Scientific and Technical Aerospace Reports

STAR

Volume 38
May 19, 2000

National Aeronautics and
Space Administration
Langley Research Center

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Scientific and Technical Aerospace Reports (STAR) is an electronic abstract journal, listing citations with abstracts for aerospace-related reports obtained from worldwide sources. It is electronically published biweekly and announces documents that have recently been entered into the NASA Scientific and Technical Information (STI) Database. The documents are of the following types:

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- NASA-owned patents and patent applications
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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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G. Mathematical and Computer Sciences
H. Physics
I. Social and Information Sciences
J. Space Sciences
K. General

Indexes

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

Subject Term Index

Personal Author Index

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Subject Categories of the Division A. Aeronautics

Select a category to view the collection of records cited.

01 Aeronautics (General) 1

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

02 Aerodynamics 3

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 12

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 15

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 16

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information, see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*. For land transportation vehicles, see *85 Technology Utilization and Surface Transportation*.

06 Avionics and Aircraft Instrumentation 27

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

07 Aircraft Propulsion and Power 29

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 34

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) 35

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

Subject Categories of the Division B. Astronautics

Select a category to view the collection of records cited.

12 Astronautics (General) 36

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

13 Astrodynamics 36

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

15 Launch Vehicles and Launch Operations 37

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 39

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 45

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 45

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

19 Spacecraft Instrumentation and Astrionics 50

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

20 Spacecraft Propulsion and Power 50

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.

23 Chemistry and Materials (General) 57

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 60

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

25 Inorganic, Organic, and Physical Chemistry 64

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 66

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

27 Nonmetallic Materials 68

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 71

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

29 Space Processing 72

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

Subject Categories of the Division D. Engineering

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31 Engineering (General) 73

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 75

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 83

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 88

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 92

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

36 Lasers and Masers 95

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

37 Mechanical Engineering 96

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 97

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.

42 Geosciences (General) 101

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 102

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 125

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 136

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

46 Geophysics 142

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 146

Includes weather observation forecasting and modification.

48 Oceanography 163

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

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51 Life Sciences (General) 176

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 178

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

53 Behavioral Sciences 182

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

54 Man/System Technology and Life Support 185

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 188

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.

60 Computer Operations and Hardware 188

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 189

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 195

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 201

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 205

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

65 Statistics and Probability 206

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

66 Systems Analysis and Operations Research 207

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

Subject Categories of the Division H. Physics

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71 Acoustics 209

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 212

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

73 Nuclear Physics 214

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 217

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

75 Plasma Physics 220

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

76 Solid-State Physics 222

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

77 Physics of Elementary Particles and Fields 225

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

Subject Categories of the Division I. Social and Information Sciences

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80 Social and Information Sciences (General) 226

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

81 Administration and Management 227

Includes management planning and research.

82 Documentation and Information Science 227

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

Subject Categories of the Division J. Space Sciences

Select a category to view the collection of records cited.

89 Astronomy 243

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

90 Astrophysics 245

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

91 Lunar and Planetary Science and Exploration 257

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

92 Solar Physics 259

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

93 Space Radiation 263

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

Subject Categories of the Division K. General

Select a category to view the collection of records cited.

99 General 266

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 38, MAY 19, 2000

01
AERONAUTICS (GENERAL)

20000037804 Research and Technology Organization, Systems Concepts and Integration Panel, Neuilly-sur-Seine, France
Advances in Vehicle Systems Concepts and Integration ***Les Avancees en Concepts Systemes pour Vehicules et en Integration***
April 2000; 400p; In English; In French, 26-28 Apr. 1999, Ankara, Turkey; See also 20000037805 through 20000037844; CD-ROM contains full text document in PDF format
Report No.(s): RTO-MP-44; AC/323(SCI)TP/17; ISBN 92-837-0011-2; Copyright Waived; Avail: CASI; A17, Hardcopy; A04, Microfiche; C01, CD-ROM

The meeting proceedings from this joint symposium on ”Advances in Vehicle Systems Concepts and Integration” contain the Technical Evaluation Reports and papers presented at Symposium (A) on ”Aircraft Update Programmes, The Economical Alternative?” and at Symposium (B) on ”Warfare Automation: Procedures and Techniques for Unmanned Vehicles”. It was organized by the Systems Concepts and Integration (SCI) Panel of the RTA in Ankara, Turkey from 26 to 28 April 1999. Symposium (A) was structured in five sessions covering Cockpit, Sensors, Engine, Overview and Lessons Learned (Part I and Part II) and was concluded by a panel discussion. Symposium (B) was structured in four sessions covering Operational requirements for unmanned vehicles, Integration aspects and mission management, Platform management and critical technologies and System concepts and mission experience.
Derived from text
Conferences; Warfare; Upgrading; Economics; Aircraft Engines; Avionics; Systems Engineering; Human-Computer Interface; Pilotless Aircraft; Human Factors Engineering

20000037811 Textron Bell Helicopter, Fort Worth, TX USA
Strategy for Long-Term Systems and Technology Advancement
Vaught, F. C., Textron Bell Helicopter, USA; Giles, L. B., Textron Bell Helicopter, USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A13-1 - A13-13; In English; See also 20000037804; Copyright Waived; Avail: CASI; A03, Hardcopy

Many challenges have emerged within the past five years for both military customers, as they plan for and purchase aircraft, and for manufacturers, in producing these aircraft. Opportunities to develop new models of military rotorcraft have decreased with steady reductions in military budgets and the post cold-war environment. These budget reductions, coupled with quantum advances in computing technologies that have advanced ground-based and airborne processing power, have shifted the focus of military customers from new model development to increased aircraft performance via system upgrades and training.
Author
Upgrading; Aircraft Performance; Aircraft Industry; Systems Engineering

20000037887 Research and Technology Organization, Neuilly-sur-Seine, France
Development and Operation of UAVs for Military and Civil Applications ***Developpement et utilisation des avions sans pilote (UAV) pour des applications civiles et militaires***
April 2000; 311p; In English, 13-17 Sep. 1999, Rhode-Saint-Genese, Belgium; See also 20000037888 through 20000037899; CD-ROM contains full text document in PDF format
Report No.(s): RTO-EN-9; AC/323(AVT)TP/24; ISBN 92-837-1033-9; Copyright Waived; Avail: CASI; A14, Hardcopy; A03, Microfiche; C01, CD-ROM

Lecture Notes for the RTO Applied Vehicle Panel (AVT) Special Course on ”Development and Operation of UAVs for Military and Civil Applications” have been assembled in this report. The following topics were covered: Overview of current UAV systems and potential for the future, Design and airworthiness requirements, Propulsion systems, Airbreathing propulsion for UVAVs, Microflyers, Experimental research at low Reynolds numbers, Payloads and sensors, Datalinks, Airspace policy, Air traffic management and Tools for software and system architecture validation. The material assembled in this report was prepared under the combined sponsorship of the RTO Applied Vehicle Technology Panel, the Consultant and Exchange Programme of RTO, the von Karman Institute for Fluid Dynamics (VKI), and the NATO Partnership for Peace Programme.
Author
Airspace; Air Traffic Control; Command and Control; Architecture (Computers); Air Breathing Engines; Propulsion System Configurations; Fluid Dynamics; Pilotless Aircraft

20000038229 NASA Langley Research Center, Hampton, VA USA
Aeronautical Engineering: A Continuing Bibliography with Indexes, Supplement 411
January 2000; 77p; In English
Report No.(s): NASA/SP-2000-7037/SUPPL411; NAS 1.21:7037/SUPPL411; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
This supplemental issue of Aeronautical Engineering, A Continuing Bibliography with Indexes (NASA/SP-2000-7037) lists reports, articles, and other documents recently announced in the NASA STI Database. The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles. Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract. The NASA CASI price code table, addresses of organizations, and document availability information are included before the abstract section. Two indexes- subject and author are included after the abstract section.
Author
Aerodynamics; Aeronautical Engineering; Bibliographies; Indexes (Documentation)

20000038230 NASA Langley Research Center, Hampton, VA USA
Aeronautical Engineering: A Continuing Bibliography With Indexes, Supplement 414
April 2000; 109p; In English
Report No.(s): NASA/SP-20000-7037/SUPPL414; NAS 1.21:7037/SUPPL414; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
This report lists reports, articles and other documents recently announced in the NASA STI Database. The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles. Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract. The NASA CASI price code table, addresses of organizations, and document availability information are included before the abstract section. Two indexes-subject and author are included after the abstract section.
Author
Bibliographies; Ground Support Equipment; Design Analysis; Performance Tests; Fabrication

20000038232 NASA Langley Research Center, Hampton, VA USA
Aeronautical Engineering: A Continuing Bibliography With Indexes, Supplement 412
February 2000; 14p; In English
Report No.(s): NASA/SP-2000-7037/SUPPL412; NAS 1.21:7037/SUPPL412; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report lists reports, articles and other documents recently announced in the NASA STI Database.
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Bibliographies; Aeronautical Engineering; Indexes (Documentation)

02
AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery. For related information see also 34 Fluid Mechanics and Heat Transfer.

20000033834 Norwegian Defence Research Establishment, Kjeller, Norway
An Estimate of the Impact of Aircraft Induced Vortices on Buildings Close to Kjevik Airport ***Et Estimat av Effekten Fra Fly-Genererte Virvler pa Bebyggelse I Nerheten av Kjevik Flyplass***
Andreassen, Oyvind, Norwegian Defence Research Establishment, Norway; Langseth, Jan Olav, Norwegian Defence Research Establishment, Norway; Jan. 10, 2000; 25p; In Norwegian; Original contains color illustrations
Contract(s)/Grant(s): Proj. FFIBM/170
Report No.(s): FFI/RAPPORT-2000/00102; ISBN 82-464-0395-8; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

At some occasions, gusty winds caused by aircrafts during approach to Kjevik airport, have caused tiles to fall down from roofs, causing potential damage. In the current study, initiated by the Norwegian air traffic and airport management, the evolution of aircraft generated vortices, as they hit simple buildings and/or the ground is simulated using the numerical package CLAWPACK. The simulations show that even for B-737 generated vortices, only modest wind-speeds (up to 10 m/s) will occur close to buildings, expected to cause in worst cases only minor if at all any damage.
Author
Boeing 737 Aircraft; Vortices; Damage; Tiles; Buildings

20000034103 Missouri Univ., Rolla, MO USA
Hypersonic Flow Control Using Upstream Focused Energy Deposition
Riggins David W., Missouri Univ., USA; Nelson, H. F., Missouri Univ., USA; [1999]; 13p; In English; 37th; 37th Aerospace Sciences Meeting, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 99-0898; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A numerical study of centerline and off-centerline power deposition at a point upstream of a two-dimensional blunt body at Mach 6.5 at 30 km altitude are presented. The full Navier-Stokes equations are used. Wave drag, lift, and pitching moment are presented as a function of amount of power absorbed in the flow and absorption point location. It is shown that wave drag is considerably reduced. Modifications to the pressure distribution in the flow field due to the injected energy create lift and a pitching moment when the injection is off-centerline. This flow control concept may lead to effective ways to improve the performance and to stabilize and control hypersonic vehicles.
Author
Hypersonic Flow; Flow Velocity; Flow Distribution; Two Dimensional Bodies; Blunt Bodies

20000034199 NASA Langley Research Center, Hampton, VA USA
An Overview of Unsteady Pressure Measurements in the Transonic Dynamics Tunnel
Schuster, David M., NASA Langley Research Center, USA; Edwards, John W., NASA Langley Research Center, USA; Bennett, Robert M., NASA Langley Research Center, USA; [2000]; 42p; In English; Dynamics Specialists, 5-6 Apr. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-1770; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NASA Langley Transonic Dynamics Tunnel has served as a unique national facility for aeroelastic testing for over forty years. A significant portion of this testing has been to measure unsteady pressures on models undergoing flutter, forced oscillations, or buffet. These tests have ranged from early launch vehicle buffet to flutter of a generic high-speed transport. This paper will highlight some of the test techniques, model design approaches, and the many unsteady pressure tests conducted in the TDT. The objectives and results of the data acquired during these tests will be summarized for each case and a brief discussion of ongoing research involving unsteady pressure measurements and new TDT capabilities will be presented.
Author
Unsteady Aerodynamics; Aeroelasticity; Flutter; Flutter Analysis; Forced Vibration; Buffeting

20000034230 Naval Postgraduate School, Monterey, CA USA
Computational Analysis of the Off-Design Performance of a Mach 6 (L/D)Ispmax Optimized Waverider
Coyne, Ellen; Sep. 1999; 145p; In English
Report No.(s): AD-A374078; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

In a continuation of ongoing Naval Postgraduate School efforts to study the performance characteristics of waverider configured vehicles, a computational fluid dynamic (CFD) analysis of the Mach 6 L/DI(sp)(max) optimized Price waverider was conducted. This analysis was performed to determine the theoretical force and moment data over a broad Mach number spectrum, and to compare theoretical and experimental results in the subsonic flight regime. The CFD determination of force and moment data represents a continuation of the ongoing analysis of the Price waverider configuration. Selected viscous and inviscid flow solutions for flight conditions in the range 0.3 is less than M(infinity) is less than 6.0, as well as a subsonic (M(infinity) = 03) angle of attack sweep, were conducted using NASA CFD software (OVERFLOW1.8b). Examination of the computed converged flow field solutions suggests that the surface pressure distributions and Mach number contours surrounding the holy are valid. Low speed force and moment coefficient data are shown to exhibit reasonable agreement with the available subsonic wind tunnel data. Additionally, supersonic CFD results show the development of the expected shock layer, exhibiting an attached shock bed at the design Mach number (M(infinity) = 6.0). Evaluation of the computed Mach number effects on lift and drag coefficients at subsonic, transonic and supersonic Mach numbers suggests that the Price waverider may exhibit some flight instabilities across the flight Mach number spectrum.
DTIC
Aerodynamic Configurations; Hypersonic Flight; Wind Tunnel Tests; Supersonic Flow; Aerodynamic Coefficients; Computational Fluid Dynamics; Subsonic Speed; Viscous Flow

20000034237 Kansas Univ. Center for Research, Inc., Flight Research Lab., Lawrence, KS USA
Aerodynamic Modeling for Aircraft in Unsteady Flight Conditions ***Final Report, 22 Mar. 1996 - 30 Sep. 1999***
Lan, C. Edward, Kansas Univ. Center for Research, Inc., USA; Apr. 06, 2000; 55p; In English
Contract(s)/Grant(s): NAG1-1821; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This report summarizes the activities in unsteady aerodynamic modeling and application of unsteady aerodynamic models to flight dynamics. A public on briefing was presented on July 21, 1999 at Langley Research Center.
Derived from text
Aerodynamic Characteristics; Flight Conditions; Unsteady Aerodynamics; Mathematical Models

20000034897 NASA Dryden Flight Research Center, Edwards, CA USA
Optimal Pitch Thrust-Vector Angle and Benefits for all Flight Regimes
Gilyard, Glenn B., NASA Dryden Flight Research Center, USA; Bolonkin, Alexander, National Academy of Sciences, USA; March 2000; 28p; In English
Contract(s)/Grant(s): RTOP 522-16-14
Report No.(s): NASA/TM-2000-209021; NAS 1.15:209021; H-2402; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The NASA Dryden Flight Research Center is exploring the optimum thrust-vector angle on aircraft. Simple aerodynamic performance models for various phases of aircraft flight are developed and optimization equations and algorithms are presented in this report. Results of optimal angles of thrust vectors and associated benefits for various flight regimes of aircraft (takeoff, climb, cruise, descent, final approach, and landing) are given. Results for a typical wide-body transport aircraft are also given. The benefits accruable for this class of aircraft are small, but the technique can be applied to other conventionally configured aircraft. The lower L/D aerodynamic characteristics of fighters generally would produce larger benefits than those produced for transport aircraft.
Author
Pitch (Inclination); Thrust Vector Control; Automatic Flight Control; Angles (Geometry)

20000034932 Analytical Services and Materials, Inc., Lancaster, CA USA
Implementation of Advanced Two Equation Turbulence Models in the USM3D Unstructured Flow Solver
Wang, Qun-Zhen, Analytical Services and Materials, Inc., USA; Massey, Steven J., Analytical Services and Materials, Inc., USA; Abdol-Hamid, Khaled S., Analytical Services and Materials, Inc., USA; April 2000; 36p; In English
Contract(s)/Grant(s): NAS4-50066; RTOP 522-31-21-01
Report No.(s): NASA/CR-2000-210102; NAS 1.26:210102; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
USM3D is a widely-used unstructured flow solver for simulating inviscid and viscous flows over complex geometries. The current version (version 5.0) of USM3D, however, does not have advanced turbulence models to accurately simulate complicated flow. We have implemented two modified versions of the original Jones and Launder k-epsilon ”two-equation” turbulence model and the Girimaji algebraic Reynolds stress model in USM3D. Tests have been conducted for three flat plate boundary layer cases,

a RAE2822 airfoil and an ONERA M6 wing. The results are compared with those from direct numerical simulation, empirical formulae, theoretical results, and the existing Spalart-Allmaras one-equation model.
Author
Applications Programs (Computers); Navier-Stokes Equation; Unstructured Grids (Mathematics); Turbulence Models; Airfoils; Wings; Viscous Flow; Flat Plates; Inviscid Flow; Computerized Simulation; Computational Fluid Dynamics

20000036432 NASA Langley Research Center, Hampton, VA USA
1998 NASA High-Speed Research Program Aerodynamic Performance Workshop, Volume 2, High Lift
McMillin, S. Naomi, Editor, NASA Langley Research Center, USA; December 1999; 990p; In English; Aerodynamic Performance, 9-13 Feb. 1998, Los Angeles, CA, USA; Sponsored by NASA, USA; See also 20000036433 through 20000036451; Original contains color illustrations
Contract(s)/Grant(s): RTOP 537-07-00
Report No.(s): NASA/CP-1999-209692/VOL2; L-17758C/VOL2; NAS 1.55:209692/VOL2; No Copyright; Avail: CASI; A99, Hardcopy; A10, Microfiche

