoskeleton (CSK) which are orchestrated through use of tensegrity architecture. In this project, we carried out studies to define the architectural and molecular basis of cellular mechanotransduction. Our major goal was to define the molecular pathway that mediates mechanical force transfer between integrins and the CSK and to determine how mechanical deformation of integrin-CSK linkages is transduced into a biochemical response. Elucidation of the mechanism by which cells sense mechanical stresses through integrins and translate them into a biochemical response should help us to understand the molecular basis of the cellular response to gravity as well as many other forms of mechanosensation and tissue regulation. The specific aims of this proposal were: 1. to define the molecular basis of mechanical coupling between integrins, vinculin, and the actin CSK; 2. to develop a computer simulation of how mechanical stresses alter CSK structure and test this model in living cells; 3. to determine how mechanical deformation of integrin-CSK linkages is transduced into a biochemical response.
Derived from text
Cells (Biology); Gravitation; Molecular Biology; Stress Analysis

20020072945 Environmental Protection Agency, National Exposure Research Lab., Las Vegas, NV USA
Integrated Probabilistic and Deterministic Modeling Techniques in Estimating Exposure to Water-Borne Contaminants: Part 2:, Part 2, Pharmacokinetic Modeling
Blancato, J. N.; Power, F. W.; Wilkes, C. R.; Tsang, A. M.; Hern, S. C.; 2001; 10p; In English
Report No.(s): PB2002-107513; EPA/600/A/02/076-Pt-2; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The Total Exposure Model (TEM) uses deterministic and stochastic methods to estimate the exposure of a person performing daily activities of eating, drinking, showering, and bathing. There were 250 time histories generated, by subject with activities, for the three exposure routes, oral, dermal, and inhalation, and these were input to the physiologically based pharmacokinetic (PBPK) model, via ERDEM (Exposure Related Dose Estimating Model). The chemicals modeled were trichloroethylene (TCE), trichloroacetic acid (TCA), and dichloroacetic acid (DCA). Time histories of concentrations and Areas Under the Curve (AUC) were determined for the liver, kidney, and venous blood. They were combined to determine the distribution at each time step and hence define the 5th, 50th, and the 95th percentiles. The important pathways and the basis for their predominance are shown. Thus highly variable exposures can be related to actual dose to various organs of the human body.
NTIS
Toxicity; Models; Estimates; Water; Contaminants; Exposure; Risk

20020072951 National Defence Research Establishment, Div. of Sensor Technology, Linkoeping, Sweden
Attempt to Generate Accommodation Depth-of Field Effects in a Virtual Retinal Display
Gustafsson, T.; Mar. 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-105055; FOI-R-0060-SE; No Copyright; Avail: National Technical Information Service (NTIS)
To experience depth and distance the eye and brain use a lot of depth 'cues.' Highly sophisticated VR systems, including graphics computers and display-systems, may render most of these 'cues,' but not the accommodation depth-of-field effect. In this report a solution is indicated how to create this accommodation effect, using an electro-optical adaptive lens in a Virtual Retinal Display, VRD.
NTIS
Visual Perception; Distance; Eye (Anatomy); Brain; Space Perception

20020072956 NASA Ames Research Center, Moffett Field, CA USA
Effects of Hypergravity Exposure on Plasma Oxytocin (OT) Concentrations in Pregnant and Lactating Rat Dams
Baer, Lisa A., Lockheed Martin Corp., USA; Wade, Charles E., NASA Ames Research Center, USA; Plaut, Karen, Vermont Univ., USA; Ronca, April E., NASA Ames Research Center, USA; [2002]; 1p; In English; International Society for Gravitational Physiology Meeting, 2-9 Jun. 2002, Stockholm, Sweden
Contract(s)/Grant(s): MH-46485; RTOP 121-10-50; RTOP 121-40-10; RTOP 121-10-40; No Copyright; Avail: Issuing Activity; Abstract Only
From pregnancy to weaning there is a progressive elevation of plasma oxytocin (OT) levels associated with nursing activity, irrespective of litter size. In the present study, we analyzed the effects of continuous 1.5G, 1.75G and 2.0G hypergravity exposure on OT plasma concentration in prepartum (Gestation Day 20) (G20) and lactating (Postnatal day) (P10) rat dams. For this study,

litter size was controlled with a yoking procedure established in our lab where individual control litters were yoked-matched to individual hypergravity litters. We reviewed all data at hypergravity irrespective of gravitational level and compared the values with the controls in both G20 (HG, n=15;SC, n=9) and P10 (HG, n=21;SC, n=16). Results showed that over time, we did observe the expected OT increase in both groups. In G20 dams, measurement of OT concentrations showed no significance. However, at P10, measurements of OT concentrations suggest a reduction of about 20% compared to established controls in our laboratory, 0.9+/-0.09 ng/ml for the controls and 0.7+/-0.06 ng/ml for centrifuged animals (pis less than 0.02). These data suggest that exposure to centrifugation may reduce OT levels during lactation. When these plasma samples were obtained, the dams were removed from the litters, and values were not adjusted for the size of the litters. The reduction in OT with centrifugation may reflect a decrease in nursing activity or a decreased responsiveness of the mammary hypothalamic axis. In addition, we have analyzed data on plasma prolactin concentrations and mammary gland development, which may give additional insight to the results of our OT measurements.
Author
High Gravity Environments; Hormones; Rats; Biological Effects

20020073064 NASA Ames Research Center, Moffett Field, CA USA
The Indirect Effect of UV: Some Good News for Microbes?
Rothschild, Lynn J., NASA Ames Research Center, USA; Purcell, Diane, Search for Extraterrestrial Intelligence Inst., USA; Rogoff, Dana, Search for Extraterrestrial Intelligence Inst., USA; Wilson, Cindy, Montana Univ., USA; [2002]; 1p; In English; Annual Meeting for the International Society for Evolutionary Protistology, 19-24 Jun. 2002, Vancouver, British Columbia, Canada; No Copyright; Avail: Issuing Activity; Abstract Only

Ultraviolet (UV) radiation is of great concern because its biological effects are predominantly harmful. UV damage may be direct or indirect, the latter mediated through the photochemical production of reactive oxygen species such as hydrogen peroxide. We measured the effect of H2O2 on various microbes both in the lab and in nature. At our study site in Yellowstone National Park, there is a UV-induced diurnal fluctuation of H2O2 extending up to one micron. Levels of DNA synthesis resulting from exposure to H2O2 were measured in several algal mats. Within naturally-occurring concentrations of H2O2, DNA synthesis increased. Laboratory studies showed that similar concentrations of H2O2 induce mitosis. We hypothesize that the low levels of H2O2 encountered in nature are inducing mitotic division. At higher levels of H2O2 a second peak in DNA synthesis was found which we interpret to represent DNA damage repair. These experiments suggest that in nature, the low levels of H2O2 produced may have a mitogenic rather than damaging effect. Assuming early levels of UV radiation were substantially higher at the time protists evolved, differential mitogenic effects could have influenced protistan evolution. With H2O2 likely to be present on such bodies as Mars and Europa, the response of organisms will be concentration-dependent and not linear.
Author (revised)
Ultraviolet Radiation; Biological Effects; Radiation Effects; Hydrogen Peroxide; Microorganisms; Mitosis; Biological Evolution

20020073065 NASA Ames Research Center, Moffett Field, CA USA
Correlative Analysis of Behavioral and Physiological Concomitants of Labor in Pregnant Rats
Baer, L. A., NASA Ames Research Center, USA; Wade, C. E., NASA Ames Research Center, USA; Ronca, A. E., NASA Ames Research Center, USA; [2002]; 1p; In English; Experimental Biology, 19-22 Apr. 2002, New Orleans, LA, USA
Contract(s)/Grant(s): MH-46485; RTOP 121-10-40; RTOP 121-10-50; No Copyright; Avail: Issuing Activity; Abstract Only

During parturition, rats exhibit characteristic behavioral expressions of labor. Lordosis contractions, consisting of an elongation of the dams body, are observed beginning several hours prior to neonate births, whereas vertical contractions, repeated rapid lifts of the abdomen, occur immediately preceding the birth of each neonate. We analyzed underlying changes in intrauterine pressure (IUP) using a telemetric sensor that we modified for use in freely-moving rats. This technique enabled us to correlate behavioral expressions of labor contractions with IUP. A small telemetric blood pressure sensor was fitted within a fluid-filled balloon, similar in size to a full term rat fetus. On Gestational day 19 of the rats' 22-day pregnancy, a unit was surgically implanted within the uterus. The dams were simultaneously videotaped, enabling us to directly correlate IUP signals with behavioral expressions of labor contractions. Earlier phases of labor, consisting predominantly of lordosis contractions were characterized by lower pressures relative to later phases during which higher pressures and vertical contractions were frequently observed.
Author
Abdomen; Birth; Labor; Rats; Blood Pressure

20020073388 NASA Ames Research Center, Moffett Field, CA USA
Biomolecular Effects of Cold Plasma Exposure
Mogul, Rakesh, NASA Ames Research Center, USA; Bolshakov, Alexander A., NASA Ames Research Center, USA; Chan,

Suzanne L., NASA Ames Research Center, USA; Stevens, Ramsey D., Eloret Corp., USA; Khare, Bishun N., Search for Extraterrestrial Intelligence Inst., USA; Meyyappan, M., NASA Ames Research Center, USA; Trent, Jonathan D., NASA Ames Research Center, USA; [2002]; 29p; In English
Contract(s)/Grant(s): RTOP 896-20-04; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The effects of cold plasma exposure on Deinococcus radiodurans, plasmid DNA and model proteins were assessed using microbiological, spectrometric and biochemical techniques. Exposure of D. radiodurans, an extremely radiation resistant microbe, to O2 plasma (less than or equal to 25 W, approx. 45 mTorr, 90 min) yielded a approx. 99.999 % sterilization and the sterilization rate was increased approx. 10-fold at 100 W and 500 mTorr. AFM images shows that the exposed cells are significantly deformed and possess 50-70 nm concavities. IR analysis indicates the chemical degradation of lipids, proteins and carotenoids of the cell wall and membrane. Intracellular damage was indicated by major absorbance loss at 1245, 1651 and 1538/cm corresponding to degradation of DNA and proteins, respectively. Biochemical experiments demonstrate that plasmas induce strand scissions and crosslinking of plasmid DNA, and reduction of enzyme activity; the degradation is power dependent with total sample loss occurring in 60 s at 200 W and 500 mTorr. Emission spectroscopy shows that D. radiodurans is volatilized into CO2, CO, N2 and H2O confirming the removal of biological matter from contaminated surfaces. The O2 plasma impacts several cellular components predominantly through chemical degradation by atomic oxygen. A CO2, plasma, however, was not effective at degrading D. radiodurans, revealing the importance of plasma composition, which has implications for planetary protection and the contamination of Mars.
Author
Biological Effects; Cold Plasmas; Enzyme Activity; Exposure; Biochemistry; Chemical Properties

20020073432 NASA Ames Research Center, Moffett Field, CA USA
Effects of Hypergravity Exposure On Plasma Oxytocin Concentrations In Pregnant and Lactating Rat Dams
Baer, Lisa A., NASA Ames Research Center, USA; Wade, Charles E., NASA Ames Research Center, USA; Ronca, April E., NASA Ames Research Center, USA; [2002]; 1p; In English
Contract(s)/Grant(s): RTOP 121-10-30; RTOP 121-10-40; RTOP 121-10-50; NIMH-46485; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Rat dams and offspring were exposed to 1.5-g, 1.75-g or 2.0-g hypergravity (hg) from Gestational day (G) 11 until Postnatal day (P) 10. To ascertain the role of maternal factors in reduced postnatal body weights of offspring developed in hg, the dams' lactational hormones were measured. Oxytocin (OT), the major hormone responsible for milk ejection, was reduced in hg dams whereas prolactin (Prl), involved in milk production, was unchanged. Video analyses of nursing behavior revealed that hg dams spent more time nursing relative to 1-g controls. We hypothesized impaired milk transfer from dam to pup, however pup body weight gains following a discrete suckling episode were comparable across conditions. Changes in lactational hormones and nursing behavior by dams exposed to hg do not account for reduced body masses of their offspring.
Author
High Gravity Environments; Rats; Gravitational Effects; Physiological Effects

20020073543 NASA Ames Research Center, Moffett Field, CA USA
Neurolab *Final Report*
Maese, A. Christopher, Editor, NASA Ames Research Center, USA; Ostrach, Louis H., Editor, NASA Ames Research Center, USA; February 2002; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Neurolab, the final Spacelab mission, launched on STS-90 on April 17, 1998, was dedicated to studying the nervous system. NASA cooperated with domestic and international partners to conduct the mission. ARC's (Ames Research Center's) Payload included 15 experiments designed to study the adaptation and development of the nervous system in microgravity. The payload had the largest number of Principal and Co-Investigators, largest complement of habitats and experiment unique equipment flown to date, and most diverse distribution of live specimens ever undertaken by ARC, including rodents, toadfish, swordtail fish, water snails, hornweed and crickets to facilitate tissue sharing and optimization of science objectives, investigators were grouped into four science discipline teams: Neuronal Plasticity, Mammalian Development, Aquatic, and Neurobiology. Several payload development challenges were experienced and required an extraordinary effort, by all involved, to meet the launch schedule. With respect to hardware and the total amount of recovered science, Neurolab was regarded as an overall success. However, a high mortality rate in one rodent group and several hardware anomalies occurred inflight that warranted postflight investigations. Hardware, science, and operations lessons were learned that should be taken into consideration by payload teams developing payloads for future Shuttle missions and the International Space Station.
Author
Spacelab Payloads; Microgravity; Neurophysiology

20020073862 NASA Ames Research Center, Moffett Field, CA USA

Absence of Change in Total Daily Energy Expenditure (EE(sub TD)) in Young and Mature Rats During 14 Days of Hypergravity

Wade, C. E., NASA Ames Research Center, USA; Moran, M. M., NASA Ames Research Center, USA; Stein, T. P., NASA Ames Research Center, USA; Hoban-Higgins, T. M., NASA Ames Research Center, USA; Fuller, P., NASA Ames Research Center, USA; Fuller, C. A., NASA Ames Research Center, USA; [1999]; 1p; In English; Experimental Biology 99, 17-21 Apr. 1999, Washington, DC, USA

Contract(s)/Grant(s): RTOP 121-10-10; No Copyright; Avail: Issuing Activity; Abstract Only

Effect of age on the response of EE(sub TD) to an increase in gravity was assessed in young (Y; 1.5 month old) and mature (M; 8 month old) Sprague-Dawley rats. Rats were implanted with transmitters to monitor activity, and metabolism was determined by the double labeled water technique. Daily food intake was measured. For each age, rats (n=8 per treatment) were exposed to centrifugation at 2G, or remained at 1G. There was a difference in EE(sub TD) between age groups, 182 plus or minus 11 and 143 plus or minus 5 kcal/kg/day in Y and M, respectively. This difference was attributed in part to a lower activity level in M animals, 48% of Y rats. After day 6 there was no effect on EE(sub TD) of exposure to 2G, or on food intake per 100g BW. Prior studies show a 20% increase in resting EE with hypergravity. In our study the level of activity was reduced to 41% of 1G in both age groups during 2G. For Y at 1G resting EE accounted for 78% of the EE(sub TD) and activity 22%, while at 2G resting EE was 96% of EE(sub TD) and activity 4%. M rats had similar changes. Independent of age, with exposure to hypergravity EE(sub TD) is maintained by behavioral changes.

Author

Food Intake; High Gravity Environments; Metabolism; Age Factor; Animals

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.

20020070794 Civil Aerospace Medical Inst., Oklahoma City, OK USA

Characteristics and Toxicological Processing of Postmortem Pilot Specimens from Fatal Civil Aviation Accidents *Final Report*

Chaturvedi, Arvind K., Civil Aerospace Medical Inst., USA; Smith, Dudley R., Civil Aerospace Medical Inst., USA; Soper, John W., Civil Aerospace Medical Inst., USA; Canfield, Dennis V., Civil Aerospace Medical Inst., USA; Whinnery, James E., Civil Aerospace Medical Inst., USA; August 2002; 14p; In English

Contract(s)/Grant(s): FAA-AM-B-01-TOX-202; FAA-AM-B-02-TOX-202

Report No.(s): DOT/FAA/AM-02/14; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Autopsied biological samples from civil aviation accident pilot fatalities are submitted to the Civil Aerospace Medical Institute (CAMI) for toxicological evaluation. However, such evaluation is dependent upon types and amounts of submitted samples, and obtaining suitable samples is governed by the nature of an accident. Characteristics of those samples and associated toxicological processing have not been well documented in the literature. Therefore, the CIAMI Toxicology Database was searched for these aspects. CAMI received samples from the pilot fatalities (CAMI cases) of approximately 80% of the 1990-2000 aviation accidents reported by the National Transportation Safety Board. Accidents and cases during June-September were higher than the other months, and more than half of the received cases had multiple samples in sufficient amounts. For example, out of 1,891 cases processed for the 1996-2000 accidents, 1,211 had at least adequate amounts of blood, urine, and/or vitreous humor; 324 had inadequate amounts of blood and urine; and 356 had no blood or urine. Muscle, liver, lung, and/or kidney samples were submitted in 90% of the cases, while cerebrospinal fluids were submitted in only 8% of the cases. The toxicologically preferred samples, blood and urine, were available in 78% and 56% of the 1,891 cases, respectively. Out of 51 cases containing only one sample type, 46 had muscle and the remaining 5 had other sample types. Samples were primarily analyzed for combustion gases, alcohol/volatiles, and drugs. Generally, the presence of analytes is demonstrated in at least 2 different sample types by using 2 different analytical techniques for reporting a particular case as ”positive.” An effective quality-assurance/quality-control is maintained throughout the process. In the majority of the aviation accidents, sufficient amounts and types of biological samples were submitted for toxicological evaluation.

Author

Aircraft Accidents; Law (Jurisprudence); Toxicology

20020070814 Central Inst. for the Deaf, Saint Louis, MO USA

Otolith-Canal Convergence In Vestibular Nuclei Neurons ***Final Report, 1 Jun. 1999 - 31 May 2002***

Dickman, J. David, Central Inst. for the Deaf, USA; Si, Xiao-Hong, Central Inst. for the Deaf, USA; [2002]; 7p; In English

Contract(s)/Grant(s): NAG2-1326; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The current final report covers the period from June 1, 1999 to May 31, 2002. The primary objective of the investigation was to determine how information regarding head movements and head position relative to gravity is received and processed by central vestibular nuclei neurons in the brainstem. Specialized receptors in the vestibular labyrinths of the inner ear function to detect angular and linear accelerations of the head, with receptors located in the semicircular canals transducing rotational head movements and receptors located in the otolith organs transducing changes in head position relative to gravity or linear accelerations of the head. The information from these different receptors is then transmitted to central vestibular nuclei neurons which process the input signals, then project the appropriate output information to the eye, head, and body musculature motor neurons to control compensatory reflexes. Although a number of studies have reported on the responsiveness of vestibular nuclei neurons, it has not yet been possible to determine precisely how these cells combine the information from the different angular and linear acceleration receptors into a correct neural output signal. In the present project, rotational and linear motion stimuli were separately delivered while recording responses from vestibular nuclei neurons that were characterized according to direct input from the labyrinth and eye movement sensitivity. Responses from neurons receiving convergent input from the semicircular canals and otolith organs were quantified and compared to non-convergent neurons.

Author

Otolith Organs; Head Movement; Stimuli; Eye Movements; Neurons

20020073167 NASA Johnson Space Center, Houston, TX USA

Space Radiation Cancer Risk Projections for Exploration Missions: Uncertainty Reduction and Mitigation

Cucinotta, Francis, NASA Johnson Space Center, USA; Badhwar, Gautam, NASA Johnson Space Center, USA; Saganti, Premkumar, NASA Johnson Space Center, USA; Schimmerling, Walter, NASA, USA; Wilson, John, NASA Langley Research Center, USA; Peterson, Leif, Baylor Coll. of Medicine, USA; Dicello, John, Johns Hopkins Univ., USA; Aug. 01, 2002; 64p; In English; Original contains color illustrations

Report No.(s): NASA/TP-2002-210777; NAS 1.60:210777; S-887; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In this paper we discuss expected lifetime excess cancer risks for astronauts returning from exploration class missions. For the first time we make a quantitative assessment of uncertainties in cancer risk projections for space radiation exposures. Late effects from the high charge and energy (HZE) ions present in the galactic cosmic rays including cancer and the poorly understood risks to the central nervous system constitute the major risks. Methods used to project risk in low Earth orbit are seen as highly uncertain for projecting risks on exploration missions because of the limited radiobiology data available for estimating HZE ion risks. Cancer risk projections are described as a product of many biological and physical factors, each of which has a differential range of uncertainty due to lack of data and knowledge. Monte-Carlo sampling from subjective error distributions represents the lack of knowledge in each factor to quantify risk projection overall uncertainty. Cancer risk analysis is applied to several exploration mission scenarios. At solar minimum, the number of days in space where career risk of less than the limiting 3% excess cancer mortality can be assured at a 95% confidence level is found to be only of the order of 100 days.

Author

Astronauts; Cancer; Galactic Cosmic Rays; Risk; Space Exploration; Planetary Environments; Radiation Hazards

20020073385 NASA Ames Research Center, Moffett Field, CA USA

Effectiveness of an Expert System for Astronaut Assistance on a Sleep Experiment

Heher, Dennis, Caelum Research Corp., USA; Callini, Gianluca, Massachusetts Inst. of Tech., USA; Essig, Susanne M., Massachusetts Inst. of Tech., USA; Young, Laurence R., Massachusetts Inst. of Tech., USA; [1998]; 33p; In English

Contract(s)/Grant(s): NAS2-14217; NCC2-570; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Principal Investigator-in-a-Box ([PI]) is an expert system designed to train and assist astronauts with the performance of an experiment outside their field of expertise, particularly when contact with the Principal Investigators on the ground is limited or impossible. In the current case, [PI] was designed to assist with the calibration and troubleshooting procedures of the Neurolab Sleep and Respiration Experiment during the pre-sleep period of no ground contact. It displays physiological signals in real time during the pre-sleep instrumentation period, and alerts the astronauts when a poor signal quality is detected. Results of the first study indicated a beneficial effect of [PI] and training in reducing anomaly detection time and the number of undetected anomalies.

For the in-flight performance, excluding the saturated signals, the expert system had an 84.2% detection accuracy, and the questionnaires filled out by the astronauts showed positive crew reactions to the expert system.
Derived from text
Astronauts; Sleep; Respiration; Physiology; Expert Systems; Education; Display Devices

20020073451 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Fishermans Bend, Australia
Salivary Immunoglobulin A (slgA) as a Biomarker of Immune Suppression Following the Combat Fitness Assessment
Pacque, Paul, Defence Science and Technology Organisation, Australia; Booth, Christine, Defence Science and Technology Organisation, Australia; Dwyer, Dan, Defence Science and Technology Organisation, Australia; May 2002; 60p; In English; Sponsored in part by S01 Health Doctrine
Report No.(s): DSTO-RR-0236; DODA-AR-012-336; Copyright; Avail: Issuing Activity

SlgA is a potential biomarker for stress. The usual day-to-day and within day variation in slgA amongst a group of healthy Army reservists was estimated and the acute response of slgA to moderate intensity exercise (Combat Fitness Assessment) undertaken in both cool-dry and hot-humid conditions was determined. The results indicate that thermal and cardiovascular strain resulting from moderate intensity exercise in hot-humid conditions suppresses slgA for at least 24 hours post-exercise. Salivary slgA exhibits a wide biological variation which casts some doubt on its usefulness as a biomarker, however because slgA has been shown to be sensitive to dietary restriction, alcohol consumption, loss of body mass, fatigue and negative emotions in previous studies and now heat-induced cardiovascular strain, further work is warranted to develop this biomarker.
Author
Biomarkers; Diets; High Temperature Environments; Physical Exercise; Sensitivity; Stress (Biology); Drugs

20020073511 NASA Ames Research Center, Moffett Field, CA USA
Is Animal Age a Factor In the Response of Bone to Spaceflight?
Morey-Holton, E. R., NASA Ames Research Center, USA; Garetto, L. P., Indiana Univ., USA; Doty, S. B., Hospital for Special Surgery, USA; Halloran, B. P., Veterans Administration Hospital, USA; Turner, R. T., Mayo Clinic, USA; Jul. 08, 2002; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The rodent bone response to spaceflight may be influenced by a multitude of actors including flight duration, strain, and housing. Review of bone formation rates during spaceflight suggests that age may also play a role in the response. Weanling rats show fewer bone changes than older rats. to determine if the long bones of weanling rats were insensitive to weight-bearing, a hindlimb unloading experiment was conducted simultaneously with a 9d shuttle flight in 34d old group-housed male rats. All animals were injected with bone markers 7d and 1d before flight and euthanized at landing, 24hr, and 72hr following recovery. If no differences in body weight, bone length, or bone formation at the tibiofibular junction were noted at the different time points, data were combined for each group. No significant differences in body weight were found at any time period among the groups. The humerus, tibia, and femur elongated significantly during the flight period with no difference in lengths between groups at the end of the flight period. The group-housed flight rats showed no change in cortical bone formation rate compared to preflight values, flight controls, or vivarium controls. However, the hindlimb unloading group showed a significant 30% decrease in bone formation rate compared to all other groups. Individually-housed 38d old animals flown for 14d showed approx. 10% suppression of cortical growth. We speculate that the mechanical threshold required for cross-sectional bone growth is reached in group-house weanling rats during spaceflight, perhaps, through physical interactions, and that the weanling animals are sensitive to loading. However, the threshold is not fully reached in either singly-housed flight or hindlimb unloaded weanling rats. Older singly-housed flight animals appear to show equal or greater bone changes compared to hindlimb unloaded rats. We conclude that age, flight duration, strain, and housing have important roles in rodent skeletal responses to spaceflight.
Author
Rats; Age Factor; Space Flight; Bones

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..

20020073420 Brookhaven National Lab., Riken BNL Research Center, Upton, NY USA
Updating the NRC's Guidance for Human Factors Engineering Reviews
O'Hara, J. M.; Brown, W. S.; Higgins, J. C.; Perensky, J. J.; Lewis, P. M.; May 15, 2002; 12p; In English
Report No.(s): DE2002-24104; BNL-NUREG-69206; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The U.S. Nuclear Regulatory Commission (NRC) reviews the human factors engineering (HFE) aspects of nuclear plants. NUREG-0800 (Standard Review Plan), Chapter 18, Human Factors Engineering, is the principal NRC staff guidance document. Two main documents provide the review criteria to support the evaluations. The HFE Program Review Model (NUREG-0711) addresses the design process from planning to verification and validation to design implementation. The Human-System Interface Design Review Guidelines (NUREG-0700) provides the guidelines for the review of the HFE aspects of human-system interface technology, such as alarms, information systems, controls, and control room design. Since these documents were published in 1994 and 1996 respectively, they have been used by NRC staff, contractors, nuclear industry organizations, as well as by numerous organizations outside the nuclear industry. Using feedback from users and NRC research conducted in recent years, both documents have been revised and updated. This was done to ensure that they remain state-of-the-art evaluation tools for changing nuclear industry issues and emerging technologies. This paper describes the methodology used to revise and update the documents and summarizes the changes made to each and their current contents.
NTIS
Nuclear Power Plants; Human Factors Engineering; Design Analysis; Ground Based Control; Systems Engineering

20020073809 NASA Ames Research Center, Moffett Field, CA USA
Toward A Crew-System Concept for Real-Time Fault Management in Next-Generation Aerospace Vehicles
McCann, Robert S., NASA Ames Research Center, USA; McCandless, Jeffrey, San Jose State Univ., USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 215-224; In English; Also announced as 20020073794; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Real-time health management on today's shuttle missions is both difficult and labor-intensive, posing a significant risk to crew safety and mission success. Next-generation space transportation vehicles are expected to incorporate several advanced information processing and information display technologies, transforming fault management into a cooperative venture between crews and intelligent systems. Optimizing the potential of this crew-system partnership poses a considerable design challenge. The new technologies vastly increase the space of design options for knowledge engineering architectures, human-machine function allocation, and human-computer interfaces. We propose an integrated program of systems-level simulation, real-time human-in-the-loop scenario simulation, and human performance modeling to 'prune' the design space and optimize the crew-systems concept.
Author
Man Machine Systems; Expert Systems; Aerospace Vehicles; Real Time Operation; Performance Prediction; Fault Detection

20020073857 NASA Ames Research Center, Moffett Field, CA USA
Advanced Life Support System Value Metric
Jones, Harry W., NASA Ames Research Center, USA; [1999]; 1p; In English; International Conference on Environmental Systems, 12-15 Jul. 1999, Denver, CO, USA
Contract(s)/Grant(s): RTOP 199-61-01; No Copyright; Avail: Issuing Activity; Abstract Only

The NASA Advanced Life Support (ALS) Program is required to provide a performance metric to measure its progress in system development. Extensive discussions within the ALS program have led to the following approach. The Equivalent System Mass (ESM) metric has been traditionally used and provides a good summary of the weight, size, and power cost factors of space life support equipment. But ESM assumes that all the systems being traded off exactly meet a fixed performance requirement, so that the value and benefit (readiness, performance, safety, etc.) of all the different systems designs are considered to be exactly equal. This is too simplistic. Actual system design concepts are selected using many cost and benefit factors and the system specification is defined after many trade-offs. The ALS program needs a multi-parameter metric including both the ESM and a System Value Metric (SVM). The SVM would include safety, maintainability, reliability, performance, use of cross cutting technology, and commercialization potential. Another major factor in system selection is technology readiness level (TRL), a

familiar metric in ALS. The overall ALS system metric that is suggested is a benefit/cost ratio, SVM/[ESM + function (TRL)], with appropriate weighting and scaling. The total value is given by SVM. Cost is represented by higher ESM and lower TRL. The paper provides a detailed description and example application of a suggested System Value Metric and an overall ALS system metric.
Author
Life Support Systems; NASA Programs; Systems Engineering; Structural Weight; Technology Assessment

55
EXOBIOLOGY

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

20020070984 Search for Extraterrestrial Intelligence Inst., Mountain View, CA USA
The Molecular Basis of Hyperthermophily: The Role of HSP60/Chaperonins In Vivo ***Final Report, 1 Apr. 1999 - 30 Jun. 2002***
Kagawa, Hiromi, Search for Extraterrestrial Intelligence Inst., USA; Aug. 27, 2002; 24p; In English
Contract(s)/Grant(s): NCC2-1111; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
In this study, we aim to understand how S. shibatae copes with high temperatures. In particular, we investigated the role of the 60 kDa heat shock protein (HSP60 or chaperonin) with the hypothesis that chaperonin stabilizes the cell membrane under stressful conditions. to prove the hypothesis, this year two questions were addressed: (1) Is the chaperonin localized in the cytoplasm or on the cell membrane? (2) Does the chaperonin show affinity to lipid in vivo? In addition to those, we intensively studied newly discovered chaperonin-related protein, gamma, to understand how it influenced the function of the other components of chaperonin and how their combined activities contributed to hyperthermophily.
Derived from text
High Temperature; Thermophiles; In Vivo Methods and Tests; Proteins; Thermal Shock; Cells (Biology)

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.

20020070789 Space Environment Corp., Providence, UT USA
Investigation and Development of Data-Driven D-Region Model for HF Systems Impacts ***Quarterly Report, 1 Jun. - 31 Aug. 2002***
Eccles, J. V., Space Environment Corp., USA; Rice, D., Space Environment Corp., USA; Sojka, J. J., Space Environment Corp., USA; Hunsucker, R. D., RP Consultants, Inc., USA; [2002]; 44p; In English
Contract(s)/Grant(s): NASW-02108; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Space Environment Corporation (SEC) and RP Consultants (RPC) are to develop and validate a weather-capable D region model for making High Frequency (HF) absorption predictions in support of the HF communications and radar communities. The weather-capable model will assimilate solar and earth space observations from NASA satellites. The model will account for solar-induced impacts on HF absorption, including X-rays, Solar Proton Events (SPE's), and auroral precipitation. The work plan includes: I . Optimize D-region model to quickly obtain ion and electron densities for proper HF absorption calculations. 2. Develop indices-driven modules for D-region ionization sources for low, mid, & high latitudes including X-rays, cosmic rays, auroral precipitation, & solar protons. (Note: solar spectrum & auroral modules already exist). 3. Setup low-cost monitors of existing HF beacons and add one single-frequency beacon. 4. Use PENEX HF-link database with HF monitor data to validate D-region/HF absorption model using climatological ionization drivers. 5. Develop algorithms to assimilate NASA satellite data of solar, interplanetary, and auroral observations into ionization source modules. 6. Use PENEX HF-link & HF-beacon data for skill score comparison of assimilation versus climatological D-region/HF absorption model. Only some satellites are available

for the PENEX time period, thus, HF-beacon data is necessary. 7. Use HF beacon monitors to develop HF-link data assimilation algorithms for regional improvement to the D-region/HF absorption model.
Author
Algorithms; Atmospheric Models; D Region; Data Bases; High Frequencies

20020073041 Fermi National Accelerator Lab., Batavia, IL USA
Distribution of Minimum Distance Among N Random Points in d Dimensions
Fischler, M.; May 2002; 16p; In English
Report No.(s): DE2002-794005; FERMILAB-TM-2170; No Copyright; Avail: Department of Energy Information Bridge
The Minimum Distance test in the DIEHARD suite for validating random number generators often indicates 'false positives,' rejecting the quality of what is actually a good generator. A reason for this is presented. The test has enough sensitivity to detect the discrepancy between the approximate theoretical distribution of minimum distance used, and the actual distribution. We present next-order corrections to the theoretical expected distribution, for the 2-dimensional case used in DIEHARD and for higher dimensions. The corrected expectation will eliminate false positives arising from theoretical distribution discrepancies, at any practical test sensitivity level.
NTIS
Dimensions; Random Numbers; Correction

60
COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware and data processing. For components see 33 Electronics and Electrical Engineering. For computer vision see 63 Cybernetics, Artificial Intelligence and Robotics.

20020073380 MRJ Technology Solutions, Inc., Moffett Field, CA USA
Integrating Cache Performance Modeling and Tuning Support in Parallelization Tools
Waheed, Abdul, MRJ Technology Solutions, Inc., USA; Yan, Jerry, MRJ Technology Solutions, Inc., USA; [1998]; 15p; In English; PPoPP 1999, May 1999, Atlanta, GA, USA
Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
With the resurgence of distributed shared memory (DSM) systems based on cache-coherent Non Uniform Memory Access (ccNUMA) architectures and increasing disparity between memory and processors speeds, data locality overheads are becoming the greatest bottlenecks in the way of realizing potential high performance of these systems. While parallelization tools and compilers facilitate the users in porting their sequential applications to a DSM system, a lot of time and effort is needed to tune the memory performance of these applications to achieve reasonable speedup. In this paper, we show that integrating cache performance modeling and tuning support within a parallelization environment can alleviate this problem. The Cache Performance Modeling and Prediction Tool (CPMP), employs trace-driven simulation techniques without the overhead of generating and managing detailed address traces. CPMP predicts the cache performance impact of source code level "what-if" modifications in a program to assist a user in the tuning process. CPMP is built on top of a customized version of the Computer Aided Parallelization Tools (CAPTools) environment. Finally, we demonstrate how CPMP can be applied to tune a real Computational Fluid Dynamics (CFD) application.
Author
Distributed Memory; Performance Prediction; Architecture (Computers); Compilers

20020073866 NASA Ames Research Center, Moffett Field, CA USA
Memory-Intensive Benchmarks: IRAM vs. Cache-Based Machines
Biswas, Rupak, NASA Ames Research Center, USA; Gaeke, Brian R., California Univ., USA; Husbands, Parry, National Energy Research Supercomputer Center, USA; Li, Xiaoye S., National Energy Research Supercomputer Center, USA; Oliker, Leonid, National Energy Research Supercomputer Center, USA; Yelick, Katherine A., California Univ., USA; [2002]; 18p; In English; IPDPS Conference, 15-19 Apr. 2002, Fort Lauderdale, FL, USA
Contract(s)/Grant(s): RTOP 725-10-31; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The increasing gap between processor and memory performance has lead to new architectural models for memory-intensive applications. In this paper, we explore the performance of a set of memory-intensive benchmarks and use them to compare the performance of conventional cache-based microprocessors to a mixed logic and DRAM processor called VIRAM. The benchmarks are based on problem statements, rather than specific implementations, and in each case we explore the fundamental

hardware requirements of the problem, as well as alternative algorithms and data structures that can help expose fine-grained parallelism or simplify memory access patterns. The benchmarks are characterized by their memory access patterns, their basic control structures, and the ratio of computation to memory operation.
Author
Memory (Computers); Microprocessors; Architecture (Computers); Algorithms; Artificial Intelligence

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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.

20020070826 NASA Dryden Flight Research Center, Edwards, CA USA
Verification and Validation of Neural Networks for Aerospace Systems
Mackall, Dale, NASA Dryden Flight Research Center, USA; Nelson, Stacy, Nelson Consulting Co., USA; Schumann, Johann, Research Inst. for Advanced Computer Science, USA; July 2002; 90p; In English
Contract(s)/Grant(s): 3006-NEL-001
Report No.(s): NASA/CR-2002-211409; NAS 1.26:211409; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
The Dryden Flight Research Center V&V working group and NASA Ames Research Center Automated Software Engineering (ASE) group collaborated to prepare this report. The purpose is to describe V&V processes and methods for certification of neural networks for aerospace applications, particularly adaptive flight control systems like Intelligent Flight Control Systems (IFCS) that use neural networks. This report is divided into the following two sections: Overview of Adaptive Systems and V&V Processes/Methods.
Author
Proving; Neural Nets; Aerospace Systems; Adaptive Control; Certification; Flight Control

20020072965 Texas Univ., Center for Transportation Research, Austin, TX USA
CRCP-10 Computer Program User's Guide, *Sep. 2000 - Aug. 2001*
Kim, S. M.; Won, M. C.; McCullough, B. F.; Aug. 2001; In English
Report No.(s): PB2002-106367; RR-1831-4; No Copyright; Avail: National Technical Information Service (NTIS)
An improved CRCP computer program, CRCP-10, has been developed for the mechanistic analysis of continuously reinforced concrete pavements. CRCP-9 and CRCP-10 use two-dimensional finite element methods to calculate stresses and strains, which is a totally different approach compared with the previous computer program. CRCP-8, which uses one-dimensional analytical methods to calculate them. Since CRCP-9 considers a static single wheel load to calculate wheel load stresses, the effects of multiple wheel loads and their variations in amplitude are ignored. to improve and accuracy of the wheel load stress calculation, CRCP-10 considers moving dynamic tandem axle loads. CRCP-10 has Windows-based user-friendly interfaces for convenient use. This report summarizes the background of the CRCP-10 development, installation procedure, communication between files, detailed guide for user input procedure, explanation of output screens, and file control procedure. This report can serve as a user's guide for the CRCP-10 computer program.
NTIS
Computer Programs; Concretes; Pavements; Reinforcement (Structures); User Manuals (Computer Programs)

20020072998 Computer Sciences Corp., Moffett Field, CA USA
Backtracking and Re-execution in the Automatic Debugging of Parallelized Programs
Matthews, Gregory, Computer Sciences Corp., USA; Hood, Robert, Computer Sciences Corp., USA; Johnson, Stephen, Greenwich Univ., UK; Leggett, Peter, Greenwich Univ., UK; [2002]; 12p; In English; International Symposium on High Performance Distributed Computing, 24-26 Jul. 2002, Unknown
Contract(s)/Grant(s): DTTS59-99-D-00437; NASA Order A-61812-D; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
In this work we describe a new approach using relative debugging to find differences in computation between a serial program and a parallel version of th it program. We use a combination of re-execution and backtracking in order to find the first difference in computation that may ultimately lead to an incorrect value that the user has indicated. In our prototype implementation we use

static analysis information from a parallelization tool in order to perform the backtracking as well as the mapping required between serial and parallel computations.
Author
Computation; Program Verification (Computers); Checkout

20020073030 NASA Ames Research Center, Moffett Field, CA USA
Compositional Specification of Software Architecture
Penix, John, NASA Ames Research Center, USA; [1998]; 4p; In English; International Software Architecture Workshop, 1-2 Nov. 1998, FL, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
This paper describes our experience using parameterized algebraic specifications to model properties of software architectures. The goal is to model the decomposition of requirements independent of the style used to implement the architecture. We begin by providing an overview of the role of architecture specification in software development. We then describe how architecture specifications are build up from component and connector specifications and give an overview of insights gained from a case study used to validate the method.
Author
Architecture (Computers); Software Engineering; Mathematical Models

20020073037 Computer Sciences Corp., Moffett Field, CA USA
NAS Grid Benchmarks, 1.0
VanderWijngaart, Rob, Computer Sciences Corp., USA; Frumkin, Michael, NASA Ames Research Center, USA; Jul. 01, 2002; 18p; In English; Global Grid Forum, 21-24 Jul. 2002, Edinburgh, UK
Contract(s)/Grant(s): RTOP 704-40-24; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
We provide a paper-and-pencil specification of a benchmark suite for computational grids. It is based on the NAS (NASA Advanced Supercomputing) Parallel Benchmarks (NPB) and is called the NAS Grid Benchmarks (NGB). NGB problems are presented as data flow graphs encapsulating an instance of a slightly modified NPB task in each graph node, which communicates with other nodes by sending/receiving initialization data. Like NPB, NGB specifies several different classes (problem sizes). In this report we describe classes S, W, and A, and provide verification values for each. The implementor has the freedom to choose any language, grid environment, security model, fault tolerance/error correction mechanism, etc., as long as the resulting implementation passes the verification test and reports the turnaround time of the benchmark.
Author
Computational Grids; Proving; Computational Fluid Dynamics; Computer Programs

20020073062 NASA Ames Research Center, Moffett Field, CA USA
Robotic Exploration: The Role of Science Autonomy
Roush, Ted L., NASA Ames Research Center, USA; Jun. 13, 2002; 1p; In English; Exploring Mars Surface and its Earth Analogues, 23-25 Sep. 2002, Sicily, Italy
Contract(s)/Grant(s): RTOP 896-30-00; No Copyright; Avail: Issuing Activity; Abstract Only
Historical mission operations have involved: (1) commands transmitted to the craft; (2) execution of commands; (3) return of scientific data; (4) evaluation of these data by scientists; and (5) recommendations for future mission activity by scientists. This cycle is repeated throughout the mission with command opportunities once or twice per day. For a rover, this historical cycle is not amenable to rapid long range traverses or rapid response to any novel or unexpected situations.
Derived from text
Robotics; Sim; Robots

20020073160 Computer Sciences Corp., Moffett Field, CA USA
Support for Debugging Automatically Parallelized Programs
Jost, Gabriele, Computer Sciences Corp., USA; Hood, Robert, Computer Sciences Corp., USA; Jul. 13, 2001; 27p; In English
Contract(s)/Grant(s): DTTS59-99-D-00437; NASA Order A-61812-D; RTOP 519-40-12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
We describe a system that simplifies the process of debugging programs produced by computer-aided parallelization tools. The system uses relative debugging techniques to compare serial and parallel executions in order to show where the computations begin to differ. If the original serial code is correct, errors due to parallelization will be isolated by the comparison. One of the primary goals of the system is to minimize the effort required of the user. To that end, the debugging system uses information produced by the parallelization tool to drive the comparison process. In particular the debugging system relies on the

parallelization tool to provide information about where variables may have been modified and how arrays are distributed across multiple processes. User effort is also reduced through the use of dynamic instrumentation. This allows us to modify the program execution without changing the way the user builds the executable. The use of dynamic instrumentation also permits us to compare the executions in a fine-grained fashion and only involve the debugger when a difference has been detected. This reduces the overhead of executing instrumentation.
Author
Program Verification (Computers); Parallel Programming; Computer Programs

20020073171 NASA Ames Research Center, Moffett Field, CA USA
Experiences Using OpenMP Based on Compiler Directed Software DSM on a PC Cluster
Hess, Matthias, High Performance Computing Center, Germany; Jost, Gabriele, Computer Sciences Corp., USA; Mueller, Matthias, NASA Ames Research Center, USA; Ruehle, Roland, NASA Ames Research Center, USA; Aug. 07, 2002; 20p; In English; Workshop on OpenMP and Applications 2002, 5-7 Aug. 2002, Fairbanks, AK, USA
Contract(s)/Grant(s): DTT559-99-D-00437; NAS2-14303; NASA Order A-61812-D; RTOP 519-40-12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this work we report on our experiences running OpenMP (message passing) programs on a commodity cluster of PCs (personal computers) running a software distributed shared memory (DSM) system. We describe our test environment and report on the performance of a subset of the NAS (NASA Advanced Supercomputing) Parallel Benchmarks that have been automatically parallelized for OpenMP. We compare the performance of the OpenMP implementations with that of their message passing counterparts and discuss performance differences.
Author
Interprocessor Communication; Architecture (Computers); Personal Computers; Computer Networks; Message Processing

20020073172 NASA Ames Research Center, Moffett Field, CA USA
MERBoard User's Guide
Trimble, Jay, NASA Ames Research Center, USA; Shab, Ted, NASA Ames Research Center, USA; Vera, Alonso, NASA Ames Research Center, USA; Gaswiller, Rich, NASA Ames Research Center, USA; Jul. 22, 2002; 20p; In English; MER 2003, 2003, Unknown; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An important goal of MERBoard is to allow users to quickly and easily share information. The front-end interface is physically a large plasma computer display with a touch screen, allowing multiple people to interact shoulder-to-shoulder or in a small meeting area. The software system allows people to interactively create digital whiteboards, browse the web, give presentations and connect to personal computers (for example, to run applications not on the MERBoard computer itself). There are four major integrated applications: a browser; a remote connection to another computer (VNC); a digital whiteboard; and a digital space (MERSpace), which is a digital repository for each individual user.
Derived from text
Computers; Electronic Bulletin Boards; Computer Conferencing

20020073190 Texas A&M Univ., Center for Tectonophysics, College Station, TX USA
CoDeveloper: A Secure, Web Invocable Collaborative Software ***Final Report***
Shasharina, S. G.; Apr. 05, 2002; 18p; In English
Report No.(s): DE2002-793328; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In Phase I we concentrated on investigating how to bring various security mechanisms into the CoDeveloper collaboration environment. In order to utilize existing CORBA security mechanisms, we started with upgrading our system to CORBA 2.3 standards (Task 1). This brought into our arsenal such technologies as Bidirectional IIOP, Portable Interceptors, and IIOP over SSL. Use of bidirectional IIOP and experimentations with various port policies allowed us to formulate our approach on how to resolve firewall issues (Task 1) and work through Web browsers. Next we investigated technologies for generating and managing security certificates. This was done by building and testing the OpenSSL and OpenLDAP products (Task 2). In order to implement higher-granularity authorization, we built and used Akenti to prototype a system with a protected resource allowing three different types of use: a stakeholder and two groups of users (Task 2).
NTIS
Computer Information Security; Computer Networks; Computer Programs; Internets

20020073378 MRJ Technology Solutions, Inc., Moffett Field, CA USA

Isosurface Extraction in Time-Varying Fields Using a Temporal Hierarchical Index Tree

Shen, Han-Wei, MRJ Technology Solutions, Inc., USA; [1998]; 8p; In English; IEEE Visualization 1998 Conference, 18-23 Oct. 1998, Research Triangle Park, NC, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-72; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Many high-performance isosurface extraction algorithms have been proposed in the past several years as a result of intensive research efforts. When applying these algorithms to large-scale time-varying fields, the storage overhead incurred from storing the search index often becomes overwhelming. this paper proposes an algorithm for locating isosurface cells in time-varying fields. We devise a new data structure, called Temporal Hierarchical Index Tree, which utilizes the temporal coherence that exists in a time-varying field and adoptively coalesces the cells' extreme values over time; the resulting extreme values are then used to create the isosurface cell search index. For a typical time-varying scalar data set, not only does this temporal hierarchical index tree require much less storage space, but also the amount of I/O required to access the indices from the disk at different time steps is substantially reduced. We illustrate the utility and speed of our algorithm with data from several large-scale time-varying CID simulations. Our algorithm can achieve more than 80% of disk-space savings when compared with the existing techniques, while the isosurface extraction time is nearly optimal.

Author

Algorithms; Extraction; Data Structures; Charge Injection Devices

20020073394 Ljubljana Univ., Fakulteta za Elektrotehniko, Ljubljana, Slovenia

Digital Image Analysis Based on a Formal System ***Formalni Sistem in Mehka Logika za Analizo Digitalne Slike: Osnovni Koncept***

Kosir, Andrej, Ljubljana Univ., Slovenia; Tasic, Jurij, Ljubljana Univ., Slovenia; Electrotechnical Review; 2002; ISSN 0013-5852; Volume 69, No. 2, pp. 143-150; In Slovene; Copyright; Avail: Issuing Activity

In this paper, a new approach to the digital image scene analysis is presented. In order to provide for a flexible theoretical background for digital image data acquisition, image object recombinig and image scene analysis, a formal system is introduced. to enable implementation of a formal system in a context of digital image analysis, a formal language and predicate calculus are also introduced. The basic idea behind it is that simple parts of complex objects can be efficiently recognized and then step by step recombined back to complex objects. During this process of recombining, an analysis of object features and relations among them can be obtained. to allow for a feasible image scene analysis, a local image information should be coded so that global information of an image can he reconstructed later. It was established that formal logic does not assure sufficient robustness of object recombination processes. In order to express transformation rules more accurately, fuzzy logic was introduced and applied. Digital image feature detection and object recognition can be seen as a part of the scene analysis. Formalization of the object classification using a formal language scene analysis is given. A computer implementation of a formal system suitable for digital image analysis is briefly presented. Simple examples of a digital image scene analysis are given. The paper ends with conclusion and plans for further work.

Author

Digital Data; Image Analysis; Fuzzy Systems; Scene Analysis; Robustness (Mathematics); Formalism

20020073403 MRJ Technology Solutions, Inc., Moffett Field, CA USA

A Measurement and Simulation Based Methodology for Cache Performance Modeling and Tuning

Waheed, Abdul, MRJ Technology Solutions, Inc., USA; Yan, Jerry, MRJ Technology Solutions, Inc., USA; [1998]; 52p; In English; Sigmetric 1999, 1-4 May 1999, Atlanta, GA, USA

Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

We present a cache performance modeling methodology that facilitates the tuning of uniprocessor cache performance for applications executing on shared memory multiprocessors by accurately predicting the effects of source code level modifications. Measurements on a single processor are initially used for identifying parts of code where cache utilization improvements may significantly impact the overall performance. Cache simulation based on trace-driven techniques can be carried out without gathering detailed address traces. Minimal runtime information for modeling cache performance of a selected code block includes: base virtual addresses of arrays, virtual addresses of variables, and loop bounds for that code block. Rest of the information is obtained from the source code. We show that the cache performance predictions are as reliable as those obtained through trace-driven simulations. This technique is particularly helpful to the exploration of various "what-if' scenarios regarding the cache performance impact for alternative code structures. We explain and validate this methodology using a simple matrix-matrix

multiplication program. We then apply this methodology to predict and tune the cache performance of two realistic scientific applications taken from the Computational Fluid Dynamics (CFD) domain.
Author
Performance Prediction; Multiprocessing (Computers); Computational Fluid Dynamics; Matrices (Mathematics); Tuning

20020073449 Maribor Univ., Fakulteta za Elektrotehniko Racunalnistvo in Informatiko, Maribor, Slovenia
A Comparative Analysis of Chaotic Encryption Systems with the XOR Encryption Function and Multishift Encryption Function ***Primerjalna Analiza Kaoticnega Sifrirnega Sistema s Sifrirno Funkcijo XOR in z Multipomicno Sifrirno Funkcijo***
Salamon, Matej, Maribor Univ., Slovenia; Dogsa, Tomaz, Maribor Univ., Slovenia; Electrotechnical Review; 2002; ISSN 0013-5852; Volume 69, No. 2, pp. 107-112; In Slovene; Copyright; Avail: Issuing Activity

Encryption in the most chaotic encryption systems based on a logical XOR operation between a plaintext and pseudo-chaotic sequence, generated with known chaotic functions such as Lorenz function, equation studied by Benoit Mandelbrot, Logistic Map, etc. As algorithms of the chaotic encryption systems are not complicated, their processing speed is very high (up to few Gb/s). A weakness of the chaotic encryption systems is their low resistance to a variety of statistical attacks. Encryption systems should be secure, so as to hide the plaintexts statistical properties in the ciphertexts. For this reason the attacker can't determine some of the plaintext properties, such as if the plaintext is an image or a text. Resistance of two chaotic encryption systems to statistical attack was compared. The observed systems differed only in their encryption function. The encryption function in the first encryption system (KXOR) was a simple XOR logical operation and in the second system (KMP) it was a multishift encryption function. As the multishift encryption function is recursive, the KMP encryption system is slower than the KXOR encryption system. In both systems a pseudo-chaotic sequence was generated with the same chaotic second order digital filter. The same statistical attack and the same set of plaintexts were used. We assumed that the attacker had the encryption system and didn't know the secret key integrated in a particular system. The attacker was able to encrypt arbitrary plaintexts. With the plaintext statistical analysis and the ciphertext statistical analysis it was able to determine the statistical properties of particular groups (images, texts, sound data, etc.). Based on statistical properties (distribution, mean value and variance) of an intercepted ciphertext it established its membership to a particular group. The plaintexts were generated automatically and were limited to normally distributed numbers having different mean values and variances. Based on ciphertexts statistical analysis, we tried to find out whether it was possible to resolve the plaintext statistical parameters.
Author
Algorithms; Statistical Analysis; Variance (Statistics); Functions (Mathematics); Coding

20020073454 Suligoj (Domen), Nova Gorica, Slovenia
Parallel Implementation of Viterbi Algorithm ***Vzporedna izvedba Viterbijevega Algoritma***
Suligoj, Domen, Suligoj (Domen), Slovenia; Trobec, Roman, Nuklearni Inst. Jozef Stefan, Yugoslavia; Robic, Borut, Ljubljana Univ., Slovenia; Electrotechnical Review; 2002; ISSN 0013-5852; Volume 69, No. 2, pp. 90-94; In Slovene; Copyright; Avail: Issuing Activity

Viterbi algorithm is an optimal convolutional decoding algorithm with superpolynomial time complexity. Basic principles of Viterbi algorithm are shown. In order to improve the algorithm throughput, one has to apply parallelism. This can be done at different levels, e.g., bit, word, or algorithm level. The paper discusses various approaches to the parallelisation of the decoding algorithm, some implemented in VLSI processing elements, and the other implemented by multiprocessor systems with general purpose processors. A Viterbi decoder basically consists of three main functional blocks. Branch Metrics block BM calculates in each time step all branch weights. Add-Compare-Select ACS unit calculates sums of weights and selects optimal survivor paths. Survivor Memory SM analyses partial results from BM and ACS and outputs decoded data within a time delay D. Note that data dependent loop is present in the ACS unit that limits the speed of the decoding procedure because actual branch weight has to be added to the accumulated weights of the survivor path at each time step. Performances of the Viterbi decoder can be improved on bit level by breaking the data dependant loop using carry-save addition and pipelining. Further, several ACS units can he used in parallel on the word level. Finally, more independent decoders may work on different blocks of input data. After decoding procedure the final result can be obtained by the multiplexing of decoded segments. The mentioned principles can be implemented either in VLSI components connected into a ring topology or by several independent general purpose or DSP processors. Theoretical speedup attainable by parallel processing is estimated to be S = pNM/E, where pN represents the number of processors, E the length of the decoded block and M less than or equal to E the length of the uniquely decoded data in a block. Considering the performance of contemporary processing elements, the achievable decoding speed using 16 processors will be in the range of 10 Mbits/sec.
Author
Viterbi Decoders; Algorithms; Multiprocessing (Computers); Parallel Processing (Computers); Convolution Integrals

20020073510 MRJ Technology Solutions, Inc., Moffett Field, CA USA

HPF Implementation of NPB2.3

Frumkin, Michael, MRJ Technology Solutions, Inc., USA; Jin, Haoqiang, MRJ Technology Solutions, Inc., USA; Yan, Jerry, MRJ Technology Solutions, Inc., USA; [1998]; 1p; In English

Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: Issuing Activity; Abstract Only

We present an HPF implementation of BT, SP, LU, FT, CG and MG of NP132.3-serial benchmark set. The implementation is based on HPF performance model of the benchmark specific primitive operations with distributed arrays. We present profiling and performance data on SGI Origin 2000 and compare the results with NPB2.3. We discuss an HPF limitation in organizing pipelined computations which results in memory and communication overhead in BT and SP.

Author

FORTRAN; Parallel Computers; Arrays

20020073515 MRJ Technology Solutions, Inc., Moffett Field, CA USA

The Feasibility of Adaptive Unstructured Computations On Petaflops Systems

Biswas, Rupak, MRJ Technology Solutions, Inc., USA; Oliker, Leonid, National Energy Research Supercomputer Center, USA; Heber, Gerd, Delaware Univ., USA; Gao, Guang, Delaware Univ., USA; [1999]; 22p; In English; Petaflops II, 15-19 Feb. 1999, Santa Barbara, CA, USA

Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This viewgraph presentation covers the advantages of mesh adaptation, unstructured grids, and dynamic load balancing. It illustrates parallel adaptive communications, and explains PLUM (Parallel dynamic load balancing for adaptive unstructured meshes), and PSAW (Proper Self Avoiding Walks).

Author

Computational Grids; Unstructured Grids (Mathematics); Dynamic Loads

20020073528 NASA Ames Research Center, Moffett Field, CA USA

Exploring Gigabyte Datasets in Real Time: Architectures, Interfaces and Time-Critical Design

Bryson, Steve, NASA Ames Research Center, USA; [1998]; 23p; In English; SIGGRAPH ’98, 19 Jul. 1998, Orlando, FL, USA

Contract(s)/Grant(s): RTOP 519-40-72; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Architectures and Interfaces: The implications of real-time interaction on software architecture design: decoupling of interaction/graphics and computation into asynchronous processes. The performance requirements of graphics and computation for interaction. Time management in such an architecture. Examples of how visualization algorithms must be modified for high performance. Brief survey of interaction techniques and design, including direct manipulation and manipulation via widgets. talk discusses how human factors considerations drove the design and implementation of the virtual wind tunnel. Time-Critical Design: A survey of time-critical techniques for both computation and rendering. Emphasis on the assignment of a time budget to both the overall visualization environment and to each individual visualization technique in the environment. The estimation of the benefit and cost of an individual technique. Examples of the modification of visualization algorithms to allow time-critical control.

Author

Architecture (Computers); Human-Computer Interface; Time Dependence; Computation; Graphical User Interface; Real Time Operation

20020073800 Johns Hopkins Univ., Applied Physics Lab., Laurel, MD USA

Perspectives on Approaches to Simulation Verification and Validation

Pace, Dale K., Johns Hopkins Univ., USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 77-83; In English; Also announced as 20020073794

Contract(s)/Grant(s): N00024-98-D-8124; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Simulation verification and validation (V and V) is a critical element in determining a simulation’s fidelity and the potential appropriateness of that simulation for a particular application. How V and V is approached depends in part upon the paradigm employed in a simulation development and application during its lifecycle. Most of the V and V literature presumes that simulation V and V is done primarily within the context of the simulation code, so that it may be changed by the simulation user to improve the simulation by correcting errors, removing limitations, or enhancing other aspects of the simulation. However, many simulation applications do not fit that paradigm. In these applications, V and V by the simulation user does not directly address the simulation code itself, but instead focuses upon how the problem addressed by the simulation is set up and how simulation results are

interpreted. This is the approach often taken when a standard or commercial code (such as the NASA Structural Analysis System, NASTRAN) is used. It is also the approach taken when a specialized simulation language or package (such as the Advanced Continuous Simulation Language, ACSL) is employed. This approach may be used for simulation applications at basic physics levels, as in many computational fluid dynamic (CFD) problems, at the component level, as in ACSL applications to simulate a brake design for a car, or at the system/multisystem level, as in use of a community standard simulation like the Extended Air Defense Simulation (EADSIM) to examine capabilities of air defense systems. These differences in simulation development and application paradigms impose important differences on the way that simulation V and V can and should be done. This paper will explore those differences and suggest how V and V by simulation users who do not directly address the simulation code itself should use (or not use) guidance from the V and V literature that is oriented toward V and V done primarily within the context of the simulation code itself.
Author
Computerized Simulation; Program Verification (Computers); Computer Programs; Computational Fluid Dynamics

20020073801 Engineous Software, Inc., Cary, NC USA
Simulation-Based Design In the Face of Uncertainty
Koch, P. N., Engineous Software, Inc., USA; Cofer, J. I., IV, Engineous Software, Inc., USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 85-97; In English; Also announced as 20020073794; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Much of engineering analysis and design today is performed employing computer simulation models of ranging fidelity. to exercise these models intelligently and eliminate the burden of manual iteration, manipulating inputs and reviewing outputs, optimization strategies are applied in a simulation-based design environment to search for designs that minimize or maximize design goals or objectives while satisfying all design requirements or constraints. Optimization algorithms, however, tend to push a design up to one or more constraint boundaries, leaving the designer with a design for which even slight uncertainties in the problem formulation or changes in the operating environment could produce failed, unsafe designs, and/or result in substantial performance degradation. While most optimization problem formulations and solution strategies are deterministic, very few real engineering problems are void of uncertainty; variation is inherent in material characteristics, loading conditions, simulation model accuracy, geometric properties, manufacturing precision, actual product usage, etc. In recent years, probabilistic design analysis and optimization methods have been developed to address uncertainty and randomness through statistical modeling and probabilistic analysis, allowing the identification of designs that qualify as not only feasible, but as consistently feasible in the face of uncertainty. In this paper, simulation-based probabilistic design analysis and optimization methods are presented, including a combination of those from structural reliability-based design and robust design communities and the more recent quality concepts of Six Sigma. Strategies for combining deterministic and probabilistic design methods to effectively trade-off design performance and performance variation, and avoid the pitfalls of deterministic optimization, are discussed. An overview is given of the probabilistic design environment provided by iSIGHT, within which the discussed methods are implemented. The probabilistic design methods are applied within this environment to the design of a pump impeller, using simulation tools from Concepts NREC. Results presented include the initial impeller design, a deterministically optimized design, a probabilistic assessment of the optimized design including robustness, reliability, and probability of failure estimates, and the final probabilistic design optimized for improved reliability and robustness.
Author
Computerized Simulation; Design Analysis; Design Optimization; Probability Theory

20020073832 Mechanical Dynamics, Inc., Ann Arbor, MI USA
Pseudo-Prototyping of Aerospace Mechanical Dynamic Systems with a Generalized Computer Program
Sohoni, Vikram N., Mechanical Dynamics, Inc., USA; Chace, Milton A., Mechanical Dynamics, Inc., USA; 20th Aerospace Mechanisms Symposium; May 1986, pp. 149-163; In English; Also announced as 20020073821; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Mechanical system CAE (computer aided engineering) is a distinct, relatively new field of computer aided mechanical engineering. It is complimentary to neighboring fields such as geometrical or solid modeling, finite element stress analysis and vibration analysis. The functional distinction of the field is that it determines the time dependent behavior of entire interconnected systems of parts and other elements, ranging through angular displacements which may be sufficiently large to require nonlinear solution. Engineers responsible for mechanical design are particularly assisted by mechanical system CAE, since this technology enables them, accurately and early, to predict the behavior of machinery or vehicles for many variations in design. Behavior assessment can be done even before the first prototype exists, or in compliment to prototype or product testing. The assistance for aerospace design is especially compelling due to extreme requirements for reliable performance, and the difficulty of providing

a zero gravity environment for physical testing. The first computer implementations were limited to kinematics. Two early programs were KAM (Kinematic Analysis Method, 1964) and COMMEND (Computer Oriented Mechanical Engineering Design, 1967). The original version of DRAM (Dynamic Response of Articulated Machinery) was completed in 1969. The ADAMS (Automated Dynamic Analysis of Mechanical Systems) program was originally completed in 1973 as doctoral thesis work by Nicolae Orlandea. ADAMS was designed as a three dimensional, large displacement dynamic program, without however some of the capabilities for impact and surface-to-surface contact possessed by DRAM. ADAMS also utilized a different coordinate scheme than DRAM and involved sparse matrix methods in the equation solutions. Again, major improvements and additions have been made to the original ADAMS code; most of them by J. Angell, R. Rampalli, and T. Wielenga. An important adjunct to ADAMS, ADAMS/MODAL, has recently been completed by V.N. SOHOni and J. Whitesell. ADAMS/MODAL performs automatic linearization of mechanical systems (this of course requires circumstances of small displacement), then proceeds to determine the system modal characteristics and time dependent response. In this paper the scope and analytical methods involved in ADAMS are reviewed, followed by a discussion of some aerospace examples. ADAMS and DRAM are intended for direct use by engineers and senior designers. For this reason much effort has been devoted to facilitating ease of use. The programs self-formulate all of the relations described in the following sections of the mechanical system. Computer graphics is utilized to provide output in a flexible, comprehensive form. ADAMS and DRAM are provided as proprietary software by Mechanical Dynamics, Inc., 3055 Plymouth Road, Ann Arbor, Michigan.
Derived from text
Computer Aided Design; Applications Programs (Computers); Mechanical Engineering; Aerospace Engineering; Systems Analysis; Computerized Simulation

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.