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

20000036433 Boeing Co., High Lift Aerodynamics ITD Team, Seattle, WA USA
High Lift Aerodynamics Technology Development
Meredith, Paul T., Boeing Co., USA; 1998 NASA High-Speed Research Program Aeodynamic Performance Workshop; December 1999; Volume 2, pp. 1873-1895; In English; See also 20000036432; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The overall goals and objectives of this paper are to: 1) Greatly increase L/D relative to SST Technology (suction Parameter greater than or equal to 92%; 2) Establish and Validate Analysis/Design Methodology; 3) Define Preferred High Lift System; and 4) Technology Readiness Level greater than or equal to 6. This paper is presented in viewgraph form.
Derived from text
Aerodynamic Configurations; Technology Assessment; Lift

20000036434 Boeing Co., Seattle, WA USA
TCA High Lift Preliminary Assessment
Wyatt, G. H., Boeing Co., USA; Polito, R. C., Boeing Co., USA; Yeh, D. T., Boeing Co., USA; Elzey, M. E., Boeing Co., USA; Tran, J. T., Boeing Co., USA; Meredith, Paul T., Boeing Co., USA; 1998 NASA High-Speed Research Program Aeodynamic Performance Workshop; December 1999; Volume 2, pp. 1897-1931; In English; See also 20000036432
Contract(s)/Grant(s): NAS1-20220; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This paper presents a TCA (Technology Concept Airplane) High lift Preliminary Assessment. The topics discussed are: 1) Model Description; 2) Data Repeatability; 3) Effect of Inboard L.E. (Leading Edge) Flap Span; 4) Comparison of 14'x22' TCA-1 With NTF (National Transonic Facility) Modified Ref. H; 5) Comparison of 14'x22' and NTF Ref. H Results; 6) Effect of Outboard Sealed Slat on TCA; 7) TCA Full Scale Build-ups; 8) Full Scale L/D Comparisons; 9) TCA Full Scale; and 10) Touchdown Lift Curves. This paper is in viewgraph form.
CASI
Lift; Technology Assessment; Civil Aviation; Transonic Wind Tunnels; Wind Tunnel Tests

20000036435 Boeing Co., Long Beach, CA USA

TCA Planform and Leading-Edge Study at High Lift Conditions

Yeh, David T., Boeing Co., USA; Clark, Roger W., Boeing Co., USA; 1998 NASA High-Speed Research Program Aeodynamic Performance Workshop; December 1999; Volume 2, pp. 1933-2003; In English; See also 20000036432; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

This report starts with the description of the objectives for the HSCT high-lift aerodynamics, followed by the numerical approach. Numerical results will be presented and comparison will be made with available test data or another CFD code. The basic flow characteristics for the TCA (Technology Concept Aircraft) configuration will be first described, followed by the discussions of the effects of spanwise extent of the leading-edge flaps, inboard leading edge camber increase and the planform variation of the TCA2.8-28 from the baseline TCA configuration. This report concludes with a summary and future plans.
Derived from text

Aircraft Configurations; Leading Edge Flaps; Planforms; Lift; Computational Fluid Dynamics; Civil Aviation

20000036436 Boeing Commercial Airplane Co., Seattle, WA USA

Prediction of High Lift Characteristics of the PTC

Ebner, Keith, Boeing Commercial Airplane Co., USA; 1998 NASA High-Speed Research Program Aeodynamic Performance Workshop; December 1999; Volume 2, pp. 2005-2053; In English; See also 20000036432; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This paper presents, in viewgraph form, Prediction of High Lift Characteristics of the PTC (Preliminary Technology Concept). The topics include: 1) PTC vs. TCA configuration aspects; 2) Common process overview; 3) Baseline wind tunnel data; 4) Buildup to PTC; 5) 3-surface optimization; 6) Programmed flap; 7) Technology projection; and 8) Touchdown performance. This paper also shows the differences between TCA and the PTC that are important to high lift aerodynamics.
CASI

Wind Tunnel Tests; Performance Prediction; Aerodynamic Characteristics; Lift; Technology Utilization; Body-Wing Configurations

20000036437 Boeing Information, Space and Defense Systems, Phantom Works, Seal Beach, CA USA

Correlation of CFD Calculations and Wind Tunnel Measurements for the M2.4-7A Arrow Wing Configuration

Woan, Chung-Jin, Boeing Information, Space and Defense Systems, USA; 1998 NASA High-Speed Research Program Aeodynamic Performance Workshop; December 1999; Volume 2, pp. 2055-2105; In English; See also 20000036432; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

A self-contained working CFD (Computational Fluid Dynamics) procedure has been presented for wind tunnel flow simulations and applied to the 4%-scale M2.4-7A Arrow Wing inside the NASA/Ames 12-ft wind tunnel with and without model supporting posts. The effect of the tunnel wall alone was found to give larger values in forces and moment as compared with the free-air case. However tunnel wall alone did not change the over-wing vortex flow structure existing in the free-air case. The effect of the model supporting posts has been found to eliminate the over-wing vortex flow existing in the free-air case. The test data from the NASA/LaRC 14’x22’ wind tunnel tests seemed to support this observation. Good quality test data are in need to further validate CFD solutions. It is recommended to use CFD to identify locations of pressure ports for wind tunnel data measurements.
Derived from text

Aerodynamic Configurations; Arrow Wings; Computational Fluid Dynamics; Wind Tunnel Tests; Scale Models; Civil Aviation

20000036438 Boeing Co., Long Beach, CA USA

4% Arrow Wing Model Test in NASA Ames 12 ft Pressure Tunnel

Edwards, Robin, Boeing Co., USA; Polito, Ryan, Boeing Co., USA; Clark, Roger, Boeing Co., USA; 1998 NASA High-Speed Research Program Aeodynamic Performance Workshop; December 1999; Volume 2, pp. 2107-2159; In English; See also 20000036432; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

The test objectives of the 4% Arrow Wing Model are to: 1) Compare results with previous test in Langley 14’x22’ tunnel; 2) Investigate effect of increased le radius; 3) Investigate Re no (Reynolds Number) effects on an alternate planform; 4) Optimize le/te (leading edge/trailing edge) flap deflection for climb; 5) Gather wing deformation data (LaRC); and 6) Gather flow visualization data. The main details of the test of the M2.4-7A Arrow Wing Model in the Ames 12’ Pressure Tunnel are shown. This paper is presented in viewgraph form.
CASI

Arrow Wings; Wind Tunnel Tests; Scale Models; Aerodynamic Configurations; Subsonic Speed

20000036439 Boeing Co., Long Beach, CA USA

Power Effects on High Lift, Stability and Control Characteristics of the TCA Model Tested in the LaRC 14 x 22 Ft Wind Tunnel

Glessner, Paul T., Boeing Co., USA; 1998 NASA High-Speed Research Program Aeodynamic Performance Workshop; December 1999; Volume 2, pp. 2161-2186; In English; See also 20000036432

Contract(s)/Grant(s): NAS1-20220; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The TCA-2 wind-tunnel test was the second in a series of planned tests utilizing the 5% Technology Concept Airplane (TCA) model. Each of the tests was planned to utilize the unique capabilities of the NASA Langley 14'x22' and the NASA Ames 12' test facilities, in order to assess specific aspects of the high lift and stability and control characteristics of the TCA configuration. However, shortly after the completion of the TCA-1 test, an early projection of the Technology Configuration (TC) identified the need for several significant changes to the baseline TCA configuration. These changes were necessary in order to meet more stringent noise certification levels, as well as, to provide a means to control dynamic structural modes. The projected changes included a change to the outboard wing (increased aspect ratio and lower sweep) and a reconfiguration of the longitudinal control surfaces to include a medium size canard and a reduced horizontal tail. The impact of these proposed changes did not affect the TCA-2 test, because it was specifically planned to address power effects on the empennage and a smaller horizontal tail was in the plan to be tested. However, the focus of future tests was reevaluated and the emphasis was shifted away from assessment of TCA specific configurations to a more general assessment of configurations that encompass the projected design space for the TC.

Derived from text

Wind Tunnel Tests; Control Stability; Lift; Aerodynamic Characteristics; Civil Aviation; Powered Models; Aerodynamic Configurations

20000036440 Boeing Co., Long Beach, CA USA

Assessment of Boundary-Layer Transition Detection and Fixing Techniques

Hammer, Marvine, Boeing Co., USA; Clark, Roger, Boeing Co., USA; 1998 NASA High-Speed Research Program Aeodynamic Performance Workshop; December 1999; Volume 2, pp. 2187-2231; In English; See also 20000036432; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This paper presents an Assessment of Boundary Layer Transition Detection and Fixing Techniques. The topics include: 1) Transition Detection Techniques Evaluation and Selection; 2) Advantages/Disadvantages of Candidate Techniques; 3) TSP (Temperature Sensitive Paint) System Detail; and 3) TSP Results. This paper is presented in viewgraph form.

CASI

Boundary Layer Transition; Imaging Techniques; Detection; Laminar Flow

20000036441 Boeing Co., Long Beach, CA USA

Experimental Study of Static and Dynamic Ground Effects for Low Aspect Ratio Wings

Owens, Lewis R., Boeing Co., USA; Powell, Arthur G., Boeing Co., USA; Curry, Robert E., Boeing Co., USA; 1998 NASA High-Speed Research Program Aeodynamic Performance Workshop; December 1999; Volume 2, pp. 2233-2297; In English; See also 20000036432; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

This presentation includes a summary of a recent experimental study of the static and dynamic ground effects for low aspect ratio wings. For the HSCT wing planforms tested in the 14x22 ft DGE test, no significant differences were found between DGE (Dynamic Ground Effects) and SGE (Static Ground Effects) test techniques. From previous ground effects data, the aspect ratios of the model wing planforms tested were such that differences in DGE and SGE data were expected. Closer examination of all the data suggested that other factors (in addition to AR) may need to be controlled to better understand this difference. Comparisons of the ground effects increment data from the 14x22 ft DGE test and the flight test for the TU-144 were good. These ground effects increments compared well even with a very basic model that represented only the wing planform of the TU-144 aircraft dynamic ground effects of low aspect ratio wings.

Derived from text

Low Aspect Ratio Wings; Ground Effect (Aerodynamics); Static Tests; Dynamic Tests; Wind Tunnel Tests; Civil Aviation

20000036442 Boeing Commercial Airplane Co., Seattle, WA USA

Potential Flow Analysis of Dynamic Ground Effect

Feifel, W. M., Boeing Commercial Airplane Co., USA; 1998 NASA High-Speed Research Program Aeodynamic Performance Workshop; December 1999; Volume 2, pp. 2299-2385; In English; See also 20000036432

Contract(s)/Grant(s): NAS1-20220; No Copyright; Avail: CASI; A05, Hardcopy; A10, Microfiche

Interpretation of some flight test data suggests the presence of a 'dynamic ground effect'. The lift of an aircraft approaching the ground depends on the rate of descent and is lower than the aircraft steady state lift at a same height above the ground. Such a lift deficiency under dynamic conditions could have a serious impact on the overall aircraft layout. For example, the increased pitch angle needed to compensate for the temporary loss in lift would reduce the tail strike margin or require an increase in landing gear length. Under HSR2 an effort is under way to clarify the dynamic ground effect issue using a multi-pronged approach. A dynamic ground effect test has been run in the NASA Langley 14x22 ft wind tunnel. Northup-Grumman is conducting time accurate CFD (Computational Fluid Dynamics) Euler analyses on the National Aerodynamic Simulator facility. Boeing has been using linear potential flow methodology which are thought to provide much needed insight in, physics of this very complex problem. The present report summarizes the results of these potential flow studies.
Derived from text
Computational Fluid Dynamics; Ground Effect (Aerodynamics); Potential Flow; F-15 Aircraft; Wind Tunnel Tests; Dynamic Tests; Aerodynamic Configurations

20000036443 Northrop Grumman Corp., Bethpage, NY USA
Dynamic Ground Effects Simulation Using OVERFLOW-D
Dwyer, Bill, Northrop Grumman Corp., USA; 1998 NASA High-Speed Research Program Aeodynamic Performance Workshop; December 1999; Volume 2, pp. 2388-2469; In English; See also 20000036432; Original contains color illustrations
Contract(s)/Grant(s): NAS1-20220; ZA0867; No Copyright; Avail: CASI; A05, Hardcopy; A10, Microfiche

This presentation is broken into 5 logical sections. The Background Information section describes the technical issues being address by this study. The Approach section describes the organization of the contract effort which was laid out as the most effective means of quantifying, with validated methods, the magnitude of dynamic ground effects for the TCA (Technology Concept Aircraft) configuration. The Validation Case section describes the analysis of the XB-70 configuration in both static and dynamic ground effect, with comparisons to wind tunnel and flight test data. The TCA Analysis section then describes the application of the same codes and methodologies to the TCA in both static and dynamic ground effect. Comparisons are made between the static and dynamic, as well as to early static data from a recent wind tunnel test on the TCA configuration. Finally, the work to date is summarized and the future direction of this study is outlined.
Derived from text
B-70 Aircraft; Ground Effect (Aerodynamics); Computerized Simulation; Wind Tunnel Tests; Applications Programs (Computers); Civil Aviation; Dynamic Tests

20000036444 NASA Langley Research Center, Hampton, VA USA
Recent Results in the Study of Static Ground Effect Using an Inviscid Unstructured Grid Code
Yaros, Steven F., NASA Langley Research Center, USA; 1998 NASA High-Speed Research Program Aeodynamic Performance Workshop; December 1999; Volume 2, pp. 2471-2507; In English; See also 20000036432; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The TetrUSS (Tetrahedral Unstructured Software System), developed at NASA LaRC, enables one to take a vehicle from its surface definition to its analyzed solution. The important parts are the shape definition, accomplished in GRIDTOOL; the initial front and volume grid generation in VGRID; the flow solver USM3D, and the various ways used to post-process the computational results.
Derived from text
Ground Effect (Aerodynamics); Unstructured Grids (Mathematics); Static Tests; Applications Programs (Computers); Wind Tunnel Tests; Inviscid Flow; Computational Fluid Dynamics

20000036445 Boeing Commercial Airplane Co., Seattle, WA USA
Potential Flow Analysis of the Mark-16 Flow Survey Probe
Roth, Eric J., Boeing Commercial Airplane Co., USA; 1998 NASA High-Speed Research Program Aeodynamic Performance Workshop; December 1999; Volume 2, pp. 2509-2543; In English; See also 20000036432; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

A flow survey probe is an important tool for investigating the complex flow field around a wind tunnel model. It is especially useful for quantitative measurements of profile and induced drag. These separate measurements, which cannot be distinguished using a force balance, are necessary for CFD validation. The cost of using a flow survey probe includes not only the hardware and software, but also the staff required to operate it. If modifications need to be made to the existing hardware, cost will increase as well. Installing the traverser is simple, especially if holes are drilled into the mounting surface prior to installation. Installation time in this case could be on the order of 45 minutes. A major drawback of any flow survey system is the possibility of aerodynamic

influence. It is important that the traverser, whose purpose is to measure the flow field created by the model, not alter that flow field and give inaccurate data. Any changes to the flow field must be taken into account.
Derived from text
Computational Fluid Dynamics; Flow Distribution; Potential Flow; Aerodynamic Configurations; Wind Tunnel Models

20000036446 Boeing Co., High Lift Aerodynamics, Seattle, WA USA
Aerodynamic Design of Inboard Sealed Slats for the TCA-3 Wind Tunnel Test
Griffiths, Robert C., Boeing Co., USA; 1998 NASA High-Speed Research Program Aeodynamic Performance Workshop; December 1999; Volume 2, pp. 2545-2583; In English; See also 20000036432; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The goal of this study was to design inboard leading edge devices that would improve the baseline plain flap performance (airplane L/D). Sealed slats were selected to focus the study on because of the success seen with these devices on the sharp outboard leading edge and because of the aerodynamic benefits inherent in the sealed slat concept. Ultimately, the result of this study was to choose the best leading edge designs, build them and test them in TCA-3. Included in this discussion are reasons as to why sealed slats work, design constraints approach taken, and computational results.
Derived from text
Wind Tunnel Tests; Aircraft Design; Civil Aviation; Leading Edge Slats; Aerodynamic Configurations

20000036447 DYNACS Engineering Co., Inc., Huntsville, AL USA
Navier-Stokes Results for HSCT High-Lift Configurations
Saladino, Anthony J., DYNACS Engineering Co., Inc., USA; Chen, Allen W., Boeing Commercial Airplane Co., USA; 1998 NASA High-Speed Research Program Aeodynamic Performance Workshop; December 1999; Volume 2, pp. 2585-2689; In English; See also 20000036432; Original contains color illustrations; No Copyright; Avail: CASI; A06, Hardcopy; A10, Microfiche

This presentation summarizes the effects of flap span and outward wing sweep on the Ref. H, and sealed slats vs. plain flaps on the TCA. In each of the three tasks, CFD was used to determine if it can duplicate the wind tunnel results and explain the phenomena. Each task has its own conclusions. Final recommendations are made based upon the conclusions of the three tasks.
Derived from text
Aerodynamic Configurations; Civil Aviation; Navier-Stokes Equation; Supersonic Transports; Lift; Computational Fluid Dynamics; Wind Tunnel Tests

20000036448 NASA Langley Research Center, Hampton, VA USA
Code Calibration Applied to the TCA High-Lift Model in the 14 x 22 Wind Tunnel (Simulation With and Without Model Post-Mount)
Lessard, Wendy B., NASA Langley Research Center, USA; 1998 NASA High-Speed Research Program Aeodynamic Performance Workshop; December 1999; Volume 2, pp. 2691-2733; In English; See also 20000036432; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The objective of this study is to calibrate a Navier-Stokes code for the TCA (30/10) baseline configuration (partial span leading edge flaps were deflected at 30 degs. and all the trailing edge flaps were deflected at 10 degs). The computational results for several angles of attack are compared with experimental force, moments, and surface pressures. The code used in this study is CFL3D; mesh sequencing and multi-grid were used to full advantage to accelerate convergence. A multi-grid approach was used similar to that used for the Reference H configuration allowing point-to-point matching across all the trailingedge block interfaces. From past experiences with the Reference H (ie, good force, moment, and pressure comparisons were obtained), it was assumed that the mounting system would produce small effects; hence, it was not initially modeled. However, comparisons of lower surface pressures indicated the post mount significantly influenced the lower surface pressures, so the post geometry was inserted into the existing grid using Chimera (overset grids).
Derived from text
Navier-Stokes Equation; Wind Tunnel Tests; Applications Programs (Computers); Aircraft Configurations; Computational Fluid Dynamics; Civil Aviation

20000036449 ASE Technologies, Inc., Cincinnati, OH USA

Aerodynamic Analysis of TCA Wing/Body/Nacelle High Lift Configurations

Fan, Xue-Tong, ASE Technologies, Inc., USA; Hickey, Paul, ASE Technologies, Inc., USA; 1998 NASA High-Speed Research Program Aeodynamic Performance Workshop; December 1999; Volume 2, pp. 2735-2764; In English; See also 20000036432; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The objectives of this work are two fold. The first objective is to develop efficient CFD modeling procedures for the TCA high lift configurations with nacelle installation. The second objective is to evaluate the effect of nacelle installation on the aerodynamic performance of the TCA high lift configurations. to achieve the first objective, we will build multi-block CFD grids to include nacelles and diverters in the TCA high lift configurations with and without deflected LE/TE (Leading Edge/Trailing Edge) flaps. and then we will use CFL3D to obtain fully converged turbulent solutions for the TCA W/B/N (Wing/Body/Nacelle) models. For the second objective, we will, from the CFD solutions, identify and analyze important flow characteristics due to nacelle installation to support Propulsion Airframe Integration. We will also provide flow and performance data for the TCA W/B/N configurations to supplement wind tunnel test.