20020073032 NASA Ames Research Center, Moffett Field, CA USA
Automatic Multilevel Parallelization Using OpenMP
Jin, Hao-Qiang, NASA Ames Research Center, USA; Jost, Gabriele, Computer Sciences Corp., USA; Yan, Jerry, NASA Ames Research Center, USA; Ayguade, Eduard, Universidad Politecnica de Catalunya, Spain; Gonzalez, Marc, Universidad Politecnica de Catalunya, Spain; Martorell, Xavier, Universidad Politecnica de Catalunya, Spain; Feb. 15, 2002; 12p; In English
Contract(s)/Grant(s): DTTS59-99-D-00437; NASA Order A-61812-D; NAS2-14303; CICYT-98-511; RTOP 519-40-12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
In this paper we describe the extension of the CAPO parallelization support tool to support multilevel parallelism based on OpenMP directives. CAPO generates OpenMP directives with extensions supported by the NanosCompiler to allow for directive nesting and definition of thread groups. We report first results for several benchmark codes and one full application that have been parallelized using our system.
Author
Parallel Programming; Computer Programs

20020073856 MRJ Technology Solutions, Inc., Moffett Field, CA USA
MPI, HPF or OpenMP: A Study with the NAS Benchmarks
Jin, H., NASA Ames Research Center, USA; Frumkin, M., NASA Ames Research Center, USA; Hribar, M., NASA Ames Research Center, USA; Waheed, A., NASA Ames Research Center, USA; Yan, J., NASA Ames Research Center, USA; [1999]; 1p; In English; Workshop on Performance Evaluation with Realistic Applications, 25 Jan. 1999, San Jose, CA, USA
Contract(s)/Grant(s): NAS2-14303; RTOP 509-10-31; No Copyright; Avail: Issuing Activity; Abstract Only
Porting applications to new high performance parallel and distributed platforms is a challenging task. Writing parallel code by hand is time consuming and costly, but this task can be simplified by high level languages and would even better be automated by parallelizing tools and compilers. The definition of HPF (High Performance FORTRAN, based on data parallel model) and OpenMP (based on shared memory parallel model) standards has offered great opportunity in this respect. Both provide simple and clear interfaces to language like FORTRAN and simplify many tedious tasks encountered in writing message passing programs. In our study, we implemented the parallel versions of the NAS Benchmarks with HPF and OpenMP directives. Comparison of their performance with the MPI implementation and pros and cons of different approaches will be discussed along

with experience of using computer-aided tools to help parallelize these benchmarks. Based on the study, potentials of applying some of the techniques to realistic aerospace applications will be presented.
Author
Parallel Programming; FORTRAN; Applications Programs (Computers); Memory (Computers)

63
CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

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

20020073127 NASA Lewis Research Center, Cleveland, OH USA
Design, Characterization and Control of the Unique Mobility Corporation Robot
Velasco, Virgilio B., Jr., Case Western Reserve Univ., USA; Newman, Wyatt S., Case Western Reserve Univ., USA; Steinetz, Bruce, NASA Lewis Research Center, USA; Kopf, Carlo, Unique Mobility, Inc., USA; Malik, John, Unique Mobility, Inc., USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 63-78; In English; Also announced as 20020073122
Contract(s)/Grant(s): NAS3-26285; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

Space and mass are at a premium on any space mission, and thus any machinery designed for space use should be lightweight and compact, without sacrificing strength. It is for this reason that NASA/LeRC (Lewis Research Center) contracted Unique Mobility Corporation to exploit their novel actuator designs to build a robot that would advance the present state of technology with respect to these requirements. Custom-designed motors are the key feature of this robot. They are compact, high-performance dc brushless servo motors with a high pole count and low inductance, thus permitting high torque generation and rapid phase commutation. Using a custom-designed digital signal processor-based controller board, the pulse width modulation power amplifiers regulate the fast dynamics of the motor currents. In addition, the programmable digital signal processor (DSP) controller permits implementation of nonlinear compensation algorithms to account for motoring vs regeneration, torque ripple, and back-EMF (Electro Motive Force). As a result, the motors produce a high torque relative to their size and weight, and can do so with good torque regulation and acceptably high velocity saturation limits. This paper presents the Unique Mobility Corporation robot prototype: its actuators, its kinematic design, its control system, and its experimental characterization. Performance results, including saturation torques, saturation velocities and tracking accuracy tests are included.
Author
Robots; Digital Systems; Actuators; Servomotors; Power Amplifiers; Pulse Duration Modulation; Signal Processing; Electromotive Forces

20020073128 Maryland Univ., College Park, MD USA
Development of an Interchangeable End Effector Mechanism for the Ranger Telerobotic Vehicle
Cohen, Robert, Maryland Univ., USA; Akin, David L., Maryland Univ., USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 79-89; In English; Also announced as 20020073122
Contract(s)/Grant(s): NAGW-2245; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

The Ranger program at the Space Systems Laboratory (SSL) at the University of Maryland is a demonstration of an extremely low cost, space flight experiment. The Ranger vehicle is designed to perform teleoperated spacecraft maintenance. Completing the various tasks included in spacecraft maintenance requires several specific tools. This paper describes the Ranger interchangeable end effector mechanism (IEEM). Its design allows Ranger to change end effectors to utilize the appropriate tool for the various tasks. The Ranger vehicle is designed with four manipulators. A seven degree-of-freedom (DOF) grappling manipulator securely attaches the vehicle to the work site. A 6 DOF camera positioning manipulator allows the operator to position a stereo pair of video cameras for visual feedback. The two remaining manipulators are the 7 DOF dexterous arms. They are the primary means by which Ranger accomplishes its required tasks. At the end of each of these dexterous manipulators is an IEEM. This paper begins with a brief overview of the Space Systems Laboratory and the Ranger program. The constraints leading to the requirements for an IEEM are described. The following section then describes the design strategies and the down selection process resulting in two candidate designs, taper and pneumatic connector type. Next, the leading candidate design is described in detail, followed by a preliminary discussion of failure modes and planned testing. The paper concludes with a brief review and a section discussing future work.
Author
Telerobotics; Degrees of Freedom; Manipulators; End Effectors

20020073137 NASA Lewis Research Center, Cleveland, OH USA

Intelligent Control of a Multi-Degree-of-Freedom Reaction Compensating Platform System Using Fuzzy Logic

Choi, Benjamin B., NASA Lewis Research Center, USA; Lawrence, Charles, NASA Lewis Research Center, USA; Lin, Yueh-Jaw, Akron Univ., USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 159-165; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

This paper presents the development of a general-purpose fuzzy logic (FL) control methodology for isolating external vibratory disturbances of space-based devices. According to the desired performance specifications, a full investigation regarding the development of an FL controller was done using different scenarios, such as variances of passive reaction-compensating components and external disturbance load. It was shown that the proposed FL controller is robust in that the FL-controlled system closely follows the prespecified ideal reference model. The comparative study also reveals that the FL-controlled system achieves significant improvement in reducing vibrations over passive systems.

Author

Automatic Control; Fuzzy Systems; Vibration Damping; Controllers

20020073215 General Accounting Office, Washington, DC USA

HIPAA Standards: Dual Code Sets Are Acceptable for Reporting Medical Procedures

Aug. 2002; 40p

Report No.(s): PB2002-108577; GAO-02-796; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The chairman, Subcommittee on Health, Committee on Ways and Means, House of Representatives, asked that we study issues surrounding procedural code sets. Specifically, we have examined the benefits and challenges associated with: (1) the International Classification of Diseases, 9th Revision (ICD-9-CM Vol. 3) and Current Procedural Terminology as standard code sets under Health Insurance Portability and Accountability Act (HIPAA), (2) International Classification of Diseases, 10th Revision, Procedural Coding System (10-PCS), the new procedural code set which was designed to replace ICD-9-CM Vol. 3, and (3) potentially replacing dual procedural code sets with a single set for reporting inpatient hospital procedures, physician services, and other medical services such as hospital outpatient procedures. In response to your request, we performed a literature review, including review of the relevant laws and regulations, the 1993 NCHS report on procedural code sets, and other published materials related to procedural code sets. We also interviewed representatives from: the American Hospital Association (AHA); the American Health Information Management Association (AHIMA), an association of health coding professionals; AMA; CMS; the National Centers for Health Statistics (NCHS); NCVHS; and 3M Health Information Systems, the contractor hired by CMS to revise ICD-9-CM Vol. 3.

NTIS

Coding; Information Management; Medical Services; Information Systems

20020073435 MRJ Technology Solutions, Inc., Moffett Field, CA USA

Self-Avoiding Walks Over Adaptive Triangular Grids

Heber, Gerd, MRJ Technology Solutions, Inc., USA; Biswas, Rupak, MRJ Technology Solutions, Inc., USA; Gao, Guang R., Delaware Univ., USA; [1999]; 6p; In English; SIAM Parallel Processing Conference, 22-24 Mar. 1999, San Antonio, TX, USA; Sponsored by Society for Industrial and Applied Mathematics, USA

Contract(s)/Grant(s): NAS2-14303; NSF CISE-97-26388; NSF MIPS-97-07125; RTOP 519-40-12; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Space-filling curves is a popular approach based on a geometric embedding for linearizing computational meshes. We present a new O(n log n) combinatorial algorithm for constructing a self avoiding walk through a two dimensional mesh containing n triangles. We show that for hierarchical adaptive meshes, the algorithm can be locally adapted and easily parallelized by taking advantage of the regularity of the refinement rules. The proposed approach should be very useful in the runtime partitioning and load balancing of adaptive unstructured grids.

Author

Algorithms; Unstructured Grids (Mathematics)

20020073450 Maribor Univ., Fakulteta za Elektrotehniko, Racunalnistvo in Informatiko, Maribor, Slovenia

Sliding Mode Robot Control with Adaptive Fuzzy Estimation of Dynamics ***Vodenje Robota v Drsnem Rezimu z Adaptivno Mehko Estimacijo Dinamike***

Rojko, Andreja, Maribor Univ., Slovenia; Jezernik, Karel, Maribor Univ., Slovenia; Electrotechnical Review; 2002; ISSN 0013-5852; Volume 69, No. 2, pp. 128-134; In Slovene; Copyright; Avail: Issuing Activity

This paper presents development and a practical implementation of a control algorithm for a motion control of a direct drive robot. The control architecture employs a decentralized sliding mode controller with the continuous torque signals, so that a chattering problem, usual in a classical sliding mode control with discontinuous signals (or variable structure systems), is avoided. Additionally, a fuzzy logic system is used for the estimation of the most of the dynamics of the each robot axis. Some of the fuzzy logic system parameters are adaptive in order to reduce a modeling error. The initial values of adaptive parameters are set by the use of the linguistic knowledge and then adjusted through the movement according to the numerical information from the sensors. The stability of the adaptation procedure is given via the Lyapunov stability theorem. The fuzzy logic systems are divided into three subsystems, each for estimation of a part of the robot dynamics. This enables systematic incorporation of the linguistic knowledge and significantly reduces the number of fuzzy rules without negatively influencing the controller performance. The experiments show that the proposed control scheme yields a stable and improved tracking performance even in the presence of the abrupt dynamic changes such as a payload variations. Although the direct drive robot has been used as a control object, the proposed controller can be also used in the motion control of a class of second order nonlinear motion control systems.
Author
Algorithms; Fuzzy Systems; Robot Control; Robot Dynamics; Adaptive Control

20020073471 Computer Sciences Corp., Moffett Field, CA USA
Resource Selection Using Execution and Queue Wait Time Predictions
Smith, Warren, Computer Sciences Corp., USA; Wong, Parkson, Computer Sciences Corp., USA; [2002]; 14p; In English
Contract(s)/Grant(s): DTTS59-99-D-00437/A61812D; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Computational grids provide users with many possible places to execute their applications. We wish to help users select where to run their applications by providing predictions of the execution times of applications on space shared parallel computers and predictions of when scheduling systems for such parallel computers will start applications. Our predictions are based on instance based learning techniques and simulations of scheduling algorithms. We find that our execution time prediction techniques have an average error of 37 percent of the execution times for trace data recorded from SGI Origins at NASA Ames Research Center and that this error is 67 percent lower than the error of user estimates. We also find that the error when predicting how long applications will wait in scheduling queues is 95 percent of mean queue wait times when using our execution time predictions and this is 57 percent lower than if we use user execution time estimates.
Author
Computational Grids; Airborne/Spaceborne Computers; Parallel Computers; Prediction Analysis Techniques; Queueing Theory; Computer Programs; Performance Prediction

20020073806 NASA Ames Research Center, Moffett Field, CA USA
Overview of Intelligent Systems and Operations Development
Pallix, J., NASA Ames Research Center, USA; Dorais, G., NASA Ames Research Center, USA; Penix, J., NASA Ames Research Center, USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 179-187; In English; Also announced as 20020073794; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC
To achieve NASA's ambitious mission objectives for the future, aircraft and spacecraft will need intelligence to take the correct action in a variety of circumstances. Vehicle intelligence can be defined as the ability to "do the right thing" when faced with a complex decision-making situation. It will be necessary to implement integrated autonomous operations and low-level adaptive flight control technologies to direct actions that enhance the safety and success of complex missions despite component failures, degraded performance, operator errors, and environment uncertainty. This paper will describe the array of technologies required to meet these complex objectives. This includes the integration of high-level reasoning and autonomous capabilities with multiple subsystem controllers for robust performance. Future intelligent systems will use models of the system, its environment, and other intelligent agents with which it interacts. They will also require planners, reasoning engines, and adaptive controllers that can recommend or execute commands enabling the system to respond intelligently. The presentation will also address the development of highly dependable software, which is a key component to ensure the reliability of intelligent systems.
Author
Aerospace Vehicles; Adaptive Control; Artificial Intelligence; Autonomy

20020073807 NASA Ames Research Center, Moffett Field, CA USA
Intelligent Control Approaches for Aircraft Applications
KrishnaKumar, K., NASA Ames Research Center, USA; Gundy-Burlet, Karen, NASA Ames Research Center, USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 189-197; In English; Also announced as

20020073794; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

This paper presents an overview of various intelligent control technologies currently being developed and studied under the Intelligent Flight Control (IFC) program at the NASA Ames Research Center. The main objective of the intelligent flight control program is to develop the next generation of flight controllers for the purpose of automatically compensating for a broad spectrum of damaged or malfunctioning aircraft components and to reduce control law development cost and time. The approaches being examined include: (a) direct adaptive dynamic inverse controller and (b) an adaptive critic-based dynamic inverse controller. These approaches can utilize, but do not require, fault detection and isolation information. Piloted simulation studies are performed to examine if the intelligent flight control techniques adequately: 1) Match flying qualities of modern fly-by-wire flight controllers under nominal conditions; 2) Improve performance under failure conditions when sufficient control authority is available; and 3) Achieve consistent handling qualities across the flight envelope and for different aircraft configurations. Results obtained so far demonstrate the potential for improving handling qualities and significantly increasing survivability rates under various simulated failure conditions.

Author

Adaptive Control; Aircraft Control; Flight Control; Failure; Control Systems Design

20020073853 NASA Ames Research Center, Moffett Field, CA USA

Molnets: An Artificial Chemistry Based on Neural Networks

Colombano, Silvano, NASA Ames Research Center, USA; Luk, Johnny, DeAnza Coll., USA; Segovia-Juarez, Jose L., Wayne State Univ., USA; Lohn, Jason, NASA Ames Research Center, USA; [2002]; 8p; In English; ANNIE 2002, 10-13 Nov. 2002, Saint Louis, MO, USA; Sponsored by Artificial Neural Networks in Engineering, Unknown

Contract(s)/Grant(s): NCC2-1189; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The fundamental problem in the evolution of matter is to understand how structure-function relationships are formed and increase in complexity from the molecular level all the way to a genetic system. We have created a system where structure-function relationships arise naturally and without the need of ad hoc function assignments to given structures. The idea was inspired by neural networks, where the structure of the net embodies specific computational properties. In this system networks interact with other networks to create connections between the inputs of one net and the outputs of another. The newly created net then recomputes its own synaptic weights, based on anti-hebbian rules. As a result some connections may be cut, and multiple nets can emerge as products of a 'reaction'. The idea is to study emergent reaction behaviors, based on simple rules that constitute a pseudophysics of the system. These simple rules are parameterized to produce behaviors that emulate chemical reactions. We find that these simple rules show a gradual increase in the size and complexity of molecules. We have been building a virtual artificial chemistry laboratory for discovering interesting reactions and for testing further ideas on the evolution of primitive molecules. Some of these ideas include the potential effect of membranes and selective diffusion according to molecular size.

Author

Chemical Reactions; Neural Nets; Chemical Evolution; Simulation

64
NUMERICAL ANALYSIS

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

20020072995 NASA Ames Research Center, Moffett Field, CA USA

Normalized Cut Algorithm for Automated Assignment of Protein Domains

Samanta, M. P., NASA Ames Research Center, USA; Liang, S., NASA Ames Research Center, USA; Zha, H., Pennsylvania State Univ., USA; [2002]; 12p; In English; PSB, 2003, Unknown

Contract(s)/Grant(s): DTTS59-99-D-0437; NASA Order A-61812-D; RTOP 755-30-11; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present a novel computational method for automatic assignment of protein domains from structural data. At the core of our algorithm lies a recently proposed clustering technique that has been very successful for image-partitioning applications. This grap.,l-theory based clustering method uses the notion of a normalized cut to partition. an undirected graph into its strongly-connected components. Computer implementation of our method tested on the standard comparison set of proteins from the literature shows a high success rate (84%), better than most existing alternative In addition, several other features of our

algorithm, such as reliance on few adjustable parameters, linear run-time with respect to the size of the protein and reduced complexity compared to other graph-theory based algorithms, would make it an attractive tool for structural biologists.
Author
Algorithms; Proteins; Domains; Computation

20020073053 Technische Univ., Faculty of Technical Mathematics and Informatics, Delft, Netherlands
Simplex-Like Method to Compute the Eigenvalue of an Irreducible (max,+) System
Van der Woude, J.; 1998; 28p; In English
Report No.(s): PB2002-105064; REPT-98-49; Copyright; Avail: National Technical Information Service (NTIS)
In this paper we present an alternative method to compute the eigenvalue of an irreducible (max +)-system. The method resembles the well-known simplex method in linear programming in the sense that the eigenvalue and a corresponding eigenvector are obtained by going along the boundary of a polygon-like set, while increasing the number of equalities in some (max +)-algebraic eigenvalue-eigenvector expression, until only equalities are left over.
NTIS
Eigenvalues; Computation; Simplex Method; Linear Programming; Optimization

20020073437 MCAT Inst., Moffett Field, CA USA
OVERGRID: A Unified Overset Grid Generation Graphical Interface
Chan, William M., MCAT Inst., USA; [1999]; 16p; In English
Contract(s)/Grant(s): NAS2-14109; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This paper presents a unified graphical interface and gridding strategy for performing overset grid generation. The interface called OVERGRID has been specifically designed to follow an efficient overset gridding strategy, and contains general grid manipulation capabilities as well as modules that are specifically suited for overset grids. General grid utilities include functions for grid redistribution, smoothing, concatenation, extraction, extrapolation, projection, and many others. Modules specially tailored for overset grids include a seam curve extractor, hyperbolic and algebraic surface grid generators, a hyperbolic volume grid generator, and a Cartesian box grid generator, Grid visualization is achieved using OpenGL while widgets are constructed with Tcl/Tk. The software is portable between various platforms from UNIX workstations to personal computers.
Author
Grid Generation (Mathematics); Graphical User Interface; Computational Grids; Extrapolation

65
STATISTICS AND PROBABILITY

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

20020070851 NASA Ames Research Center, Moffett Field, CA USA
What is a Question?
Knuth, Kevin H., NASA Ames Research Center, USA; [2002]; 22p; In English; Maximum Entropy and Bayesian Methods 2002, 3-7 Aug. 2002, Idaho, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A given question can be defined in terms of the set of statements or assertions that answer it. Application of the logic of inference to this set of assertions allows one to derive the logic of inquiry among questions. There are interesting symmetries between the logics of inference and inquiry; where probability describes the degree to which a premise implies an assertion, there exists an analogous quantity that describes the bearing or relevance that a question has on an outstanding issue. These have been extended to suggest that the logic of inquiry results in functional relationships analogous to, although more general than, those found in information theory. Employing lattice theory, I examine in greater detail the structure of the space of assertions and questions demonstrating that the symmetries between the logical relations in each of the spaces derive directly from the lattice structure. Furthermore, I show that while symmetries between the spaces exist, the two lattices are not isomorphic. The lattice of assertions is described by a Boolean lattice 2(sup N) whereas the lattice of real questions is shown to be a sublattice of the free distributive lattice FD(N) = 2(sup 2(sup N)). Thus there does not exist a one-to-one mapping of assertions to questions, there is no reflection symmetry between the two spaces, and questions in general do not possess unique complements. Last, with these lattice structures in mind, I discuss the relationship between probability, relevance and entropy.
Author
Boolean Algebra; Lattices (Mathematics); Probability Theory; Logic

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

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

20020072953 Technische Univ., Faculty of Technical Mathematics and Informatics, Delft, Netherlands
Integrating Vectors and Multiple Scales for Singularly Perturbed Ordinary Differential Equations
vanHorssen, W. T.; 1998; 34p; In English
Report No.(s): PB2002-105062; REPT-98-41; Copyright; Avail: National Technical Information Service (NTIS)

In this paper it will be shown that the (recently developed) perturbation method based on integrating vectors and multiple scales can also be applied to initial value problems for systems of singularly perturbed ordinary differential equations. Asymptotic approximations of first integrals can be obtained that are valid for all times. It will turn out that no matching principles are needed to obtain these asymptotic results. Several elementary examples are treated to show how this perturbation method can be applied.
NTIS
Differential Equations; Perturbation Theory; Singularity (Mathematics); Measure and Integration

20020073040 Argonne National Lab., IL USA
Workshop on Agent Simulation: Applications, Models, and Tools
Macal, C. M.; Sallach, D.; Oct. 1999; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-37176; No Copyright; Avail: National Technical Information Service (NTIS)

The many motivations for employing agent-based computation in the social sciences are reviewed. It is argued that there exist three distinct uses of agent modeling techniques. One such use--the simplest--is conceptually quite close to traditional simulation in operations research. This use arises when equations can be formulated that completely describe a social process, and these equations are explicitly soluble, either analytically or numerically. In the former case, the agent model is merely a tool for presenting results, while in the latter it is a novel kind of Monte Carlo analysis. A second, more commonplace usage of computational agent models arises when mathematical models can be written down but not completely solved. In this case the agent-based model can shed significant light on the solution structure, illustrate dynamical properties of the model, serve to test the dependence of results on parameters and assumptions, and be a source of counter-examples. Finally, there are important classes of problems for which writing down equations is not a useful activity. In such circumstances, resort to agent-based computational models may be the only way available to explore such processes systematically, and constitute a third distinct usage of such models.
NTIS
Computerized Simulation; Mathematical Models; Computation; Sociology

20020073054 Technische Univ., Faculty of Technical Mathematics and Informatics, Delft, Netherlands
Scaled Gauss-Newton Primal-Dual Search Direction for Semidefinite Optimization
Klerk, E. D.; Peng, J.; Roos, C.; Terlaky, T.; 1998; 28p; In English
Report No.(s): PB2002-105063; REPT-98-50; Copyright; Avail: National Technical Information Service (NTIS)

Interior point methods for semidefinite optimization (SDO) have recently been studied intensively, due to their polynomial complexity and practical efficiency. Most of these methods are extensions of linear optimization (LO) algorithms. Unlike in the LO case, there are several different ways of constructing primal-dual search directions in SDO. The usual scheme is to apply linearization in conjunction with symmetrization to the perturbed optimality conditions of the SDO problem. Symmetrization is necessary since the linearized system is overdetermined. A way of avoiding symmetrization is to find a least squares solution of the overdetermined system. Such a 'Gauss Newton' direction was investigated by Kruk et al., without giving any complexity analysis. In this paper we present a similar direction where a local norm is used in the least squares formulation, and we give a polynomial complexity analysis of the resulting primal-dual algorithm.
NTIS
Linearization; Optimization; Algorithms

20020073055 Technische Univ., Faculty of Technical Mathematics and Informatics, Delft, Netherlands
New Complexity Analysis of the Primal-Dual Method for Semidefinite Optimization based on the NT-Direction
Peng, J.; Roos, C.; Terlaky, T.; 1998; 30p; In English
Report No.(s): PB2002-105061; REPT-98-46; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Interior point methods for semidefinite optimization have recently been studied intensively, due to their polynomial complexity and practical efficiency. Many search directions have been proposed to symmetrize the corresponding Newton system. In this paper, we first introduce a variational principle for defining the search direction and show that the Nesterov-Todd (NT) direction is optimal under this principle. Secondly, we provide a unified analysis for both large-update and small-update interior point methods using the NT direction and derive polynomial iteration bounds for such methods.
NTIS
Optimization; Research; Complexity

20020073810 Northrop Grumman Corp., El Segundo, CA USA
Model-Based Verification of Diagnostic Systems
Brown, S. A., Northrop Grumman Corp., USA; Pecheur, C., Research Inst. for Advanced Computer Science, USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 225-233; In English; Also announced as 20020073794
Contract(s)/Grant(s): NAS8-01100; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

This paper discusses problems and opportunities inherent in the verification and validation (V and V) of diagnostic (health monitoring) systems. In complex client systems it can be difficult or impossible to even define the system requirements without reference to a functional model of the client system, causing the verification requirements to themselves require verification. This circularity becomes explicit when the diagnostic system to be verified contains, or uses in its development, a functional model of the client system; in some cases identical to or derived from the functional model used to define the verification requirements. In this discussion the system verification problem is decomposed into separate verifications of the algorithms, software engines, and client system models. Formal methods are proposed as being particularly well suited to verification of models representing physical systems.
Author
Systems Health Monitoring; Proving; Complex Systems

20020073811 NASA Ames Research Center, Moffett Field, CA USA
Analysis and Optimization of IVHM: The Fundamental Trades
Merriam, M. L., NASA Ames Research Center, USA; Brown, S., Northrop Grumman Corp., USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 235-241; In English; Also announced as 20020073794; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

In traditional treatments of Integrated Vehicle Health Management (IVHM) it is easy to get lost in the jargon. Common words are used in uncommon ways and acronyms abound. Furthermore, a considerable legacy is derived from traditional Reliability and Maintainability thinking in which the replacement of old parts with new parts is the principal remedy. This work explains IVHM in terms of a few simple trade offs, including fault prediction cost vs recovery cost, diagnostic precision vs. maintenance costs, and onboard testing (”Built In Test”) versus external test equipment. These trades lead to different strategies depending on mission length, safety requirements, and prevailing interest rates. The effects of recent progress in diagnostic modeling (such as Model Based Reasoning) on these trades will be discussed.
Author
Failure; Failure Analysis; Fault Detection; Wear; Cost Analysis

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THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology set theory, group theory and and number theory.

20020072960 Royal Inst. of Tech., Dept. of Mathematics, Stockholm, Sweden
Nonexpanding Maps and Busemann Functions
Karlsson, A.; Nov. 1999; 17p; In English
Report No.(s): PB2002-105056; TRITA-MAT-99-MA-22; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We give alternative simple proofs and stronger versions of some results of Beardon, (Be 90) and (Be 97). These results concern contractions of certain locally compact metric spaces and generalize the classical theorems of Wolff and Denjoy about the iteration of a holomorphic map of the unit disk. In the case of unbounded orbits, there are two types of statements that sometimes can be proven; first, about invariant horoballs, and second, about the convergence of the iterates to a point on the

boundary. to establish statements of the latter type, some hyperbolicity or visibility property is assumed. A few further remarks of similar type are made concerning certain random products of semicontractions and concerning semicontractions of Gromov hyperbolic spaces.
NTIS
Beryllium Isotopes; Metric Space; Contraction

20020073161 NASA Ames Research Center, Moffett Field, CA USA
High-Order Semi-Discrete Central-Upwind Schemes for Multi-Dimensional Hamilton-Jacobi Equations
Bryson, Steve, NASA Ames Research Center, USA; Levy, Doron, Stanford Univ., USA; Aug. 08, 2002; 34p; In English
Contract(s)/Grant(s): RTOP 704-40-42; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
We present the first fifth order, semi-discrete central upwind method for approximating solutions of multi-dimensional Hamilton-Jacobi equations. Unlike most of the commonly used high order upwind schemes, our scheme is formulated as a Godunov-type scheme. The scheme is based on the fluxes of Kurganov-Tadmor and Kurganov-Tadmor-Petrova, and is derived for an arbitrary number of space dimensions. A theorem establishing the monotonicity of these fluxes is provided. The spacial discretization is based on a weighted essentially non-oscillatory reconstruction of the derivative. The accuracy and stability properties of our scheme are demonstrated in a variety of examples. A comparison between our method and other fifth-order schemes for Hamilton-Jacobi equations shows that our method exhibits smaller errors without any increase in the complexity of the computations.
Author
Hamilton-Jacobi Equation; Upwind Schemes (Mathematics); Discretization (Mathematics)

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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.

20020070792 Argonne National Lab., IL USA
Are Recoil Polarization Measurements of G(P)(E)/G(P)(M) Consistent with Rosenbluth Separation Data
Arrington, J.; Apr. 30, 2002; 8p; In English
Report No.(s): DE2002-43168; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Recent recoil polarization measurements in Hall A at Jefferson Lab show that the ratio of the electric to magnetic form factors for the proton decreases significantly with increasing Q(sup 2). This contradicts previous Rosenbluth measurements which indicate approximate scaling of the form factors ((micro)(sub p) G(sub E)(sup p)(Q(sup 2))/G(sub M)(sup p) (Q(sup 2)) (approx) 1). The cross section measurements were reanalyzed to try and understand the source of this discrepancy. They find that the Rosenbluth measurements are consistent when normalization uncertainties are taken into account, and that the discrepancy cannot come from errors in one or two data sets. If there is a problem in the Rosenbluth data, it must be a systematic, (epsilon)-dependent uncertainty affecting several experiments.
NTIS
Polarization; Errors; Baryons; Protons

20020073058 Kentucky Univ., Dept. of Physics and Astronomy, Lexington, KY USA
Low-Lying Dirac Eigenmodes, Topological Charge Fluctuations and the instanton Liquid Model
Horvath, I.; Dong, S. J.; Draper, T.; Lee, F. X.; Thacker, H. B.; May 07, 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-794465; No Copyright; Avail: National Technical Information Service (NTIS)
The local structure of low-lying eigenmodes of the overlap Dirac operator is studied. It is found that these modes cannot be described as linear combinations of 'would-be' zeromodes associated with instanton excitations that underly the Instanton Liquid Model. This implies that the instanton liquid scenario for spontaneous chiral symmetry breaking in QCD is not accurate. More generally, our data suggests that the vacuum fluctuations of topological charge are not effectively dominated by localized lumps of unit charge with which the topological 'would-be' zeromodes could be associated.
NTIS
Topology; Dirac Equation; Eigenvectors

20020073130 NASA Kennedy Space Center, Cocoa Beach, FL USA

Innovative Mechanism for Measuring the Mass Properties of an Object

Wolcott, Kedron R., I-NET, Inc., USA; Graham, Todd A., NASA Kennedy Space Center, USA; Doty, Keith L., Florida Univ., USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 107-121; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

The Kennedy Space Center Robotics Group recently completed development and testing on a novel approach to measure the mass properties of a rigid body. This unique design can measure the payload's weight, mass center location, and moments of inertia about three orthogonal axes. Furthermore, these measurements only require a single torque sensor and a single angular position sensor.

Author

Measuring Instruments; Weight Measurement; Rigid Structures; Torque Sensors (Robotics); Position Sensing

20020073156 Fermi National Accelerator Lab., Batavia, IL USA

Analytic Studies of the Long Range Beam-Beam Tune Shifts and Chromaticities

Erdelyi, B.; Sen, T.; May 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-794463; FERMILAB-TM-2171; No Copyright; Avail: National Technical Information Service (NTIS)

A formula is derived, which allows efficient analytical evaluation of the long range beam-beam tune shifts and chromaticities with amplitude. It assumes that the beams are infinitely short, oppositely charged, and with Gaussian transversal profile. The formula employs an innite sum with favorable convergence rates, making it well suited especially for the long structure of the formula was analyzed. It is shown that the tune shifts and chromaticities change sign at certain values of the separation and/or amplitude, and folds in the footprints are predicted. Some special cases were studied in more detail. Applications to the Tevatron are presented, including some proposed compensation schemes.

NTIS

Numerical Analysis; Beam Interactions; Particle Accelerators

20020073395 Ljubljana Univ., Fakulteta za Elektrotehniko, Ljubljana, Slovenia

Premagnetized Linearity Correctors Calibration with Optimal Partial Demagnetization *Kalibriranje Predmagnetiziranih Korektorjev Nelinearnosti z Optimalnim Delnim Razmagnetenjem*

Nedeljkovic, David, Ljubljana Univ., Slovenia; Nastran, Janez, Ljubljana Univ., Slovenia; Ambrozic, Vanja, Ljubljana Univ., Slovenia; Eletrotechnical Review; 2002; ISSN 0013-5852; Volume 69, No. 2, pp. 95-100; In Slovene; Copyright; Avail: Issuing Activity

The paper presents a method for calibration of premagnetized linearity correctors (Fig. 1) that are used in CRT monitors and TV sets. There are several different ways of setting a stable operating point of a permanent magnet [1-4]. The most suitable method from the energy perspective is the pulse method. A magnetization procedure for the corrector's permanent magnet to attain its saturation level and then its partial demagnetization is described (Fig. 2). Basic topologies for a pulse-generating device are given (Figs. 3 and 5) that are used to magnetize the permanent magnet with an aperiodic current transient (Fig. 4) (1-7), while the demagnetization is made with a dumped periodic current transient (Fig. 6) (8). The aim of calibration is to set the corrector inductance characteristic LC (10 within the required tolerance range (Figs. 7 and 8). This can be achieved with a procedure (Fig. 9), laying a special emphasis on the demagnetization voltage determination. Namely, when the demagnetization voltage is properly determined, only one demagnetization pulse is needed for the corrector to attain the specified limits (less than 3% at the reference current) within a short period of time (in less than 4 s). This fact is very important for cost-effective mass-production. A comprehensive test site, controlled by LabView software, is also presented (Fig. 10). Some further work should be done for the magnetization circuitry design and control to improve energy efficiency of magnetizing pulses.

Author

Demagnetization; Linearity; Magnetization; Permanent Magnets; Pulse Modulation

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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.