Derived from text

Computational Fluid Dynamics; Civil Aviation; Nacelles; Lift; Aerodynamic Characteristics; Wind Tunnel Tests; Body-Wing Configurations

20000036450 Boeing Co., Long Beach, CA USA

Canard Integration for CFD Analysis of HSCT High Lift Configurations

Yeh, David T., Boeing Co., USA; 1998 NASA High-Speed Research Program Aeodynamic Performance Workshop; December 1999; Volume 2, pp. 2765-2829; In English; See also 20000036432; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

This report starts with the description of the objectives for canard integration analysis, followed by the numerical approach. The methodologies behind the automated canard modeling procedure are described and the integration process to obtain the numerical solutions is then summarized. A sample solution is presented and analyzed for the TCA wing/body/canard configuration with a part span leading edge flap deflected at 30 degrees and the trailing edge flaps deflected at 10 degrees at a high lift condition. This report concludes with a summary and future plans.

Derived from text

Canard Configurations; Civil Aviation; Computational Fluid Dynamics; Lift; Supersonic Transports; Numerical Analysis

20000036451 ASE Technologies, Inc., Cincinnati, OH USA

Comparison of CFL3D Solutions Using Alternative Grid Interfacing Schemes

Fan, Xue-Tong, ASE Technologies, Inc., USA; Hickey, Paul, ASE Technologies, Inc., USA; 1998 NASA High-Speed Research Program Aeodynamic Performance Workshop; December 1999; Volume 2, pp. 2831-2847; In English; See also 20000036432; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The objectives of this work are twofold. The first objective is to compare and cross-examine the CFL3D solutions for the TCA W/B/N (Wing/Body/Nacelle) models using two different grid interfacing methods: face-matching (or patching) with RONNIE and overlapping with MAGGIE. The second objective is to evaluate these two methods and determine which one is better suited for the CFD modeling of the TCA W/B/N configurations. The grid interfacing method will be evaluated in terms of grid generation effort, block interface quality, and computer resources. Special attention is paid to the potential technical difficulties involved, especially in the case of deflected TE flaps for TCA (Technology Concept Aircraft) high lift configurations.

Derived from text

Computational Fluid Dynamics; Computational Grids; Civil Aviation; Applications Programs (Computers); Aerodynamic Configurations

20000037696 Naval Surface Warfare Center, Dahlgren Div., Dahlgren, VA USA

Improvements in Pitch Damping for the Aeroprediction Code with Particular Emphasis on Flare Configurations *Final Report*

Moore, Frank G.; Hymer, Tom C.; Apr. 2000; 49p; In English

Report No.(s): AD-A375056; NSWCDD/TR-00/009; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

New capability has been added to the NSWC aeroprediction code to allow aerodynamics to be predicted for Mach numbers up to 20 for configurations with flares. This new capability includes extending the static aerodynamic predictions for Mach numbers less than 1.2, improving the body alone pitch damping for Mach numbers above 2.0, and developing a new capability for pitch damping of flared configurations at Mach numbers up to 20. This new capability for flared configurations was validated

for several different configurations in the Mach number range of 2 to 8.8. In general, pitch damping predictions of the improved capability was within 20 percent of either experimental data or computational fluid dynamics calculations. This accuracy level is believed to be quite adequate for dynamic derivatives in the preliminary design stage. These new additions to the aeroprediction code will be transitioned to users as part of the 2002 version of the code (APO2).
DTIC
Aerodynamic Configurations; Aerodynamic Stability; Accuracy

20000037720 NASA Langley Research Center, Hampton, VA USA
Contributions of Transonic Dynamics Tunnel Testing to Airplane Flutter Clearance
Rivera, Jose A., NASA Langley Research Center, USA; Florance, James R., NASA Langley Research Center, USA; [2000]; 20p; In English; Dynamics Specialists Conference, 5-6 Apr. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-1768; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Transonic Dynamics Tunnel (TDT) became in operational in 1960, and since that time has achieved the status of the world's premier wind tunnel for testing large in aeroelastically scaled models at transonic speeds. The facility has many features that contribute to its uniqueness for aeroelastic testing. This paper will briefly describe these capabilities and features, and their relevance to aeroelastic testing. Contributions to specific airplane configurations and highlights from the flutter tests performed in the TDT aimed at investigating the aeroelastic characteristics of these configurations are presented.
Author
Transonic Wind Tunnels; Aircraft Configurations; Aeroelasticity; Dynamic Tests

20000037779 NASA Dryden Flight Research Center, Edwards, CA USA
Aerodynamic Lift and Moment Calculations Using a Closed-Form Solution of the Possio Equation
Lin, Jensen, California Univ., USA; Iliff, Kenneth W., NASA Dryden Flight Research Center, USA; April 2000; 26p; In English
Contract(s)/Grant(s): NCC2-374; RTOP 529-50-04
Report No.(s): NASA/TM-2000-209019; NAS 1.15:209019; H-2374; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this paper, we present closed-form formulas for the lift and moment coefficients of a lifting surface in two dimensional, unsteady, compressible, subsonic flow utilizing a newly developed explicit analytical solution of the Possio equation. Numerical calculations are consistent with previous numerical tables based on series expansions or ad hoc numerical schemes. More importantly, these formulas lend themselves readily to flutter analysis, compared with the tedious table-look-up schemes currently in use.
Author
Aerodynamic Coefficients; Lift; Aeroelasticity; Method of Moments; Unsteady Aerodynamics; Laplace Transformation

20000037896 Naval Air Systems Command, Patuxent , MD USA
Tactical Payloads for UAVs
Carruso, Amy Houle, Naval Air Systems Command, USA; Development and Operation of UAVs for Military and Civil Applications; April 2000, pp. 9-1 - 9-5; In English; See also 20000037887; Copyright Waived; Avail: CASI; A01, Hardcopy

The Tactical Systems Program Office of the Program Executive Officer, Cruise Missiles and Unmanned Aerial Vehicles PEO(CU) is developing and refining Payload Concepts of Operation (CONOPS) based on demonstrated capabilities, new technology, and emerging operator needs. The Tactical Systems Program Office continues to expand technical and operational capabilities for increased Unmanned Aerial Vehicle (UAV) applications. to support future military operations, the Tactical Systems Program Office foresees UAVs as a complement to manned and space based systems. Traditionally, UAV Payload operations focused on the ElectroOptical/InfraRed (EO/IR) reconnaissance role. While still the highest priority requirement, new technologies have expanded potential payload applications. Aware of the importance of newly maturing technologies, the Tactical Systems Program Office continuously monitors technologies sponsored by the Government and industry to determine their direct application to UAV airborne platforms and ground stations.
Author
Pilotless Aircraft; Payloads; Aerial Reconnaissance; Infrared Imagery; Infrared Radiation

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents. For related information see also 16 Space Transportation and 85 Urban Technology and Transportation.

20000033823 NASA Glenn Research Center, Cleveland, OH USA

The NASA Aviation Safety Program: Overview

Shin, Jaiwon, NASA Glenn Research Center, USA; March 2000; 14p; In English; 45th; International Gas Turbine and Aeroengine Technical Congress, 8-11 May 2000, Munich, Germany; Sponsored by American Society of Mechanical Engineers, USA

Contract(s)/Grant(s): RTOP 577-90-20

Report No.(s): NASA/TM-2000-209810; E-12119; NAS 1.15:209810; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In 1997, the USA set a national goal to reduce the fatal accident rate for aviation by 80% within ten years based on the recommendations by the Presidential Commission on Aviation Safety and Security. Achieving this goal will require the combined efforts of government, industry, and academia in the areas of technology research and development, implementation, and operations. to respond to the national goal, the National Aeronautics and Space Administration (NASA) has developed a program that will focus resources over a five year period on performing research and developing technologies that will enable improvements in many areas of aviation safety. The NASA Aviation Safety Program (AvSP) is organized into six research areas: Aviation System Modeling and Monitoring, System Wide Accident Prevention, Single Aircraft Accident Prevention, Weather Accident Prevention, Accident Mitigation, and Synthetic Vision. Specific project areas include Turbulence Detection and Mitigation, Aviation Weather Information, Weather Information Communications, Propulsion Systems Health Management, Control Upset Management, Human Error Modeling, Maintenance Human Factors, Fire Prevention, and Synthetic Vision Systems for Commercial, Business, and General Aviation aircraft. Research will be performed at all four NASA aeronautics centers and will be closely coordinated with Federal Aviation Administration (FAA) and other government agencies, industry, academia, as well as the aviation user community. This paper provides an overview of the NASA Aviation Safety Program goals, structure, and integration with the rest of the aviation community.

Author

Aircraft Accidents; Aircraft Safety; Accident Prevention; Commercial Aircraft; Fire Prevention; Flight Safety; Human Performance

20000034032 Army Cold Regions Research and Engineering Lab., Hanover, NH USA

Remote Sensing of In-Flight Icing Conditions: Operational, Meteorological, and Technological Considerations ***Final Report***

Ryerson, Charles C., Army Cold Regions Research and Engineering Lab., USA; March 2000; 76p; In English

Contract(s)/Grant(s): NASA Order C-73343-E; RTOP 548-21-23

Report No.(s): NASA/CR-2000-209938; E-12186; NAS 1.15:209938; ERDC-CRREL-M-00-1; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Remote-sensing systems that map aircraft icing conditions in the flight path from airports or aircraft would allow icing to be avoided and exited. Icing remote-sensing system development requires consideration of the operational environment, the meteorological environment, and the technology available. Operationally, pilots need unambiguous cockpit icing displays for risk management decision-making. Human factors, aircraft integration, integration of remotely sensed icing information into the weather system infrastructures, and avoid-and-exit issues need resolution. Cost, maintenance, power, weight, and space concern manufacturers, operators, and regulators. An icing remote-sensing system detects cloud and precipitation liquid water, drop size, and temperature. An algorithm is needed to convert these conditions into icing potential estimates for cockpit display. Specification development requires that magnitudes of cloud microphysical conditions and their spatial and temporal variability be understood at multiple scales. The core of an icing remote-sensing system is the technology that senses icing microphysical conditions. Radar and microwave radiometers penetrate clouds and can estimate liquid water and drop size. Retrieval development is needed; differential attenuation and neural network assessment of multiple-band radar returns are most promising to date. Airport-based radar or radiometers are the most viable near-term technologies. A radiometer that profiles cloud liquid water, and experimental techniques to use radiometers horizontally, are promising. The most critical operational research needs are to assess cockpit and aircraft system integration, develop avoid-and-exit protocols, assess human factors, and integrate remote-sensing information into weather and air traffic control infrastructures. Improved spatial characterization of cloud and precipitation liquid-water content, drop-size spectra, and temperature are needed, as well as an algorithm to convert sensed conditions into a measure of icing potential. Technology development also requires refinement of inversion techniques. These

goals can be accomplished with collaboration among federal agencies including NASA, the FAA, the National Center for Atmospheric Research, NOAA, and the Department of Defense. This report reviews operational, meteorological, and technological considerations in developing the capability to remotely map in-flight icing conditions from the ground and from the air.
Author
Remote Sensing; In Situ Measurement; Aircraft Icing; Cockpits; Drop Size; Drops (Liquids); Moisture Content; Temperature; Cloud Physics

20000034077 Naval Research Lab., Chemical Dynamics and Diagnostics Branch, Washington, DC USA
Development of an Early Warning Multi-criteria Fire Detection System: Analysis of Transient Fire Signatures Using a Probabilistic Neural Network ***Interim Report, Jan.-Sep. 1999***
Shaffer, Ronald E.; Rose-Pehrsson, Susan L.; Williams, Frederick W.; Barry, Colin; Gottuk, Daniel T.; Feb. 16, 2000; 33p; In English
Report No.(s): AD-A373837; NRL/MR/6110--00-8429; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report describes the progress made in developing an early warning, multi-criteria, fire detection system for the Office of Naval Research (ONR) program on Damage Control: Automation for Reduced Manning (DC-ARM). In this work, the analysis of transient fire signatures is studied using a probabilistic neural network (PNN). Experiments are described to study the effects of various PNN training parameters and to determine the optimal sensor suite combination, which enables both early fire detection and high nuisance source rejection. Comparisons are made between the candidate sensor arrays, commercial fire detection systems, and sensor arrays proposed in previous reports. Recommendations and directions for future research are also given.
DTIC
Fires; Neural Nets; Early Warning Systems; Fire Prevention; Detection

20000034152 Naval Postgraduate School, Monterey, CA USA
USA Marine Corps; (USMC) KC-130J Tanker Replacement Requirements and Cost/Benefit Analysis
McCarthy, Mitchell J.; Dec. 1999; 114p; In English
Report No.(s): AD-A374094; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy
NAVAIR funded a research project to answer the question: how many KC-130Js Aerial Refueling Tankers will the US Marine Corps (USMC) need to meet their future wartime requirements? This thesis supports that study. Thesis results were incorporated into the recently completed Marine KC-130 Requirements Study. by Professors Gates, Kwon, Washburn, and Anderson. Specifically, the thesis focuses on the tradeoffs the USMC faces between requirements, performance, and life-cycle costs. The KC-130J aerial refueling requirement must support expected USMC fixed-wing refueling demand during two nearly simultaneous major theater wars. Furthermore, refueling capacity must keep the average time an aircraft waits in the aerial refueling queue (CT(q)) below five minutes. To define the tradeoff between the KC-130J requirement and system performance (waiting time), the thesis develops a Simulation Model using the ARENA(copyright) simulation language. The simulation model highlights the impact of capacity failures (refueling drogues and hoses) and overlaps between KC-130J sorties, two potentially significant factors that can't be explored with standard static queuing theory models. Next, the thesis develops a Life Cycle Cost (LCC) Model that incorporates cost variability using the Crystal Ball EXCEL(copyright) spreadsheet add-on. The model defines the tradeoffs between LCC and KC-130J fleet size. The resulting analysis and conclusions specify a base-case KC-130J requirement and discuss the tradeoffs between the requirement, life-cycle cost and system performance.
DTIC
Tanker Aircraft; Cost Analysis; Cost Effectiveness

20000034220 Naval Postgraduate School, Monterey, CA USA
An Analytical Comparison of Human Factor Maintenance Related Part Failures for Naval Reserve Fleet Logistics Support Wing
Allen, Daniel L.; Dec. 1999; 122p; In English
Report No.(s): AD-A374275; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
Naval Aviation has experienced extensive change in recent years. Financial constraints, force reductions, and increasing operation tempo have impacted not only the material condition of Naval aircraft, but also the personnel who maintain them. The Naval Aviation Community has extensively studied the role of human factors in aviation mishaps. However, the need to study the impact of human factors in maintenance on part failures remains. As replacement parts for aircraft continue to rise in price, the need to mitigate the unnecessary failure/destruction of piece parts is an ever increasing priority. This study examines the relationship between part failures and human factors by comparing incident rates between VR Wing with the rest of Naval

Aviation. Five hundred safety incident reports are analyzed; fiscal year totals are determined, and an incident per flying hour rate is computed. Regression results indicate an increasing trend in human factors related arts incidents, VR compares no different from the rest of Naval Aviation.
DTIC
Regression Analysis; Aircraft Accidents; Military Aircraft; Military Aviation

20000034863 Naval Postgraduate School, Monterey, CA USA
Forecasting MV-22 Aerial Refueling Training Missions for 2D Marine Aircraft Wing
Stevenson, Robert J.; Dec. 1999; 119p; In English
Report No.(s): AD-A373793; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
The MV-22 ”Osprey” was designed as a ”medium-lift” replacement for the Marine Corps CH-46E ”Sea Knight” and CH-53D ”Sea Stallion” helicopters. The MV-22’s tilt-rotor technology will allow it to exploit the operational envelopes of both helicopters and turbo-prop aircraft. This expanded performance envelope, along with the capability to conduct aerial refueling, will allow a MV-22 lifted force to influence future operations through an increase in range and speed. This thesis quantifies the impact that fielding the MV-22 within the 2nd Marine Aircraft Wing (MAW) will have on its KC-130 squadrons. This impact arises from the MV- 22’s capability to receive fuel in-flight (aerial refuel). Since the CH-46E and CH-53D could not aerial refuel, their pilots did not have a need to conduct aerial refueling training, and thus
DTIC
Air to Air Refueling; C-130 Aircraft; Tilt Rotor Aircraft

20000034868 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
Defense Transportation: More Reliable Information Key to Managing Airlift Services More Efficiently
Mar. 2000; 30p; In English; Report to Congressional Requesters.
Report No.(s): AD-A374285; GAO/NSIAD-00-6; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The U.S. Transportation Command provides global air, land, and sea transportation services for all defense components in order to maintain a mobilization capability in time of peace and to meet national security needs in time of war. Its air transportation services are provided through the Air Force Air Mobility Command. In fiscal year 1997, the Air Mobility Command accounted for about 63 percent ($2.5 billion) of the total reported operating costs ($4.0 billion) of the U.S. Transportation Command, with most of the remaining 37 percent ($1.5 billion) representing the operating costs of the Army Military Traffic Management Command and the Navy Military Sealift Command for land and sea transportation, respectively.
DTIC
Air Transportation; Management; Marine Transportation

20000034917 Federal Aviation Administration, John A. Volpe National Transportation Systems Center, Cambridge, MA USA
Human Factors for Air Traffic Control Specialists: A User’s Manual for Your Brain ***Final Report, Feb. - May 1999***
Cardosi, K. M.; Nov. 1999; 54p; In English; Original contains color illustrations
Report No.(s): PB2000-103404; DOT/VNTSC/FAA-99/6; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This document presents the findings of human factors research and other information useful to air traffic control specialists in a succinct and easy-to-read format. Topics include: controller-pilot voice communications, memory, fatigue, and the effects of stress on information processing. Techniques are presented for: helping to reduce the probability of errors in voice communications, remembering specific information, identifying signs of stress that could affect performance, and reducing fatigue.
NTIS
Air Traffic Controllers (Personnel); Human Factors Engineering; User Manuals (Computer Programs); Pilot Performance

20000036518 General Accounting Office, Resources, Community and Economic Development Div., Washington, DC USA
Aviation Security: Slow Progress in Addressing Long-Standing Screener Performance Problems
Mar. 16, 2000; 13p; In English; Testimony: Before the Subcommittee on Aviation, Committee on Transportation and Infrastructure, House of Representatives.
Report No.(s): AD-A374810; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
We appreciate the opportunity to be here today to discuss aviation security, in particular airport screeners. Securing an air transportation system the size of this nation’s-with hundreds of airports, thousands of aircraft, and tens of thousands of flights daily carrying millions of passengers and pieces of baggage-is a difficult task. Events over the past decade have shown that the threat of terrorism against the USA is an ever-present danger. Aviation is an attractive target for terrorists, and because the air

transportation system is critical to the nation's well-being, protecting it is an important national issue. A single lapse in aviation security can result in hundreds of deaths, destruction of equipment worth hundreds of millions of dollars, and have immeasurable negative impacts on the economy and the public's confidence in air travel. A number of measures have been put in place by the Federal Aviation Administration (FAA) and the aviation industry to provide the security needed for the aviation system; among the most important ones are the passenger screening checkpoints and the screeners who operate them. Concerns have been raised for many years by GAO and others about the effectiveness of screeners and the need to improve their performance. Two Presidential commissions-established after the bombing of Pan Am Flight 103 in 1988 and the then-unexplained crash of TWA Flight 800 in 1996-as well as numerous GAO and Department of Transportation Inspector General reports have highlighted problems with screening and the need for improvements. This situation still exists, Mr. Chairman, and as I will discuss, there are long-standing problems that affect screener performance.
DTIC
Aircraft; Aeronautics; Security

20000038235 NASA Langley Research Center, Hampton, VA USA
High-Speed Research Surveillance Symbology Assessment Experiment
Kramer, Lynda J., NASA Langley Research Center, USA; Norman, R. Michael, Boeing Co., USA; April 2000; 68p; In English; Original contains color illustrations
Contract(s)/Grant(s): RTOP 577-60-10-01
Report No.(s): NASA/TM-2000-210107; L-17957; NAS 1.15:210107; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Ten pilots flew multiple approach and departure scenarios in a simulation experiment of the High-Speed Civil Transport to evaluate the utility of different airborne surveillance display concepts. The primary eXternal Visibility System (XVS) display and the Navigation Display (ND) were used to present tactical and strategic surveillance information, respectively, to the pilot. Three sensors, the Traffic Alert and Collision Avoidance System, radar, and the Automatic Dependent Surveillance-Broadcast system, were modeled for this simulation and the sensors surveillance information was presented in two different symbology sets to the pilot. One surveillance symbology set used unique symbol shapes to differentiate among the sensors, while the other set used common symbol shapes for the sensors. Surveillance information in the form of escape guidance from threatening traffic was also presented to the pilots. The surveillance information (sensors and escape guidance) was either presented head-up on the primary XVS display and head-down on the ND or head-down on the ND only. Both objective and subjective results demonstrated that the display concepts having surveillance information presented head-up and head-down have surveillance performance benefits over those concepts having surveillance information displayed head-down only. No significant symbology set differences were found for surveillance task performance.
Author
Human Performance; Space Surveillance (Spaceborne); Display Devices

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information see also 17 Space Communications, Spacecraft Communications, Command and Tracking and 32 Communications and Radar.

20000037889 Remote Services Ltd., Northwood, UK
Airspace Policy and Air Traffic Management
Clot, Andre J., Remote Services Ltd., UK; Development and Operation of UAVs for Military and Civil Applications; April 2000, pp. 2A-1 - 2A-26; In English; See also 20000037887; Copyright Waived; Avail: CASI; A03, Hardcopy

The world of manned aviation has been the predominant aerial activity in the skies for the 20th century. The fundamental principle by which the infrastructure and institutional arrangements have been predicated is that there is a man in the loop in the air (pilots) and on the ground (air traffic controllers). With the advent of extremely capable Unmanned Aerial Vehicle (UAV) systems, this will no longer be the case and many assumptions about how aircraft are designed, developed and operated will be challenged. However, in the 21st century this will be an evolutionary process and the organisations that will take it forward are already in place today, to begin the task of providing the necessary frameworks within which UAV systems will co-exist alongside manned aircraft. The challenges for these organisations include legislation and regulation, airspace policy, air traffic management,

airworthiness, certification, communications, command and control. This lecture covers issues relating to airspace policy and air traffic management aspects.
Author
Pilotless Aircraft; Command and Control; Law (Jurisprudence); Air Traffic Control; Certification; Policies

20000038157 NASA Goddard Space Flight Center, Greenbelt, MD USA
An Automated Method for Navigation Assessment for Earth Survey Sensors Using Island Targets
Patt, F. S., General Sciences Corp., USA; Woodward, R. H., General Sciences Corp., USA; Gregg, W. W., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 147-148; Repr. from International Journal of Remote Sensing, v. 18, no. 16, 1997 p 3311-3336; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

An automated method has been developed for performing navigation assessment on satellite-based Earth sensor data. The method utilizes islands as targets which can be readily located in the sensor data and identified with reference locations. The essential elements are an algorithm for classifying the sensor data according to source, a reference catalogue of island locations, and a robust pattern-matching algorithm for island identification. The algorithms were developed and tested for the Sea-viewing Wide Field-of-view Sensor (SeaWiFS), an ocean colour sensor. This method will allow navigation error statistics to be automatically generated for large numbers of points, supporting analysis over large spatial and temporal ranges.
Author
Space Navigation; Remote Sensors; Islands; Ocean Color Scanner; Remote Sensing

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology. For related information see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics. For land transportation vehicles see 85 Urban Technology and Transportation.

20000034240 Naval Postgraduate School, Monterey, CA USA
Modeling and Simulation Support for the Operational Test and Evaluation of a Tactical Airborne Reconnaissance System
Schmidt, Kevin J.; Dec. 1999; 179p; In English
Report No.(s): AD-A374081; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

Today's decreasing defense budget has forced the military to reduce its spending on operational testing of new equipment, among many other areas. Reduced testing has forced evaluators to focus their attention on possible sensitive issues prior to and during testing of new equipment. The Simulation, Test, and Evaluation Process implemented in 1995 to help reduce testing costs has been an integral part of the test and evaluation process. This thesis develops stochastic simulations to suggest the sensitive aspects of operating and maintaining a system of mobile reconnaissance platforms, specifically a helicopter force, (more specifically the RAH-66 Comanche) prior to and during actual testing. The simulation can also be implemented to compare the effectiveness of different mobile reconnaissance platforms to augment the conduct of side by side field testing of actual platforms. This simple, stochastic, event driven simulation may be used to conduct sensitivity analysis on system design and operational issues, including attrition, for mobile reconnaissance platforms in order to focus the attention of the testers and evaluators on influential parameters during testing. It may also be used to inform force design decision makers.
DTIC
Aerial Reconnaissance; Helicopters; Aircraft Reliability; Flight Simulation; Computerized Simulation

20000034241 Naval Postgraduate School, Monterey, CA USA
Time Domain Validation of the Sikorsky General Helicopter (GenHel) Flight Dynamics Simulation Model for the UH-60L Wide Chord Blade Modification
Barrie, Robert L., Jr; Dec. 1999; 158p; In English
Report No.(s): AD-A374100; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Helicopter design at the Sikorsky Aircraft Corporation is aided by the use of the Sikorsky General Helicopter (GenHel(R)) Flight Dynamics Simulation Model. Specifically, GenHel output is used by both handling qualities and maneuver loads engineers as a predictive design tool. Inherent in the use of an analytical model is the requirement for validation. This report seeks to validate the GenHel(R) flight dynamics simulation models used in the design of the UH-60L Wide Chord Blade (WCB) modification. initially comparisons are made between the current analytical models and flight test data for selected trim flight conditions and dynamic maneuvers. Based on the correlation of the data, modifications are made to the analytical model where necessary. The

modified analytical model will be validated through a final comparison with test flight data. The goal of this report is to validate the use of Sikorsky's GenHel(R) flight simulation program as an analytic predictive tool in the design of the WCB modification and identify any areas where improvements could be applied. Validation of the WCB GenHel model serves two purposes. First it confirms the ability of GenHel to model the flight dynamic response of the UH-60L with the WCB modification. Second it confirms the predictive loads forwarded to the structural engineers during the design phase of the WCB.
DTIC
Helicopters; Flight Simulation; Aircraft Models; Computerized Simulation; Helicopter Design; Sikorsky Aircraft

20000034246 Tennessee Univ., Dept. of Mechanical and Aerospace Engineering, Knoxville, TN USA
Performance Investigation and Characterization of Scramjet and Dual-Mode Scramjet Flow-Fields
Riggins, David W., Tennessee Univ., USA; [2000]; 51p; In English
Contract(s)/Grant(s): NAG1-2167; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The following compilation documents significant deliverables under this grant. Note that this summary is extracted from a larger report provided to the Hyper-X office last year at the conclusion of the grant. Current status is documented of the ongoing JANNAF (Joint-Army-Navy-NASA-AirForce) Scramjet Test standards activity from the standpoint of the Analysis SubGroup of which the PI was requested by NASA to be chairman. Also included are some representative contributions to date from the Principle investigator relating to this activity.
Derived from text
Flow Distribution; Supersonic Combustion Ramjet Engines; Combustion Efficiency; Performance Prediction

20000034252 Naval Postgraduate School, Monterey, CA USA
Dissemination and Storage of Tactical Unmanned Aerial Vehicle Digital Video Imagery at the Army Brigade Level
Apostolopoulos, Andreas K.; Tisdale, Riley O.; Sep. 1999; 185p; In English
Report No.(s): AD-A374041; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche
The Department of Defense Joint Technical Architecture has mandated a migration from analog to digital technology in the Command, Control, Communication, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) community. The Tactical Unmanned Aerial Vehicle (TUAV) and Tactical Control System (TCS) are two brigade imagery intelligence systems that the Army will field within the next three years to achieve information superiority on the modern digital battlefield. These two systems provide the brigade commander with an imagery collection and processing capability never before deployed under brigade control. The deployment of the Warfighter Information Network (WIN), within three to five years, will ensure that a digital dissemination network is in place to handle the transmission bandwidth requirements of large digital video files. This thesis examines the storage and dissemination capabilities of this future brigade imagery system. It calculates a minimum digital! storage capacity requirement for the TCS Imagery Product Library, analyzes available storage media based on performance, and recommends a high capacity storage architecture based on modern high technology fault tolerance and performance. A video streaming technique is also recommended that utilizes the digital interconnectivity of the WIN for dissemination of video imagery throughout the brigade.
DTIC
Aerial Reconnaissance; Video Signals; Pilotless Aircraft; Surveillance; Digital Television; Command and Control

20000034865 Warner Robins Air Logistics Center, Robins AFB, GA USA
An Evaluation of Air Force Aircraft Battle Damage Repair Techniques Applicable to Repair Activities Onboard the International Space Station
Chaudhary, Ravi; Hall, Stephen; Feb. 1999; 11p; In English
Report No.(s): AD-A373801; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
USA Air Force (USAF) Aircraft Battle Damage Repair (ABDR) strategies, techniques and technologies are directly applicable to NASA efforts to develop on-orbit repair capabilities for the International Space Station (ISS). At the operational level, USAF repair strategies developed since the Vietnam War stressed the need for methodical damage assessment, categorization, and repair. This approach should be adopted for future repair operations onboard the ISS. At the technical level, repairs based upon material ultimate properties, preparation for damage to multiple systems and specialized damage effects have shaped ABDR techniques to provide flexible repair strategies for Air Force aircraft. These techniques should also be considered when developing ISS repair strategies. Overall, a baseline for comparison between ISS repair and ABDR clearly demonstrates

the need for further technical interchange. Lessons learned from ABDR experiences with provide early insight into techniques and strategies proposed for on-orbit ISS repair operations.
DTIC
Damage Assessment; Aircraft Maintenance; International Space Station; Technology Transfer

20000036491 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
F-22 Aircraft: Development Cost Goal Achievable If Major Problems Are Avoided
Mar. 2000; 28p; In English; Report to Congressional Committees.
Report No.(s): AD-A374624; GAO/NSIAD-00-68; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Since the beginning of the F-22 development program in 1991, the Air Force's estimated cost to develop the aircraft has increased. Cost trends in 1995 showed a potential for costs to increase further. Concerned about these growing costs, the Assistant Secretary of the Air Force for Acquisition established the Joint Estimating Team to estimate the most probable costs to complete F-22 development and production. The team consisted of personnel from the Air Force, DOD, and private industry. The team concluded in 1997 that additional time would be required to complete the development program and estimated that costs would increase from $17.4 billion to $18.688 billion. The team recommended several changes to the development program's schedule, including slower manufacturing for a more efficient transition from development to low-rate initial production and an additional 12 months to complete avionics development. The Air Force and the Under Secretary of Defense for Acquisition, Technology, and Logistics generally adopted the team's recommendations to extend the development program schedule, including the dates for accomplishing interim events.
DTIC
Fighter Aircraft; Cost Estimates; Avionics

20000036540 RAND Corp., Santa Monica, CA USA
Innovative Management in the DARPA High Altitude Endurance Unmanned Aerial Vehicle Program
Drezner, Jeffrey A.; Sommer, Geoffrey; Leonard, Robert S.; Jan. 1999; 161p; In English
Contract(s)/Grant(s): DASW01-95-C-0059
Report No.(s): AD-A374660; RAND/MR-1054-DARPA; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The High Altitude Endurance Unmanned Aerial Vehicle (HAE UAV) program, a joint program conducted under the direction of the Defense Advanced Research Projects Agency (DARPA), incorporates a number of innovative elements in its acquisition strategy. The objectives of this research are to understand how the various innovations affect the program outcomes and to identify the lessons of the HAE UAV program that might be applied to a wider variety of projects to improve DoD acquisition strategies. The HAE UAV program includes two air vehicle programs, the Tier II Plus Global Hawk and the Tier III Minus DarkStar, and a Common Ground Segment. The program is divided into four phases. This study was initiated in 1994. The RAND study approach is to observe and report on the program, phase by phase. A report covering the Phase I experience of the Global Hawk was issued in 1997.1 This report covers the Phase II experience of all three components of the RAE UAV program; neither DarkStar nor the Common Ground Segment experienced Phase I. The information is complete through August 1998. The reports covering the HAE UAV program are intended to be cumulative; that is, each successive report provides coverage of the entire program up to that point. Thus, some of the data presented in the earlier report on Phase I of the Global Hawk program is reproduced here in an abbreviated form.
DTIC
Remotely Piloted Vehicles; Pilotless Aircraft

20000037692 Air Force Research Lab., Air Vehicles Directorate, Wright-Patterson AFB, OH USA
Modular Control Law Design for the Innovative Control Effectors (ICE) Tailless Fighter Aircraft Configuration 101-3 *Final Report, 1 Apr 1997-1 May 1999*
Buffington, James F.; Jun. 1999; 154p; In English
Contract(s)/Grant(s): Proj-2304
Report No.(s): AD-A374954; AFRL-VA-WP-TR-1999-3057; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

A modular flight control system is developed for a tailless fighter aircraft with innovative control effectors. Dynamic inversion control synthesis is used to develop a full envelope flight control law. Minor dynamic inversion command variable revisions are required due to the tailless nature of the configuration studied to achieve nominal stability and performance. Structured singular value and simulation analysis shows that robust stability is achieved and robust performance is slightly

deficient due to modeling errors. A multi-branch linear programming based method is developed and used for allocation of redundant limited control effectors.
DTIC
Aerodynamic Configurations; Fighter Aircraft; Tailless Aircraft; Dynamic Control; Error Analysis