20020070866 NASA Glenn Research Center, Cleveland, OH USA
Gust Acoustics Computation with a Space-Time CE/SE Parallel 3D Solver
Wang, X. Y., Taitech, Inc., USA; Himansu, A., Taitech, Inc., USA; Chang, S. C., NASA Glenn Research Center, USA; Jorgenson, P. C. E., NASA Glenn Research Center, USA; [2002]; 6p; In English; ICCFD: 2nd International Conference in Computational Fluid Dynamics, Unknown
Contract(s)/Grant(s): NAS3-97186; RTOP 708-90-33; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The benchmark Problem 2 in Category 3 of the Third Computational Aero-Acoustics (CAA) Workshop is solved using the space-time conservation element and solution element (CE/SE) method. This problem concerns the unsteady response of an isolated finite-span swept flat-plate airfoil bounded by two parallel walls to an incident gust. The acoustic field generated by the interaction of the gust with the flat-plate airfoil is computed by solving the 3D (three-dimensional) Euler equations in the time domain using a parallel version of a 3D CE/SE solver. The effect of the gust orientation on the far-field directivity is studied. Numerical solutions are presented and compared with analytical solutions, showing a reasonable agreement.
Author
Gusts; Space-Time Ce/Se Method; Aeroacoustics; Unsteady Aerodynamics

20020071046 Johns Hopkins Univ., Dept. of Mechanical Engineering, Baltimore, MD USA
Acoustic Bubble Removal from Boiling Surfaces ***Final Report, 18 Jul. 1996 - 31 Dec. 2000***
Prosperetti, Andrea, Johns Hopkins Univ., USA; [2000]; 3p; In English
Contract(s)/Grant(s): NAG3-1924; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
The object of the study was the investigation of the forces generated by standing acoustic waves on vapor bubbles, both far and near boundaries. In order to accomplish this objective, in view of the scarcity of publications on the topic, it has been necessary to build an edifice of knowledge about vapor bubbles in sound and flow fields from the ground up, as it were. We have addressed problems of gradually greater difficulty as follows: 1. In the first place, the physics of an stationary isolated bubble subject to a sound field in an unbounded liquid was addressed; 2. The case of bubbles translating in a stationary pressure field was then considered; 3. This was followed by a study of the combined effects of sound and translation, 4. and of a neighboring boundary 5. Finally, a new method to deal with nonspherical bubbles was developed- In addition to the work on vapor bubbles, some studies on gas bubbles were conducted in view of NASA's interest in the phenomenon of sonoluminescence.
Author
Sound Waves; Acoustic Emission; Bubbles; Removal; Boiling; Surface Noise Interactions

20020073512 NASA Ames Research Center, Moffett Field, CA USA
Computational AeroAcoustics for Fan Noise Prediction
Envia, Ed, NASA Ames Research Center, USA; Hixon, Ray, Toledo Univ., USA; Dyson, Rodger, NASA Ames Research Center, USA; [2002]; 37p; In English; Rolls-Royce Corporation, 21 May 2002, Indianapolis, IN, USA; Original contains color illustrations
Contract(s)/Grant(s): RTOP 781-30-11
Report No.(s): NONP-NASA-DK-2002123074; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; A02, Diskette
An overview of the current state-of-the-art in computational aeroacoustics as applied to fan noise prediction at NASA Glenn is presented. Results from recent modeling efforts using three dimensional inviscid formulations in both frequency and time domains are summarized. In particular, the application of a frequency domain method, called LINFLUX, to the computation of rotor-stator interaction tone noise is reviewed and the influence of the background inviscid flow on the acoustic results is analyzed. It has been shown that the noise levels are very sensitive to the gradients of the mean flow near the surface and that the correct computation of these gradients for highly loaded airfoils is especially problematic using an inviscid formulation. The ongoing development of a finite difference time marching code that is based on a sixth order compact scheme is also reviewed. Preliminary results from the nonlinear computation of a gust-airfoil interaction model problem demonstrate the fidelity and accuracy of this approach. Spatial and temporal features of the code as well as its multi-block nature are discussed. Finally, latest results from an

ongoing effort in the area of arbitrarily high order methods are reviewed and technical challenges associated with implementing correct high order boundary conditions are discussed and possible strategies for addressing these challenges ore outlined.
Author
Aeroacoustics; Aerodynamic Noise; Fan Blades; Noise Prediction; Rotor Aerodynamics; Time Marching

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ATOMIC AND MOLECULAR PHYSICS

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

20020070890 NASA Goddard Space Flight Center, Greenbelt, MD USA
On the Structure of the Iron K-Edge
Palmeri, P., NASA Goddard Space Flight Center, USA; Mendoza, C., NASA Goddard Space Flight Center, USA; Kallman, T. R., NASA Goddard Space Flight Center, USA; Bautista, M. A., Instituto Venezolano de Investigaciones Cientificas, Venezuela; Jul. 10, 2002; 10p; In English
Contract(s)/Grant(s): FONACIT Proj. S1-20011000912; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
It is shown that the commonly held view of a sharp Fe K edge must be modified if the decay pathways of the series of resonances converging to the K thresholds are adequately taken into account. These resonances display damped Lorentzian profiles of nearly constant widths that are smeared to impose continuity across the threshold. by modeling the effects of K damping on opacities, it is found that the broadening of the K edge grows with the ionization level of the plasma, and the appearance at high ionization of a localized absorption feature at 7.2 keV is identified as the Kbeta unresolved transition array.
Author
Damping; Plasmas (Physics); Mathematical Models; K Lines; Opacity; Ionization

20020072955 Jefferson (Thomas) National Accelerator Facility, Jefferson Lab., Newport News, VA USA
Electroexcitation of Nucleon Resonances
Burkert, V. D.; Mar. 01, 2002; 18p; In English
Report No.(s): DE2002-795621; No Copyright; Avail: Department of Energy Information Bridge
Recent electroproduction results in the domain of s-channel nucleon resonance excitation are presented, and preliminary data in the search for missing states will be discussed. I also address a new avenue to pursue N(star) physics using exclusive deeply virtual Compton scattering, recently measured for the first time at JLab and DESY.
NTIS
Excitation; Electron Scattering

20020072970 Pennsylvania Univ., Philadelphia, PA USA
Tevatron Bunch Length Studies at CDF
Jones, M.; Kephart, B.; Vidal, R.; May 06, 2002; In English
Report No.(s): DE2002-794464; FERMILAB-TM-2172; No Copyright; Avail: National Technical Information Service (NTIS)
A luminous interaction region can be described by the distribution in (x; y; z) over which persistent probability (pp) interactions are observed in a detector. The spatial size of this distribution can be written in terms of expressions that involve only combinations of the proton and anti-proton bunch sizes. Hence, it is not possible to determine the sizes of the proton and anti-proton bunches independently by tting the distribution of (x; y; z) from the recorded events.
NTIS
Particle Accelerators; Research Facilities; Beamforming

20020072972 Princeton Univ., Plasma Physics Lab., NJ USA
Enhanced Mode Conversion of Thermally Emitted Electron Bernstein Waves (EBW) to Extraordinary Mode
Jones, B.; Efthimion, P. C.; Taylor, G.; Munsat, T.; Wilson, J. R.; Jan. 2002; 24p; In English
Report No.(s): DE2002-795719; PPPL-3659; No Copyright; Avail: Department of Energy Information Bridge
In the CDX-U spherical torus, approximately 100% conversion of thermal EBWs to X-mode has been observed by controlling the electron density scale length (Ln) in the conversion region with a local limiter outside the last closed flux surface. The radiation temperature profile agrees with Thomson scattering electron temperature data. Results are consistent with theoretical calculations

of conversion efficiency using measured Ln. by reciprocity of the conversion process, prospects for efficient coupling in EBW heating and current drive scenarios are strongly supported.
NTIS
Energy Conversion Efficiency; Electron Density (Concentration); Temperature Profiles; Thomson Scattering

20020072973 California Univ., Lawrence Berkeley National Lab., Berkeley, CA USA
Status of the SNS H Ion Source and Low-Energy Beam Transport System
Keller, R.; Thomae, E.; 2002; In English
Report No.(s): DE2002-795512; LBNL-49732; No Copyright; Avail: National Technical Information Service (NTIS)
This paper will discuss the latest design features of the ion source and LEBT, give performance data for the integrated system, and report on relevant commissioning results obtained with the SNS RFQ accelerator. Perspectives for further improvements will be outlined in concluding remarks.
NTIS
Ion Sources; Transport Theory; Beamforming

20020073031 NASA Goddard Space Flight Center, Greenbelt, MD USA
Relativistic Radiative and Auger Rates for Fe XXIV
Bautista, M. A., Instituto Venezolano de Investigaciones Cientificas, Venezuela; Mendoza, C., NASA Goddard Space Flight Center, USA; Kallman, T. R., NASA Goddard Space Flight Center, USA; Palmeri, P., NASA Goddard Space Flight Center, USA; [2002]; 26p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
As part of a project to compute improved atomic data for the spectral modeling of iron K lines, we report extensive calculations and comparisons of radiative and Auger rates for transitions involving the K-vacancy states in Fe XXIV. by making use of several computational codes, a detailed study is carried out of orbital representation, configuration interaction, relativistic corrections, cancellation effects, and fine tuning. It is shown that a formal treatment of the Breit interaction is essential to render the important magnetic correlations that take part in the decay pathways of this ion. As a result, the accuracy of the present A-values is firmly ranked at better than 10% while that of the Auger rates at only 15%.
Author
Iron; K Lines; X Ray Spectroscopy; Atomic Physics

20020073042 Jefferson (Thomas) National Accelerator Facility, Jefferson Lab., Newport News, VA USA
Orbitally Excited Baryon Spectroscopy in the 1/N(c) Expansion
Schat, C. L.; Apr. 01, 2002; 14p; In English
Report No.(s): DE2002-793484; No Copyright; Avail: Department of Energy Information Bridge
The discussion of the 70-plet of negative parity baryons illustrates the large N(sub c) QCD approach to orbitally excited baryons. In the case of the l = 1 baryons the existing data allows to make numerous predictions to first order in the SU(3) symmetry breaking. New relations between splittings are found that follow from the spin-flavor symmetry breaking. The Lambda(1405) is well described as a three-quark state and a spin-orbit partner of the Lambda(1520). Singlet states with higher orbital angular momentum l are discussed.
NTIS
Angular Momentum; Baryons; Spectroscopy; Quarks

20020073043 Thomas Jefferson National Accelerator Facility, Newport News, VA USA
Resonance Region to DIS, Quark-Hadron Duality at Jefferson Lab
Wood, S. A.; 2002; 12p; In English
Report No.(s): DE2002-793383; No Copyright; Avail: Department of Energy Information Bridge
New measurements of inclusive electron scattering on the proton and deuteron have been made at Jefferson Lab with a four-momentum transfer range of 0.3 equal to or less than Q (sup 2) equal to or less than 4.5 (GeV/c) (sup 2) as a study of quark-hadron duality at low Q (sup 2). The F (sub 2) structure function is found to scale about a common scaling curve down to Q (sup 2) of 0.5 (GeV/c) (sup 2), indicating that higher twist effects are small. Duality in other observables and in electron scattering on nuclei are also discussed.
NTIS
Electron Scattering; Deuterons; Momentum Transfer

20020073189 Department of Energy, Office of Environmental Management, Washington, DC USA
Innovative Technology Summary Report: ISOCS for Free Release: Deactivation and Decommissioning Focus Area
Dec. 2001; 44p; In English
Report No.(s): DE2002-793485; DOE/EM-0618; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
ISOCS is a Germanium-detector gamma-ray characterization system that can identify specific nuclei, and quantitatively determine the corresponding radioactive inventory in situ. ISOCS response to a series of point sources surrounding it have been characterized using a Monte Carlo code. The steel-jacketed lead shielding can be mounted around the Germanium detector to provide 1 or 2 inches of shielding from background radiation, and to change the field of view between 30, 90, or 180 degrees. The detector rotates on the cart for alignment with the target. The computer controls the InSpector multichannel analyzer and the Genie-PC software provides peak identification, data and error analysis, and system quality assurance. The ISOXSW software is the key feature of the system in that it automatically determines the relationship between the radioactive source geometry, the measured count rate, and the amount of radioactive material present using the ISOCS characterized detector data.
NTIS
Radioactive Materials; Technology Assessment; Semiconductor Devices; Quality Control

20020073191 California Univ., Lawrence Berkeley National Lab., Berkeley, CA USA
Ups and Downs of J/Psi Suppression
Vogt, R.; 2002; 40p; In English
Report No.(s): DE2002-788022; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
An overview of the present status of J/(psi) suppression in p(A) nucleus-nucleus interactions is presented. In both cases model predictions are summarized and compared to the data, interactions are presented.
NTIS
Nuclear Interactions; Ionic Collisions

20020073421 Brookhaven National Lab., Riken BNL Research Center, Upton, NY USA
9.3 Resonant X-ray Scattering as a Probe of Orbital and Charge Ordering
Nelson, C. S.; Hill, J. P.; Gibbs, D.; 2002; 8p; In English
Report No.(s): DE2002-24057; BNL-69165; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Resonant x-ray scattering is a powerful experimental technique for probing orbital and charge ordering. It involves tuning the incident photon energy to an absorption edge of the relevant ion and observing scattering at previously 'forbidden' Bragg peaks, and it allows high-resolution, quantitative studies of orbital and charge order- even from small samples. Further, resonant x-ray scattering from orbitally ordered systems exhibits polarization- and azimuthal-dependent properties that provide additional information about the details of the orbital order that is difficult, or impossible, to obtain with any other technique.
NTIS
Resonance Scattering; Ion Scattering; Tuning; X Ray Scattering

20020073422 Brookhaven National Lab., Riken BNL Research Center, Upton, NY USA
Aspects of Coulomb Dissociation and Interference in Peripheral Nucleus-Nucleus Collisions
Nystrand, J.; Baltz, A. J.; Klein, S. P.; Oct. 2001; 14p; In English
Report No.(s): DE2002-24209; BNL-69267; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Coherent vector meson production in peripheral nucleus-nucleus collisions is discussed. These interactions may occur for impact parameters much larger than the sum of the nuclear radii. Since the vector meson production is always localized to one of the nuclei, the system acts as a two-source interferometer in the transverse plane. by tagging the outgoing nuclei for Coulomb dissociation it is possible to obtain a measure of the impact parameter and thus the source separation in the interferometer. This is of particular interest since the life-time of the vector mesons are generally much shorter than the impact parameters of the collisions.
NTIS
Dissociation; Nuclear Interactions; Radii

20020073513 NASA Ames Research Center, Moffett Field, CA USA
Generating the Infrared Spectra of Large Interstellar Molecules with Density Functional Theory
Bauschlicher, Charles W., Jr., NASA Ames Research Center, USA; [1999]; 1p; In English; American Physical Society Meeting, 20-26 Mar. 1999, Atlanta, GA, USA; Sponsored by American Physical Society, USA
Contract(s)/Grant(s): RTOP 519-40-12; No Copyright; Avail: Issuing Activity; Abstract Only

It is now possible to compute IR (infrared) spectra of large molecules with an accuracy of 30 per cm, or better, using density function theory. This is true for cations, anions, and neutrals. Thus it possible to generate synthetic IR spectra that can help interpret experimental spectra and fill in for missing experimental data. These synthetic spectra can be used as input into interstellar models. In addition to IR spectra, it is possible to compute energetic properties to help understand which molecules can be formed in the interstellar environment.
Author
Infrared Spectra; Macromolecules; Astronomical Models

20020073519 NASA Ames Research Center, Moffett Field, CA USA
Correlation Consistent Basis Sets for In
Bauschlicher, Charles W., Jr., NASA Ames Research Center, USA; [1999]; 1p; In English
Contract(s)/Grant(s): RTOP 519-40-12; No Copyright; Avail: Issuing Activity; Abstract Only
Correlation consistent basis sets are developed for a 13 electron correlation treatment of In atom. The basis sets are used in all-electron (AE) and effective core potential (ECP) calculations. The atomization energies of InCl and InCl3 are used as a test of the basis set. The results are extrapolated to the complete basis set (CBS) limit. The AE and ECP CCSD(T) CBS values are in very good mutal when the AE values are corrected for scalar relativistic effects. The best computed values are in good agreement with experiment.
Author
Indium; Scalars; Relativistic Effects

20020073524 NASA Ames Research Center, Moffett Field, CA USA
TiCl, TiH and TiH+ Bond Energies, a Test of a Correlation Consistent Ti Basis Set
Bauschlicher, Charles W., Jr., NASA Ames Research Center, USA; [1999]; 1p; In English
Contract(s)/Grant(s): RTOP 519-40-12; No Copyright; Avail: Issuing Activity; Abstract Only
Correlation consistent basis sets are developed for Ti atom. The polarization functions are optimized for the average of the 3F and 5F states. One series of correlation consistent basis sets is for 3d and 4s correlation, while the second series includes 3s and 3p correlation as well as 3d and 4s correlation. These basis sets are tested using the Ti 3F-5F separation and the dissociation energies of TiCl X4Phi, TiH X4Phi, and TiH(+) X3Phi. The CCSD(T) complete basis set limit values are determined by extrapolation. The Douglas Kroll approach is used to compute the scalar relativistic effect. Spin-orbit effects are taken from experiment and/or computed at the CASSCF level. The Ti 3F-5F separation is in excellent agreement with experiment, while the TiCl, TiH, and TiH(+) bond energies are in good agreement with experiment. Extrapolation with the valence basis set is consistent with other atoms, while including 3s and 3p correlation appears to make extrapolation.
Author
Titanium Compounds; Scalars; Valence; Chemical Bonds; Relativistic Effects

20020073525 NASA Ames Research Center, Moffett Field, CA USA
Symmetry Breaking and the B3LYP Functional
Bauschlicher, Charles W., Jr., NASA Ames Research Center, USA; Hudgins, Douglas M., NASA Ames Research Center, USA; Allamandola, Louis J., NASA Ames Research Center, USA; [1999]; 1p; In English
Contract(s)/Grant(s): RTOP 519-40-12; No Copyright; Avail: Issuing Activity; Abstract Only
The infrared spectra of six molecules, each of which contains a five-membered ring, and their cations are determined using density functional theory (DFT); both the B3LYP and BP86 functionals are used. The computed results are compared with the experimental spectra. For the neutral molecules, both methods are in good agreement with experiment. Even the Hartree-Fock (HF) approach is qualitatively correct for the neutrals. For the cations, the HF approach fails, as found for other organic ring systems. The B3LYP and BP86 approaches are in good mutual agreement for five of the six cation spectra, and in good agreement with experiment for four of the five cations where the experimental spectra are available. It is only for the fluoranthene cation, where the BP86 and B3LYP functionals yield different results; the BP86 yields the expected C2v symmetry, while the B3LYP approach breaks symmetry. The experimental spectra supports the BP86 spectra over the B3LYP, but the quality of the experimental spectra does not allow a critical evaluation of the accuracy of the BP86 approach for this difficult system.
Author
Broken Symmetry; Functionals; Infrared Spectra; Organic Compounds; Cations

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.

20020071037 Argonne National Lab., IL USA
Active and Passive Safety Control Performance in Sub-critical, Accelerator-Driven Nuclear Reactors
Cahalan, J. E.; Eriksson, M.; 2002; 28p; In English
Report No.(s): DE2002-43200; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Traditional safety performance requirements for nuclear reactors have been developed for critical reactors, whose kinetics characteristics differ significantly from sub-critical, accelerator-driven nuclear reactors. In a critical nuclear reactor, relatively small amounts of reactivity (negative or positive) can produce large changes in the fission rate. In sub-critical reactors, the self-multiplication (k) decreases as the sub-criticality (1k) increases, and the responsiveness to small reactivity changes decreases. This makes sub-critical nuclear reactors less responsive to positive reactivity insertions than critical reactors. Also, larger negative reactivity insertions are needed in sub-critical reactors to shut down the fission chain if the neutron source remains. This paper presents the results from a computational analysis of the safety performance of sub-critical, accelerator-driven nuclear reactors. Coupled kinetics and thermal-hydraulics models are used to quantify the effectiveness of traditional protection and control system designs in sub-critical reactors. The analyses also quantify the role of inherent, passive reactivity feedback mechanisms in sub-critical reactors. Computational results are used to develop conclusions regarding the most favorable and effective means for reactor control and protection in sub-critical, accelerator-driven nuclear reactors.
NTIS
Nuclear Reactors; Accelerators; Temperature Distribution; Analysis (Mathematics)

20020072969 Fermi National Accelerator Lab., Batavia, IL USA
Beam Effects from an Increase of LINAC Current from 40 ma to 49 Miliamperes
Tomlin, R.; Jun. 2002; 80p; In English
Report No.(s): DE2002-795137; FERMILAB-TM-2173; No Copyright; Avail: Department of Energy Information Bridge

On March 25, 2002 the FNAL Linac had been running at a decreased 40 ma of beam current for some time. Both the 400 MeV Linac and the 8GeV Booster had been tuned to optimum running during that time. Optimum running for the Booster was at 4.1e12 per pulse. Losses at injection and at transition were limiting intensity at the time. by March 26, 2002 the Linac beam current had been increased to 49 ma. The optimum Booster intensity immediately jumped to 4.5e12 per pulse and increased in the next few days to 4.8e12 and 5e12 per pulse. Booster was not retuned until early April when a low-loss 5.0e12 was obtained for stacking operations. Linac current had sagged to 47 ma by then. Measurements were made on the 25th at 40 ma and the 26th and 27th at 49 ma. This is a report and discussion of those measurements.
NTIS
Linear Accelerators; Beam Currents; Injection

20020073044 Adelaide Univ., Dept. of Physics and Mathematical Physics, Australia
New Slant on Hadron Structure
Detmold, W.; Melnitchouk, W.; Thomas, A. W.; Wright, S. V.; Dec. 2000; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-793143; No Copyright; Avail: National Technical Information Service (NTIS)

Rather than regarding the restriction of current lattice QCD simulations to quark masses that are 5-10 times larger than those observed, we note that this presents a wonderful opportunity to deepen our understanding of QCD. Just as it has been possible to learn a great deal about QCD by treating Nc as a variable, so the study of hadron properties as a function of quark mass is leading us to a much deeper appreciation of hadron structure. As examples we cite recent progress in using the chiral properties of QCD to connect hadron masses, magnetic moments, charge radii and structure functions calculated at large quark masses within lattice QCD with the values observed physically.
NTIS
Quantum Chromodynamics; Hadrons; Quarks; Particle Mass; Simulation

20020073203 California Univ., Davis, CA USA
Recent Results on Jet Fragmentation from CDF
Safonov, A.; Jun. 2002; 12p; In English
Report No.(s): DE2002-795101; CDF/PUB/JET/CDFR/5941; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In this paper, the most recent results on jet fragmentation obtained at the Collider Detector at Fermilab Tevatron are presented. The multiplicity and momentum distribution of charged particles inside jets in dijet events are compared to the predictions of the Modified Leading Log Approximation complemented with the hypothesis of Local Parton-Hadron Duality. Values for the two parameters of the model are extracted, the cut-off scale Q(sub eff) = 230 (+/-) 40 MeV and the rate of parton-to-hadron conversions K(sub LPHD)(sup charged) = 0.56 (+/-) 0.10. A fit of the data for the ratio of multiplicities in gluon and quark jets r, where r is treated as a free parameter, results in r = 1.9 (+/-) 0.5. Also, we compare the charged particle multiplicities in dijet and (gamma)-jet events. The comparison allows for an extraction of a model-independent ratio of multiplicities in gluon and quark jets. We report r = N(sub g)/N(sub q) = 1.61 (+/-) 0.11(stat) (+/-) 0.28(syst) for E(sub jet) = 40 GeV.
NTIS
Charged Particles; Particle Accelerators; Particle Emission

20020073411 Brookhaven National Lab., Riken BNL Research Center, Upton, NY USA
Measurements of the Coupling Impedance of the SNS Extraction Kickers
Davino, D.; Hahn, H.; Lee, Y. Y.; 2002; 8p; In English
Report No.(s): DE2002-24190; BNL-68908; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Spallation Neutron Source (SNS) Accumulator ring extraction system includes 14 modules of ferrite kicker magnets with window-frame geometry. Among all ring components, the extraction kickers make the single largest contribution to the coupling impedance budget. A prototype was constructed and various design options impacting the transverse coupling impedance have been thoroughly studied. Bench as well as system measurements were performed to determine the benefits from an external circuit resistance, from using different ferrites material, and from adding a novel ferrite winding. The results presented in this paper confirm that a resistive termination in the external circuit yields a solution with sufficiently reduced transverse coupling impedance. In order to determine the total contribution of all modules, an equivalent circuit and a simple scaling law was derived from measurements of full and half size magnets.
NTIS
Neutron Sources; Accumulators; Design Analysis; Magnets

20020073419 Brookhaven National Lab., Riken BNL Research Center, Upton, NY USA
Intra-Beam Scattering Measurements in RHIC
Fischer, W.; Connolly, R.; Tepikian, S.; van Zeijts, J.; Zeno, K.; 2002; 8p; In English
Report No.(s): DE2002-24175; BNL-68938; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

CHIC in gold operation shows significant intra-beam scattering due to the high charge state of the stored ions. Intra-beam scattering leads to longitudinal and transverse emittance growth. The longitudinal emittance growth causes debunching in operation; the transverse emittance growth contributes to the reduction of the beam and luminosity lifetimes. The longitudinal and transverse beam growth was measured. Beam growth measurement are compared with computations.
NTIS
Scattering; Charged Particles; Beam Leads; Emittance

20020073473 Brookhaven National Lab., Riken BNL Research Center, Upton, NY USA
Upgrading the SNS Compressor Ring to 3 MW
Weng, W. T.; Blaskiewicz, M.; Fedotov, A.; Lee, Y. Y.; Raparia, D.; 2002; 8p; In English
Report No.(s): DE2002-24186; BNL-68888; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The initial performance goal for the SNS compressor ring is 1.4 MW with 1.0 GeV linac beam. During the design phase many considerations and provisions have been made to allow progressive increase in power level of the ring, ultimately to 3.0 MtY and beyond after years of improvements. The most important provision for future higher power operation is an increase in beam energy from 1.0 to 1.3 GeV. other possible upgrades covered in this report include ion source current, new stripper foil material, injection and extraction systems, transverse damper, barrier cavity, and electron clearing to avoid e-p instability.
NTIS
Neutron Sources; Compressors; Beams (Radiation); Linear Accelerators

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OPTICS

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

20020073057 NASA Glenn Research Center, Cleveland, OH USA
A Theoretical Analysis of a New Polarimetric Optical Scheme for Glucose Sensing in the Human Eye
Rovati, Luigi L., Modena Univ., Italy; Boeckle, Stefan, Brescia Univ., Italy; Ansari, Rafat R., NASA Glenn Research Center, USA; [2002]; 14p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The challenging task of in vivo polarimetric glucose sensing is the identification and selection of a scheme to optically access the aqueous humor of the human eye. In this short communication an earlier approach of Cote et al. is theoretically compared with our new optical scheme. Simulations of the new scheme using the eye model of Navarro, suggest that the new optical geometry can overcome the limitations of the previous approach for in vivo measurements of glucose in a human eye.
Author
Eye (Anatomy); Glucose; Polarimetry; Nonintrusive Measurement

20020073129 NASA Marshall Space Flight Center, Huntsville, AL USA
Diamond Turning in the Production of X-Ray Optics
Fawcett, Steven C., NASA Marshall Space Flight Center, USA; 28th Aerospace Mechanisms Symposium; May 1994, pp. 91-105; In English; Also announced as 20020073122; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

A demonstration x-ray optic has been produced by diamond turning and replication techniques that could revolutionize the fabrication of advanced mirror assemblies. The prototype optic was developed as part of the Advanced X-ray Astrophysics Facility - Spectrographic project (AXAF-S). The initial part of the project was aimed at developing and testing the replication technique so that it could potentially be used for the production of the entire mirror array comprised of up to 50 individual mirror shells.
Author
Diamonds; X Ray Optics; Fabrication; Mirrors; Segmented Mirrors

20020073175 Defence Science and Technology Organisation, Weapons System Div., Fishermans Bend, Australia
A Phenomenological Model of Scintillation of Infrared Radiation from Point Targets Over Water and Measurements of the Model Parameters
Warren, R. C., Defence Science and Technology Organisation, Australia; January 2002; 66p; In English
Report No.(s): DSTO-RR-0231; DODA-AR-012-166; Copyright; Avail: Issuing Activity

As part of a study of the long range detection of antiship missiles (ASMs) by infrared search and track (IRST) systems using staring sensors, measurements of scintillation of an infrared source have been made. Scintillation of IR (infrared) radiation from ASMs is one of a few features which may enhance ASM detectability by IRST systems. The measurements were made in the 3-5 micron band at ranges of 17 km and 19.9 km over water. The data were used to provide values for parameters of a phenomenological model of scintillation for use in development of detection algorithms. The parameters were the magnitude of irradiance, blurring effects and image location, and the correlation coefficients of these parameters. It was found that the probability distribution for the irradiance fluctuations was log-Gaussian, as predicted by theory. There was a temporal correlation for each of the parameters which was quantified by a correlation time, but none of the parameters were correlated with any other. Approximate methods were developed for correcting the data for the finite pixel size effects of the camera and the blurring effect of the optics.
Author
Antiship Missiles; Missile Detection; Infrared Tracking; Scintillation; Algorithms

20020073521 NASA Ames Research Center, Moffett Field, CA USA
A New Optical Aerosol Spectrometer
Fonda, Mark, NASA Ames Research Center, USA; Malcolmson, Andrew, Insitec Measurement Systems, USA; Bonin, Mike, Insitec Measurement Systems, USA; Stratton, David, Search for Extraterrestrial Intelligence Inst., USA; Rogers, C. Fred, Desert Research Inst., USA; [1998]; 2p; In English; AAAR Conference, 21 Jun. 1998, Cincinnati, OH, USA
Contract(s)/Grant(s): NAS2-14073; No Copyright; Avail: Issuing Activity; Abstract Only

An optical particle spectrometer capable of measuring aerosol particle size distributions from 0.02 to 100 micrometers has been developed. This instrument combines several optical methods in one, in-situ configuration; it can provide continuous data collection to encompass the wide dynamic size ranges and concentrations found in studies of modeled planetary atmospheres as

well as terrestrial air quality research. Currently, the system is incorporated into an eight liter capacity spherical pressure vessel that is appropriate both for flowthrough and for in-situ particle generation. The optical sizing methods include polarization ratio, The scattering, and forward scattering detectors, with illumination from a fiber-coupled, Argon-ion laser. As particle sizes increase above 0.1 micrometer, a customized electronics and software system automatically shifts from polarization to diffraction-based measurements as the angular scattering detectors attain acceptable signal-to-noise ratios. The number concentration detection limits are estimated to be in the part-per-trillion (ppT by volume) range, or roughly 1000 submicron particles per cubic centimeter. Results from static experiments using HFC134A (approved light scattering gas standard), flow-through experiments using sodium chloride (NaCl) and carbon particles, and dynamic 'Tholin' (photochemical produced particles from ultraviolet (UV)-irradiated acetylene and nitrogen) experiments have been obtained. The optical spectrometer data obtained with particles have compared well with particle sizes determined by electron microscopy. The 'Tholin' tests provided real-time size and concentration data as the particles grew from about 30 nanometers to about 0.8 micrometers, with concentrations ranging from ppT to ppB, by volume. Tests are still underway, to better define sizing accuracy and concentration limits, these results will be reported.
Author
Spectrometers; Optical Measurement; Aerosols

20020073523 NASA Glenn Research Center, Cleveland, OH USA
The Stretched Lens Array (SLA): A Low-Risk, Cost-Effective Array Offering Wing-Level Performance of 180 W/KG and 300 W/M2 at 300 VDC
ONeill, Mark, Entech, Inc., USA; Piszczor, Michael F., NASA Glenn Research Center, USA; Eskenazi, Michael I., ACE-Able Engineering Co., Inc., USA; McDanal, A. J., Entech, Inc., USA; George, Patrick J., NASA Glenn Research Center, USA; Botke, Matthew M., ACE-Able Engineering Co., Inc., USA; Brandhorst, Henry W., Auburn Univ., USA; Edwards, David L., NASA Marshall Space Flight Center, USA; Jaster, Paul A., Minnesota Mining and Mfg. Co., USA; [2002]; 6p; In English; 37th Intersociety Energy Conversion Engineering Conference (IECEC), 29-31 Jul. 2002, Washington, DC, USA
Contract(s)/Grant(s): RTOP 755-A4-07
Report No.(s): IECEC 2002 Paper 20115-2; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
At IECEC 2001, our team presented a paper on the new stretched lens array (SLA), including its evolution from the successful SCARLET array on the NASA/JPL Deep Space 1 spacecraft. Since that conference, the SLA team has made significant advances in the SLA technology, including component-level improvements, array-level optimization, space environment exposure testing, and prototype hardware fabrication and evaluation. This paper describes the evolved version of the SLA, highlighting recent improvements in the lens, solar cell, photovoltaic receiver, rigid panel structure, and complete solar array wing.
Author
Aerospace Environments; Cost Effectiveness; Solar Arrays; Conferences; Performance Tests; Micrometeoroids; Photovoltaic Effect

20020073865 NASA Glenn Research Center, Cleveland, OH USA
A New Optical Scheme for a Polarimetric-Based Glucose Sensor
Ansari, Rafat R., NASA Glenn Research Center, USA; Boeckle, Stefan, Brescia Univ., Italy; Rovati, Luigi, Modena Univ., Italy; [2002]; 27p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
We describe a new optical scheme to perform polarimetric measurements to detect glucose concentration in the aqueous humor of a model eye. The ultimate aim is to apply this technique in designing a new instrument for measuring glucose levels in diabetic patients routinely, frequently, and non-invasively. The scheme exploits the Brewsterreflection of circularly polarized light off of the lens of the eye. Theoretically, this backreflected linearly polarized light on its way to the detector is expected to rotate its state of polarization due to the presence of glucose molecules in the aqueous humor of patients. An experimental laboratory setup based on this scheme was designed and tested by measuring a range of known concentration of glucose solutions dissolved in water.
Author
Glucose; Polarimetry; Eye (Anatomy); Mathematical Models; Sensors