20000037702 Advanced Research and Applications Corp., Sunnyvale, CA USA
Integrated Detector Technology for Corrosion Inspection ***Final Report, 1 Jun. 1999-28 Feb. 2000***
Smith, Jerel A., Advanced Research and Applications Corp., USA; Feb. 28, 2000; 21p; In English
Contract(s)/Grant(s): F49620-99-C-0032
Report No.(s): AD-A374752; P-014-FR-00; AFRL-SR-BL-TR-00-0065; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This project investigated the use of gas micro-strip detectors as a means of improving the throughput of an innovative technique for detecting hidden corrosion in aging aircraft. The evaluations included the development of system, detector and data-readout concepts capable of meeting the resolution and throughput goals for this instrument, and the modeling and computation of x-ray and electron interactions in the detector. The results of this evaluation indicate that these detectors can be adapted to this application and can achieve the spatial resolution and count rates required to support a system throughput up to 25 m/hr for detection of 5% corrosion in lap joints. This throughput, nearly two orders-of-magnitude faster than the existing demonstration system, is sufficient to support the use of this instrument as a practical adjunct to existing technologies. The next step in development would be the fabrication of this detector and the demonstration that the sensitivity and throughput targets can be achieved in a demonstration system.
DTIC
Aircraft Maintenance; X Rays; Corrosion; Readout; Gas Detectors; Fabrication

20000037805 Textron Bell Helicopter, H-1 Upgrade Program, Fort Worth, TX USA
The H-1 Upgrade Program: Affordable War Fighting Capability for the US Marines
Myers, Alan W., Textron Bell Helicopter, USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A2-1 - A2-18; In English; See also 20000037804; Copyright Waived; Avail: CASI; A03, Hardcopy

In late 1996, Bell Helicopter Textron Inc. was awarded a contract from the USA Marine Corps for the H-1 Upgrade Program. The program award was preceded by studies of all aircraft and approaches available to provide helicopter war fighting capability for the Marine Air Ground Task Force through the first quarter of the 21st century and beyond. Upgrades were defined for both the UH-1N utility helicopter and the AH-1W attack helicopter to integrate the following enhancements: Improved mission capability; Increased performance and maneuverability; Additional survivability features; Reduced pilot workload; Potential for growth; These enhancements give the Marine Corps the equivalent of new, state-of-the-art, zero-time aircraft, with 10,000-hour service lives. Total ownership cost affordability was, of course, a major requirement. Commonality, improvements in reliability and maintainability, the use of COTS/NDI equipment, and the reuse of existing equipment were encouraged to enhance squadron operability and supportability and help reduce recurring and O&S costs. Cost As An Independent Variable (CAIV) studies were also required to continuously evaluate potential cost reduction elements in trade against program and technical requirements. Bell and NAVAIR formed Integrated Product Teams (IPT) with representatives from all functional disciplines, to improve communication and to ensure the configuration designs were not only adequate technically but were also cost-effective to manufacture and to operate and support in the fleet. This IPT process has been instrumental in improving the contractor/customer approval process during design reviews. This paper summarizes the H-1 Upgrade Program. The Marine Corps modernization plan is described and the role of the H-1 is defined. The resulting configurations are described, as is the process of optimizing configuration details within program constraints.
Author
Upgrading; Maneuverability; Warfare; Aircraft Survivability

20000037806 British Aerospace Public Ltd. Co., Military Aircraft and Aerostructures, Preston, UK
The Tornado GR4 Programme: A New Approach
Watkins, T., British Aerospace Public Ltd. Co., UK; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A4-1 - A4-9; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

The growing costs of new weapon systems will encourage potential customers to consider upgrading their existing fleets. Today's aircraft will therefore be expected to remain longer in service and counter the threats of the future. Industry will need to adapt from developing and manufacturing new weapon systems to finding ways to improve the capability of an existing asset to maintain a deterrent in a higher technological environment. According to the 1997 British Aerospace Military Aircraft Value Plan

’The upgrade and re-life of existing aircraft is a valuable market opportunity - over the past five years the upgrade of existing assets has accounted for 16 per cent of the total value of combat orders world-wide’. The RAF’s IDS (Interdictor Strike) Tornado aircraft are expected to have a service life-span of up to 40 years and to ensure their combat effectiveness are currently undergoing a Mid Life Update (MLU) - the largest of its kind in Europe. The Mid Life Update programme returns 142 IDS Tornado aircraft to industry and upgrades them to a new variant, designated Tornado GR4/4A, which will become the new common standard for the RAF IDS aircraft. This paper will provide an introductory overview of the programme looking at the historical backcloth, the three contract elements, and how we are tackling the future requirements of our customer. Finally the paper considers why an update for the Tornado was the right approach for the RAF in its quest to maintain an effective capability to match the defence needs of the United Kingdom in the early 21st century.
Author
Weapon Systems; Manufacturing; Upgrading; MRCA Aircraft

20000037807 Dassault Aviation, Direction Technique Systemes, Saint-Cloud, France
MIRAGE 2000 Combat Aircraft Upgrade in Dassault Aviation: Solution for NWDS System Open and Affordable
Picard, Alain, Dassault Aviation, France; Madon, Laurent, Dassault Aviation, France; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A5-1 - A5-4; In English; See also 20000037804; Copyright Waived; Avail: CASI; A01, Hardcopy

MIRAGE 2000 are in operational service within several Air Forces since 1983. The outstanding structural sturdiness of the Mirage allowing them to fly over 2015-2020, allow Dassault Aviation to consider mid-life update. MIRAGE 2000 mid-life update shall comply with the following criteria : Multirole aircraft, able to carry a wide variety of Air to Air and Air to Surface missions, Affordable costs, Replacement of current sensors (for example : RDM radar) by state of the art modern sensors with up to date operational performances (for example : multi shoot fire control), Replacement of the current WNDS core system by an open system based on modular avionics architecture allowing, in particular, to separate application software and hardware, Replacement of the current cockpit lay out by a modern glass cockpit taking benefit of the numerous advantages of the Man - Machine - Interface fitted on the MIRAGE 2000-5, Implementation of new functions, by the customer’s national industry, thanks to a modem software workshop installed at the customer’s facilities. The target of this mid-life update is to obtain a new version of MIRAGE 2000 with a fly away price for new aircraft of 80% of the one of MIRAGE 2000-5 but with attractive operational characteristics.
Author
Software Engineering; Upgrading; Mirage Aircraft

20000037808 National Defence Headquarters, Ottawa, Ontario Canada
Aircraft Life Extension: CC130 Hercules Avionics Update
Daley, C. P., National Defence Headquarters, Canada; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A10-1 - A10-11; In English; See also 20000037804; Copyright Waived; Avail: CASI; A03, Hardcopy

The Canadian Department of National Defence (DND), having taken measures to ensure the structural integrity of the CC130 Hercules to beyond 2010, studied a number of technical and economic options with respect to extending the life of its ageing CC130 Hercules avionics suite. The Department selected the option of a consolidated and comprehensive avionics update as the preferred option to ensure the aircraft can perform its missions with peak efficiency and that the avionics would meet or outlast the estimated life expectancy for the aircraft.
Author
Structural Failure; Upgrading; Life (Durability); C-130 Aircraft

20000037809 Alenia Aeronautica, Turin, Italy
Enhancing Tactical Transport Capabilities: Cockpit Evolution from G222 to C-27J
Evangelisti, Gianluca, Alenia Aeronautica, Italy; Spinoni, Maurizio, Alenia Aeronautica, Italy; Jones, Patrick F., Lockheed Martin Aeronautical Systems, USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A11-1 - A11-9; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

The C-27J is the latest derivative of the service-proven G222 tactical transport. With over 20 years of production and more than 100 aircraft delivered, the G222 has served the military transport needs of Air Forces around the world including the Italian Air Force (AMI) and USAF. In 1996, Alenia Aerospazio and Lockheed Martin Aeronautical Systems (LMAS) decided to jointly develop the C-27J Spartan tactical transport aircraft. Based on the rugged G222 / C-27A design, the C-27J maintains the existing well-proven military airframe while updating those systems that could best take advantage of state-of-the-art technologies. The avionics, propulsion, and general aircraft systems were selected for upgrades, including the incorporation of avionics and cockpit upgrades developed for and certified on the LMAS C-130J aircraft. After a brief historic overview of the G222 family, from its

early VTOL roots through intermediate experiences such as the USAF C-27A and Italian Air Force G222 3A avionics modernization program, this paper illustrates the process followed for the development of the C-27J cockpit. The process used to select a cockpit configuration that allows optimized operational capabilities while reducing overall development costs is presented, together with a description of main cockpit features.
Author
Cockpits; Upgrading; Structural Design

20000037812 Defence Evaluation Research Agency, Farnborough, UK
Integration of Defensive Aids
Zanker, Philip M., Defence Evaluation Research Agency, UK; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A14-1 - A14-10; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper, arising from project and research work at DERA UK, considers the application of, and options and possibilities for, the integration of electronic combat (EC) equipments, specifically defensive aids systems (DAS) into air vehicles, focusing upon the problems and issues of retrofit and upgrade programmes. The paper describes the threat to air platforms, citing both intense conflict and peace - keeping scenarios, and introduces the potential advantages of fully integrated defensive aids in terms of aircraft survivability, and in contributing towards overall situational awareness. The retrofit and integration of defensive aids into an in-service aircraft present some challenging problems. The level of integration is a determinant of the cost and complexity of the programme. The choices range from the basic mechanical integration of separate subsystems; through the integration of a defensive aids system within itself; the integration of the system into existing cockpit displays and controls and into other avionic systems; to the ultimate level of integration in which the defensive aids become an intimate part of the flight avionics suite. The style of avionics and cockpit controls present in the target aircraft is another key factor in the cost and complexity of the upgrade task. Retrofit into well integrated avionics, and multifunction displays, implies that software modification, and hence re-certification, will represent a major part of the integration task. The paper describes the features of integration which may be achieved at the different integration levels. A high level of integration is needed to facilitate data fusion, an important contributor to situational awareness. The paper discusses the structure of data fusion implementations, and the accompanying problems. Modifications and additions to ground support elements are identified as essential to the success of the retrofit or upgrade programme as a whole. The desired level of EC integration will be driven by the customer's specification, which in turn is scoped by his understanding of the detailed issues in integration: the features and facilities which are both feasible and operationally useful. The risk exists that integration features may be sacrificed to contain costs, resulting in fits of expensive and capable items of kit which cannot be used operationally to their full potential.
Author
Upgrading; Avionics; Defense Program; Systems Engineering; Systems Integration

20000037817 Flight Test Squadron (0416th), Edwards AFB, CA USA
Lessons from the Front Line: The Role of Flight Test in Aircraft Update Programs
Hoey, David J., Flight Test Squadron (0416th), USA; Skeen, Matt E., Flight Test Squadron (0416th), USA; Thomas, Evan C., Flight Test Squadron (0416th), USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A21-1 - A21-6; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

Many nations today face the choice between procuring new aircraft or upgrading their existing fleet aircraft, An upgrade is frequently seen as a cost-effective solution to meet new mission requirements in a timely fashion. An upgrade allows the user to capitalize on technological advances since the development of the basic airframe. A key aspect of any aircraft program, whether an upgrade or an initial development, is the flight test phase. Flight test is the final stage where the new capabilities are evaluated for their likelihood to deliver added utility to the war fighter. However, given an avionics upgrade for a proven aircraft system, such as the F-16, the need for a flight test program is often questioned. "After all, it is only software" is a common comment. This paper will explore the need for, and benefits of, flight test in upgrade programs. It will address the economics of testing, examine the limitations of upgrades, and touch on issues of incorporating new technology into existing weapon systems. Examples and lessons learned from actual programs either tested or currently under test at the 416th Flight Test Squadron, Edwards AFB, California will be incorporated. These flight test lessons can be easily applied to other procurement programs.
Author
Upgrading; Flight Tests; Avionics

20000037818 Boeing Co., Mesa, AZ USA

The AH-64D Apache Longbow: Affordable Evolution

Dimmery, Hugh M., Boeing Co., USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A22-1 - A22-3; In English; See also 20000037804; Copyright Waived; Avail: CASI; A01, Hardcopy

The US Army and Boeing Rotorcraft are enhancing the capabilities that made the AH-64A Apache the best attack helicopter in the world. These enhancements are resulting in the most capable, fully integrated, combat weapons platform for the twenty-first century: the AH-64D Apache Longbow. The Apache was the result of the requirement for an advanced attack helicopter. In the early 1970s the US Army decided to replace its AH-l Cobra fleet based on lessons learned from its history (Vietnam), and an analysis of its primary threat, the former Warsaw Pact. The Army's concept was to use "massed forces for massed effects." New technologies enabling standoff weapons employment; the ability to perform multiple target engagements; and night operations capabilities were combined with redundant systems; ballistically tolerant components; and a crashworthy airframe and cockpit resulting in the AH-64A. The AH-64A entered service in 1986 with the US Army and later with five international defense forces (Israel, Egypt, Saudi Arabia, the United Arab Emirates, and Greece). In the Army's endeavor to field a twenty-first century platform, the AH-64A Apache provides the basic airframe; and all the basic survivability features that make it a great, survivable aircraft are retained. Boeing is digitizing the combat proven AH-64A Apache. Using "state-of-the-art" technology, the AH-64D now merges sensor inputs; generates mission data; generates graphical displays (a picture is worth a thousand words); and manages a wealth of information resulting in a totally integrated weapons platform.

Derived from text

AH-64 Helicopter; Design Analysis; Aircraft Structures

20000037819 Georgia Tech Research Inst., Aerospace and Transportation Lab., Smyrna, GA USA

MH-53J Service Life Extension Program: A Special Operational Forces Rotorcraft Winner

Crawford, Charles C., Georgia Tech Research Inst., USA; Mason, Henry, Warner Robins Air Logistics Center, USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A23-1 - A23-12; In English; See also 20000037804; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper presents a summary of the air vehicle modifications (largely structural) that were made and the airworthiness qualification flight test program that was conducted to expand the operational gross weight capability and enhance the structural integrity of the subject helicopter. The impact on both vibration and dynamic component retirement times are discussed. The paper includes both technical and cost information to support program benefits of this modernization approach, but will address only the basic air vehicle, including its rotor/drive and propulsion systems. Discussion of special mission equipment peculiar to the special operational forces mission and most shipboard operations features, can not be included.

Author

Service Life; Rotary Wing Aircraft; Aircraft Reliability

20000037820 National Defence Headquarters, Directorate of Technical Airworthiness, Ottawa, Ontario Canada

The Canadian Air Force Experience: Selecting Aircraft Life Extension as the Most Economical Solution

Landry, Normand, National Defence Headquarters, Canada; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A24-1 - A24-10; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

Canada like several other countries has limited resources to trade-in its outdated and ageing fleets for state-of-the-art weapon systems. With the CFl88 and the CP140, the Canadian Forces (CF) have chosen, as with the CFl16 before, to perform a structural and systems upgrade. These upgrades will allow the aircraft to meet their operational requirements until the first quarter of the next century. The choice for this course of action is based on option analysis studies. In the end, fleet modernization has proven to be the most economical solution. This paper will present the approach taken and the assumptions made for the various scenarios studied to reach that conclusion. Avionics packages are readily available off-the-shelf and in most cases the decision is based mostly on structural limitations. Hence in-service failures and results of full scale fatigue tests obtained through collaborative agreements can be a cost effective way to determine the cost of ownership of each fleet. The paper will briefly talk about the concept taken for the CP140 but will use the CF188 as the demonstration test case.

Author

Life (Durability); Aircraft Structures; Upgrading

20000037821 DaimlerChrysler Aerospace A.G., Manching, Germany

Transall C-160 Life Extension and Avionics Upgrade Programs

Blumschein, P., DaimlerChrysler Aerospace A.G., Germany; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A26-1 - A26-5; In English; See also 20000037804; Copyright Waived; Avail: CASI; A01, Hardcopy

Since 1967 the Transall C-160 is the transport aircraft of the German Air Force. After carrying out of life extension measures, avionics upgrade and other improvements of the technical equipment, the Transall C-160 can be operated under economical conditions far beyond 2010. Life extension measures for C-160 started in 1984 (LEDA I and LEDA II). These measures were only carried out for the wings. After taking apart the aircraft in this high scope, more than 30% of complaints were discovered in comparison to the normal preventive maintenance activities. As a result an investigation of aircraft areas and zones not yet subject to inspection measures (PUNIB) was carried out. PUNIB was the basis for LEDA III. In LEDA III the whole structure of the aircraft was inspected. In this manner the life time of the aircraft was extended step by step. Primarily the specification of the original air frame lifetime was restricted to 1995 or 8000 flights (LEDA I, LEDA II). After LEDA III the lifetime for C-l60 was extended to 2010 or 12000 flights. Because of the spare part situation avionic upgrades in 1987 and the replacement of the flight management system (FMS) and the flight control/flight director system (FCS) in 1993 in combination with the replacement of the wiring was carried out. These measures will be finished in 1999. Over and above, the replacement of the intercom system, the improvement of the self defense suite and the integration of a traffic alert and collision avoidance system (TCAS II) as well as other technical measures will be taken. These increase the reliability and improve the precision of the mission management. Moreover the spare part situation was improved since the mid 80's by the aircraft update programmes.
Author
Life (Durability); Upgrading; C-160 Aircraft

20000037822 Eurocopter France, Marseille, France
The Cougar C.SAR: An Example of Optimization of an Existing Helicopter ***Le Cougar C.SAR, un Exemple d'Optimisation d'un Helicoptere existant***
Cabrit, P., Eurocopter France, France; Jaillet, P., Eurocopter France, France; Giacino, T., Eurocopter France, France; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A27-1 - A27-4; In French; See also 20000037804; Copyright Waived; Avail: CASI; A01, Hardcopy

The COUGAR is a military transport helicopter in the 9-ton class which is primary used in various versions by many armies worldwide (45 client countries). Since this helicopter was launched, EUROCOPTER has consistently developed improvements to this apparatus so that its users may benefit from the most up-to-date equipment on the market while retaining its fundamental military qualities. A special effort was made to provide a very high-performance apparatus for the "SAR" (*) combat mission.
Derived from text
F-9 Aircraft; Military Helicopters

20000037823 Woodall (David), Fairfax, VA USA
Technical Evaluation Report
Woodall, David, Woodall (David), USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. TB-1 - TB-5; In English; See also 20000037804; Copyright Waived; Avail: CASI; A01, Hardcopy

The Systems Concepts and Integration Panel (SCIP) Joint symposium on Advances In Vehicle Systems Concepts and Integration was held in Ankara, Turkey from 26 to 28 April 1999. Symposium (A) Aircraft Update Programmes, The Economical Alternative? Is reported separately. Symposium (B) Warfare Automation Procedures and Techniques for Unmanned Vehicles, reported on here, was the continuation of a series of symposia initially addressing unmanned tactical air vehicles (UTAs) and more recently broadened to include other forms of unmanned vehicles (UVS). The potential importance of UTAs to NATO was identified in the Advisory Group for Aerospace Research & Development (AGARD) Aerospace 2020 report and addressed during two symposia during 1997. Many of the concepts of interest, potential system elements and their performance, and issues associated with the development of UTA capabilities were initially addressed during the earlier symposia. This symposium provided an update on progress in these areas and other forms of UVs.
Derived from text
Conferences; North Atlantic Treaty Organization (NATO); Research and Development; Economics; Aeronautical Engineering

20000037825 Dassault Aviation, Technical Systems Dept., Saint-Cloud, France
Unmanned Fighter Planes (UCAV): The Viewpoint of an Airframe Designer ***Les Avions de Combat Non Habites (UCAV): Le Point de vue d'un Avionneur***
Condroyer, Daniel, Dassault Aviation, France; Helie, Pierre, Dassault Aviation, France; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B2-1 - B2-6; In French; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

After discussing the context of growing interest in promoting the development of unmanned planes, the article will first demonstrate how, following a first step devoted to offsetting the operator in order to free it from the latter's limitations (such as endurance)-a step which takes the form of systems at the demonstration and operation levels-it is possible to plan for innovation

concepts in unmanned fighter planes integrated into complex devices which will meet users' criteria (cost, lethality, flexibility, availability, attrition). Secondly, on the basis of work performed along these lines by Dassault Aviation, the article discusses the techniques and technologies considered necessary for implementing these devices in terms of perception, control, man/system interaction.
Derived from text
Airframes; Design Analysis; Pilotless Aircraft

20000037826 Turkish Land Forces Command, Technical and Project Management Dept., Ankara, Turkey
UAV Requirements and Design Consideration
Torun, Erdal, Turkish Land Forces Command, Turkey; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B4-1 - B4-8; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper deals with the UAV requirements based on the battlefield experiences. UAV roles in tactical areas and constraints which affect the UAV mission to be conducted are explained and suggestions are given. Constraints: such as environmental conditions, effects on UAV missions, battlefield situations, operational restrictions and technological limits are overviewed. Based on the current applications and systems, some remarks are presented. Considering the future requirements: air vehicle performance data link and expected payload specifications for a general UAV system are addressed. Assessments and recommendations are given for system design consideration.
Derived from text
Pilotless Aircraft; Systems Engineering; Reconnaissance

20000037840 Atlas Elektronik G.m.b.H., Bremen, Germany
Unmanned Air Vehicles for the Army: Future Concepts
Baeker, Joachim, Atlas Elektronik G.m.b.H., Germany; Grobecker, Helmut, Atlas Elektronik G.m.b.H., Germany; Hastedt, Ralf, Atlas Elektronik G.m.b.H., Germany; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B20-1 - B20-7; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

The micro drones are not considered in this report because the required technologies and special branches have to be applicated with partly completely new attempts and approaches. As examples for this statement I will mention only the aerodynamics, the microelectronics and micromechanics as well as bio-chemical sensors and neuronal intelligent structures. The way shown here to future UAV systems goes ahead from of the existing and in near future developed technologies for tactical UAV systems and demonstrates about application variants the direction towards far-reaching UAV systems with NATO compatibility.
Derived from text
Pilotless Aircraft; Defense Program; Drone Vehicles; Aerodynamics; Micromechanics; Smart Structures; Microelectronics

20000037844 Lockheed Martin Tactical Aircraft Systems, Fort Worth, TX USA
UCAV Concepts for CAS
Chaput, Armand, Lockheed Martin Tactical Aircraft Systems, USA; Henson, Ken C., Lockheed Martin Tactical Aircraft Systems, USA; Ruszkowski, Robert A., Jr., Lockheed Martin Tactical Aircraft Systems, USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B27-1 - B27-12; In English; See also 20000037804; Copyright Waived; Avail: CASI; A03, Hardcopy

A system concept is described that would give individual combat users access to and (limited) control of a network of unmanned air vehicles. Applications would be both lethal and nonlethal. In the nonlethal form, unmanned combat air vehicles could respond to fire support requests as if they were the virtual equivalent of organic, long-range artillery. In the nonlethal form, unmanned reconnaissance air vehicles could point their sensors at locations and/or areas of interest and respond with target imagery or coordinates of selected target types. Capabilities currently exist to evaluate these concepts in simulated or actual field trials and/or to develop an initial operating capability (IOC).
Derived from text
Combat; Pilotless Aircraft; Aerial Reconnaissance; Systems Engineering

20000037888 European Unmanned Vehicle Systems Association, Paris, France
UAVs: Current Situation and Considerations for the Way Forward
vanBlyenburgh, Peter, European Unmanned Vehicle Systems Association, France; Development and Operation of UAVs for Military and Civil Applications; April 2000, pp. 1-1 - 1-27; In English; See also 20000037887; Copyright Waived; Avail: CASI; A03, Hardcopy

This document will try to give the reader an overview of the current situation pertaining to unmanned aerial vehicle (UAV) systems in the world and it is will endeavour to give some indications on what the future may have in store for us. It does not have

the pretention of being complete and covering everything going on in this field in every country, but rather it will try to give a representative overview of the UAVs currently in use, being considered for purchase and the general state of UAV-related technology and the industry involved.
Derived from text
Pilotless Aircraft; Remote Control; Range; Endurance

20000037892 Defence Procurement Agency, Bristol, UK
Design and Airworthiness Requirements for Military Unmanned Air Vehicle Systems
Rogers, Bernard C., Defence Procurement Agency, UK; Development and Operation of UAVs for Military and Civil Applications; April 2000, pp. 4-1 - 4-14; In English; See also 20000037887; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper examines the safety implications and factors to be considered for the procurement of a UAV and identities the design requirements to be used as a guide to produce an air vehicle specification. It will touch on matters covered in more detail by other presenters because of the need to reflect the information they provide within the new standard. It should be noted that while appreciating that dirigibles and micro UAV#s will be introduced in the future, it was agreed that the current UK Defence Standard 00-970 should comply with current policy agreed within the UK (UK) Ministry of Defence (MOD), and that by the Civil Aviation Authority (CAA), which is, that UAV Systems under 20kgs should be treated as models and as such do not need to comply with the regulations governing aircraft. This paper also identifies the role of the ”Airworthiness, Design Requirements and Procedures (ADRP) organisation” of the UK MOD Defence Procurement Agency (DPA) and details the work being carried out in developing a set of general design and airworthiness requirements for UAV systems. ADRP are part of the new Defence Procurement Agency (DPA). which was formed on the 1st of April 1999, to take forward the ”SMART” Procurement initiative, which aims to use faster, cheaper and better ways of equipping the UK armed forces. This involves Integrated Project Teams (IPT) managing the programmes throughout the life of the equipment. This paper discusses the current and future UAV Systems requirements and gives a brief insight into the strategy adopted to produce a set of regulatory documents and procedures for the guidance of the MOD Integrated Project Team leader (IPT/L). This is done by ensuring adequate procedures are in place for the safe and airworthy operation of such aircraft. These procedures set the minimum standard required to accommodate the safe operation of all UAV systems in all airspace conditions subject to any limitations and constraints imposed by the design.
Author
Aircraft Reliability; Pilotless Aircraft; Aircraft Design; Safety Factors; Airships

20000037895 Georgia Tech Research Inst., Atlanta, GA USA
MicroFlyers and Aerial Robots: Missions and Design Criteria
Michelson, Robert C., Georgia Tech Research Inst., USA; Development and Operation of UAVs for Military and Civil Applications; April 2000, pp. 7-1 - 7-13; In English; See also 20000037887; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper provides an overview of the issues surrounding the design and choice of appropriate missions for a new class of unmanned flying vehicles known as MicroFlyers, Micro Air Vehicles, and Aerial Robots. These terms are often used interchangeably to refer to small flying machines varying from what amounts to ”intelligent dust” up to vehicles in the size range of small radio-controlled models (i.e., having a typical maximum dimension of one meter). Because of the size of this class of air vehicle, it can engage in missions that are non-traditional, such as indoor flight through confined spaces, or en mass, to overwhelm a target in swarms. Also because of size, many of these vehicles will have to be autonomous. In some cases, the design of the vehicle will benefit from biological mimicry wherein the behavioral and locomotive techniques used by birds and insects will be of advantage. However, the small size of these air vehicles will also constrain them in the physical environment in much the same way that insects are not necessarily free to navigate at will in the presence of wind and precipitation.
Author
Aircraft Design; Design Analysis; Robots; Pilotless Aircraft

20000037897 Royal Military Academy, Brussels, Belgium
Various Sensors Aboard UAVs
Schweicher, E. J., Royal Military Academy, Belgium; Development and Operation of UAVs for Military and Civil Applications; April 2000, pp. 10-1 - 10-72; In English; See also 20000037887; Copyright Waived; Avail: CASI; A04, Hardcopy

In order to deal with all possible UAV imaging sensors, we better choose the example of a recently introduced UAV: the General Atomics Predator UAV. The Predator sensor payload includes an q (Electra-Optical) suite, a Ku-band SAR sensor, Ku-band and UHF-band satellite communications (SATCOM), a C-band light-of-sight data link, and a GPS/INS navigator. The Predator’s SAR sensor is the Northrop Grumman (Westinghouse) Tactical Endurance Synthetic Aperture Radar (TESAR). TESAR provides continuous, near real time strip-map transmitted imagery over an 800 meter swath at slant ranges up to 11km.

Maximum data rate is 500,000 pixels per second. The target resolution is 0.3meters. TESAR weight and power consumption are 80kg and 1200W respectively. A lighter weight, lower cost SAR is currently in development for Predator. The Predator's EO sensor suite is the VERSATRON Skyball SA-144/18 quartet sensor. It consists of a PtSi 512x512 MWIR (Mid Wave IR) FLIR with six fields of view (to easily perform either detection or recognition or identification), a color TV camera with a 10X zoom, a color TV 9OOmm camera and an eyesafe pulsed Er: glass laser rangefinder (this Er: glass laser could advantageously be replaced by an eyesafe Er: YAG laser because YAG is a better heat sink than glass enabling a higher efficiency). The diameter of the EO sensor turret is relatively small-35cm. The turret has precision pointing with a line-of-sight stabilization accuracy of 10 microrad. It is anticipated that high performance UAV's of the year 2010 will have a broad range of missions, including surveillance, reconnaissance, communication , intelligence gathering of threat electronic emissions, target designation for weapons attacking moving targets, and communication relay.
Author
Synthetic Aperture Radar; Satellite Communication; Payloads; Laser Range Finders; Imaging Techniques; FLIR Detectors; Communication Satellites

20000037899 Notre Dame Univ., Dept. of Aerospace and Mechanical Engineering, IN USA
Aerodynamic Measurements at Low Reynolds Numbers for Fixed Wing Micro-Air Vehicles
Mueller, Thomas J., Notre Dame Univ., USA; Development and Operation of UAVs for Military and Civil Applications; April 2000, pp. 8-1 - 8-32; In English; See also 20000037887; Copyright Waived; Avail: CASI; A03, Hardcopy

A description of the micro-air vehicle (MAV) concept and design requirements is presented. These vehicles are very small and therefore operate at chord Reynolds numbers below 200,000 where very little data is available on the performance of lifting surfaces, i.e., airfoils and low aspect-ratio wings. This paper presents the results of a continuing study of the methods that can be used to obtain reliable force and moment data on thin wings in wind and water tunnels. to this end, a new platform force and moment balance, similar to an already existing balance, was designed and built to perform lift, drag and moment measurements at low Reynolds numbers. Balance characteristics and validation data are presented. Results show a good agreement between published data and data obtained with the new balance. Results for lift, drag and pitching moment about the quarter chord with the existing aerodynamic balance on a series of thin flat plates and cambered plates at low Reynolds numbers are presented. They show that the cambered plates offer better aerodynamic characteristics and performance. Moreover, it appears that the trailing-edge geometry of the wings and the turbulence intensity up to about 1% in the wind tunnel do not have a strong effect on the lift and drag for thin wings at low Reynolds numbers. However, the presence of two endplates for two-dimensional tests and one endplate for the semi-infinite tests appears to have an undesirable influence on the lift characteristics at low Reynolds numbers. The drag characteristics for thin flat-plate wings of aspect ratio greater than one do not appear to be affected by the endplates. The effect of the endplates on the drag characteristics of cambered-plate wings is still under investigation. It is known, however, that endplates do have an effect on the drag and lift characteristics of a cambered Eppler 61 airfoil/wing.
Author
Fixed Wings; Aerodynamic Characteristics; Low Reynolds Number; Pilotless Aircraft; Aerodynamic Drag; Drag Measurement

20000038197 Georgia Inst. of Tech., Atlanta, GA USA
Elementary Model of Nose Gear Retraction and Oleo-Pneumatic Strut Compression
Beachkofski, Brian K.; Aug. 06, 1999; 28p; In English
Report No.(s): AD-A374308; AFIT-FY00-68; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Landing gear systems have two major non-linear components that need to be modeled in order to fully represent a complete landing profile, the extension actuator and the oleo-pneumatic strut. In order to test the equations of motion, the components were put together as part of a system similar to the F-15 nose gear. Working Model tested the geometry, yielding a geometry specific force time diagram that compares well to experimental results. A real system's actuator follows a control system input, which is designed to follow a force displacement path. The equations governing a typical actuator are integrated to compare two models: a simplified model and one that assumes no leaking nor compressibility of the fluid. The strut acts as a spring mass system, with a non-linear spring and a damper proportional to the square of the velocity. The strut equations of motion are formulated as well as the constraints for both constant velocity and a simulated drop test. These equations are also integrated to show either a force displacement or time displacement diagrams. The results are then compared to the expected values for each type of test, showing data consistent with experimental and other computational methods.
DTIC
Pneumatic Control; Control Valves; Actuators; Hydraulic Control; Hydraulic Equipment; Fluidics; Landing Gear; Nose Wheels

20000038214 Institute for Human Factors TNO, Soesterberg, Netherlands

Task and Training Analysis Image Interpreter SPERWER ***Interim Report Taak- en Trainingsanalyse Beeldanalist SPERWER***

vandenBosch, K., Institute for Human Factors TNO, Netherlands; Barnard, Y. F., Institute for Human Factors TNO, Netherlands; Helsdingen, A. S., Institute for Human Factors TNO, Netherlands; Feb. 23, 1999; 66p; In Dutch

Contract(s)/Grant(s): A98/KL/602; TNO Proj. 730.3

Report No.(s): TD99-0021; TM-99-A018; Copyright; Avail: Issuing Activity

Starting midway 2000 the 101 RPV company of the Royal Netherlands Army will be responsible for the deployment of unmanned aerial vehicles (the SPERWER) for military intelligence and reconnaissance in enemy territory. The information collected by the SPERWERs sensors [daylight and Thermal InfraRed (TIR)] are being sent to a Ground Control Station (GCS), and is interpreted by an image interpreter. For the development of training in interpreting thermal images, the Royal Netherlands Army requested the TNO Human Factors Research Institute, in cooperation with the school for military intelligence, to conduct a task- and training analysis. The task analysis was based on the basis of provisional functional-technical en tactical information on the SPERWER. Three main tasks were identified: device operation, image interpretation, and reporting. The most important one, image interpretation, can be further subdivided into: perception, analysing, interpreting and concluding. These tasks need to be performed simultaneously and integrated rather than sequentially. The training analysis provides suggestions with respect to the best training approach. Because the image interpreter works with dynamic images, a high level of skill in device operation is required for setting the instruments accurately and rapidly. This demands frequent and intensive practice. The acquisition of skill in image interpretation requires sufficient, systematic, and representative images for practice. Sufficient to ensure that image interpretation takes place on thermal signature and not on superficial image features; systematic to show effects of environmental conditions (day/night, rain, etc.); and representative to make sure that students practice on the type of images that they are likely to encounter in real missions. Skill in reporting involves selection (what do I report and what not) and correct communication procedures. The results in this report will be used to develop databases and models required for generating the thermal images needed for training. The effectivity of training will be investigated empirically in a field study. It is recommended to conduct research into mental work load, to the use of advanced technologies for improving image quality (data fusion) and to methods for data reduction (area-of-interest).