20020073868 NASA Ames Research Center, Moffett Field, CA USA
On-Line Fringe Tracking and Prediction at IOTA
Wilson, Edward, NASA Ames Research Center, USA; Mah, Robert, NASA Ames Research Center, USA; [1999]; 1p; In English; ICO XVIII for the Next Millinium, USA
Contract(s)/Grant(s): NAS2-14217; No Copyright; Avail: Issuing Activity; Abstract Only

The Infrared/Optical Telescope Array (IOTA) is a multi-aperture Michelson interferometer located on Mt. Hopkins near Tucson, Arizona. to enable viewing of fainter targets, an on-line fringe tracking system is presently under development at NASA Ames Research Center. The system has been developed off-line using actual data from IOTA, and is presently undergoing on-line implementation at IOTA. The system has two parts: (1) a fringe tracking system that identifies the center of a fringe packet by fitting a parametric model to the data; and (2) a fringe packet motion prediction system that uses characteristics of past fringe packets to predict fringe packet motion. Combined, this information will be used to optimize on-line the scanning trajectory, resulting in improved visibility of faint targets. Fringe packet identification is highly accurate and robust (99% of the 4000 fringe packets were identified correctly, the remaining 1% were either out of the scan range or too noisy to be seen) and is performed in 30-90 milliseconds on a Pentium II-based computer. Fringe packet prediction, currently performed using an adaptive linear predictor, delivers a 10% improvement over the baseline of predicting no motion.
Author
On-Line Systems; Infrared Telescopes; Optical Equipment; Tracking (Position); Prediction Analysis Techniques

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PLASMA PHYSICS

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

20020072954 Princeton Univ., Plasma Physics Lab., NJ USA
Diagnostic of the Spatial and Velocity Distribution of Alpha Particles in Tokamak Fusion Reactor Using Beat-Wave Generated Lower Hybrid Wave ***Final Report, 1994-1996***
Rogers, J. H.; Valeo, E.; Hwang, D. Q.; Horton, R. D.; Evans, R. W.; 2002; 16p; In English
Report No.(s): DE2002-762752; No Copyright; Avail: Department of Energy Information Bridge
The alpha particles in a fusion reactor play a key role in the sustaining the fusion reaction. It is the heating provided by the alpha particles that help a fusion reactor operating in the ignition regime. It is, therefore, essential to understand the behavior of the alpha population both in real space and velocity space in order to design the optimal confinement device for fusion application. Moreover, the alphas represent a strong source of free energy that may generate plasma instabilities. Theoretical studies has identified the Toroidal Alfven Eigenmode (TAE) as an instability that can be excited by the alpha population in a toroidal device. Since the alpha has an energy of 3.5 MeV, a good confinement device will retain it in the interior of the plasma. Therefore, alpha measurement system need to probe the interior of a high density plasma. Due to the conducting nature of a plasma, wave with frequencies below the plasma frequency can not penetrate into the interior of the plasma where the alphas reside. This project uses a wave that can interact with the perpendicular motion of the alphas to probe its characteristics.
NTIS
Alpha Particles; Plasma Diagnostics; Tokamak Devices; Plasmas (Physics); Plasma Frequencies; Magnetohydrodynamic Stability

20020073048 Princeton Univ., Plasma Physics Lab., NJ USA
Oxidative Tritium Decontamination System
Gentile, C. A.; Parker, J. J.; Guttadora, G. L.; Ciebiera, L. P.; Feb. 2002; 14p; In English
Report No.(s): DE2002-796125; PPPL-3671; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The Princeton Plasma Physics Laboratory, Tritium Systems Group has developed and fabricated an Oxidative Tritium Decontamination System (OTDS), which is designed to reduce tritium surface contamination on various components and items. The system is configured to introduce gaseous ozone into a reaction chamber containing tritiated items that require a reduction in tritium surface contamination. Tritium surface contamination (on components and items in the reaction chamber) is removed by chemically reacting elemental tritium to tritium oxide via oxidation, while purging the reaction chamber effluent to a gas holding tank or negative pressure HVAC system. Implementing specific concentrations of ozone along with catalytic parameters, the system is able to significantly reduce surface tritium contamination on an assortment of expendable and non-expendable items. This paper will present the results of various experimentation involving employment of this system.
NTIS
Decontamination; Plasma Physics; Effluents

20020073063 Argonne National Lab., Energy Technology Div., IL USA

Development of Comprehensive and Integrated Models for Inertial Fusion Cavity Dynamics

Hassanein, A.; Morozov, V.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-43173; ANL-ET/02-04; No Copyright; Avail: National Technical Information Service (NTIS)

The chamber walls in inertial fusion energy (IFE) reactors are exposed to harsh conditions following each target implosion. Key issues of the cyclic IFE operation include intense photon and ion deposition, wall thermal and hydrodynamic evolution, wall erosion and fatigue lifetime, and chamber clearing and evacuation to ensure chamber conditions prior to target implosion. Several methods for wall protection have been proposed in the past, each having its own advantages and disadvantages. These methods include bare walls, gas-filled cavities, and liquid walls/jets. We have developed detailed models for reflected laser light, emitted photon, and target debris deposition and interaction with chamber components and implemented them in the comprehensive HEIGHTS software package. The hydrodynamic response of gas-filled cavities and photon radiation transport of the deposited energy has been calculated using new and advanced numerical techniques. Fragmentation models of liquid jets as a result of the deposited energy have also been developed, and the impact on chamber clearing dynamics has been evaluated. The focus of this study is to critically assess the reliability and the dynamic response of chamber walls in various proposed protection methods in IFE systems.

NTIS

Cavities; Deposition; Photons; Ions; Walls; Erosion; Fatigue (Materials); Fusion Propulsion

20020073509 Eloret Corp., Moffett Field, CA USA

Flow Characteristics of UHV Nitrogen Arcjet

Chang, C. H., Eloret Corp., USA; Grunthaner, F. J., Eloret Corp., USA; BicknellTassius, R., Eloret Corp., USA; Peelman, P., Eloret Corp., USA; Grunthaner, P. J., Eloret Corp., USA; Giuliani, J. L., Eloret Corp., USA; Apruzese, J. P., Eloret Corp., USA; Kepple, P., Eloret Corp., USA; [1998]; 1p; In English; AVS Meeting, Nov. 1998, Baltimore, MD, USA

Contract(s)/Grant(s): RTOP 632-10-01; No Copyright; Avail: Issuing Activity; Abstract Only

Flow characteristics in the nozzle of a nitrogen arcjet have been simulated by a model. Electrons, ions, and neutral atoms and molecules are represented as separate species. Dissociation, ionization, and recombination are treated as separate reactions. Thermal non-equilibrium is represented by a two-temperature model. Energy input to plasma from the arc is modeled as a source determined by local current and electrical conductivity. Momentum and energy losses and recombinations at the nozzle wall are included as source/sink determined by fluxes to the wall. The results show essentially frozen gas-phase reactions and thermal nonequilibrium due to Joule heating of electrons and in the expansion part of the nozzle. Wall interactions have strong effects on the results, indicating that they play important roles in the flow due to very high surface area relative to the volume of the plasma. For example, plasma velocity decreases from 6000 m per s without wall interactions to 3000 m per s with modest amount of wall interactions. These results also show reasonable agreement with optical emission measurements, which confirms that the arcjet plasma is far from LTE. The spectra suggest nitrogen dissociation levels of 0.3% - 9%, depending on nitrogen flow rate and arc plasma current, which also determine the relative amounts of excited atomic and molecular nitrogen. Langmuir probe studies of the source show that electron and ion fluxes increase with increasing power, and that the ion energy distribution shifts to lower energies. Typical ion fluxes were on the order of 4E-9 A/cm**2 with a maximum ion kinetic energy of 3.5eV. The median electron energy was 1eV, with a maximum of less than 4eV.

Author

Flow Characteristics; Nozzle Walls; Dynamic Models; Electron Energy; Plasma Interactions

20020073803 Air Force Research Lab., Edwards AFB, CA USA

Architecture and Initial Results of a 3-D Plasma Simulation System for Spacecraft-Thruster Interaction Assessment

Fife, J. M., Air Force Research Lab., USA; Gibbons, M. R., Air Force Research Lab., USA; VanGilder, D. B., Engineering Research and Consulting, Inc., USA; Kirtley, D. E., Engineering Research and Consulting, Inc., USA; 2nd JANNAF Modeling and Simulation Subcommittee Meeting; April 2002; Volume 1, pp. 121-126; In English; Also announced as 20020073794; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

A 3-D Plasma Interaction Modeling System is being developed to predict the interaction of electric propulsion plumes with surfaces. The system, named COLISEUM, is designed to be flexible, usable, and expandable, allowing users to define surfaces with their choice of off-the-shelf 3-D solid modeling packages. These surfaces are then loaded into COLISEUM, which performs plasma operations based on user commands. Functional modules will range from simple (prescribed plume field) to complex (full PIC-DSMC) depending on the user's request. Surface interaction parameters such as ion flux, ion energy, sputtering, and re-deposition are computed. Development to date has progressed to include modules that a) import and superimpose prescribed

plume distributions, and b) perform ray tracing of flux from point sources. This paper presents some of the first COLISEUM results - sputtering predictions on a spacecraft and in a vacuum chamber due to a Hall-effect thruster.
Author
Computerized Simulation; Plasma Propulsion; Plumes; Three Dimensional Models

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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.

20020072227 Seville Univ., Dpto. de Fisica de la Materia Condensada, Spain
High-Temperature Mechanical Properties of Cr(3+) Doped Sapphire Fibers
Sayir, A., NASA Glenn Research Center, USA; QuispeCancapa, J. J., Seville Univ., Spain; deArellanoLopez, A. R., Seville Univ., Spain; [2002]; 6p; In English; 26th Annual Conference on Composites, Advanced Ceramics, Materials, and Structures, Unknown Contract(s)/Grant(s): F49620-00-1-0048; MAT2000-1533-C03-03; NCC3-850; RTOP 708-31-13; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

High-temperature slow-crack growth of single crystal 10 wt% Cr2O3 - Al2O3 (nominal composition) fibers has been studied by tensile rupture experiments at 1400 C, under different stressing rates (0.5 to 41.5 MPa/s). Slow-crack growth (SCG) is less pronounced with increasing Cr2O3. Rupture stresses increased with the stressing rate from 397 MPa to 515 MPa, resulting in a SCG exponent, N=19. The Cr2O3 composition was analyzed by Energy Dispersed X-Ray Spectra (EDS) and fracture surfaces were studied by scanning electron microscopy (SEM). Results are compared with previous studies on 100-300 ppm Cr3(+) doped sapphire fibers and on commercial sapphire fibers.
Author
Doped Crystals; Crack Propagation; Fibers; Single Crystals; Cracks; Stresses; Rupturing

20020072724 NASA Marshall Space Flight Center, Huntsville, AL USA
Search for Spin Filtering by Electron Tunneling Through Ferromagnetic EuS Barriers in Pbs
Figielski, T., Polish Academy of Sciences, Poland; Morawski, A., Polish Academy of Sciences, Poland; Wosinski, T., Polish Academy of Sciences, Poland; Wrotek, S., Polish Academy of Sciences, Poland; Makosa, A., Polish Academy of Sciences, Poland; Lusakowska, E., Polish Academy of Sciences, Poland; Story, T., Polish Academy of Sciences, Poland; Sipatov, A. Yu., National Technical Univ., Ukraine; Szczerbakow, A., Polish Academy of Sciences, Poland; Grasza, K., Polish Academy of Sciences, Poland; [2002]; 1p; In English; 2nd International Conference on Physics and Applications of Spin Related Phenomena in Semiconductors, 23-27 Jul. 2002, Wuerzburg, Germany; No Copyright; Avail: Issuing Activity; Abstract Only

Perpendicular transport through single- and double-barrier heterostructures consisting of ferromagnetic EuS layers embedded into PbS matrix was investigated. Manifestations of both resonant tunneling and spin filtering through EuS barrier have been observed.
Author
Electron Tunneling; Ferromagnetic Materials

20020072726 NASA Marshall Space Flight Center, Huntsville, AL USA
Flight Planning for the International Space Station-Levitation Observation of Dendrite Evolution in Steel Ternary Alloy Rapid Solidification
Flemings, M. C., NASA Marshall Space Flight Center, USA; Matson, D. M., NASA Marshall Space Flight Center, USA; Loser, W., NASA Marshall Space Flight Center, USA; Hyers, R. W., NASA Marshall Space Flight Center, USA; Rogers, J. R., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; Proceedings of 2002 NASA Materials Science Conference, 25-26 Jun. 2002, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The paper is an overview of the status and science for the LODESTARS research project. The program is aimed at understanding how melt convection influences phase selection and the evolution of rapid solidification microstructures
Author
Rapid Quenching (Metallurgy); Microstructure; Melts (Crystal Growth); Ternary Alloys

20020072731 NASA Marshall Space Flight Center, Huntsville, AL USA

Carbon Nanotubes Growth by CVD on Graphite Fibers

Zhu, Shen, Universities Space Research Association, USA; Su, Ching-Hua, NASA Marshall Space Flight Center, USA; Cochrane, J. C., Universities Space Research Association, USA; Lehoczky, S. L., NASA Marshall Space Flight Center, USA; Muntele, I., Alabama Agricultural and Mechanical Univ., USA; Ila, D., Alabama Agricultural and Mechanical Univ., USA; [2002]; 1p; In English; 8th International Conference on Diamond Science and Technology 2002, 22 Jul. 20002, Victoria, Australia

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

Due to the superior electrical and mechanical properties of carbon nanotubes (CNT), synthesizing CNT on various substances for electronics devices and reinforced composites have been engaged in many efforts for applications. This presentation will illustrate CNT synthesized on graphite fibers by thermal CVD. On the fiber surface, iron nanoparticles as catalysts for CNT growth are coated. The growth temperature ranges from 600 to 1000 C and the pressure ranges from 100 Torr to one atmosphere. Methane and hydrogen gases with methane content of 10% to 100% are used for the CNT synthesis. At high growth temperatures (greater than or equal to 900 C), the rapid inter-diffusion of the transition metal iron on the graphite surface results in the rough fiber surface without any CNT grown on it. When the growth temperature is relative low (650-800 C), CNT with catalytic particles on the nanotube top ends are fabricated on the graphite surface. (Methane and hydrogen gases with methane content of 10% to 100% are used for the CNT synthesis.) (By measuring the samples) Using micro Raman spectroscopy in the breath mode region, single-walled or multi-walled CNT (MWCNT), depending on growth concentrations, are found. Morphology, length and diameter of these MWCNT are determined by scanning electron microscopy and Raman spectroscopy. The detailed results of syntheses and characterizations will be discussed in the presentation.

Author

Carbon Nanotubes; Nanostructure Growth; Graphite; Vapor Deposition

20020072975 Iowa State Univ. of Science and Technology, Ames, IA USA

Length Scale Correlations of Cellular Microstructures in Directionally Solidified Binary System

Shen, Y.; 2002; 60p; In English

Report No.(s): DE2002-797636; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In a cellular array, a range of primary spacing is found to be stable under given growth conditions. Since a strong coupling of solute field exists between the neighboring cells, primary spacing variation should also influence other microstructure features such as cell shape and cell length. The existence of multiple solutions is examined in this study both theoretically as well as experimentally. A theoretical model is developed that identifies and relates four important microstructural lengths, which are found to be primary spacing, tip radius, cell width and cell length. This general microstructural relationship is shown to be valid for different cells in an array as well as for other cellular patterns obtained under different growth conditions. The unique feature of the model is that the microstructure correlation does not depend on composition or growth conditions since these variables scale microstructural lengths to satisfy the relationship obtained in this study. Detailed directional solidification experimental studies have been carried out in the succinonitrile-salol system to characterize and measure these four length scales.

NTIS

Microstructure; Directional Solidification (Crystals); Stability; Mathematical Models

20020073028 NASA Ames Research Center, Moffett Field, CA USA

The Hydrogen Abstraction from A Diamond(111) Surface in A Uniform Electric Field

Ricca, Alessandra, NASA Ames Research Center, USA; Bauschlicher, Charles W., Jr., NASA Ames Research Center, USA; Kang, Jeung Ku., Stanford Univ., USA; Musgrave, Charles B., Stanford Univ., USA; [1998]; 17p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Bond breaking in a strong electric field is shown to arise from a crossing of the ionic and covalent asymptotes. The specific example of hydrogen abstraction from a diamond(111) surface is studied using a cluster model. The addition of nearby atoms in both the parallel and perpendicular direction to the electric field are found to have an effect. It is also shown that the barrier is not only related to the position of the ionic and covalent asymptotes.

Author

Hydrogen; Electric Fields; Dissociation; Molecular Interactions; Ionization; Atomic Excitations; Chemical Bonds

20020073033 Computer Sciences Corp., Moffett Field, CA USA

Computational Nanotechnology of Nanotubes, Composites, and Electronics

Srivastava, D., Computer Sciences Corp., USA; [2002]; 6p; In English; US National Congress of Applied Mechanics (USNCAM), 24-27 Jun. 2002, Blacksburg, VA, Vienna, Reno, NV, USA, Austria, USA

Contract(s)/Grant(s): RTOP 704-40-32; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This viewgraph presentation addresses carbon nanotubes, their mechanical and thermal properties, and their structure, as well as possible miniature devices which may be assembled in the future from carbon nanotubes.

CASI

Carbon Nanotubes; Nanotechnology; Nanostructure (Characteristics); Nanostructures (Devices)

20020073075 NASA Glenn Research Center, Cleveland, OH USA

Continuous Beam Steering From a Segmented Liquid Crystal Optical Phased Array

Titus, Charles M., Kent State Univ., USA; Pouch, John, NASA Glenn Research Center, USA; Nguyen, Hung, NASA Glenn Research Center, USA; Miranda, Felix, NASA Glenn Research Center, USA; Bos, Philip J., Kent State Univ., USA; Jun. 20, 2002; 33p; In English

Contract(s)/Grant(s): NAG3-2539; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Optical communications to and from deep space probes will require beams possessing divergence on the order of a microradian, and must be steered with sub-microradian precision. Segmented liquid crystal spatial phase modulators, a type of optical phased array, are considered for this ultra-high resolution beam steering. It is shown here that in an ideal device of this type, there are ultimately no restrictions on the angular resolution. Computer simulations are used to obtain that result, and to analyze the influence of beam truncation and substrate flatness on the performance of this type of device.

Author

Beam Steering; Optical Communication; Satellite Communication; Phased Arrays; Computerized Simulation; Angular Resolution; Liquid Crystals

20020073384 NASA Ames Research Center, Moffett Field, CA USA

Nanoscale Etching and Indentation of Silicon(001) Surface with Carbon Nanotube Tips

Dzegilenko, Fendor N., NASA Ames Research Center, USA; Srivastava, Deepak, NASA Ames Research Center, USA; Saini, Subhash, NASA Ames Research Center, USA; Jul. 10, 1998; 7p; In English

Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The possibility of nanoscale etching and indentation of Si(001)(2x1) surface by (8,0) and (10,10) carbon nanotube tips is demonstrated, for the first time, by classical molecular dynamics simulations employing Tersoff's many-body potential for a mixed C/Si/Ge system. In the nanotube tip barely touching the surface scenario atomistic etching is observed, where as in the nanoindentation scenario nanotube tip penetrates the surface without much hindrance. The results are explained in terms of the relative strength of C-C, C-Si, and Si-Si bonds.

Author

Carbon Nanotubes; Nanoindentation; Silicon; Etching

20020073423 Brookhaven National Lab., Riken BNL Research Center, Upton, NY USA

HPVB and HPVZM Shaped Growth of CdZnTe, CdSe and ZnSe Crystals

Kolesnikov, N. N.; James, R. B.; Berzigiarova, N. S.; Kulakov, M. P.; 2002; 16p; In English

Report No.(s): DE2002-24203; BNL-24203; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Growth of bulk II-VI compound crystals is often carried out by the high-pressure vertical Bridgman method (HPVB) or by means of vertical zone melting under high pressure of an inert gas (HPVZM). HPVB is the most widely applied technique, especially for the manufacturing of CdTe and CdZnTe detector-grade crystals. At the same time there is strong experimental evidence that HPVZM has distinct advantages compared to HPVB, because it allows for better control of the main composition of the crystal.

NTIS

Crystal Growth; Bubbles; Cadmium Selenides; Bridgman Method

20020073470 Seville Univ., Dpto. de Fisica de la Materia Condensada, Spain

Microstructure and High Temperature Plastic Behavior of 5m% Er2O3 Doped ZrO2 Fibers and Bulk Crystals

QuispeCancapa, J. J., Seville Univ., Spain; PintoGomez, A. R., Seville Univ., Spain; MartinezFernandez, J., Seville Univ., Spain; Sayir, A., NASA Glenn Research Center, USA; [2002]; 6p; In English; 26th Annual Conference on Composites, Advanced

Ceramics, Materials, and Structures, Unknown
Contract(s)/Grant(s): NCC3-850; F49620-00-1-0048; MAT2000-1533-C0303; RTOP 708-31-13; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The microstructure and high temperature mechanical properties of 5 mol% Er203 doped Zr02 fibers were studied at temperatures between 1300 C and 1570 C by tensile creep tests, and bulk crystals by constant strain rate compression tests at 1400 C. The microstructure of the as-fabricated and plastically deformed crystals was characterized by scanning electron microscopy. The hardening characteristics, structure of activated slip planes, and saturation of creep strain are discussed, The mechanical properties are compared with other zirconia alloys.
Author
Zirconium Oxides; Plastic Deformation; Microstructure; High Temperature; Doped Crystals; Creep Properties; Fiber Composites; Crystal Growth

20020073514 MRJ Technology Solutions, Inc., Moffett Field, CA USA
Conductance of Carbon Nanotubes
Datta, Supriyo, MRJ Technology Solutions, Inc., USA; Anatram, M. P., NASA Ames Research Center, USA; [1998]; 1p; In English; American Physical Society, 20-26 Mar. 1999, Atlanta, GA, USA; Sponsored by American Physical Society, USA
Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: Issuing Activity; Abstract Only

The recent report of quantized conductance in a 4 m long multiwalled nanotube (MWNT) raises the exciting possibility of ballistic transport at room temperature over relatively long distances. We argue that this is made possible by the special symmetry of the eigenstates of the lowest propagating modes in metallic nanotubes which suppresses backscattering. This unusual effect is absent for the higher propagating modes so that transport is not ballistic once the bias exceeds the cut-off energy for the higher modes, which is estimated to be approximately 75 meV for nanotubes of diameter approximately 15 nm. Also, we show that the symmetry of the eigenstates can significantly affect their coupling to the reservoir and hence the contact resistance. A simple model is presented that can be used to understand the observed conductance-voltage characteristics.
Author
Carbon Nanotubes; Contact Resistance; Ballistics; Eigenvectors

20020073522 MRJ Technology Solutions, Inc., Moffett Field, CA USA
Carbon Nanotube Based Nano-Electro-Mechanical Systems (NEMS)
Han, Jie, NASA Ames Research Center, USA; Dai, Hongjie, Stanford Univ., USA; Saini, Subhash, NASA Ames Research Center, USA; [1998]; 1p; In English; International Conference on Integrated Nano/Microtechnology for Space Applications, 1-6 Nov. 1998, Houston, TX, USA; Sponsored by NASA Ames Research Center, USA
Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: Issuing Activity; Abstract Only

Carbon nanotubes (CNT) enable nanoelectromechanical systems (NEMS) because of their inherent nanostructure, intrinsic electric conductivity and mechanical resilience. The collaborative work between Stanford (experiment) and NASA Ames (theory and simulation) has made progress in two types of CNT based NEMS for nanoelectronics and sensor applications. The CNT tipped scanning probe microscopy (SPM) is a NEMS in which CNT tips are used for nanoscale probing, imaging and manipulating. It showed great improvement in probing surfaces and biological systems over conventional tips. We have recently applied it to write (lithography) and read (image) uniform SiO2 lines on large Si surface area at speed up to 0.5 mm per s. Preliminary work using approximately 10 nm multiwall nanotube tips produced approximately 10 nm structures and showed that the CNT tips didn't wear down when crashed as conventional tips often do. This presents a solution to the long standing tip-wear problem in SPM nanolithography. We have also explored potential of CNT tips in imaging DNA in water. Preliminary experiment using 10 nm CNT tips reached 5 nm resolution. The 1 nm nanolithography and 1 nm DNA imaging can be expected by using approximately 1 nm CNT tips. In contrast to CNT tipped SPM, we also fabricated CNT devices on silicon wafer in which CNTs connect patterned metallic lines on SiO2/Si by a simple chemical vapor deposition process. Using conventional lithography for silicon wafer, we have been able to obtain CNT based transistors and sensors. Investigations of the CNT NEMS as physical, biological and chemical sensors are in progress and will be discussed.
Author
Carbon Nanotubes; Microelectromechanical Systems; Nanotechnology; Microscopy

20020073864 Eloret Corp., Sunnyvale, CA USA
Computational Studies of the Interaction of H/H2 with Diamond and Silicon Surfaces
Walch, Stephen P., NASA Ames Research Center, USA; Goddard, William A., III, California Inst. of Tech., USA; Cagin, Tahir, California Inst. of Tech., USA; [1998[; 1p; In English; Sixth Foresight Conference on Molecular Nanotechnology, 13-15 Nov.

1998, Unknown
Contract(s)/Grant(s): NRA2-36628; NAG2-1131; No Copyright; Avail: Issuing Activity; Abstract Only

The interaction of hydrogen atoms and molecules with diamond and silicon surfaces is important in several important applications. Two areas that we are interested are: 1) tribology (molecular level friction) and 2) the role of H atoms in silicon chemical vapor deposition (CVD). In the tribology area, H atoms can be used to tie off dangling bonds, which otherwise form bonds between adjacent surfaces, and lead to resistance to sliding the surfaces by each other. Processes which are important in understanding molecular level friction include barriers to addition of H/H2 to the surface and barriers to migration of H atoms on the surface. In the silicon CVD area, we have studied the process of H2 elimination from the 100 surface of silicon. Cluster models for the dime surfaces of diamond are presented. The unrelaxed 100 surface has carbene like surface carbon atoms; however, for the relaxed surface these dimerize to give rows of surface dimers and there is a significant amount of p bonding between the radical orbitals of the dimer. The 110 surface has zig-zag rows of carbon atoms with a dangling bond on each carbon atom. These dangling bonds are hybridized away from each other and thus interact less strongly than for the 100 surface. Finally, the 111 surface has surface C atoms arranged in a triangular pattern and the surface dangling bonds are well separated from each other (second nearest neighbor distance) leading to almost no interaction between adjacent dangling bonds. These qualitative features may be quantified by computing the overlap of adjacent dangling bonds in a GVB(pp) calculation. The overlaps are 0.462, 0.292, and 0.016 for the diamond 100, 110, and 111 surfaces, respectively.
Author
Diamonds; Hydrogen; Hydrogen Atoms; Silicon; Tribology

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SOCIAL AND INFORMATION SCIENCES (GENERAL)

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

20020070988 NASA Goddard Space Flight Center, Greenbelt, MD USA
The NASA Goddard Space Flight Center Virtual Science Fair
Bolognese, Jeff, NASA Goddard Space Flight Center, USA; Walden, Harvey, NASA Goddard Space Flight Center, USA; June 2002; 82p; In English
Report No.(s): NASA/TM-2002-210011; NAS 1.15:210011; Rept-2002-01339-0; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report describes the development of the NASA Goddard Space Flight Center Virtual Science Fair, including its history and outgrowth from the traditional regional science fairs supported by NASA. The results of the 1999 Virtual Science Fair pilot program, the mechanics of running the 2000 Virtual Science Fair and its results, and comments and suggestions for future Virtual Science Fairs are provided. The appendices to the report include the original proposal for this project, the judging criteria, the user's guide and the judge's guide to the Virtual Science Fair Web site, the Fair publicity brochure and the Fair award designs, judges' and students' responses to survey questions about the Virtual Science Fair, and lists of student entries to both the 1999 and 2000 Fairs.
Author
Surveys; Websites; Documents; Virtual Properties

20020072221 American Inst. for Research, Washington, DC USA
CRM Assessment: Determining the Generalization of Rater Calibration Training. Summary of Research Report: Gold Standards Training, *Feb. 1998 - Jun. 2002*
Baker, David P., American Inst. for Research, USA; [2002]; 55p; In English
Contract(s)/Grant(s): NCC2-1084; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The extent to which pilot instructors are trained to assess crew resource management (CRM) skills accurately during Line-Oriented Flight Training (LOFT) and Line Operational Evaluation (LOE) scenarios is critical. Pilot instructors must make accurate performance ratings to ensure that proper feedback is provided to flight crews and appropriate decisions are made regarding certification to fly the line. Furthermore, the Federal Aviation Administration's (FAA) Advanced Qualification Program (AQP) requires that instructors be trained explicitly to evaluate both technical and CRM performance (i.e., rater training) and also requires that proficiency and standardization of instructors be verified periodically. to address the critical need for effective pilot instructor training, the American Institutes for Research (AIR) reviewed the relevant research on rater training and, based on "best practices" from this research, developed a new strategy for training pilot instructors to assess crew performance. In addition, we

explored new statistical techniques for assessing the effectiveness of pilot instructor training. The results of our research are briefly summarized below. This summary is followed by abstracts of articles and book chapters published under this grant.
Author
Pilot Training; Training Evaluation; Flight Crews; Flight Training; Human Performance

20020073852 NASA Ames Research Center, Moffett Field, CA USA
Science/Engineering: Open Doors
White, Susan, NASA Ames Research Center, USA; [1999]; 1p; In English; Women in Science Conference, 17-18 May 1999, Chicago, IL, USA
Contract(s)/Grant(s): RTOP 242-82-10; No Copyright; Avail: Issuing Activity; Abstract Only
Trends in American society are changing the role of women in science and engineering, but all the elements in our society change at different rates. Women, like men, must choose during their teenage years to continue their training in math or science, or they close the door that can lead them to futures in the interesting and satisfying fields of science and engineering. The key is to keep girls involved in the hard sciences through the adolescent crisis. Many mentoring and outreach programs exist to help young women cross this threshold. These programs include hands-on science experiences, mentoring or putting young women in contact with women scientists and engineers, and internships, Viewpoints and histories of contemporary women engineers are discussed.
Author
Engineers; Scientists; Conferences

20020073858 Southern Univ., Baton Rouge, LA USA
Building the Capacity of HBCU's for Establishing Effective Globe Partnerships ***Final Report, 1 Apr. - 30 Jun. 2002***
Bagayoko, Diola, Southern Univ., USA; Ford, Robert L., Southern Univ., USA; June 2002; 63p; In English; Building Capacity: Linking Across the Atlantic, 17-22 Mar. 2002, Washington, DC, USA; Sponsored by Howard Univ., USA; Orginial contains color illustrations
Contract(s)/Grant(s): NAG5-11936; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The special GLOBE train-the-trainer (TTT) workshop entitled "Building the Capacity of HBCUs For Establishing Effective GLOBE Partnerships" was help for the purpose of expanding GLOBE training capacity on the campuses of Historically Black Colleges and Universities (HBCUs) and community colleges (CCs). The workshop was held March 17-22, 2002 in Washington, D.C. at Howard University. It was designed to establish research and instructional collaboration between and among U.S. universities (HBCUs and CCs) and African countries. Representatives from 13 HBCUs, and two community colleges were represented among trainees, so were representatives from eight African countries who were financially supported by other sources. A total of 38 trainees increased their knowledge of GLOBE protocols through five days of rigorous classroom instruction, field experiences, cultural events, and computer lab sessions.
Author
Africa; Universities; Conferences; Minorities

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ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20020070915 NASA Glenn Research Center, Cleveland, OH USA
Real World Connections Through Videoconferences
Peterson, Ruth, NASA Glenn Research Center, USA; [2002]; 16p; In English; Japan 2001 Science, Creativity and the Young Mind Workshop, 23 Jul. 2001, Bristol, England, UK
Contract(s)/Grant(s): RTOP 332-41-00; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The Learning Technologies Project (LTP) is a partner in the National Aeronautics and Space Administration's (NASA's) educational technology program unit, an electronic community center that fosters interaction, collaboration, and sharing among educators, learners, and scientists. The goal of the NASA Glenn Research Center's Learning Technologies Project is to increase students' interest and proficiency in mathematics, science, and technology through the use of computing and communications technology and by using NASA's mission in aerospace technology as a theme. The primary components are: (1) Beginner's Guide to Aeronautics, including interactive simulation packages and teacher-created online activities. (2) NASA Virtual Visits,

videoconferences (with online pre-post-conference activities) connecting students and teachers to NASA scientists and researchers.
Derived from text
Video Conferencing; Video Communication; Teleconferencing; Electronic Mail; Computerized Simulation

20020073047 Santa Fe Inst., NM USA
Broad Research Project on the Sciences of Complexity ***Final Report, 15 Sep. 1994 - 15 Nov. 1999***
2002; 26p; In English
Report No.(s): DE2002-761435; No Copyright; Avail: Department of Energy Information Bridge
Previous DOE support for 'A Broad Research Program in the Sciences of Complexity' permitted the Santa Fe Institute to initiate new collaborative research within its Integrative Core activities as well as to host visitors to participate in research on specific topics that serve as motivation and testing ground for the study of general principles of complex systems. The critical aspect of this support is its effectiveness in seeding new areas of research. Indeed, this Integrative Core has been the birthplace of dozens of projects that later became more specifically focused and then won direct grant support independent of the core grants. But at early stages most of this multidisciplinary research was unable to win grant support as individual projects-both because it did not match well with existing grant program guidelines, and because the amount of funding needed was often too modest to justify a formal proposal to an agency. In fact, one of the attributes of core support has been that it permitted SFI to encourage high-risk activities because the cost was quite low. What is significant is how many of those initial efforts have been productive in the SFI environment.
NTIS
Research Projects; Multidisciplinary Research; Complex Systems; Motivation

20020073220 General Accounting Office, Washington, DC USA
Canceled DOD Appropriations: Improvements Made but More Corrective Actions are Needed
Jul. 2002; 40p
Report No.(s): PB2002-108362; GAO-02-747; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Specifically, you asked that we (1) monitor DOD's efforts to correct the problems for fiscal year 2000 closed account adjustments that were identified in our prior audit, (2) determine if DOD has experienced similar problems with closed account adjustments made during fiscal year 2001, (3) determine why DOD needs to make so many adjustments to the closed accounts, and (4) identify options available to DOD or the Congress to end the practice of adjusting closed appropriation accounts. Our previous review included a detailed review of $2.2 billion (81 percent) of the $2.7 billion DOD reported closed appropriation account adjustments made during fiscal year 2000. DOD is now reviewing its fiscal year 2001 closed account adjustments to determine if there are problems similar to those we identified for fiscal year 2000. As agreed with your offices, for our current review, we evaluated the $291 million of closed account adjustments for which DOD had completed its own assessments. DOD has advised us that it plans to review an additional $1.1 billion of its reported $1.9 billion of fiscal year 2001 closed account adjustments.
NTIS
Appropriations; Financial Management; Accounting

20020073229 Defence Science and Technology Organisation, Maritime Operation Div., Fishermans Bend, Australia
Representations and Processes In Decision Modelling
Greenhill, Stewart, Curtin Univ. of Technology, Australia; Venkatesh, Svetha, Curtin Univ. of Technology, Australia; Pearce, Adrian, Curtin Univ. of Technology, Australia; Ly, Thanh Chi, Defence Science and Technology Organisation, Australia; March 2002; 78p; In English
Report No.(s): DSTO-GD-0318; DODA-AR-012-146; Copyright; Avail: Issuing Activity
This report contains a survey by Curtin University on decision modelling which covers: 1) Our current understanding of how we make decisions, and points out our qualities, our weaknesses and the types of aids that could help us. Of note is the theory that people commit to options even though alternatives exist once a situation has been recognized. 2) Techniques useful for eliciting and representing knowledge about how experts make decisions. 3) What is situation assessment and how others have tried to capture the process and use the captured information. 4) The different technologies that could be employed to represent the process of situation assessment. This report represents the first step of a larger project to represent how submarine commanders assess situations.
Author
Decision Making; Situational Awareness; Decision Support Systems; Decision Theory; Data Mining

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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.