Author

Data Bases; Data Reduction; Image Resolution; Infrared Radiation; Multisensor Fusion; Remotely Piloted Vehicles; Training Analysis; Workloads (Psychophysiology)

06
AVIONICS AND AIRCRAFT INSTRUMENTATION

20000033824 NASA Glenn Research Center, Cleveland, OH USA

Wireless Telemetry for Gas-Turbine Applications

DeAnna, Russell G., Army Research Lab., USA; March 2000; 26p; In English

Contract(s)/Grant(s): RTOP 577-40-20; DA Proj. 1L1-61102-AH-45

Report No.(s): NASA/TM-2000-209815; E-12124; NAS 1.15:209815; ARL-MR-474; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Wireless telemetry technology for transmitting power and data to and from sensors located inside a gas-turbine engine is reviewed. Two scenarios are considered: a rotating sensor hardwired to a shaft-mounted, inductively-coupled system; and a stationary or rotating microsensor telemetry module. Applications of these telemetry scenarios in the gas-turbine operating environment, the types of sensor measurements, the principles of telemetry, and a review of the current state of microfabricated components for telemetry systems are given. Inductive coupling for both data and power transmission is emphasized in the first scenario. The microsensor telemetry module discussed in the second scenario would need battery power or an alternative power source. These technologies are emerging and do not represent available products. A brief list of alternative technologies for providing power is presented at the end.

Author

Wireless Communication; Telemetry; Gas Turbine Engines; Technology Assessment; Data Processing; Data Transmission

20000037810 Litton Guidance and Control Systems, Northridge, CA USA

A Modern Integrated Avionics System for the Next Generation U.S.M.C. Attack and Utility Helicopters

Dowell, John A., Litton Guidance and Control Systems, USA; Wade, Ronald C., Naval Air Systems Command, USA; Advances

in Vehicle Systems Concepts and Integration; April 2000, pp. A12-1 - A12-12; In English; See also 20000037804; Copyright Waived; Avail: CASI; A03, Hardcopy

The USA Marine Corps awarded the first phase of the H-1 platform upgrade program to Bell Helicopter in late 1996. This effort resulted in substantial improvements to both the AH-1 Gunship and UH-1 Utility aircraft. Upgrades included a new transmission and a 4-bladed rotor with resulting improvements in mission effectiveness and cost of ownership. In 1997, the program was expanded to provide a modern suite of avionics incorporating improved sensors, cockpits, weapons processing, helmet-mounted displays and an advanced centralized mission processing subsystem. This technical paper will review the basis for architectural decisions of the avionics and the criteria for selection of key sensors and displays. Major attributes of redundancy and commonality are described, together with an overview of an advanced open architecture mission computer.
Author
Avionics; Attack Aircraft; Upgrading

20000037813 Societe d'Applications Generales d'Electricite et de Mecanique, Defense and Security Div., Nanterre, France
Modular Avionics Upgrade: The Cost Effective Solution to Adapt Existing Fighters to the Operational Requirements of Today's Battlefield
Dedieu, Christian, Societe d'Applications Generales d'Electricite et de Mecanique, France; Loffler, Eric, Societe d'Applications Generales d'Electricite et de Mecanique, France; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A15-1 - A15-4; In English; See also 20000037804; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper presents already fielded implementations of an avionics upgrade package developed to offer a modular solution to a wide range of modem operational requirements. The SAGEM SA upgrade concept allows to match specifications ranging from basics performance enhancement, such as high accuracy navigation for low level flight, up to full multi-role capability with sophisticated air-to-surface weapon delivery and multi-target air-to-air fire control. The upgraded system implements all state of art features available on the most recent fighters, particularly for pilot interface (HOTAS, glass cockpit, NVG compatibility, ...) as well as for system architecture (modular avionics, high level of redundancy and back-up modes, ADA HOL programming, object oriented software ...). The presentation will describe how the most recent technologies can be inducted in older platforms more rapidly than on newly developed airframes, therefore ensuring that the most demanded operational requirements are fully satisfied. In particular, sensor technologies (pulse-Doppler Radar, thermal imaging and IRST ...) will be addressed, as well as smart weapons (guidance kits, advanced tire control software ...) which are driving factors for the overall accuracy for the success of the mission. A special highlight will be given on ground support equipment and procedures both at operational and maintenance levels. These facilities include part-task trainers and mission planning systems to help the pilots optimize their missions; in parallel an integrated logistic support is deployed to give all necessary tools to the maintenance crews.
Author
Avionics; Upgrading; Fighter Aircraft; Systems Engineering

20000037898 Societe Nationale de Construction Aeronautique, Gosselies, Belgium
The B-HUNTER UAV System
Delonge, Robert, Jr., Societe Nationale de Construction Aeronautique, Belgium; Development and Operation of UAVs for Military and Civil Applications; April 2000, pp. 11-1 - 11-17; In English; See also 20000037887; Copyright Waived; Avail: CASI; A03, Hardcopy

The purpose of this paper consists to provide a general overview of the B-HUNTER UAV System that has been chosen by the Belgian Army Ground Forces. From year 2001, the B-HUNTER UAV system will replace the Epervier UAV System which was in use in the Belgian Army since more than 20 years. The B-HUNTER UAV System is derived from the US Short Range HUNTER Tactical UAV that has been developed and qualified according to the most severe NATO requirements by a joint venture composed of Israel Aircraft Industries Ltd. (IAI) and TRW Inc. It has been recently successfully deployed in Kosovo operation with proven operational results that have been reported in profusion of press releases. This paper will describe the main upgrades at system and subsystem level that will be performed in the frame of the Belgian Contract by the Belgian EAGLE Temporary Association. The B-HUNTER UAV system and subsystem are described. In the course of the B-HUNTER UAV Program, a lot of attention will be paid to the potential integration of the B-HUNTER UAV System in the civil air space. According to the Belgian law, UAV Systems have to comply with the following overall safety objective: 'The B-HUNTER UAV System must allow during all its life safely execution of UAV missions above populated areas taking into account Belgian environmental conditions'. A short introduction to the activities performed in the frame of the B-HUNTER UAV program with regards to airworthiness issues is presented.
Author
Pilotless Aircraft; Aircraft Reliability; Aircraft Industry; Aircraft Design

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.

20000033822 NASA Glenn Research Center, Cleveland, OH USA
Implementation of a Compressor Face Boundary Condition Based on Small Disturbances
Slater, John W., NASA Glenn Research Center, USA; Paynter, Gerald C., Boeing Co., USA; March 2000; 14p; In English; 45th; International Gas Turbine and Aeroengine Technical Congress, 8-11 May 2000, Munich, Germany; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): RTOP 714-04-50
Report No.(s): NASA/TM-2000-209945; E-12193; NAS 1.15:209945; ASME-2000-GT-0005; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A compressor-face boundary condition that models the unsteady interactions of acoustic and convective velocity disturbances with a compressor has been implemented into a three-dimensional computational fluid dynamics code. Locally one-dimensional characteristics along with a small-disturbance model are used to compute the acoustic response as a function of the local stagger angle and the strength and direction of the disturbance. Simulations of the inviscid flow in a straight duct, a duct coupled to a compressor, and a supersonic inlet demonstrate the behavior of the boundary condition in relation to existing boundary conditions. Comparisons with experimental data show a large improvement in accuracy over existing boundary conditions in the ability to predict the reflected disturbance from the interaction of an acoustic disturbance with a compressor.
Author
Computational Fluid Dynamics; Boundary Conditions; Simulation; Dimensional Analysis; Unsteady State; Three Dimensional Models

20000033864 SyPort Systems, Inc., Bridgewater, NJ USA
Evaluation of Reciprocating Aircraft Engines with Unleaded Fuels ***Final Report, Feb. 1997 - Sep. 1998***
Atwood, David H., SyPort Systems, Inc., USA; Knopp, Kenneth J., Federal Aviation Administration, USA; Dec. 1999; 82p; In English
Contract(s)/Grant(s): DTFA03-95-C-00004
Report No.(s): AD-A373996; DOT/FAA/AR-99/70; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Recent Clean Air Act legislation banned the uses of leaded fuels however, due to significant safety concerns, the EPA has not enforced compliance on the general aviation community. Nonetheless, significant economic pressures will continue to mount concerning the purchase, handling, and shipping of lead containing fuels and the disposal of lead tainted engine oils. This is driving the need to develop a high Motor Octane unleaded alternative to the current leaded stock. The cost to develop this alternatives expected to be exponentially proportional to the motor octane number of the fuel. historically, safety margins were determined by ensuring that the particular engine be without limiting detonation throughout its operating envelope on a particular aviation fuel. There is very limited data on the actual motor octane requirement of the majority of the fleet. A Coordinating Research Council Subcommittee has been formed to address the development of an unleaded fuel, with the current focus being the determination of the minimum motor octane number required for knock free operation of the majority of the piston engine fleet. This report details ongoing FAA efforts toward this effort. Data from both ground based engine testing and in-flight testing are included. The findings suggest that greater than 100 motor octane number will be required with lean fuel flow schedule conditions requiring substantially greater motor octane numbers. The data also suggest that significant decrease in octane requirement can be obtained by substantial power deration for the large turbocharged engines.
DTIC
Engine Design; Aircraft Design; Piston Engines

20000034011 Texas A&M Univ., College Station, TX USA
Unsteady High Turbulence Effects on Turbine Blade Film Cooling Heat Transfer Performance Using a Transient Liquid Crystal Technique ***Final Report***
Han, J. C., Texas A&M Univ., USA; Ekkad, S. V., Texas A&M Univ., USA; Du, H., Texas A&M Univ., USA; Teng, S., Texas A&M Univ., USA; February 2000; 228p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG3-1656; RTOP 714-01-4A
Report No.(s): NASA/CR-2000-209929; E-12173; NAS 1.26:209929; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

Unsteady wake effect, with and without trailing edge ejection, on detailed heat transfer coefficient and film cooling effectiveness distributions is presented for a downstream film-cooled gas turbine blade. Tests were performed on a five-blade linear cascade at an exit Reynolds number of 5.3 x 10(exp 5). Upstream unsteady wakes were simulated using a spoke-wheel type wake generator. Coolant blowing ratio was varied from 0.4 to 1.2; air and CO2 were used as coolants to simulate different density ratios. Surface heat transfer and film effectiveness distributions were obtained using a transient liquid crystal technique; coolant temperature profiles were determined with a cold wire technique. Results show that Nusselt numbers for a film cooled blade are much higher compared to a blade without film injection. Unsteady wake slightly enhances Nusselt numbers but significantly reduces film effectiveness versus no wake cases. Nusselt numbers increase only slic,htly but film cooling, effectiveness increases significantly with increasing, blowing ratio. Higher density coolant (CO2) provides higher effectiveness at higher blowing ratios (M = 1.2) whereas lower density coolant (Air) provides higher 0 effectiveness at lower blowing ratios (M = 0.8). Trailing edge ejection generally has more effect on film effectiveness than on the heat transfer, typically reducing film effectiveness and enhancing heat transfer. Similar data is also presented for a film cooled cylindrical leading edge model.
Author
Film Cooling; Heat Transfer; Liquid Crystals; Turbine Blades; Turbulence Effects; Gas Turbine Engines; Unsteady Flow

20000034012 NASA Glenn Research Center, Cleveland, OH USA
On Flowfield Periodicity in the NASA Transonic Flutter Cascade, Part 2, Numerical Study
Chima, Rodrick V., NASA Glenn Research Center, USA; McFarland, Eric R., NASA Glenn Research Center, USA; Wood, Jerry R., NASA Glenn Research Center, USA; Lepicovsky, Jan, DYNACS Engineering Co., Inc., USA; March 2000; 14p; In English; Original contains color illustrations
Contract(s)/Grant(s): RTOP 523-26-13
Report No.(s): NASA/TM-2000-209933/PT1; NAS 1.15:209933/PT1; E-12177/PT1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The transonic flutter cascade facility at NASA Glenn Research Center was redesigned based on a combined program of experimental measurements and numerical analyses. The objectives of the redesign were to improve the periodicity of the cascade in steady operation, and to better quantify the inlet and exit flow conditions needed for CFD predictions. Part I of this paper describes the experimental measurements, which included static pressure measurements on the blade and endwalls made using both static taps and pressure sensitive paints, cobra probe measurements of the endwall boundary layers and blade wakes, and shadowgraphs of the wave structure. Part II of this paper describes three CFD codes used to analyze the facility, including a multibody panel code, a quasi-three-dimensional viscous code, and a fully three-dimensional viscous code. The measurements and analyses both showed that the operation of the cascade was heavily dependent on the configuration of the sidewalls. Four configurations of the sidewalls were studied and the results are described. For the final configuration, the quasi-three-dimensional viscous code was used to predict the location of mid-passage streamlines for a perfectly periodic cascade. by arranging the tunnel sidewalls to approximate these streamlines, sidewall interference was minimized and excellent periodicity was obtained.
Author
Flow Distribution; Periodic Variations; Transonic Flow; Inlet Flow; Outlet Flow; Transonic Flutter

20000034013 General Electric Co., Aircraft Engines, Cincinnati, OH USA
Full 3D Analysis of the GE90 Turbofan Primary Flowpath *Final Report*
Turner, Mark G., General Electric Co., USA; March 2000; 100p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS3-26617; RTOP 509-10-11
Report No.(s): NASA/CR-2000-209951; E-12205; NAS 1.26:209951; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The multistage simulations of the GE90 turbofan primary flowpath components have been performed. The multistage CFD code, APNASA, has been used to analyze the fan, fan OGV and booster, the 10-stage high-pressure compressor and the entire turbine system of the GE90 turbofan engine. The code has two levels of parallel, and for the 18 blade row full turbine simulation has 87.3 percent parallel efficiency with 121 processors on an SGI ORIGIN. Grid generation is accomplished with the multistage Average Passage Grid Generator, APG. Results for each component are shown which compare favorably with test data.
Author
Three Dimensional Models; Turbofans; Computational Fluid Dynamics; Computational Grids; Simulation

20000034022 Texas A&M Univ., Dept. of Mechanical Engineering, College Station, TX USA

Effect of Film-Hole Shape on Turbine Blade Film Cooling Performance ***Final Report***

Han, J. C., Texas A&M Univ., USA; Teng, S., Texas A&M Univ., USA; February 2000; 64p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG3-1656; RTOP 714-01-4A

Report No.(s): NASA/CR-2000-209932; E-12176; NAS 1.26:209932; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The detailed heat transfer coefficient and film cooling effectiveness distributions as well as tile detailed coolant jet temperature profiles on the suction side of a gas turbine blade A,ere measured using a transient liquid crystal image method and a traversing cold wire and a traversing thermocouple probe, respectively. The blade has only one row of film holes near the gill hole portion on the suction side of the blade. The hole geometries studied include standard cylindrical holes and holes with diffuser shaped exit portion (i.e. fanshaped holes and laidback fanshaped holes). Tests were performed on a five-blade linear cascade in a low-speed wind tunnel. The mainstream Reynolds number based on cascade exit velocity was 5.3 x 10(exp 5). Upstream unsteady wakes were simulated using a spoke-wheel type wake generator. The wake Strouhal number was kept at 0 or 0.1. Coolant blowing ratio was varied from 0.4 to 1.2. Results show that both expanded holes have significantly improved thermal protection over the surface downstream of the ejection location, particularly at high blowing ratios. However, the expanded hole injections induce earlier boundary layer transition to turbulence and enhance heat transfer coefficients at the latter part of the blade suction surface. In general, the unsteady wake tends to reduce film cooling effectiveness.

Author

Heat Transfer Coefficients; Coolants; Temperature Profiles; Suction; Turbine Blades; Heat Measurement; Film Cooling

20000034102 National Academy of Sciences - National Research Council, Hampton, VA USA

Numerical Simulation of Dual-Mode Scramjet Combustors

Rodriguez, C. G., National Academy of Sciences - National Research Council, USA; Riggins, D. W., Tennessee Univ., USA; Bittner, R. D., FDC/NYMA, Inc., USA; [2000]; 29p; In English

Contract(s)/Grant(s): NAG1-2167; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Results of a numerical investigation of a three-dimensional dual-mode scramjet isolator-combustor flow-field are presented. Specifically, the effect of wall cooling on upstream interaction and flow-structure is examined for a case assuming jet-to-jet symmetry within the combustor. Comparisons are made with available experimental wall pressures. The full half-duct for the isolator-combustor is then modeled in order to study the influence of side-walls. Large scale three-dimensionality is observed in the flow with massive separation forward on the side-walls of the duct. A brief review of convergence-acceleration techniques useful in dual-mode simulations is presented, followed by recommendations regarding the development of a reliable and unambiguous experimental data base for guiding CFD code assessments in this area.

Author

Simulation; Three Dimensional Models; Mathematical Models; Supersonic Combustion Ramjet Engines; Combustion; Combustion Chambers

20000034104 Missouri Univ., Rolla, MO USA

The Numerical Investigation of a Dual-Mode Scramjet Combustor

Riggins, David, Missouri Univ., USA; [1998]; 18p; In English

Contract(s)/Grant(s): NAG1-189; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A numerical investigation of a multiple-jet array dual-mode scramjet combustor has been performed utilizing a three-dimensional Navier-Stokes code with finite-rate chemistry. Results indicate substantial upstream interaction in the form of an oblique shock/expansion train upstream of the combustor, culminating in completely subsonic flow in the vicinity of fuel injectors. The flow returns to supersonic velocities in the downstream (diverging) portion of the combustor. Mixing and combustion are rapid in this flow and predicted combustion efficiency closely matches experimental data. However, comparisons of wall pressure between the simulation and the experiment show i) substantial underprediction of the upstream interaction distance and ii) moderate overprediction of peak pressure in the vicinity of the entrance of the combustor. This can be at least partially explained by examination of available experimental data; this data shows a very significant movement of the entering vitiated airflow to the sides of the combustor (around the injector array and the upstream interaction front as a whole). This important effect is currently being examined by an extension of the modeling to include the entire half-duct of the same combustor geometry.