20020070682 NASA Langley Research Center, Hampton, VA USA
Experimental OAI-Based Digital Library Systems
Nelson, Michael L., Editor, NASA Langley Research Center, USA; Maly, Kurt, Editor, Old Dominion Univ., USA; Zubair, Mohammad, Editor, Old Dominion Univ., USA; Rusch-Feja, Diann, Editor, Max-Planck-Inst. for Human Development, Germany; April 2002; 140p; In English; 5th European Conference on Research and Advanced Technology for Digital Libraries, 4-9 Sep. 2001, Darmstadt, Germany; Also announced as 20020070683 through 20020070691; Original contains color illustrations
Contract(s)/Grant(s): RTOP 992-16-05-02
Report No.(s): NASA/TM-2002-211638; L-18186; NAS 1.15:211638; Copyright Waived; Avail: CASI; A07, Hardcopy; A02, Microfiche

The objective of Open Archives Initiative (OAI) is to develop a simple, lightweight framework to facilitate the discovery of content in distributed archives (http://www.openarchives.org). The focus of the workshop held at the 5th European Conference on Research and Advanced Technology for Digital Libraries (ECDL 2001) was to bring researchers in the area of digital libraries who are building OAI based systems so as to share their experiences, problems they are facing, and approaches they are taking to address them. The workshop consisted of invited talks from well-established researchers working in building OAI based digital library system along with short paper presentations.
Author
Digital Systems; Conferences; Integrated Library Systems; Data Processing

20020070683 Edinburgh Univ., Science and Engineering Library, Learning and Information Centre Project, UK
Convincing the Institution: Developing an Institutional Open Archive of Research Publications at the University of Edinburgh
MacColl, John, Edinburgh Univ., UK; Conacher, Avril, Edinburgh Univ., UK; Experimental OAI-Based Digital Library Systems; April 2002, pp. 27-33; In English; Also announced as 20020070682; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

This paper examines the process of creating an archive of research publications within a single, large research-oriented university. At the University of Edinburgh, we are in the process of creating such an archive at the present time, and are currently working with the Faculty of Science & Engineering, which is the largest faculty in the University, with approximately 7,000 students. Other faculties will be included in the archive at a later date, assuming additional funding can be made available. The creation of the archive is being led by the library, which is fully committed to the idea of an open research archive sustained by self-archiving. Creating a shared vision of this is difficult in several ways.
Author
Documents; Universities; Integrated Library Systems

20020070684 Tufts Univ., Perseus Project, MA USA
Integrated Data Harvesting in the Perseus Digital Library System
Smith, David A., Tufts Univ., USA; Mahoney, Anne, Tufts Univ., USA; Experimental OAI-Based Digital Library Systems; April 2002, pp. 34-42; In English; Also announced as 20020070682; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

The Perseus Project's document management system provides services for extracting information from diverse documents and reintegrating that information into document display. We demonstrate OAI services that integrate harvested metadata into the Perseus system and describe experiments with distributed information extraction on full text via the OAI protocol.
Author
Information Management; Digital Systems; Data Integration

20020070685 Dortmund Univ., Computer Science 6, Germany

Heterogeneity in Open Archives Metadata

Fischer, Gudrun, Dortmund Univ., Germany; Fuhr, Norbert, Dortmund Univ., Germany; Experimental OAI-Based Digital Library Systems; April 2002, pp. 43-46; In English; Also announced as 20020070682; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

In this paper, we have mentioned mostly syntactic differences between different open archives. In order to provide meaningful search and browse services, this heterogeneity needs to be reduced. We therefore strongly recommend using the Dublin Core specification. Additionally, Dublin Core qualifiers would significantly improve the comparability, parsing, and interpretation of the data. In order to cover all Dublin Core fields and treat substructures, additional Dublin Core qualifiers need yet to be developed. Author

Data Management; Heterogeneity; Documents

20020070686 Southampton Univ., Open Citation Project, UK

Enhancing OAI Metadata for Eprint Services: Two proposals

Brody, Tim, Southampton Univ., UK; Jiao, Zhuoan, Southampton Univ., UK; Hitchcock, Steve, Southampton Univ., UK; Carr, Les, Southampton Univ., UK; Harnad, Stevan, Southampton Univ., UK; Experimental OAI-Based Digital Library Systems; April 2002, pp. 47-52; In English; Also announced as 20020070682; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

The Open Archives Initiative has always maintained a distinction between data providers and service providers. The works at a functional level; some current projects are showing that it is less significant at an operational level. The Open Citation project harvests reference data from full-text eprint archives for reference linking, citation analysis and citation-ranked search. These are regarded as service to make these data available for export back to the full-text archives and to other service providers. Thus OpCit becomes a data provider too. The current Open Archives Protocol for Metadata Harvesting says nothing about full-text data harvesting for services such as these, nor about the export of processed data. This short paper outlines two proposals for progress on these issues.

Author

Protocol (Computers); Data Processing; Data Management

20020070687 European Organization for Nuclear Research

Integration of Grey Literature with Electronic Journals in the CERN Library

Pettenati, Corrado, European Organization for Nuclear Research; Experimental OAI-Based Digital Library Systems; April 2002, pp. 53-70; In English; Also announced as 20020070682; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

The topics include: 1) The CERN Library; 2) Definitions; 3) CERN grey literature management; 4) OAi protocol at CERN Library; and 5) A proposal for a new service in OAi protocol. This paper is presented in viewgraph form.

CASI

Libraries; Protocol (Computers); Data Integration

20020070688 Southampton Univ., UK

The Use of Open Archives: Who, How Often and Why

Carr, Les, Southampton Univ., UK; Experimental OAI-Based Digital Library Systems; April 2002, pp. 71-90; In English; Also announced as 20020070682; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

A general overview on the use of open archives is presented. The topic include: 1) Reasons for Introspection; 2) Usage analysis; 3) Attitude Analysis; and 4) Reflection. This paper is presented in viewgraph form.

CASI

Information Management; Literature

20020070689 Food and Agriculture Organization of the United Nations, Documentation Group, Rome, Italy

Metadata Framework for Resource Discovery of Agricultural Information

Onyancha, Irene, Food and Agriculture Organization of the United Nations, Italy; LeHuntWard, Fynvola, Food and Agriculture Organization of the United Nations, Italy; Fisseha, Frehiwot, Food and Agriculture Organization of the United Nations, Italy; Anibaldi, Stefano, Food and Agriculture Organization of the United Nations, Italy; Keizer, Johannes, Food and Agriculture Organization of the United Nations, Italy; Katz, Steve, Food and Agriculture Organization of the United Nations, Italy; Experimental OAI-Based Digital Library Systems; April 2002, pp. 91-98; In English; Also announced as 20020070682; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

This report outlines a proposed metadata framework for resource discovery of agricultural resources, and in particular to describe information resources in agricultural sciences. The overall work is the result of a collaborative effort between a number of partners in the agricultural community and the World Agricultural Information Centre of Food and Agriculture Organization (FAO). The endeavour is formally referred to as the ”Agricultural Metadata Standards Initiative., (AG Standard). It is based upon the elements and qualifiers proposed by the Dublin Core Metadata Initiative (DCMI).

Author

Agriculture; Data Processing; Information Management

20020070690 Old Dominion Univ., VA USA

OAI Experiences with Arc and Kepler

Zubair, Mohammad, Old Dominion Univ., USA; Experimental OAI-Based Digital Library Systems; April 2002, pp. 99-124; In English; Also announced as 20020070682; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

OAI is making feasible to build higher level services that federates metadata from heterogeneous resources and provide a unified interface for users to access these resources. The topics include: 1) Arc Overview; 2) Architecture; 4) Search Service; 5) Interactive Search; 6) Kepler Framework; and 7) Technical Report Interchange (TRI). This paper is in viewgraph form.

CASI

Architecture (Computers); Data Processing

20020070691 Humboldt Univ., Computing Centre, Berlin, German Democratic Republic

Open Archive Forum: European Support for Open Archives

Dobratz, Susanne, Humboldt Univ., German Democratic Republic; Experimental OAI-Based Digital Library Systems; April 2002, pp. 125-132; In English; Also announced as 20020070682; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

This paper presents European support for Open Archives. The topics include: 1) Project background; 2) Project objectives; and 3) practical details. This paper is presented in viewgraph form.

CASI

Data Processing; Protocol (Computers); Documents

20020070818 ManTech International Corp., USA

Implementating the 2001 Edition of SNT-TC-1A: Recertification Requirements

Schafer, Thom, ManTech International Corp., USA; Mar. 22, 2002; 4p; In English; American Society for Nondestructive Testing, Inc. (ASNT) Meeting, 22 Mar. 2002, Portland, OR, USA; Sponsored by American Society for Nondestructive Testing, Inc., USA Contract(s)/Grant(s): NAS5-32537; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This presentation covers recertification requirements for SNT-TC-1A including documentation requirements.

CASI

Certification; Nondestructive Tests

20020070912 NASA Glenn Research Center, Cleveland, OH USA

Gearing

Coy, John J., Army Aviation Systems Command, USA; Townsend, Dennis P., NASA Glenn Research Center, USA; Zaretsky, Erwin V., NASA Glenn Research Center, USA; December 1985; 72p; In English

Report No.(s): NASA/RP-1152; E-2003; NAS 1.61:1152; AVSCOM-TR 84-C-15; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Gearing technology in its modern form has a history of only 100 years. However, the earliest form of gearing can probably be traced back to fourth century B.C. Greece. This publication draws together current gear practice and integrates It with recent

advances in the technology. The history of gearing is reviewed briefly in the Introduction. Subsequent sections describe types of gearing and their geometry, processing, and manufacture. Both conventional and more recent methods of determining gear stress and deflections are considered. The subjects of life prediction and lubrication are additions to the literature, New and more complete methods of power loss prediction as well as an optimum design of spur gear meshes are described. Conventional and new types of power transmission systems are presented.
Author
Gear; Lubrication; Life (Durability)

20020072841 Rhode Island Univ., Transportation Center, USA
Design and Development of Information and Computer Systems for URITC (University of Rhode Island Transportation Center)
Peckham, J.; Dipippo, L.; Wolfe, V. F.; Oct. 2001; 56p; In English
Report No.(s): PB2002-108483; URI-TC-536105; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The purpose of the project is to provide the design of an infrastructure that will support ongoing and future research projects and the daily functioning of the transportation center. This includes statistical analyses and evaluations of products, systems and techniques for the development, maintenance, and scheduling of the intermodal transportation systems. This infrastructure will have several features that will facilitate ease of use, rapid initial development, and well designed growth and maintenance as follows: Real-time; Data warehousing and mining; Extensible and maintainable; Concurrence; Open and Free Software (whenever possible and practical); Web-based.
NTIS
Information Systems; Computer Programming; Transportation; Computer Systems Design

20020072950 National Defence Research Establishment, Dept. of Command and Control Warfare Technology, Linkoeping, Sweden
UML Based Metamodel for Modeling of Combat Structures ***UML Baserad Metamodell foer Modellering av Bekaempningskedjor***
Hallberg, N.; Fransson, J.; Mar. 2001; 28p; In Swedish
Report No.(s): PB2002-104972; FOI-R-0159-SE; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The purpose of this study is to create a meta-model for modeling and developing command and control systems. The resulting models could be used to describe the behavior of an individual tank as well as of a larger unit or a functional chain.
NTIS
Command and Control; Models; Information Systems

20020073170 NASA Ames Research Center, Moffett Field, CA USA
CIP Training Manual: Collaborative Information Portal Advance Training Information for Field Test Participants
Schreiner, John, NASA Ames Research Center, USA; Jul. 24, 2002; 4p; In English; MER 2003, 2003, Unknown; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
The Collaborative Information Portal (CIP) is a web-based information management and retrieval system. Its purpose is to provide users at MER (Mars Exploration Rover) mission operations with easy access to a broad range of mission data and products and contextual information such as the current operations schedule. The CIP web-server provides this content in a user customizable web-portal environment. Since CIP is still under development, only a subset of the full feature set will be available for the EDO field test. The CIP web-portal will be accessed through a standard web browser. CIP is intended to be intuitive and simple to use, however, at the training session, users will receive a one to two page reference guide, which should aid them in using CIP. Users must provide their own computers for accessing CIP during the field test. These computers should be configured with Java 1.3 and a Java 2 enabled browser. Macintosh computers should be running OS 10.1.3 or later. Classic Mac OS (OS 9) is not supported. For more information please read section 7.3 in the FIASCO Rover Science Operations Test Mission Plan. Several screen shots of the Beta Release of CIP are shown on the following pages.
Author
Information Management; Education; Internet Resources; Computer Networks

20020073182 Istituto Superiore di Sanita, Lab. di Virologia, Rome, Italy
Fourth Research Project on the Ethical, Psycho-social, Legal, Behavioral, Patient Care and Prevention Issues on AIDS: Operational Plan ***Quarto Progetto di Ricerca sugli Aspetti Etici, Psico-Sociali, Giuridici, Comportamentali, Assistenziali e Della Prevenzione nel Campo dell'AIDS. Piano Executivo***
Verani, P.; 2001; 38p; In Italian
Report No.(s): PB2002-105625; ISTISAN-01/24; Copyright; Avail: National Technical Information Service (NTIS), Microfiche
Contents include the following: Introduction; Statistical framework for shot-boundary detection (Introduction, Previous work on shot-boundary detection, A robust statistical framework for shot-boundary detection, Detector for abrupt shot boundaries, Discussion); Automatically abstracting video using key frames (Introduction, Previous work on key-frame extraction, Extracting key frames by approximating the curve of visual-content variations, Key-frame extraction based on cluster-validity analysis, Discussion); High-level video content analysis (Introduction, Related work, Automatically segmenting movies into logical story units, Detecting anchor person shots in news programs, Discussion); Trends in image coding: The 'Fourth Criterion' (Introduction, A concept of an alternative image CODEC, Image CODEC based on simplified VQ, Performance evaluation, Discussion); Directions for future research; References; Summary.
NTIS
Information Retrieval; Multimedia; Cluster Analysis; Patients; Performance Tests

20020073198 American Geological Inst., Alexandria, VA USA
Fossil Energy: Educational Geoscience Data Repository System, Phase 3, Implementation and Operation of the Repository ***Annual Report, Nov. 2001 - Mar. 2002***
May 2002; 22p; In English
Report No.(s): DE2002-794378; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The National Geoscience Data Repository System, Phase III was an operational project focused on coordinating and facilitating transfers of at-risk geoscience data from the private sector to the public domain.
NTIS
Geology; Data Transmission; Data Bases; Geophysics

84
LAW, POLITICAL SCIENCE AND SPACE POLICY

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

20020072840 National Drug Intelligence Center, Johnstown, PA USA
Drug Threat Assessment: USA - Canada Border
Dec. 2001; 44p; In English
Report No.(s): PB2002-108514; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
During the Fourth Canada-USA Cross-Border Crime Forum, held in Washington, D.C., in June 2000, it was agreed to undertake a joint assessment of the common threat posed by the cross-border drug trade. The enclosed report, USA-Canada Border Drug Threat Assessment, is the result of that agreement. Numerous agencies involved in fighting drugs participated in its preparation. The National Drug Intelligence Center was critical in the production of the final report. This assessment has confirmed that illicit drugs are being transported in both directions across the border to meet demand in both our countries. Its preparation has also served to highlight the importance of collecting and sharing data and intelligence on the drug problem to truly understand the magnitude of the threat posed by drugs. Effective strategic decision making depends on this.
NTIS
Drugs; Threat Evaluation; Canada; Police; Borders; Control

20020073173 General Accounting Office, Washington, DC USA
Export Controls: More Thorough Analysis Needed to Justify Changes in High Performance Computer Controls
Jul. 2002; 40p; In English
Report No.(s): PB2002-108365; GAO-02-892; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The USA controls the export of high performance computers for national security and foreign policy reasons. U.S. export control policy seeks to balance U.S. economic interests in promoting high technology exports with national security interests in maintaining a military advantage over potential adversaries. High performance computers have both civilian and military applications, operate at or above a defined performance threshold (measured in millions of theoretical operations per second), and

require an export license to particular destinations such as China, India, and Russia. The President has periodically changed, on the basis of technological advances, the threshold above which licenses are required.
NTIS
Foreign Policy; Commerce; Computers; International Trade

20020073217 ACTION/Peace Corps, Washington, DC USA
Peace Corps' Strategic Plan FY 2000-2005 under the Government Performance and Results Act
Sep. 29, 2000; 28p; In English
Report No.(s): PB2002-108586; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
The Peace Corps is pleased to provide its revised Government Performance and Results Act (GPRA) strategic plan reflecting the agency's long-standing commitment to the unique role that its Volunteers perform to further the three goals set forth in the Peace Corps Act: to work at the grassroots level with people of the host countries in sustainable development activities that will improve the conditions of their lives; and to foster improved mutual understanding and build links between the American people and the people of host countries; to demonstrate, through the personal commitment of the Volunteers, the interest and involvement of American citizens in the welfare of people of other countries that is distinct and separate from the official relations and policies of governments.
NTIS
Governments; Policies; Reflection

85
TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION

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

20020073107 NASA Marshall Space Flight Center, Huntsville, AL USA
Technology Assessments within NASA's Integrated Technology Assessment Center
Taylor, J. L., NASA Marshall Space Flight Center, USA; Neely, M. A., NASA Marshall Space Flight Center, USA; Curran, F. M., Science Applications International Corp., USA; Christensen, E. R., Science Applications International Corp., USA; Escher, D., Science Applications International Corp., USA; Lovell, N., Science Applications International Corp., USA; 26th JANNAF Airbreathing Propulsion Subcommittee Meeting; April 2002; Volume 1, pp. 155-162; In English; Also announced as 20020073093; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC
NASA's Advanced Space Transportation Program (ASTP) founded the Integrated Technology Assessment Center (ITAC) to provide a comprehensive, systematic approach to identify long-term technology needs, to quantify payoffs for technology investments, and to assess the progress of ASTP-sponsored technology programs in the hypersonics/Earth-to-orbit area. to accomplish these goals, the ITAC has assembled an experienced team representing a broad sector of the aerospace community and developed a systematic assessment process complete with supporting tools. In the ITAC approach, concepts for transportation systems are first selected based on relevance to the ASTP. Models of these concepts are then developed and data on advanced technologies are collected. Projections of key technology characteristics with respect to the specific concepts of interest are made. Both the models and technology projections are then fed into the ITAC's probabilistic systems analysis framework. The probabilistic outputs are weighed against metrics of interest to ASTP and a multivariate decision making process is used to provide inputs for technology prioritization within the ASTP. At present, the ITAC program is working to evaluate a variety of technologies for three two-stage hypersonic vehicle concepts. Concepts include an all rocket, vertical take off-horizontal landing (VTHL) system, a horizontal take-off-horizontal landing (HTHL) RBCC-propelled first stage/all rocket second stage system, and an HTHL turbine-based first stage/all rocket second stage system. This paper will provide a status update of the ITAC program including current results and plans.
Author
Technology Assessment; Multivariate Statistical Analysis; Systems Analysis; Transportation

20020073424 Environmental Protection Agency, National Exposure Research Lab., Las Vegas, NV USA
Global Positioning Systems: Technical Implementation Guidance
Bridges, T.; Brilis, G. M.; Hansen, D.; Itkin, C.; Cross, C.; Apr. 2002; 70p; In English
Report No.(s): PB2002-107532; NERL/LV/ESD-02-048; EPA/600/R-02/031; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The U.S. EPA Geospatial Quality Council (GQC) was formed in 1998 to provide Quality Assurance guidance for the development, use, and products of geospatial activities and research. The long-term goals of the GQC are expressed in a living document, currently the EPA GeospatialQuality Council Strategy Plan, FY-02, EPA/600/R-011063. The GQC is approaching the development of guidance and technical documents in the flow order of the Geospatial Information Lifecycle. The first two major products of the GQC are: a training course GIS for QA Professionals, which can be located at htti://www.epa.gov/RegionO6/6en/gis-ga/index.htm, and the EPA QA Guidance for Developing Geospatially-related Quality Assurance Projects,EPA/600/R-01/062. It is important to note that the GQC operates without a budget. A survey conducted jointly by the EPA Data Acquisition Branch (DAB) of the Office of Information Collection in the Office of Environmental Information and the GQC determined that the approach to GPS data collection and disposition throughout the EPA was inconsistent.GQC literature research determined that existing documents were technically outdated and did not address legal considerations, data disposition, and information management. This document is intended to fill that gap and be treated as a living document by its organization custodian.
NTIS
Quality Control; Life (Durability); Global Positioning System; Environment Protection; Manuals

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SPACE SCIENCES (GENERAL)

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

20020072224 NASA Glenn Research Center, Cleveland, OH USA
The Next Generation of Space Cells for Diverse Environments
Landis, Geoffrey A., NASA Glenn Research Center, USA; Bailey, Sheila, NASA Glenn Research Center, USA; Raffaelle, Ryne, Rochester Inst. of Tech., USA; [2002]; 7p; In English; 6th European Space Power Conference, 6-11 May 2002, Oporto, Portugal
Contract(s)/Grant(s): RTOP 755-A4-04; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Future science, military and commercial space missions are incredibly diverse. Military and commercial missions range from large arrays of hundreds of kilowatt to small arrays of ten watts in various Earth orbits. While science missions also have small to very large power needs there are additional unique requirements to provide power for near-sun missions and planetary exploration including orbiters, landers and rovers both to the inner planets and the outer planets with a major emphasis in the near term on Mars. These mission requirements demand cells for low intensity, low temperature applications, high intensity, high temperature applications, dusty environments and often high radiation environments. This paper discusses mission requirements, the current state of the art of space solar cells, and a variety of both evolving thin-film cells as well as new technologies that may impact the future choice of space solar cells for a specific mission application.
Author
Solar Cells; Space Missions; Space Exploration; Earth Orbits; Mission Planning

89
ASTRONOMY

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

20020070796 NASA Goddard Space Flight Center, Greenbelt, MD USA
In Hot Pursuit of the Hidden Companion of Carinae: An X-Ray Determination of the Wind Parameters
Pittard, J. M., Leeds Univ., UK; Corcoran, M. F., Universities Space Research Association, USA; [2002]; 14p; In English
Contract(s)/Grant(s): NCC5-356; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present X-ray spectral fits to a recently obtained Chandra grating spectrum of eta Carinae, one of the most massive and powerful stars in the Galaxy and which is strongly suspected to be a colliding wind binary system. Hydrodynamic models of

colliding winds are used to generate synthetic X-ray spectra for a range of mass-loss rates and wind velocities. They are then fitted against newly acquired Chandra grating data. We find that due to the low velocity of the primary wind (approximately 500 km per sec), most of the observed X-ray emission appears to arise from the shocked wind of the companion star. We use the duration of the lightcurve minimum to fix the wind momentum ratio at eta = 0.2. We are then able to obtain a good fit to the data by varying the mass-loss rate of the companion and the terminal velocity of its wind. We find that M(sub 2) is approximately 10(exp -5) solar mass per yr and upsilon(sub infinity(sub 2)) is approximately 3000 km per sec. With observationally determined values of approximately 500- 700 km per sec for the velocity of the primary wind, our fit implies a primary mass-loss rate of M(sub 1) approximately 2.5 x 10(exp -4) solar mass per yr. This value is smaller than commonly inferred, although we note that a lower mass-loss rate can reduce some of the problems noted when a value as high as 10(exp -3) solar mass per yr is used. The wind parameters of the companion are indicative of a massive star which may or may not be evolved. The line strengths appear to show slightly sub-solar abundances, although this needs further confirmation. It also appears that the primary star is responsible for the nebula.
Author
Companion Stars; X Ray Spectra; Early Stars; Wind Velocity; Terminal Velocity; Mathematical Models; X Ray Spectroscopy; X Ray Astronomy

20020070803 NASA Goddard Space Flight Center, Greenbelt, MD USA
No Compton Reflection In a Chandra/RXTE Observation of Mkn 509: Implications for the Fe-K Line Emission From Accreting X-Ray Sources
Yaqoob, Tahir, NASA Goddard Space Flight Center, USA; Padmanabhan, Urmila, Johns Hopkins Univ., USA; Kraemer, Steven B., NASA Goddard Space Flight Center, USA; Crenshaw, D. Michael, Georgia State Univ., USA; Mckernan, Barry, Johns Hopkins Univ., USA; George, Ian M., NASA Goddard Space Flight Center, USA; Turner, T. Jane, NASA Goddard Space Flight Center, USA; Apr. 29, 2002; 24p; In English
Contract(s)/Grant(s): NCC5-447; NAG5-10769; NAG5-7385; NAG5-4103; GO1-2101X; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We report the results of simultaneous Chandra and RXTE observations of the Seyfert 1 galaxy Mkn 509. We deconvolve the broad and narrow Fe-K emission-line components for which we measure rest-frame equivalent widths of 119+/-18 eV and 57+/-13 eV respectively. The broad line has a FWHM of 57,600((sup 14,400)(sub -21,000)) km/s and the narrow line is unresolved, with an upper limit on the FWHM of 4,940 km/s. Both components must originate in cool matter since we measure rest-frame center energies of 6.36((sup +0.13)(sub -0.12)) keV and 6.42+/-0.01 keV for the broad and narrow line respectively. This rules out He-like and H-like Fe for the origin of both the broad and narrow lines. If, as is widely accepted, the broad Fe-K line originates in Thomson-thick matter (such as an accretion disk), then one expects to observe spectral curvature above approximately 10 keV, (commensurate with the observed broad line), characteristic of the Compton-reflection continuum. However our data sets very stringent limits on deviations of the observed continuum from a power law. Light travel-time delays cannot be invoked to explain anomalies in the relative strengths of the broad Ferry line and Compton-reflection continuum since they are supposed to originate in the same physical location. We are forced to conclude that both the broad and narrow Fe-K lines had to originate in Thomson-thin matter during our observation. This result, for a single observation of just one source, means that our understanding of Fe K line emission and Compton reflection from accreting X-ray sources in general needs to be re-examined. For example, if an irradiated accretion disk existed in Mkn 509 at the time of the observations, the lack of spectral curvature above approximately 10 keV suggests two possibilities. Either the disk was Thomson-thick and highly ionized, having negligible Fe-K line emission and photoelectric absorption or the disk was Thomson-thin producing some or all of the broad Fe-K line emission. In the former case, the broad Fe-K line had to have produced in a Thomson-thin region elsewhere. In both cases the predicted spectral curvature above approximately 10 keV is negligible. An additional implication of our results is that any putative obscuring torus in the system, required by unification models of active galaxies, must also be Thomson-thin. The same applies to the optical broad line region (BLR) if it has a substantial covering factor.
Author
Accretion Disks; Active Galaxies; X Ray Astronomy; K Lines; Spectral Line Width; Curvature; Astronomical Models

20020070815 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
VEXT: A Virtual Observatory Exploration Toolkit *Final Report*
Schneider, Jeff, Carnegie-Mellon Univ., USA; Connolly, Andy, Pittsburgh Univ., USA; [2002]; 14p; In English
Contract(s)/Grant(s): NAG5-10739; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This final report consists of two main parts. The first is taken from a paper by the PiCA (Pittsburgh Computational Astrostatistics) Group which describes our ongoing work in fast computation of n-point correlation functions. We present here

a new algorithm for the fast computation of N-point correlation functions in large astronomical data sets. The algorithm is based on kd-trees which are decorated with cached sufficient statistics thus allowing for orders of magnitude speed-ups over the naive non-tree-based implementation of correlation functions. We further discuss the use of controlled approximations within the computation which allows for further acceleration. In summary, our algorithm now makes it possible to compute exact, all-pairs, measurements of the two, three and four-point correlation functions for cosmological data sets like the Sloan Digital Sky Survey and the next generation of Cosmic Microwave Background experiments. The second part summarizes the progress made by the PiCA Group in this area through the AISR grant.
Author
Algorithms; Correlation; Astrophysics; Sky Surveys (Astronomy); Statistics

20020071039 NASA Goddard Space Flight Center, Greenbelt, MD USA
Toroidal Varied-Line Space (TVLS) Gratings
Thomas, Roger J., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; Astronomical Telescopes and Instrumentation, 22-28 Aug. 2002, Waikoloa, HI, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

It is a particular challenge to develop a stigmatic spectrograph for XUV wavelengths since the very low normal-incidence reflectance of standard materials most often requires that the design be restricted to a single optical element which must simultaneously provide both re-imaging and spectral dispersion. This problem has been solved in the past by the use of toroidal gratings with uniform line-spaced rulings (TULS). A number of solar EUV (Extreme Ultraviolet) spectrometers have been based on such designs, including SOHO/CDS, Solar-B/EIS, and the sounding rockets SERTS and EUNIS. More recently, Kita, Harada, and collaborators have developed the theory of spherical gratings with varied line-space rulings (SVLS) operated at unity magnification, which have been flown on several astronomical satellite missions. We now combine these ideas into a spectrometer concept that puts varied-line space rulings onto toroidal gratings. Such TVLS designs are found to provide excellent imaging even at very large spectrograph magnifications and beam-speeds, permitting extremely high-quality performance in remarkably compact instrument packages. Optical characteristics of two solar spectrometers based on this concept are described: SUMI, proposed as a sounding rocket experiment, and NEXUS, proposed for the Solar Dynamics Observatory mission.
Author
Solar Spectrometers; Design Analysis; Product Development; Optical Properties

20020071045 NASA Goddard Space Flight Center, Greenbelt, MD USA
Design and Fabrication of Two-Dimensional Superconducting Bolometer Array for SAFIRE
Benford, Dominic, NASA Goddard Space Flight Center, USA; Voellmer, George, NASA Goddard Space Flight Center, USA; Chervenak, Jay, NASA Goddard Space Flight Center, USA; Irwin, Kent, National Inst. of Standards and Technology, USA; Moseley, S. Harvey, NASA Goddard Space Flight Center, USA; Shafer, Rick, NASA Goddard Space Flight Center, USA; Staguhn, Johannes, Science Systems and Applications, Inc., USA; [2002]; 2p; In English; SPIE Workshop, 22-28 Aug. 2002, Waikoloa, HI, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Submillimeter and Far-InfraRed Experiment (SAFIRE) on the SOFIA airborne observatory will employ a large-format, two-dimensional, close-packed bolometer array. SAFIRE is an imaging Fabry-Perot spectrometer operating at wavelengths between 100 micron and 700 micron. The array format is 16x32 pixels, using a 32-element multiplexer developed in part for this instrument. The low backgrounds achieved in spectroscopy require very sensitive detectors with NEPs (Noise Equivalent Powers) of order 5x10(exp 18)W/square root of Hz. An architecture which permits 512 pixels to be placed adjacent to each other in an area the size of a postage stamp, integrate them with multiplexers, and provide all the necessary wiring interconnections is a complex proposition, but can be achieved. Superconducting detectors can be close-packed using the Pop-Up Detector (PUD) format, and SQUID multiplexers operating at the detector bas temperature can be intimately coupled to them. The result is a compact array, easily scalable to kilopixel arrays. Engineering results from the first such detector arrays will be presented.
Author
Bolometers; Wavelength Division Multiplexing; Design Analysis; Equipment Specifications; Product Development

20020071072 NASA Goddard Space Flight Center, Greenbelt, MD USA
Progress Towards High-Sensitivity Arrays of Detectors of Sub-mm Radiation using Superconducting Tunnel Junctions with Radio-Frequency Single-Electron Transistors
Stevenson, T. R., NASA Goddard Space Flight Center, USA; Hsieh, W.-T., NASA Goddard Space Flight Center, USA; Li, M. J., NASA Goddard Space Flight Center, USA; Stahle, C. M., NASA Goddard Space Flight Center, USA; Wollack, E. J., NASA

Goddard Space Flight Center, USA; Schoelkopf, R. J., Yale Univ., USA; [2002]; 1p; In English; Second Workshop on New Concepts for Far-IR Submillimeter Space Astronomy, 7-8 Mar. 2002, Greenbelt, MD, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The science drivers for the SPIRIT/SPECS missions demand sensitive, fast, compact, low-power, large-format detector arrays for high resolution imaging and spectroscopy in the far infrared and submillimeter. Detector arrays with 10,000 pixels and sensitivity less than 10(exp 20)-20 W/Hz(exp 20)0.5 are needed. Antenna-coupled superconducting tunnel junction detectors with integrated rf single-electron transistor readout amplifiers have the potential for achieving this high level of sensitivity, and can take advantage of an rf multiplexing technique when forming arrays. The device consists of an antenna structure to couple radiation into a small superconducting volume and cause quasiparticle excitations, and a single-electron transistor to measure currents through tunnel junction contacts to the absorber volume. We will describe optimization of device parameters, and recent results on fabrication techniques for producing devices with high yield for detector arrays. We will also present modeling of expected saturation power levels, antenna coupling, and rf multiplexing schemes.

Author

Tunnel Junctions; Wavelength Division Multiplexing; Transistors; Stellar Spectrophotometry; Product Development; Systems Engineering; Submillimeter Waves

20020071073 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Stellar Imager (SI) Mission Concept

Carpenter, Kenneth S., NASA Goddard Space Flight Center, USA; Schrijver, Carolus J., Lockheed Martin Advanced Technology Center, USA; [2002]; 2p; In English; SPIE Astronomical Telescopes and Instrumentation, 22-28 Aug. 20002, Waikoloa, HI, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Stellar Imager (SI) is envisioned as a space-based, UV-optical interferometer composed of 10 or more one-meter class elements distributed with a maximum baseline of 0.5 approximately km. It will image stars and binaries with one hundred to one thousand resolution elements on their surface and enable long-term studies of stellar magnetic activity patterns and their evolution with time, for comparison with those on the sun. It will also sound their interiors through asteroseismology to image internal structure, differential rotation, and large-scale circulations. SI will enable us to understand the various effects of magnetic fields of stars, the dynamos that generate these fields, and the internal structure and dynamics of the stars in which these dynamos operate. The ultimate goal of the mission is to achieve the best possible forecasting of solar activity as a driver of climate and space weather on times scales ranging from months to decades, and an understanding of the impact of stellar magnetic activity on astrobiology and life in the Universe. The road to that goal will revolutionize our understanding of stars and stellar systems, the building blocks of the Universe. Fitting naturally within the NASA and ESA long-term time lines, SI complements defined missions, and with them will show us entire other solar systems, from the central star to their orbiting planets. In this paper we will describe the scientific goals of the mission, the performance requirements needed to address those goals, and the design concepts now under study.

Author

Interferometers; Stellar Magnetic Fields; Stellar Activity; Asteroseismology; Stellar Interiors; Mission Planning

20020071075 NASA Goddard Space Flight Center, Greenbelt, MD USA

Ultralow-Background Large-Format Bolometer Arrays

Benford, Dominic, NASA Goddard Space Flight Center, USA; Chervenak, Jay, NASA Goddard Space Flight Center, USA; Irwin, Kent, National Inst. of Standards and Technology, USA; Moseley, S. Harvey, NASA Goddard Space Flight Center, USA; [2002]; 2p; In English; SPIE Workshop, 22-28 Aug. 2002, Waikoloa, HI, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

In the coming decade, work will commence in earnest on large cryogenic far-infrared telescopes and interferometers. All such observatories - for example, SAFIR, SPIRIT, and SPECS - require large format, two dimensional arrays of close-packed detectors capable of reaching the fundamental limits imposed by the very low photon backgrounds present in deep space. In the near term, bolometer array architectures which permit 1000 pixels - perhaps sufficient for the next generation of space-based instruments - can be arrayed efficiently. Demonstrating the necessary performance, with Noise Equivalent Powers (NEPs) of order 10-20 W/square root of Hz, will be a hurdle in the coming years. Superconducting bolometer arrays are a promising technology for providing both the performance and the array size necessary. We discuss the requirements for future detector arrays in the far-infrared and submillimeter, describe the parameters of superconducting bolometer arrays able to meet these requirements, and

detail the present and near future technology of superconducting bolometer arrays. of particular note is the coming development of large format planar arrays with absorber-coupled and antenna-coupled bolometers.
Author
Bolometers; Product Development; Design Analysis; Satellite-Borne Instruments; Wavelength Division Multiplexing

20020072722 NASA Marshall Space Flight Center, Huntsville, AL USA
Chandra Observations of Neutron Stars: An Overview
Weisskopf, M. C., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; Seminar of Neutron Stars and Pulsars, 21-21 Jan. 2002, Bad Honnef, Germany; No Copyright; Avail: Issuing Activity; Abstract Only

We present a brief review of Chandra observations of neutron stars, with a concentration on neutron stars in supernova remnants. The early Chandra results clearly demonstrate how critical the angular resolution has been in order to separate the neutron star emission from the surrounding nebulosity.
Author
Neutron Stars; Supernova Remnants; Spaceborne Telescopes

20020072729 NASA Goddard Space Flight Center, Greenbelt, MD USA
Radio Sources Associated with Intermediate X-ray Luminosity Objects in Merging Galaxy Systems
Neff, S. G., NASA Goddard Space Flight Center, USA; Ulvestad, J. S., National Radio Astronomy Observatory, USA; [2002]; 1p; In English; 2002 Summer Program of the Aspen Center for Physics, 24 Jun. - 7 Jul. 2002, Aspen, CO, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We present new, high-resolution 6, 3.6, and 2 cm radio images of a time-ordered sequence of merging galaxy systems. The new data have a resolution of less than 100pc and a sensitivity comparable to a few x Cas A. We detect compact radio sources in all systems, generally embedded in more diffuse radio emission at the longer wavelengths. Several of the compact radio sources are coincident with compact Intermediate-luminosity X-ray Objects (IXOs) in these systems, and many more are within the 3$/sigma$ Chandra position errors for other IXOs. The fraction of radio identifications and the nature of the radio sources changes as a function of merger stage. These data suggest that the IXOs are associated with complexes of supernova remnants, and therefore with star formation that has occurred within the last $/sim$10$circumflex7$ yr, but are not located in HII regions where copious star formation is occurring currently.
Author
Radio Sources (Astronomy); Radio Emission; Luminosity; X Ray Imagery; Galactic Evolution

20020072985 Hawaii Univ., Inst. for Astronomy, Honolulu, HI USA
Observation and Analysis of Jovian and Saturnian Satellite Mutual Events ***Final Report, 15 Mar. 1997 - 14 Sep. 2001***
Tholen, David J., Hawaii Univ., USA; [2001]; 4p; In English
Contract(s)/Grant(s): NAG5-4223; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The main goal of this research was to acquire high time resolution photometry of satellite-satellite mutual events during the equatorial plane crossing for Saturn in 1995 and Jupiter in 1997. The data would be used to improve the orbits of the Saturnian satellites to support Cassini mission requirements, and also to monitor the secular acceleration of Io's orbit to compare with heat flow measurements.
Author
Photometry; Saturn (Planet); Jupiter (Planet); Io; Cassini Mission; Data Processing

20020073005 National Optical Astronomy Observatories, Tucson, AZ USA
NOAO Newsletter, No. 71
Isbell, Doug, Editor, National Optical Astronomy Observatories, USA; Lauer, Tod R., Editor, National Optical Astronomy Observatories, USA; Bell, Dave, Editor, National Optical Astronomy Observatories, USA; vanderBliek, Nicole, Editor, National Optical Astronomy Observatories, USA; Green, Richard, Editor, National Optical Astronomy Observatories, USA; Hinkle, Ken, Editor, National Optical Astronomy Observatories, USA; Adams, Sally, Editor, National Optical Astronomy Observatories, USA; Leibacher, John, Editor, National Optical Astronomy Observatories, USA; Piano, Priscilla, Editor, National Optical Astronomy Observatories, USA; Hopkins, Stephen, Editor, National Optical Astronomy Observatories, USA; September 2002; 49p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This journal issue is the newsletter of the National Optical Astronomical Observatory for the month of September, 2002. It summarizes recent research, and contains information on the US Gemini Program (USGP), telescope access time and other issues

at observatories, operations at Kitt Peak National Observatory (KPNO), the National Solar Observatory (NSO), as well as public affairs and educational outreach.
Author
Astronomical Observatories; Operations; Education

20020073029 NASA Ames Research Center, Moffett Field, CA USA
The Discovery of Extrasolar Planets by Backyard Astronomers
Castellano, Tim, NASA Ames Research Center, USA; Laughlin, Greg, California Univ., USA; [2002]; 10p; In English; IAPPP Western Wing Workshop, 22-23 May 2002, Big Bear, CA, USA; Sponsored by International Amateur-Professional Photoelectric Photometry, Unknown; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The discovery since 1995 of more than 80 planets around nearby solar-like stars and the photometric measurement of a transit of the jovian mass planet orbiting the solar-like star HD 209458 (producing a more than 1% drop in brightness that lasts 3 hours) has heralded a new era in astronomy. It has now been demonstrated that small telescopes equipped with sensitive and stable electronic detectors can produce fundamental scientific discoveries regarding the frequency and nature of planets outside the solar system. The modest equipment requirements for the discovery of extrasolar planetary transits of jovian mass planets in short period orbits around solar-like stars are fulfilled by commercial small aperture telescopes and CCD (charge coupled device) imagers common among amateur astronomers. With equipment already in hand and armed with target lists, observing techniques and software procedures developed by scientists at NASA's Ames Research Center and the University of California at Santa Cruz, non-professional astronomers can contribute significantly to the discovery and study of planets around others stars. In this way, we may resume (after a two century interruption!) the tradition of planet discoveries by amateur astronomers begun with William Herschel's 1787 discovery of the 'solar' planet Uranus.
Author
Extrasolar Planets; Stars; Astronomy; Astronomical Photometry

20020073168 NASA Ames Research Center, Moffett Field, CA USA
Spectroscopic Detection of a Stellar-like Photosphere in an Accreting Protostar
Greene, Thomas P., NASA Ames Research Center, USA; Lada, Charles J., Harvard-Smithsonian Center for Astrophysics, USA; [2002]; 16p; In English
Contract(s)/Grant(s): RTOP 344-37-22-11; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present high-resolution (R is approximately equal to 18,000), high signal-to-noise 2 micron spectra of two luminous, X-ray flaring Class I protostars in the rho Ophiuchi cloud acquired with the NIRSPEC (near infrared spectrograph) of the Keck II telescope. We present the first spectrum of a highly veiled, strongly accreting protostar which shows photospheric absorption features and demonstrates the stellar nature of its central core. We find the spectrum of the luminous (L (sub bol) = 10 solar luminosity) protostellar source, YLW 15, to be stellar-like with numerous atomic and molecular absorption features, indicative of a K5 IV/V spectral type and a continuum veiling r(sub k) = 3.0. Its derived stellar luminosity (3 stellar luminosity) and stellar radius (3.1 solar radius) are consistent with those of a 0.5 solar mass pre-main-sequence star. However, 70% of its bolometric luminosity is due to mass accretion, whose rate we estimate to be 1.7 x 10(exp -6) solar masses yr(exp -1). We determine that excess infrared emission produced by the circumstellar accretion disk, the inner infalling envelope, and accretion shocks at the surface of the stellar core of YLW 15 all contribute significantly to its near-IR (infrared) continuum veiling. Its rotational velocity v sin i = 50 km s(exp -1) is comparable to those of flat-spectrum protostars but considerably higher than those of classical T Tauri stars in the rho Oph cloud. The protostar may be magnetically coupled to its circumstellar disk at a radius of 2 - 3 R(sub *). It is also plausible that this protostar can shed over half its angular momentum and evolve into a more slowly rotating classical T Tauri star by remaining coupled to its circumstellar disk (at increasing radius) as its accretion rate drops by an order of magnitude during the rapid transition between the Class I and Class II phases of evolution. The spectrum of WL 6 does not show any photospheric absorption features, and we estimate that its continuum veiling is r(sub k) is greater than or equal to 4.6. Its low luminosity (2 solar masses) and high veiling dictate that its central protostar is very low mass, M is approx. 0.1 solar masses. We also evaluate multi-epoch X ray data along with these spectra and conclude that the X ray variabilities of these sources are not directly related to their protostellar rotation velocities.
Author
Infrared Telescopes; Protostars; Photosphere; Stellar Activity; Infrared Astronomy; Accretion Disks; Stellar Spectra

20020073436 Caelum Research Corp., Moffett Field, CA USA

SOFIA's Choice: Automating the Scheduling of Airborne Observations

Frank, Jeremy, Caelum Research Corp., USA; [1999]; 10p; In English; 2nd International Workshop on Planning and Scheduling for Space, 16-18 Mar. 2000, Unknown

Contract(s)/Grant(s): NAS2-14217; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper describes the problem of scheduling observations for an airborne telescope. Given a set of prioritized observations to choose from, and a wide range of complex constraints governing legitimate choices and orderings, how can we efficiently and effectively create a valid flight plan which supports high priority observations? This problem is quite different from scheduling problems which are routinely solved automatically in industry. For instance, the problem requires making choices which lead to other choices later, and contains many interacting complex constraints over both discrete and continuous variables. Furthermore, new types of constraints may be added as the fundamental problem changes. As a result of these features, this problem cannot be solved by traditional scheduling techniques. The problem resembles other problems in NASA and industry, from observation scheduling for rovers and other science instruments to vehicle routing. The remainder of the paper is organized as follows. In 2 we describe the observatory in order to provide some background. In 3 we describe the problem of scheduling a single flight. In 4 we compare flight planning and other scheduling problems and argue that traditional techniques are not sufficient to solve this problem. We also mention similar complex scheduling problems which may benefit from efforts to solve this problem. In 5 we describe an approach for solving this problem based on research into a similar problem, that of scheduling observations for a space-borne probe. In 6 we discuss extensions of the flight planning problem as well as other problems which are similar to flight planning. In 7 we conclude and discuss future work.

Author

Roving Vehicles; Flight Plans; Telescopes; Scheduling

20020073457 Swedish Inst. of Space Physics, Uppsala, Sweden

Tail Lobe Revisited: Magnetic Field Modeling Based on Plasma Data

Karlsson, S. B. P.; Tsyganenko, N. A.; Jun. 1999; 34p; In English; Sponsored in part by Anna Maria Lundin Scolarship Fund

Report No.(s): PB2002-105057; IRF-SR-260; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Plasma data from the ISEE-1 and -2 spacecraft during 1977-1980 have been used to determine the distribution of data points in the magnetotail in the range of distances -20 is less than XGSM is less than --15, i.e. which of the records that were located in the current sheet, in the tail lobe, in the magnetosheath and in the boundary layers respectively. The ISEE-1 and -2 magnetic field data for the records in the tail lobe were then used to model the tail lobe magnetic field dependence on the solar wind dynamic pressure, on the Interplanetary Magnetic Field (IMF) and on the Dst index. The tail lobe magnetic field was assumed to be dependent on the square root of the dynamic pressure based on the balance between the total magnetic pressure in the tail lobes and the dynamic pressure of the solar wind. The IMF dependent terms, added to the pressure term, were sought in many different forms while the Dst dependence of the tail lobe magnetic field was assumed to be linear. The field shows a strong dependence on the square root of the dynamic pressure and the different IMF dependent terms all constitute a significant contribution to the total field. However, the dependence on the Dst index turned out to be very weak at those down-tail distances. The results of this study are intended to be used for parameterizing future versions of the data-based models of the global magnetospheric magnetic field.

NTIS

Dynamic Pressure; International Sun Earth Explorer 1; Interplanetary Magnetic Fields; Magnetic Effects; Wind Pressure; Magnetosheath

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ASTROPHYSICS

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

20020070804 NASA Goddard Space Flight Center, Greenbelt, MD USA

Chandra Observation of Luminous and Ultraluminous X-ray Binaries in M101

Mukai, K., NASA Goddard Space Flight Center, USA; Pence, W. D., NASA Goddard Space Flight Center, USA; Snowden, S. L., NASA Goddard Space Flight Center, USA; Kuntz, K. D., Maryland Univ. Baltimore County, USA; 2002; 14p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

X-ray binaries in the Milky Way are among the brightest objects on the X-ray sky. With the increasing sensitivity of recent missions, it is now possible to study X-ray binaries in nearby galaxies. We present data on six ultraluminous binaries in the nearby

spiral galaxy, M101, obtained with Chandra ACIS-S. of these, five appear to be similar to ultraluminous sources in other galaxies, while the brightest source, P098, shows some unique characteristics. We present our interpretation of the data in terms of an optically thick outflow, and discuss implications.
Author
X Ray Binaries; X Ray Astronomy; X Ray Spectroscopy; Stellar Luminosity; Spiral Galaxies; Black Holes (Astronomy)

20020070806 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Spin Pulse of the Intermediate Polar V1062 Tauri
Hellier, Coel, Keele Univ., UK; Beardmore, A. P., Keele Univ., UK; Mukai, Koji, NASA Goddard Space Flight Center, USA; 2002; 4p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
We combine ASCA and RXTE data of V1062 Tau to confirm the presence of a 62-min X-ray pulsation. We show that the pulsation is caused largely by the variation of dense partial absorption, in keeping with current models of accretion onto magnetic white dwarfs. Further parameterisation of the spin pulse is, however, hampered by ambiguities in the models.
Author
Cataclysmic Variables; White Dwarf Stars; X Ray Spectroscopy; X Ray Astronomy; Energy Absorption; Deposition; Accretion Disks

20020070809 NASA Goddard Space Flight Center, Greenbelt, MD USA
Photoionization and High Density Gas
Kallman, T., NASA Goddard Space Flight Center, USA; Bautista, M., NASA Goddard Space Flight Center, USA; [2002]; 66p; In English
Contract(s)/Grant(s): NAG5-1732; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
We present results of calculations using the XSTAR version 2 computer code. This code is loosely based on the XSTAR v.1 code which has been available for public use for some time. However it represents an improvement and update in several major respects, including atomic data, code structure, user interface, and improved physical description of ionization/excitation. In particular, it now is applicable to high density situations in which significant excited atomic level populations are likely to occur. We describe the computational techniques and assumptions, and present sample runs with particular emphasis on high density situations.
Author
Photoionization; Computer Programs; Atomic Excitations; Radiation Transport; Astronomical Models

20020070813 NASA Goddard Space Flight Center, Greenbelt, MD USA
Chandra Observations of the Evening Core of the Starburst Galaxy NGC 253
Weaver, K. A., NASA Goddard Space Flight Center, USA; Heckman, T. M., Johns Hopkins Univ., USA; Dahlem, M., European Southern Observatory, Chile; 2002; 16p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Chandra observations of the core of the nearby starburst galaxy NGC 253 reveal a heavily absorbed source of hard X-rays embedded within the nuclear starburst region. The source has an unabsorbed, 2 to 10 keV luminosity of greater than or equal to 10(exp 39) erg per s and photoionizes the surrounding gas. We observe this source through a dusty torus with a neutral absorbing column density of N(sub eta) approximately 2 x 10(exp 23)cm (exp -2). The torus is hundreds of pc across and collimates the starburst-driven nuclear outflow. We suggest that the ionizing source is an intermediate-mass black hole or a weakly accreting supermassive black hole, which may signal the beginnings or endings of AGN (active galactic nuclei) activity.
Author
Active Galactic Nuclei; Starburst Galaxies; X Ray Astronomy; X Ray Spectroscopy; Image Analysis; Black Holes (Astronomy); Photoionization

20020071043 NASA Goddard Space Flight Center, Greenbelt, MD USA
Imaging Forming Planetary Systems: The HST/STIS Legacy and Prospects for Future Missions
Grady, Carol, NASA Goddard Space Flight Center, USA; Woodgate, Bruce E., NASA Goddard Space Flight Center, USA; Bowers, Charles, NASA Goddard Space Flight Center, USA; Weinberger, Alycia, Carnegie Institution of Washington, USA; Schneider, Glenn, Arizona Univ., USA; [2002]; 1p; In English; SPIE Astronomical Telescopes and Instrumentation, 22-28 Aug. 2002, Waikoloa, HI, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The first indication that debris and protoplanetary disks associated with other, young planetary systems were sufficiently nearby to image came with the IRAS detection of infrared excesses around β Pic, Vega, Fomalhaut, and ϵ Eri. Moving beyond analysis of the infrared excess to optical and near-IR imaging requires access to high Strehl ratio and high contrast imaging techniques, with the ability to efficiently reject the residual scattered and diffracted light from the star to reveal the fainter scattered light and circumstellar emission originating from the vicinity of the star. HST/STIS imaging studies have made use of incomplete Lyot coronagraphic imaging modes to reveal the warped, inner disk of β Pic, provide the highest spatial resolution images of young debris disk systems such as HR 4796A, have revealed the presence of azimuthally symmetric structure in HD 141569 and HD 163296, and have demonstrated that currently active, collimated outflows survive to higher stellar masses than previously expected, and through more of the star's pre-main sequence lifetime than anticipated. The HST/STIS coronagraphic imaging legacy will be discussed, together with the implications for future NIR and optical high contrast imaging capabilities.
Author
Infrared Astronomy Satellite; Imaging Techniques; Spaceborne Telescopes; Planetary Evolution

20020072225 NASA Goddard Space Flight Center, Greenbelt, MD USA
NASA Fuse Cycle 1 Program A100. FUV Spectra of Evolved Late-K and M Stars: Mass Loss revisited and Stellar Activity *Final Report*
Harper, Graham M., NASA Goddard Space Flight Center, USA; Aug. 28, 2002; 3p; In English
Contract(s)/Grant(s): NAG5-9010; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
Program A100 was awarded 50 ksec of FUSE observing time. Targets alpha TrA (K3 II) and gamma Cru (N13 III) were originally assigned 25 ksec each, to be observed in the medium aperture. Once the in-flight performance and telescope alignment problems were known, the observations were reprogrammed to optimized the scientific return of the program. alpha TrA was scheduled for 25 ksec observations in both the medium and large apertures. The principle aim of this program was to measure the stellar FUV line and continuum emission, in order to estimate the photoionization radiation field and to determine the level of stellar activity through the fluxes in the collisionally excited high temperature diagnostics: C III 977A and O VI 1032,1038A doublet. The medium aperture observations were obtained successfully while the large aperture observations were thought by Johns Hopkins University (JHU)to be lost to satellite problems. There was insufficient signal-to noise in the medium aperture short wavelength SiC channels to do quantitative science. The long wavelength LiF spectra are of high signal-to-noise (SN) and show pronounced emission lines near lambdalambda1100 - 1140A. Emission had been observed at these wavelength in low resolution and low SN ORFEUS-SPAS 11 spectra obtained by Dupree & Brickhouse (1998 ApJ 500, L33), however, they were unable to identify these features. One of the first problems faced in the early FUSE mission was establishing a reliable wavelength scale, especially between the different channels. With the medium aperture data in hand we decided to identify the features and thereby establish an absolute wavelength scale for the channels where the emission occurred. We first established that the emission was fluorescent. and then we constructed a fluorescent line formation model for all neutrals. and singly ionized species with atomic numbers up to 28, and the H2 molecule. We used datasets of radiative rates and energy levels which were as complete as possible and available in an electronic format (millions of transitions). We found that most, but not all, emission was from Fe II pumped by H Lyalpha. This is not typical fluorescence, since the emission is shortward of the pumping transitions near 1215.6A.
Author
Stellar Activity; Signal to Noise Ratios; Energy Levels; Radiation Distribution; Emission Spectra

20020072229 NASA Goddard Space Flight Center, Greenbelt, MD USA
Orbital Evolution of Jupiter-Family Comets
Ipatov, S. I., Academy of Sciences (USSR), USSR; Mather, J. S., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; 200th Meeting of the American Astronomical Society, 2-6 Jun. 2002, Albuquerque, NM, USA; No Copyright; Avail: Issuing Activity; Abstract Only
We investigated the evolution for periods of at least 5-10 Myr of 2500 Jupiter-crossing objects (JCOs) under the gravitational influence of all planets, except for Mercury and Pluto (without dissipative factors). In the first series we considered N=2000 orbits near the orbits of 30 real Jupiter-family comets with period less than 10 yr, and in the second series we took 500 orbits close to the orbit of Comet 10P Tempel 2. We calculated the probabilities of collisions of objects with the terrestrial planets, using orbital elements obtained with a step equal to 500 yr and then summarized the results for all time intervals and all bodies, obtaining the total probability P(sub sigma) of collisions with a planet and the total time interval T(sub sigma) during which perihelion distance of bodies was less than a semimajor axis of the planet. The values of P = 10(exp 6)P(sub sigma)/N and T = T(sub sigma)/1000

yr are presented in Table together with the ratio r of the total time interval when orbits were of Apollo type (at e less than 0.999) to that of Amor type.
Author
Celestial Bodies; Orbital Elements; Rendezvous Trajectories; Interplanetary Trajectories; Collisions

20020073165 NASA Ames Research Center, Moffett Field, CA USA
Hierarchies of Models: Toward Understanding Planetary Nebulae
Knuth, Kevin H., NASA Ames Research Center, USA; Hajian, Arsen R., Naval Observatory, USA; [2002]; 12p; In English; Maximum Entropy and Bayesian Methods, 3-7 Aug. 2002, Moscow, ID, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Stars like our sun (initial masses between 0.8 to 8 solar masses) end their lives as swollen red giants surrounded by cool extended atmospheres. The nuclear reactions in their cores create carbon, nitrogen and oxygen, which are transported by convection to the outer envelope of the stellar atmosphere. As the star finally collapses to become a white dwarf, this envelope is expelled from the star to form a planetary nebula (PN) rich in organic molecules. The physics, dynamics, and chemistry of these nebulae are poorly understood and have implications not only for our understanding of the stellar life cycle but also for organic astrochemistry and the creation of prebiotic molecules in interstellar space. We are working toward generating three-dimensional models of planetary nebulae (PNe), which include the size, orientation, shape, expansion rate and mass distribution of the nebula. Such a reconstruction of a PN is a challenging problem for several reasons. First, the data consist of images obtained over time from the Hubble Space Telescope (HST) and spectra obtained from Kitt Peak National Observatory (KPNO) and Cerro Tololo Inter-American Observatory (CTIO). These images are of course taken from a single viewpoint in space, which amounts to a very challenging tomographic reconstruction. Second, the fact that we have two disparate and orthogonal data types requires that we utilize a method that allows these data to be used together to obtain a solution. to address these first two challenges we employ Bayesian model estimation using a parameterized physical model that incorporates much prior information about the known physics of the PN. In our previous works we have found that the forward problem of the comprehensive model is extremely time consuming. to address this challenge, we explore the use of a set of hierarchical models, which allow us to estimate increasingly more detailed sets of model parameters. These hierarchical models of increasing complexity are akin to scientific theories of increasing sophistication, with each new model/theory being a refinement of a previous one by either incorporating additional prior information or by introducing a new set of parameters to model an entirely new phenomenon. We apply these models to both a simulated and a real ellipsoidal PN to initially estimate the position, angular size, and orientation of the nebula as a two-dimensional object and use these estimates to later examine its three-dimensional properties. The efficiency/accuracy tradeoffs of the techniques are studied to determine the advantages and disadvantages of employing a set of hierarchical models over a single comprehensive model.
Author
Astronomical Models; Planetary Nebulae; Stellar Evolution; Cosmochemistry

20020073508 NASA Ames Research Center, Moffett Field, CA USA
Interstellar PAH Emission in the 11-14 micron Region: New Insights and a Tracer of Ionized PAHs
Hudgins, Douglas M., NASA Ames Research Center, USA; Allamandola, Louis J., NASA Ames Research Center, USA; [1999]; 1p; In English
Contract(s)/Grant(s): RTOP 344-02-06-01; Copyright; Avail: Issuing Activity; Abstract Only

The Ames infrared spectral database of isolated, neutral and ionized polycyclic aromatic hydrocarbons (PAHs) shows that aromatic CH out-of-plane bending frequencies are significantly shifted upon ionization. For non-adjacent and doubly-adjacent CH groups, the shift is pronounced and consistently toward higher frequencies. The non-adjacent modes are blueshifted by an average of 27 per cm and the doubly-adjacent modes by an average of 17 per cm. For triply- and quadruply-adjacent CH out-of-plane modes the ionization shifts are more erratic and typically more modest. As a result of these ionization shifts, both the non-adjacent and doubly-adjacent CH out-of-plane modes move out of the regions classically associated with their respective vibrations in neutral PAHs. The doubly-adjacent modes of ionized PAHs tend to fall into the frequency range traditionally associated with the non-adjacent modes, while the non-adjacent modes are shifted to frequencies above those normally attributed to out-of-plane bending vibrations. Consequently, the origin of the interstellar infrared emission feature near 11.2 microns, traditionally attributed to the out-of-plane bending of non-adjacent CH groups on PAHs is rendered ambiguous. Instead, this feature likely reflects contributions from both non-adjacent CH units in neutral PAHs and doubly-adjacent CH units in PAH cations, the dominant charge state in the most energetic emission regions. This greatly relieves the structural constraints placed on the interstellar PAH population by the dominance of the 11.2 micron band in this region and eliminates the necessity to invoke extensive dehydrogenation of the emitting species. Furthermore, these results indicate that the emission between 926 and 904 per

cm (10.8 and 11.1 microns) observed in many sources can be unambiguously attributed to the non-adjacent CH out-of-plane bending modes of moderately-sized (fewer than 50 carbon atom) PAH cations making this emission an unequivocal tracer of ionized interstellar PAHs.
Author
Polycyclic Aromatic Hydrocarbons; Cations; Frequency Shift; Ionization

20020073527 NASA Ames Research Center, Moffett Field, CA USA
The Role of Tides in Known Multi-Planet Systems
Lissauer, Jack J., NASA Ames Research Center, USA; [2002]; 1p; In English; 189th International Astronomical Union Colloquium, 16-20 Sep. 2002, Nanjing, China
Contract(s)/Grant(s): RTOP 344-30-50-01
Report No.(s): Rept-1; No Copyright; Avail: Issuing Activity; Abstract Only
The first known extrasolar planet system, upsilon Andromedae, was discovered in 1999. The number of stars known to possess more than one planet has been growing rapidly since then. The dynamical interactions among such planets can be quite strong. These interactions can excite the orbital eccentricities of planets, even planets orbiting very close to their stars. Stellar tides can damp the eccentricities of such close-in planets, removing dynamical energy from the system and ultimately affecting the motions of all of the planets. These and other effects of tides in extrasolar multi-planet systems will be discussed.
Author
Extrasolar Planets; Tides; Planetary Systems; Orbital Mechanics

20020073531 Smithsonian Astrophysical Observatory, Cambridge, MA USA
Structure, Motion, and Evolution of Star-Forming Dense Cores ***Annual Report, 1 Sep. 2001 - 31 Aug. 2002***
Myers, Philip C., Smithsonian Astrophysical Observatory, USA; September 2002; 12p; In English
Contract(s)/Grant(s): NAG5-6266; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Under this grant in the past year we have pursued spectral-line observations of star-forming regions over size scales from 0.01 pc to 0.5 pc. Our main goal has been to measure the systematic and turbulent motions of condensing and collapsing gas. The following summary is excerpted from our recent application for a new three-year grant, submitted in June, 2002.
Author
Gravitational Collapse; Interstellar Gas; Star Formation; Line Spectra

20020073532 NASA Ames Research Center, Moffett Field, CA USA
Dispersal of Disks Around Young Stars
Hollenbach, David, NASA Ames Research Center, USA; [2002]; 1p; In English; Ecole Normale Superieure on Star Formation, 18 Sep. - 19 Oct. 2002, Paris, France; Sponsored by Ecole Normale Superieure, France
Contract(s)/Grant(s): RTOP 344-04-10-02; No Copyright; Avail: Issuing Activity; Abstract Only
We review the evidence pertaining to the lifetimes of planet-forming disks and discuss possible disk dispersal mechanisms: 1) viscous accretion of material onto the central source; 2) close stellar encounters; 3) stellar winds; and 4) photoevaporation by ultraviolet radiation. We focus on 3) and 4) and describe the quasi-steady state appearance and the overall evolution of disks under the influence of winds and radiation from the central star and of radiation from external OB stars. Viscous accretion likely dominates disk dispersal in the inner disk (r approx. or less than 10 AU), while photoevaporation is the principal process of disk dispersal outside of r approx. or greater than 10 AU for low mass stars. Disk dispersal timescales are compared and discussed in relation to theoretical estimates for planet formation timescales. Photoevaporation may explain the large differences in the hydrogen content of the giant planets in the solar system. The commonly held belief that our early sun's stellar wind dispersed he solar nebula is called into question. Finally, we model the small bright objects ('proplyds') observed in the Orion Nebula as disks around young, low mass stars which are externally illuminated by the UV (ultraviolet) photons from the nearby massive star Theta(1)C.
Author
Planetary Evolution; Stellar Winds; Quasi-Steady States; Massive Stars; Protoplanetary Disks

20020073534 NASA Ames Research Center, Moffett Field, CA USA
H2, CO and Dust Emission Around Low Mass Stars
Hollenbach, David, NASA Ames Research Center, USA; [2002]; 1p; In English; Ecole Normale Superieure on Star Formation, 18 Sep. - 19 Oct. 2002, Paris, France; Sponsored by Ecole Normale Superieure, France
Contract(s)/Grant(s): RTOP 344-04-10-02; No Copyright; Avail: Issuing Activity; Abstract Only

We model the thermal balance, the chemistry, and the radiative transfer in dusty disks orbiting young, low mass stars. These models are motivated by observations of infrared and ultraviolet transitions of H2 from protoplanetary disks, as well as millimeter and submillimeter observations of other molecules such as CO, and infrared continuum observations of the dust. The dust grains are heated primarily by the stellar radiation and the infrared radiation field produced by the dust itself. The gas is heated by collisions with warmer dust grains, X-rays from the region close to the stellar surface, UV (ultraviolet) pumping of hydrogen molecules, and the grain photoelectric heating mechanism initiated by UV photons from the central star. We treat cases where the gas to dust ratio is high, because the dust has settled to the midplane and coagulated into relatively large objects. We discuss situations in which the infrared emission from H2 can be detected, and how the comparison of the observations with our models can deduce physical parameters such as the mass and the density and temperature distribution of the gas.
Author
Radiative Transfer; Temperature Distribution; Stars; Accretion Disks; Protoplanetary Disks; Dust; Hydrogen; Carbon Monoxide

20020073545 NASA Ames Research Center, Moffett Field, CA USA
Star Formation In the Galaxy and the Fluctuating UV Radiation Field
Hollenbach, David, NASA Ames Research Center, USA; Parravano, Antonio, Universidad de Los Andes, Venezuela; McKee, Christopher H., California Univ., USA; [2002]; 1p; In English; Ecole Normale Superieure on Star Formation, 18 Sep. - 19 Oct. 2002, Paris, France; Sponsored by Ecole Normale Superieure, France
Contract(s)/Grant(s): RTOP 344-04-10-02; No Copyright; Avail: Issuing Activity; Abstract Only
We examine the formation of massive stars in the Galaxy, the resultant fluctuating UV (ultraviolet) radiation field, and the effect of this field on the star-forming interstellar medium. There are substantial fluctuations of the UV radiation field in space (scales of 100's of parsecs) and time (time-scales of order 100 million years). The FUV (far ultraviolet) (6 eV less than hv less than 13.6 eV) field and the pressure determines whether the thermal balance of the neutral gas results in cold clouds or warm (T approx. 10(exp 4) K) neutral medium. We show how to calculate the average fractions of the gas in the cold and warm phases when the interstellar gas is subject to this fluctuating FUV field. The knowledge of how these fractions depend on the gas properties and on the FUV sources is a basic step in building a model of the large scale behavior of the ISM (interstellar medium) and the mutual relation between the ISM and the star formation rate.
Author
Ultraviolet Astronomy; Far Ultraviolet Radiation; Star Formation; Interstellar Matter

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LUNAR AND PLANETARY SCIENCE AND EXPLORATION

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

20020072847 NASA Glenn Research Center, Cleveland, OH USA
Robots and Humans in Planetary Exploration: Working Together?
Landis, Geoffrey A., NASA Glenn Research Center, USA; Jul. 10, 2002; 7p; In English
Contract(s)/Grant(s): RTOP 755-A4-02; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Today's approach to human-robotic cooperation in planetary exploration focuses on using robotic probes as precursors to human exploration. A large portion of current NASA planetary surface exploration is focussed on Mars, and robotic probes are seen as precursors to human exploration in: Learning about operation and mobility on Mars; Learning about the environment of Mars; Mapping the planet and selecting landing sites for human mission; Demonstration of critical technology; Manufacture fuel before human presence, and emplace elements of human-support infrastructure
Author
Planetary Surfaces; Space Exploration; Robots; Mars Surface; Mars Probes

20020072958 NASA Ames Research Center, Moffett Field, CA USA
Titan: A Place with Atmosphere
McKay, Christopher P., NASA Ames Research Center, USA; Apr. 22, 2002; 1p; In English; Jupiter after Galileo Cassini, 17-21 Jun. 2002, Lisbon, Portugal
Contract(s)/Grant(s): RTOP 344-38-82-04; No Copyright; Avail: Issuing Activity; Abstract Only
Titan is the largest moon of the planet Saturn and is the only moon in the solar system with a substantial atmosphere. Its atmosphere is mostly made of nitrogen and has a pressure one and a half times larger than sea level pressure on Earth. In these

respects Titan's atmosphere is the closest twin to Earth's. Methane is found in Titan's atmosphere and results in the formation of a organic smog layer in the atmosphere via chemistry that is similar to the current theories for the origin of life on Earth. Unfortunately, Titan is much too cold for water to be liquid and life is therefore unlikely, earth-like life that is. Titan's atmosphere has a greenhouse effect which is much stronger than the Earth's. However the organic smog layer produces an anti-greenhouse effect that cuts the greenhouse warming in half. The surface of Titan remains unknown, hidden by the thick smog layer, but it may be an ocean of liquid methane and ethane or maybe just lakes. When the NASA/ESA mission to the Saturn System, Cassini/Huygens reaches Saturn in a few years it will launch a probe that to the surface of Titan and show us this world that is strange and yet in many ways similar to our own.
Author
Titan; Atmospheric Composition; Smog; Methane; Nitrogen; Satellite Atmospheres

20020072988 NASA Glenn Research Center, Cleveland, OH USA
Pathfinder: A Retrospective
Landis, Geoffrey A., NASA Glenn Research Center, USA; May 01, 2002; 5p; In English; British Interplanetary Society Meeting, 1 May 2002, London, UK; Sponsored by British Interplanetary Society, UK; Original contains color illustrations
Contract(s)/Grant(s): RTOP 755-A4-02; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
Mars is one of the most interesting planets in the solar system, featuring enormous canyons, giant volcanoes, and indications that, early in its history, it might have had rivers and perhaps even oceans. Five years ago, in July of 1997, the Pathfinder mission landed on Mars, bringing with it the microwave-oven sized Sojourner rover to wander around on the surface and analyse rocks. Among the experiments on the mission was one designed to analyse dust deposition. Pathfinder is only the first of an armada of spacecraft which will examine Mars from the pole to the equator in the next decade, culminating with a mission to bring humans to Mars.
Author (revised)
Mars (Planet); Mars Missions; Mars Pathfinder; Mars Environment

20020073066 NASA Ames Research Center, Moffett Field, CA USA
Intercalibration of Mars Global Surveyor Datasets
Houben, Howard, Bay Area Environmental Research Inst., USA; Bergstrom, R. W., Bay Area Environmental Research Inst., USA; Hollingsworth, J., San Jose State Univ., USA; Smith, M., NASA Goddard Space Flight Center, USA; Martin, T., Jet Propulsion Lab., California Inst. of Tech., USA; Hinson, D., Stanford Univ., USA; May 08, 2002; 1p; In English; Committee on Space Research (COSPAR) 2002, 10-19 Oct. 2002, Houston, TX, USA
Contract(s)/Grant(s): RTOP 344-34-21-04; No Copyright; Avail: Issuing Activity; Abstract Only
The calibration and validation of satellite soundings of atmospheric variables is always a difficult prospect, but this difficulty is greatly magnified when the measurements are made at a different planet, whose meteorology is poorly known and poorly constrained, and for which there are virtually no prospects of obtaining ground truth. The Mars Global Surveyor which has been circling Mars in its mapping orbit since early 1999 includes a variety of instruments capable of making atmospheric observations: the Thermal Emission Spectrometer (TES) which takes more than 100,000 nadir-view infrared spectra per day (although these observations are confined to the 2am - 2pm time of the sun-fixed orbit); much less frequent TES limb scans (still only at 2am and 2pm); the Mars Horizon Sensor Assembly measures side-looking broadband 15 micrometer radiation; Radio Science occultations at favorable seasons give high resolution temperature profiles; the Mars orbiter Camera and Mars Orbiter Laser Altimeter have made water, dust, and carbon dioxide cloud detections. These observations are now being supplemented by high-resolution 15 micron measurements by THEMIS on Mars Odyssey. Thus, all of these observations are made at different times and places. Data assimilation techniques are being used to fuse this vast array of observations into a single dataset that best represents our understanding of the Martian atmosphere, its current meteorological state, and the relevant instrumental properties.
Author
Mars (Planet); Mars Atmosphere; Mars Global Surveyor; Satellite Sounding; Atmospheric Sounding; Atmospheric Composition; Data Integration

20020073407 NASA Ames Research Center, Moffett Field, CA USA
Compositional Remote Sensing of Icy Planets and Satellites Beyond Jupiter
Roush, T. L., NASA Ames Research Center, USA; Jun. 20, 2002; 1p; In English; Solar System Remote Sensing, 20-21 Sep. 2002, Pittsburgh, PA, USA
Contract(s)/Grant(s): RTOP 344-30-30-01; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The peak of the solar energy distribution occurs at visual wavelengths and falls off rapidly in the infrared. This fact, improvements in infrared detector technology, and the low surface temperatures for most icy objects in the outer solar system have resulted in the bulk of telescopic and spacecraft observations being performed at visual and near-infrared wavelengths. Such observations, begun in the early 1970's and continuing to present, have provided compositional information regarding the surfaces of the satellites of Saturn and Uranus, Neptune's moon Triton, Pluto, Pluto's moon Charon, Centaur objects, and Kuiper belt objects. Because the incident sunlight penetrates the surface and interacts with the materials present there, the measured reflected sunlight contains information regarding the surface materials, and the ratio of the reflected to incident sunlight provides a mechanism of identifying the materials that are present.
Derived from text
Icy Satellites; Composition (Property); Planetary Surfaces; Infrared Astronomy

20020073529 NASA Ames Research Center, Moffett Field, CA USA
Autonomous Rovers for Mars Exploration
Anderson, Corin, Washington Univ., USA; Bresina, John, NASA Ames Research Center, USA; Golden, Keith, NASA Ames Research Center, USA; Smith, David E., NASA Ames Research Center, USA; Smith, Trey, Carnegie-Mellon Univ., USA; Washington, Richard, Caelum Research Corp., USA; [1999]; 14p; In English; 1999 IEEE Aerospace Conference, 1999, Aspen, CO, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Rovers will play a critical role in the exploration of Mars. Near-term mission plans call for long traverses over unknown terrain, robust navigation and instrument placement, and reliable operations for extended periods of time. Longer-term missions may visit multiple science sites in a single day and perform opportunistic science data collection, as well as complex scouting, construction, and maintenance tasks in preparation for an eventual human presence. The Pathfinder mission demonstrated the potential for robotic Mars exploration but at the same time indicated the need for more rover autonomy. The highly ground-intensive control with infrequent communication and high latency limited the effectiveness of the Sojourner rover. When failures occurred, Sojourner often sat idle for extended periods of time, awaiting further commands from earth. In future missions, the tasks will be more complex and extended; hence there will be even more situations where things do not go exactly as planned. Significant advances in rover autonomy are needed to cope with increasing task complexity and greater execution uncertainty. Towards this end, we have designed an on-board executive architecture that incorporates robust operation, resource utilization, and failure recovery. In addition, we have designed ground tools to produce and refine contingent schedules that take advantage of the on-board architecture's flexible execution characteristics. Together, the on-board executive and the ground tools constitute an integrated rover autonomy architecture. This work draws from our experience with the Deep Space One autonomy experiment, with enhancements to ensure robust operation in the face of the unpredictable, complex environment that the rover will encounter on Mars. The rover autonomy architecture is currently being developed and deployed on the Marsokhod rover platform at NASA Ames Research Center. The capabilities of the rover autonomy architecture to support autonomous operations will be demonstrated concretely in upcoming field tests.
Author
Architecture (Computers); Marsokhod Mars Roving Vehicles; Autonomy

20020073530 NASA Ames Research Center, Moffett Field, CA USA
Saturn's Ring: Pre-Cassini Status and Mission Goals
Cuzzi, Jeff N., NASA Ames Research Center, USA; [1999]; 58p; In English
Contract(s)/Grant(s): RTOP 624-06-86; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
In November 1980, and again in August 1981, identical Voyager spacecraft flew through the Saturn system, changing forever the way we think about planetary rings. Although Saturn's rings had been the only known ring system for three centuries, a ring system around Uranus had been discovered by stellar occultations from Earth in 1977, and the nearly transparent ring of Jupiter was imaged by Voyager in 1979 (the presence of material there had been inferred from charged particle experiments on Pioneer 10 and 11 several years earlier). While Saturn had thus temporarily lost its uniqueness as having the only ring system, with Voyager it handily recaptured the role of having the most fascinating one. The Voyager breakthroughs included spiral density and bending waves such as cause galactic structure; ubiquitous fine-scale radial 'irregular' structure, with the appearance of record-grooves; regional and local variations in particle color; complex, azimuthally variable ring structure; empty gaps in the rings, some containing very regular, sharp-edged, elliptical rings and one containing both a small moonlet and incomplete arcs of dusty material; and shadowy 'spokes' that flicker across the main rings. One of the paradigm shifts of this period was the realization that many aspects of planetary rings, and even the ring systems themselves, could be 'recent' on geological timescales. These early results are reviewed and summarized in the Arizona Space Science series volumes 'Saturn'. (An excellent review of ring dynamics

at a formative stage is by Goldreich and Tremaine.) From the mid 1980's to the time of this writing, progress has been steady, while at a less heady pace, and some of the novel ring properties revealed by Voyager 1 and 2 are beginning to be better understood. It is clearly impossible to cite, much less review, every advance over the last decade; however, below we summarize the main advances in understanding of Saturn's rings since the mid 1980's, in the context of the Cassini Science Objectives.
Author
Saturn Rings; Planetology

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SOLAR PHYSICS

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

20020071040 NASA Goddard Space Flight Center, Greenbelt, MD USA
Science Prospects from the STEREO Mission
Davila, Joseph M., NASA Goddard Space Flight Center, USA; St.Cyr, O. C., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; 34th Committee on Space Research Scientific Assembly, 10-19 Oct. 2002, Houston, TX, USA; Sponsored by Committee on Space Research, Unknown; No Copyright; Avail: Issuing Activity; Abstract Only

The solar magnetic field is constantly generated beneath the surface of the Sun by the solar dynamo. to balance this flux generation, there is constant dissipation of magnetic flux at and above the solar surface. The largest phenomenon associated with this dissipation is the Coronal Mass Ejection (CME). The Solar and Heliospheric Observatory (SOHO) has provided remarkable views of the corona and CMEs, and served to highlight how these large interplanetary disturbances can have terrestrial consequences. STEREO is the next logical step to study the physics of CME origin, propagation, and terrestrial effects. Two spacecraft with identical instrument complements will be launched on a single launch vehicle in November 2007. One spacecraft will drift ahead and the second behind the Earth at a separation rate of 22 degrees per year. Observation from these two vantage points will for the first time allow the observation of the three-dimensional structure of CMEs and the coronal structures where they originate. Each STEREO spacecraft carries a complement of 10 instruments, which include (for the first time) an extensive set of BOTH remote sensing and in-situ instruments. The remote sensing suite is capable of imaging CMEs from the solar surface out to beyond Earth's orbit (1 AU), and in-situ instruments are able to measure distribution functions for electrons, protons, and ions over a broad energy range, from the normal thermal solar in wind plasma to the most energetic solar particles. It is anticipated that these studies will ultimately lead to an increased understanding, of the CME process and eventually to the ability to predict CME occurrence and thereby 'forecast' the condition of the near-Earth environment.
Author
Solar Magnetic Field; Coronal Mass Ejection; Solar Corona; Space Missions

20020071042 NASA Goddard Space Flight Center, Greenbelt, MD USA
A New Diagnostic Technique for the Solar Corona
Nelson, R., Catholic Univ. of America, USA; Davila, Joseph M., NASA Goddard Space Flight Center, USA; St.Cyr, O. C., Catholic Univ. of America, USA; [2002]; 1p; In English; American Astronomical Society 200th Meeting, 2-6 Jun. 2002, Albuquerque, NM, USA; Sponsored by American Astronomical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Over the last 30-40 years spectroscopic observation of the EUV (extreme ultraviolet) line emission has proved invaluable as a diagnostic of the solar coronal plasma state. Line ratios have been used to determine electron density, electron temperature and ion flow velocity. In this paper, we present results obtained with a new measurement technique that uses spectroscopic observations of the white light corona to obtain the electron density, temperature, and flow velocity. A prototype instrument has been designed and built to obtain visible light spectra (3800-4300 A) with modest resolution. This instrument was used to obtain coronal observations during the June 2001 eclipse in Zambia. The data were corrected for sky and instrument transmission to derive the electron temperature and flow speed. Results from these measurements will be discussed.
Author
Stellar Spectrophotometry; Solar Corona; Prototypes; Extreme Ultraviolet Radiation

20020071074 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Effects of Low- and High-Energy Cutoffs on Solar Flare Microwave and Hard X-Ray Spectra
Holman, G. D., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; American Astronomical Society Meeting, 2-6 Jun. 2002, Albuquerque, NM, USA; Sponsored by American Astronomical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Microwave and hard x-ray spectra provide crucial information about energetic electrons and their environment in solar flares. These spectra are becoming better determined with the Owens Valley Solar Array (OVSA) and the recent launch of the Ramaty High Energy Solar Spectroscopic Imager (RHESSI). The proposed Frequency Agile Solar Radiotelescope (FASR) promises even greater advances in radio observations of solar flares. Both microwave and hard x-ray spectra are sensitive to cutoffs in the electron distribution function. The determination of the high-energy cutoff from these spectra establishes the highest electron energies produced by the acceleration mechanism, while determination of the low-energy cutoff is crucial to establishing the total energy in accelerated electrons. This paper will show computations of the effects of both high- and low-energy cutoffs on microwave and hard x-ray spectra. The optically thick portion of a microwave spectrum is enhanced and smoothed by a low-energy cutoff, while a hard x-ray spectrum is flattened below the cutoff energy. A high-energy cutoff steepens the microwave spectrum and increases the wavelength at which the spectrum peaks, while the hard x-ray spectrum begins to steepen at photon energies roughly an order of magnitude below the electron cutoff energy. This work discusses how flare microwave and hard x-ray spectra can be analyzed together to determine these electron cutoff energies. This work is supported in part by the NASA Sun-Earth Connection Program. Author

X Ray Spectra; Microwave Spectra; Solar Flares; Electron Distribution; Electron Energy

20020072732 NASA Marshall Space Flight Center, Huntsville, AL USA

Coronal Heating and the Increase of Coronal Luminosity with Magnetic Flux

Moore, R. L., NASA Marshall Space Flight Center, USA; Falconer, D. A., NASA Marshall Space Flight Center, USA; Porter, J. G., NASA Marshall Space Flight Center, USA; Hathaway, D. H., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 200th Meeting of the American Astronomical Society, 2-6 Jun. 2002, Albuquerque, NM, USA; Sponsored by American Astronomical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We present the observed scaling of coronal luminosity with magnetic flux in a set of quiet regions. Comparison of this with the observed scaling found for active regions suggests an underlying difference between coronal heating in active regions and quiet regions. From SOHO/EIT coronal images and SOHO/MDI magnetograms of four similar large quiet regions, we measure L(sub corona) and Phi(sub total) in random subregions ranging in area from about four supergranules [(70,000 km)(exp 2)] to about 100 supergranules [(0.5 R(sub sun))(exp 2)], where L(sub corona) is the luminosity of the corona in a subregion and Phi(sub total) is the flux content of the magnetic network in the subregion. This sampling of our quiet regions yields a correlation plot of Log L(sub corona) vs Log Phi(sub total) appropriate for comparison with the corresponding plot for active regions. For our quiet regions, the mean values of L(sub corona) and Phi(sub total) both increase linearly with area (simply because each set of subregions of the same area has very nearly the same mean coronal luminosity per unit area and mean magnetic flux per unit area), and in each constant-area set the values of L(sub corona) and Phi(sub total) 'scatter' about their means for that area. This results in the linear least-squares fit to the Log ((L (sub corona)), vs Log ((Phi (sub total)) plot having a slope somewhat less than one. If active regions mimicked our quiet regions in that all large sets of same-area active regions had the same mean coronal luminosity per unit area and same mean magnetic flux per unit area, then the least-squares fit to their Log((L (sub corona)) vs Log((Phi (sub total)) plot would also have a slope of less than one. Instead, the slope for active regions is 1.2. Given the observed factor of three scatter about the least-squares linear fit, this slope is consistent with Phi(sub total) on average increasing linearly with area (A) as in quiet regions, but L(sub corona) on average increasing as the volume (A(exp 1.5)) of the active region instead of as the area. This possibility is reasonable if the heating in active regions is a burning down of previously-stored coronal magnetic energy rather than a steady dissipation of energy flux from below as expected in quiet regions.
Author

Magnetic Flux; Luminosity; Solar Corona; Heating

20020073223 NASA Goddard Space Flight Center, Greenbelt, MD USA

Are Solar Activity Variations Amplified by the QBO: A Modeling Study

Mengel, J. G., Science Systems and Applications, Inc., USA; Mayr, H. G., NASA Goddard Space Flight Center, USA; Drob, D. P., Naval Research Lab., USA; Porter, H. S., Furman Univ., USA; [2002]; 1p; In English; 2002 Spring AGU, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Solar cycle activity effects (SCAE) in the lower and middle atmosphere, reported in several studies, are difficult to explain on the basis of the small changes in solar radiation that accompany the 11-year cycle. It is therefore natural to speculate that dynamical processes may come into play to produce a leverage. Such a leverage may be provided by the Quasi-Biennial Oscillation (QBO) in the zonal circulation of the stratosphere, which has been linked to solar activity variations. Driven primarily by wave mean flow interaction, the QBO period and its amplitude are variable but are also strongly influenced by the seasonal cycle in the solar radiation. This influence extends to low altitudes and is referred to as 'downward control'. Small changes in the solar radiative forcing may produce small changes in the period and phase of the QBO, but these in turn may produce measurable

differences in the wind field. Thus, the QBO may be an amplifier of solar activity variations and a natural conduit of these variations to lower altitudes. to test this hypothesis, we conducted experiments with a 2D version of our Numerical Spectral Model that incorporates Hines' Doppler Spread Parameterization for small-scale gravity waves (GW). Solar cycle radiance variations (SCRV) are accounted for by changing the radiative heating rate on a logarithmic scale from 0.1% at the surface to 1% at 50 km to 10% at 100 km. With and without SCRV, but with the same GW flux, we then conduct numerical experiments to evaluate the magnitude of the SCAE in the zonal circulation. The numerical results indicate that, under certain conditions, the SCAE is significant and can extend to lower altitudes where the SCRV is small. For a modeled QBO period of 30 months, we find that the seasonal cycle in the solar forcing acts as a strong pacemaker to lock up the phase and period of the QBO. The SCAE then shows up primarily as a distinct but relatively weak amplitude modulation. But with a different QBO period between 30 and 34 (or less than 30, presumably) months, the seasonal phase lock is weak. Solar flux variations in the seasonal cycle then cause variations in the QBO period and phase. These amplify the SCAE to produce relatively large variations in the wind field. The SCAE in this case extends to mid-latitudes.
Author
Solar Activity; Quasi-Biennial Oscillation; Mathematical Models; Numerical Analysis; Annual Variations; Solar Cycles

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SPACE RADIATION

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

20020070798 NASA Goddard Space Flight Center, Greenbelt, MD USA
Galactic Starburst NGC 3603 from X-Rays to Radio
Moffat, A. F. J., Montreal Univ., Canada; Corcoran, M. F., NASA Goddard Space Flight Center, USA; Stevens, I. R., Birmingham Univ., UK; Skalkowski, G., Montreal Univ., Canada; Marchenko, S. V., Montreal Univ., Canada; Muecke, A., Montreal Univ., Canada; Ptak, A., Carnegie-Mellon Univ., USA; Koribalski, B. S., Australia Telescope National Facility, Australia; Brenneman, L., NASA Goddard Space Flight Center, USA; Mushotzky, R., NASA Goddard Space Flight Center, USA; [2002]; 18p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NGC 3603 is the most massive and luminous visible starburst region in the Galaxy. We present the first Chandra/ACIS-I X-ray image and spectra of this dense, exotic object, accompanied by deep cm-wavelength ATCA radio image at similar or less than 1 inch spatial resolution, and HST/ground-based optical data. At the S/N greater than 3 level, Chandra detects several hundred X-ray point sources (compared to the 3 distinct sources seen by ROSAT). At least 40 of these sources are definitely associated with optically identified cluster O and WR type members, but most are not. A diffuse X-ray component is also seen out to approximately 2 feet (4 pc) form the center, probably arising mainly from the large number of merging/colliding hot stellar winds and/or numerous faint cluster sources. The point-source X-ray fluxes generally increase with increasing bolometric brightnesses of the member O/WR stars, but with very large scatter. Some exceptionally bright stellar X-ray sources may be colliding wind binaries. The radio image shows (1) two resolved sources, one definitely non-thermal, in the cluster core near where the X-ray/optically brightest stars with the strongest stellar winds are located, (2) emission from all three known proplyd-like objects (with thermal and non-thermal components, and (3) many thermal sources in the peripheral regions of triggered star-formation. Overall, NGC 3603 appears to be a somewhat younger and hotter, scaled-down version of typical starbursts found in other galaxies.
Author
Early Stars; Galactic Clusters; X Ray Astronomy; X Ray Spectra; X Ray Sources; Starburst Galaxies

20020070799 NASA Goddard Space Flight Center, Greenbelt, MD USA
Broad-Band Continuum and Line Emission of the gamma-Ray Blazar PKS 0537-441
Pian, E., Trieste Univ., Italy; Falomo, R., Padua Univ., Italy; Hartman, R. C., NASA Goddard Space Flight Center, USA; Maraschi, L., Brera Astronomical Observatory, Italy; Tavecchio, F., Brera Astronomical Observatory, Italy; Tornikoski, M., Helsinki Univ. of Technology, Finland; Treves, A., University of Insubria, Italy; Urry, C. M., Yale Univ., USA; Ballo, L., Brera Astronomical Observatory, Italy; Mukherjee, R., Barnard Coll., USA; [2002]; 10p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

PKS 0537-441, a bright gamma ray emitting blazar was observed at radio, optical, UV and X-ray frequencies during various EGRET paintings, often quasi-simultaneously. In 1995 the object was found in an intense emission state at all wavelengths. BeppoSAX observations made in 1998, non-simultaneously with exposures at other frequencies, allow us to characterize

precisely the spectral shape of the high energy blazer component, which we attribute to inverse Compton scatter in The optical-to-gamma-ray spectral energy distributions at the different epochs show that the gamma-ray luminosity dominates the barometric output. This, together with the presence of optical and UV line emission, suggests that, besides the synchrotron self-Compton mechanism, the Compton upscattering of photons external to the jet (e.g., in the broad line region) may have a significant role for high energy radiation. The multiwavelength variability can be reproduced by changes of the plasma bulk Lorentz factor. The spectrum secured by ICE in 1995 appears to be partially absorbed shortward of approximately 1700 Angstroms. However, this signature is not detected in the HST spectrum taker during a lower state of the source. The presence of intervening absorbers is not supported by optical imaging and spectroscopy of the field.
Author
Blazars; Broadband; Continuums; Gamma Rays; Light (Visible Radiation); Spectral Emission; Ultraviolet Radiation; Astrophysics

20020070800 NASA Goddard Space Flight Center, Greenbelt, MD USA
Evidence for Temporally-Extended, High-Energy Emission from Gamma Ray Burst 990104
Wren, D. N., Maryland Univ., USA; Bertsch, D. L., NASA Goddard Space Flight Center, USA; Ritz, S., NASA Goddard Space Flight Center, USA; [2002]; 15p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

It is well known that high-energy emission (MeV - GeV) has been observed in several gamma ray bursts and temporally-extended emission from lower-energy gamma rays through radio wavelengths is well established. Observations of extended, high-energy emission are, however, scarce. Here we present evidence for a gamma ray burst emission that is both high-energy and extended, coincident with lower energy emissions. For the very bright and long burst, GRB 990104, we show light curves and spectra that confirm emission above 50 MeV, approximately 152 seconds after the BATSE (Burst and Transient Source Experiment) trigger and initial burst emission. Between the initial output and the main peak, seen at both low and high energy, there was a period of approx. 100 s during which the burst was relatively quiet. This burst was found as part of an ongoing search for high-energy emission in gamma ray bursts.
Author
Gamma Ray Bursts; Gamma Ray Astronomy; Emission

20020070816 Hawaii Univ., Inst. for Astronomy, Honolulu, HI USA
Search for X-Ray Emission in the Nearest Known Brown Dwarf ***Annual Report, 1 Sep. 2000 - 31 Aug. 2002***
Martin, Eduardo, Hawaii Univ., USA; Aug. 15, 2002; 2p; In English; Mini-Symposium MS-7 on Magnetic Activity in Stellar Evolution in the JENAM 2001, 13-14 Sep. 2001, Munich, Germany
Contract(s)/Grant(s): NAG5-9992; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The XMM observations were obtained on 2001 January 07-08 for 51767 s. The Optical Monitor (OM) was used with the V filter for four exposures of 5000 s each in imaging mode. We used the data given by the OM to confirm the presence of the source in the field of view. The European Photon Imaging Camera (EPIC) MOS1 (Metal Oxide Semiconductor) and MOS2 were used 48724 s each in prime full window mode with 2.5 s time resolution. The EPIC PN was used 46618 s in prime full window mode with 73.4 ms time resolution.
Derived from text
X Ray Astronomy; Brown Dwarf Stars; Metal Oxide Semiconductors; Emission

20020072740 NASA Marshall Space Flight Center, Huntsville, AL USA
Nine Years of Observations of Hard X-Rays from Relativistic Jet Objects with BATSE
Fishman, G. J., Universities Space Research Association, USA; Harmon, B. A., NASA Marshall Space Flight Center, USA; Fishman, G. J., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; Fourth Microquasar Workshop, 27 May - 1 Jun. 2002, Cargese, Corsica, France; No Copyright; Avail: Issuing Activity; Abstract Only

The observed hard X-ray temporal and spectral characteristics will be displayed for over nine years of BATSE (Burst and Transient Source Experiment) data from the Compton Observatory. These observations were obtained using the Earth occultation technique, a technique that has become increasingly more sensitive and accurate as systematic effects are understood and corrected. The principal objects that are being presented in this study include: GRO J1655-40, GRS 1915+105, Cyg X-3, Cyg X-1, XTE J1550-564, XTE J1859+226, XTE J1748-288, and V4641 Sgr. Light curves and spectral will be presented and discussed in terms of relativistic jet production in these systems.
Author (revised)
X Ray Stars; Stellar Spectra; X Ray Astronomy

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GENERAL

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

20020073404 NASA Glenn Research Center, Cleveland, OH USA

Instrumentation and Controls Division Overview: Sensors Development for Harsh Environments at Glenn Research Center

Zeller, Mary V., NASA Glenn Research Center, USA; Lei, Jih-Fen, NASA Glenn Research Center, USA; Jul. 29, 2002; 27p; In English; Sensor Symposium, 29-31 Jul. 2002, Baltimore, MD, USA; Original contains color illustrations

Contract(s)/Grant(s): RTOP 755-9E-00

Report No.(s): NONP-NASA-CD-2002119783; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; C01, CD-ROM

The Instrumentation and Controls Division is responsible for planning, conducting and directing basic and applied research on advanced instrumentation and controls technologies for aerospace propulsion and power applications. The Division's advanced research in harsh environment sensors, high temperature high power electronics, MEMS (microelectromechanical systems), nanotechnology, high data rate optical instrumentation, active and intelligent controls, and health monitoring and management will enable self-feeling, self-thinking, self-reconfiguring and self-healing Aerospace Propulsion Systems. These research areas address Agency challenges to deliver aerospace systems with reduced size and weight, and increased functionality and intelligence for future NASA missions in advanced aeronautics, economical space transportation, and pioneering space exploration. The Division also actively supports educational and technology transfer activities aimed at benefiting all humankind. Derived from text

Aerospace Systems; NASA Programs; Propulsion; Instruments; Control

20020073859 NASA Goddard Space Flight Center, Greenbelt, MD USA

Laboratory for Atmospheres: Philosophy, Organization, Major Activities, and 2001 Highlights *Annual Report*

Hoegy, Walter R., NASA Goddard Space Flight Center, USA; Cote, Charles, E., NASA Goddard Space Flight Center, USA; January 2002; 207p; In English; Original contains color illustrations

Report No.(s): NASA/NP-2002-4-453-GSFC; NAS 1.83:4-453-GSFC; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

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Derived from text

Earth Sciences; Earth Atmosphere; Meteorology; Laboratories

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