Author

Supersonic Combustion Ramjet Engines; Combustion; Combustion Chambers; Three Dimensional Models; Navier-Stokes Equation; Oblique Shock Waves

20000036536 California Univ., San Diego, Dept. of the Aerospace and Mechanical Engineering Sciences, La Jolla, CA USA
A Second Generation of Backstepping Designs and Robust Nonlinear Control of Aeroengines ***Final Report, 1 Feb. 1998-30 Sep. 1999***
Krstic, Miroslav; Nov. 23, 1999; 11p; In English
Contract(s)/Grant(s): F49620-98-1-0064; F08671-98-0-0319
Report No.(s): AD-A374640; AFRL-SR-BL-TR-00-0059; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The research completed has established connections between systematic methods of nonlinear stabilization and nonlinear optimal control. The redesigns of adaptive and robust nonlinear controllers developed under this grant are inverse optimal, and thus use less control effort and possess a certain margin of robustness to some uncertainties. This grant has also produced the first methods for stabilization for stochastic nonlinear systems. The most significant among the results is disturbance attenuation and adaptive stabilization for systems with noise of unknown covariance. Finally, the grant has revived a whole research area called extremum seeking control which deals with non-model-based on-line optimization. The PI and the group obtained the first stability guarantees for extremum seeking schemes and proposed techniques for their application to much more general classes of systems than previously possible. The ultimate deal of the theoretical research was an application to nonlinear instabilities arising in aeroengines. The PI has advanced the state of the art in this area in three directions. First, he developed the first nonlinear control laws with guaranteed regions of attraction and robustness to some modeling errors. Second, he pioneered the methods for seeking of the maximum of the compressor pressure rise characteristic. Third, he designed the first model-based adaptive controllers for thermoacoustic instabilities in combustion chambers. The results of the work have been published (or submitted for publication) in 1 book, 22 journal pacers, a number of conference papers, and four book chapters.
DTIC
Aircraft Engines; Nonlinear Systems; Control Theory; Adaptive Control; Error Analysis

20000037815 Rolls-Royce Allison, Indianapolis, IN USA
Achieving Helicopter Modernization with Advanced Technology Turbine Engines
Dickens, Fred W., Rolls-Royce Allison, USA; Thomason, Tommy, Rolls-Royce Allison, USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A18-1 - A18-9; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

Military and commercial helicopter operators worldwide are faced with a common dilemma-when to replace existing fleets with newer, more capable, and yes, more expensive helicopters. Alternatively, how often and how much should they spend on upgrades. Either decision may be based on operational needs, operational support costs, or a combination of both. On a personal level, you go through a similar process when deciding to replace the family car with a new or used car. As long as the basic mission remains unchanged, such as the daily commute to and from work, and the vehicle is reliable and replacement parts are readily available, then you probably can't economically rationalize a new car. Automobile upgrades are virtually limitless as there are many sources for new engines, radios, security systems, power door locks, stereo systems, cruise controls, trailer hitches, and fog lights, among others. All of these options serve the same purpose: to make an existing car more functional or to extend its life. A replacement can be rationalized when repair costs become too expensive, you experience a major failure, the car is no longer reliable, fuel costs or fuel consumption become prohibitive, or there is no longer room for the growing family. Likewise, there are many examples where helicopter replacements are necessary in lieu of upgrades. Helicopter replacements are appropriate when the mission need and capability of the replacement is so compelling that upgrades to the existing system are simply cost prohibitive and/or the desired performance is not achievable within the existing airframe structure. Crashworthiness, cargo volume, night/adverse weather capability, payload, range, speed, battle damage vulnerability, multi-engine requirements, and marinization, among many other considerations, might contribute to the replacement decision. A few examples of cost and mission effective replacement helicopters are listed in Figure 1. The replacement of the CH-46 helicopter with the V-22 Osprey tiltrotor is the most compelling example of an extraordinary aircraft capability redefining an operational mission.
Author
Turbine Engines; Upgrading; Military Helicopters; Aircraft Engines

20000037816 Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Military Engines Div., Evry, France
The Modernization of Snecma Military Engines: Recent Developments and Perspectives ***La Modernisation des Moteurs Militaires Snecma Developpements Recents et Perspectives***
Coquelet, Michel, Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, France; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A20-1 - A20-6; In French; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

To date, 47 armed forces have used over 6,000 engines sold by Snecma of CFMI, the common (50/50) subsidiary of Snecma (France) and GE (US). Among the engines currently in use, some have been in service for over 30 years. In order to maintain a high level of satisfaction among our clientele, Snecma has adopted an agenda of continuous improvement, including: Extending life span and reducing maintenance costs; Proposing modifications due to changes in use; Industry participation in client countries. Author

Aircraft Engines; Product Development; Aircraft Production

20000037894 Naval Air Systems Command, Patuxent , MD USA

The Development and Operational Challenges of UAV and UCAV Airbreathing Propulsion

Cifone, Anthony, Naval Air Systems Command, USA; Parsons, Wayne, Naval Air Systems Command, USA; Development and Operation of UAVs for Military and Civil Applications; April 2000, pp. 6-1 - 6-14; In English; See also 20000037887; Copyright Waived; Avail: CASI; A03, Hardcopy

There are a large number of Unmanned Aerial Vehicles (UAVs) throughout the world performing a variety of functions. The variety of conditions under which they operate, e.g., speed, altitude, endurance, VTOL, payload etc. impact or limit the type and size of propulsion system needed. This paper will define the various UAV categories and will characterize the types of engines and propulsors available for them. The variability of design features and their effect on characteristics will be shown. The effect of propulsion system trades on total system capability will be discussed.

Derived from text

Air Breathing Engines; Pilotless Aircraft

20000038013 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France

Recommended Practices for Monitoring Gas Turbine Engine Life Consumption *Pratiques Recommandees pour le Controle du Vieillissement des turbomoteurs*

April 2000; 181p; In English; CD-ROM contains full text document in PDF format

Report No.(s): RTO-TR-28; AC/323(AVT)TP/22; ISBN 92-837-1032-0; Copyright Waived; Avail: CASI; A09, Hardcopy; A02, Microfiche; C01, CD-ROM

The Task Group analysed the use of life monitoring systems in modern engines (from 1990) and in ageing fleets. The design and operational factors to be considered beforehand are described. Particular attention is paid to turbine disks. Regulatory requirements for safety standards are considered. Civil military practices, maintenance policies and procedures, modes and mechanics of service usage are covered as well as their influence on life consumption. Lifting procedures, monitoring system verification and validation, operational management considerations an usage monitoring approaches are dealt with.

Author

Gas Turbine Engines; Engine Monitoring Instruments; Systems Health Monitoring

20000038018 California Univ., Combustion Lab., Irvine, CA USA

Effect of Jet Injection Angle and Number of Jets on Mixing and Emissions From a Reacting Crossflow at Atmospheric Pressure *Final Report*

St.John, D., California Univ., USA; Samuelsen, G. S., California Univ., USA; April 2000; 20p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG3-1110; RTOP 714-02-20

Report No.(s): NASA/CR-2000-209949; E-12202; NAS 1.26:209949; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The mixing of air jets into hot, fuel-rich products of a gas turbine primary zone is an important step in staged combustion. Often referred to as ”quick quench,” the mixing occurs with chemical conversion and substantial heat release. An experiment has been designed to simulate and study this process, and the effect of varying the entry angle (0 deg, 22.5 deg and 45 deg from normal) and number of the air jets (7, 9, and 11) into the main flow, while holding the jet-to-crossflow mass-low ratio, MR, and momentum-flux ratio, J, constant (MR = 2.5;J = 25). The geometry is a crossflow confined in a cylindrical duct with side-wall injection of jets issuing from orifices equally spaced around the perimeter. A specially designed reactor, operating on propane, presents a uniform mixture to a module containing air jet injection tubes that can be changed to vary orifice geometry. Species concentrations of O2, CO, CO2, NO(x) and HC were obtained one duct diameter upstream (in the rich zone), and primarily one duct radius downstream. From this information, penetration of the jet, the spatial extent of chemical reaction, mixing, and the optimum jet injection angle and number of jets can be deduced.

Author

Air Jets; Cross Flow; Injection; Flow Characteristics; Flow Geometry; Jet Mixing Flow; Fuel Injection; Emission; Gas Turbines

08
AIRCRAFT STABILITY AND CONTROL

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

20000037722 NASA Langley Research Center, Hampton, VA USA
Contributions of the Transonic Dynamics Tunnel to the Testing of Active Control of Aeroelastic Response
Perry, Boyd, III, NASA Langley Research Center, USA; Noll, Thomas E., NASA Langley Research Center, USA; Scott, Robert C., NASA Langley Research Center, USA; [2000]; 18p; In English; Dynamics Specialists Conference, 5-6 Apr. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-1769; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

By the 1960s, researchers began to investigate the feasibility of using active controls technology (ACT) for increasing the capabilities of military and commercial aircraft. Since then many researchers, too numerous to mention, have investigated and demonstrated the usefulness of ACT for favorably modifying the aeroelastic response characteristics of flight vehicles. As a result, ACT entered the limelight as a viable tool for answering some very difficult design questions and had the potential for obtaining structural weight reductions optimizing maneuvering performance, and satisfying the multimission requirements being imposed on future military and commercial aircraft designs. Over the past 40 years, the NASA Langley Research Center (LaRC) has played a major role in developing ACT in part by its participation in many wind-tunnel programs conducted in the Transonic Dynamics Tunnel (TDT). These programs were conducted for the purposes of: (1) establishing concept feasibility; (2) demonstrating proof of concept; and (3) providing data for validating new modeling, analysis, and design methods. This paper provides an overview of the ACT investigations conducted in the TDT. For each program discussed herein, the objectives of the effort, the testing techniques, the test results, any, signIficant findings, and the lessons learned with respect to ACT testing are presented.
Derived from text
Active Control; Aeroelasticity; Dynamic Response; Transonic Wind Tunnels; Wind Tunnel Tests; Aircraft Design

20000037837 Turkish Aerospace Industries, Avionics Group, Ankara, Turkey
Flight Control Law Design and HIL Simulation of a UAV
Ulku, A., Turkish Aerospace Industries, Turkey; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B17-1 - B17-6; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

An adaptive control methodology, merging two known approaches to flight control problem, gain-scheduling and direct eigenspace assignment (DEA), is developed. A gain-scheduled inner (stability) loop structure is shown to minimize the variance of the outer (guidance) loop gains and increase the robustness of the system. The employment of DEA with gain scheduling is observed to decouple the longitudinal and lateral flight modes resulting adequate system stability, enhanced robustness and control surface effectiveness. This methodology is used in the flight control law design of a UAV.
Derived from text
Adaptive Control; Flight Control; Hardware-In-The-Loop Simulation; Pilotless Aircraft; Control Systems Design

20000037838 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Unmanned Research Vehicle (URV): Development, Implementation, and Flight Test of a MIMO Digital Flight Control System Designed using Quantitative Feedback Theory
Houpis, C. H., Air Force Inst. of Tech., USA; Rasmussen, S. J., Air Force Inst. of Tech., USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B18-1 - B18-12; In English; See also 20000037804; Copyright Waived; Avail: CASI; A03, Hardcopy

The Quantitative Feedback Theory (QFT) design technique, which has the ability to bridge the gap between theory and the real-world control design problem, is utilized in the design of a MIMO digital flight control system for an unmanned research vehicle (URV) that is presented in this paper. The design illustrates how the real-world knowledge of the plant to be controlled and the desired performance specifications can be utilized in trying to achieve a successful robust design for a nonlinear control problem. This paper presents some of the issues involved in developing, implementing, and flight testing a flight control system (FCS) designed using QFT. Achieving a successful FCS involves a number of steps: specification of the control problem, aircraft model data, theoretical flight control system design, implementation, ground testing, and flight test. The last three steps embody the practical engineering aspects that are vital to achieving a successful FCS. The main emphasis of this paper is on these steps, First, there is a brief explanation of the MIMO design QFT process. This is followed by a description of the steps involved in the implementation and testing of a QFT designed FCS. Thus, this presentation provides an overview of using robust control system design to increase quality in attempting to demonstrate the Bridging the Gap between control theory and the realities of a

successful control system design. In facing the technological problems of the future. it is necessary that engineers of the future must be able to bridge the gap, i.e., this Bridging the Gap must be addressed to better prepare the engineers for the 21st century. Author

Control Systems Design; Flight Tests; MIMO (Control Systems); Research Vehicles; Pilotless Aircraft; Feedback

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands. For related information see also 14 Ground Support Systems and Facilities (Space).

20000034014 NASA Glenn Research Center, Cleveland, OH USA

Restoration of the Hypersonic Tunnel Facility at NASA Glenn Research Center, Plum Brook Station

Woodling, Mark A., NASA Glenn Research Center, USA; March 2000; 18p; In English; 38th; Aerospace Sciences, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 282-20-02-02

Report No.(s): NASA/TM-2000-209930; E-12174; NAS 1.15:209930; AIAA Paper 2000-0163; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NASA Glenn Research Center's Hypersonic Tunnel Facility (HTF), located at the Plum Brook Station in Sandusky, Ohio, is a non-vitiated, free-jet facility, capable of testing large-scale propulsion systems at Mach Numbers from 5 to 7. As a result of a component failure in September of 1996, a restoration project was initiated in mid- 1997 to repair the damage to the facility. Following the 2-1/2 year effort, the HTF has been returned to an operational condition. Significant repairs and operational improvements have been implemented in order to ensure facility reliability and personnel safety. As of January 2000, this unique, state-of-the-art facility was ready for integrated systems testing.

Author

Component Reliability; Hypersonic Wind Tunnels; Maintenance; Propulsion System Performance; Reliability; Restoration

20000034099 NASA Langley Research Center, Hampton, VA USA

Past, Present, and Future Capabilities of the Transonic Dynamics Tunnel from an Aeroelasticity Perspective

Cole, Stanley R., NASA Langley Research Center, USA; Garcia, Jerry L., NASA Langley Research Center, USA; [2000]; 24p; In English; Dynamics Specialists Conference, 5-6 Apr. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2000-1767; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NASA Langley Transonic Dynamics Tunnel (TDT) has provided a unique capability for aeroelastic testing for forty years. The facility has a rich history of significant contributions to the design of many USA commercial transports, military aircraft, launch vehicles, and spacecraft. The facility has many features that contribute to its uniqueness for aeroelasticity testing, perhaps the most important feature being the use of a heavy gas test medium to achieve higher test densities. Higher test medium densities substantially improve model-building requirements and therefore simplify the fabrication process for building aeroelastically scaled wind tunnel models. Aeroelastic scaling for the heavy gas results in lower model structural frequencies. Lower model frequencies tend to a make aeroelastic testing safer. This paper will describe major developments in the testing capabilities at the TDT throughout its history, the current status of the facility, and planned additions and improvements to its capabilities in the near future.

Author

Aeroelasticity; Transonic Wind Tunnels; Wind Tunnel Models; Wind Tunnel Tests; Test Facilities

20000034231 NASA Glenn Research Center, Cleveland, OH USA

Flow Quality Studies of the NASA Glenn Research Center Icing Research Tunnel Circuit (1995 Tests)

Arrington, E. Allen, NYMA, Inc., USA; Kee-Bowling, Bonnie A., NASA Glenn Research Center, USA; Gonsalez, Jose C., NYMA, Inc., USA; March 2000; 170p; In English

Contract(s)/Grant(s): RTOP 523-90-1A

Report No.(s): NASA/TM-2000-107479; NAS 1.15:107479; E-10767; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The purpose of conducting the flow-field surveys described in this report was to more fully document the flow quality in several areas of the tunnel circuit in the NASA Glenn Research Center Icing Research Tunnel. The results from these surveys

provide insight into areas of the tunnel that were known to exhibit poor flow quality characteristics and provide data that will be useful to the design of flow quality improvements and a new heat exchanger for the facility. An instrumented traversing mechanism was used to survey the flow field at several large cross sections of the tunnel loop over the entire speed range of the facility. Flow-field data were collected at five stations in the tunnel loop, including downstream of the fan drive motor housing, upstream and downstream of the heat exchanger, and upstream and downstream of the spraybars located in the settling chamber upstream of the test section. The data collected during these surveys greatly expanded the data base describing the flow quality in each of these areas. The new data matched closely the flow quality trends recorded from earlier tests. Data collected downstream of the heat exchanger and in the settling chamber showed how the configuration of the folded heat exchanger affected the pressure, velocity, and flow angle distributions in these areas. Smoke flow visualization was also used to qualitatively study the flow field in an area downstream of the drive fan and in the settling chamber/contraction section.
Author
Flow Distribution; Wind Tunnel Tests; Flow Visualization; Ice Formation

12
ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see 91 Lunar and Planetary Exploration.

20000034902 NASA Marshall Space Flight Center, Huntsville, AL USA
Commercial Contributions to the Success of the HEDS Enterprise: A Working Model
Nall, Mark, NASA Marshall Space Flight Center, USA; Askew, Ray, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 51st; 51st International Astronautical Congress, 2-6 Oct. 2000, Rio de Janeiro, Brazil; No Copyright; Avail: Issuing Activity; Abstract Only

The future of NASA involves the exploration of space beyond the confines of orbit about the Earth. This includes robotic investigations and Human Exploration and Development of Space (HEDS). The HEDS Strategic Plan states: ”HEDS will join with the private sector to stimulate opportunities for commercial development in space as a key to future settlement. Near-term efforts will emphasize joint pilot projects that provide clear benefit to Earth from the development of near-Earth space.” In support of this endeavor, NASA has established the Commercial Development of Space as a prime goal and is exploring all the ways in which NASA might make contributions to this development. NASA has long supported the development of space for commercial use. In 1985 it formally established and provided funds to support a program which created a number of joint ventures between universities and industry for this purpose. These were known as Centers for the Commercial Development of Space (CCDS). In 1999 NASA established a broader policy on commercialization with the aim of encouraging near-term commercial investment in conjunction with the International Space Station. Joint pilot projects will be initiated to stimulate this near-term investment. The long-term development of commercial concepts utilizing space access continues through the activities of the Commercial Space Centers (CSC), a sub-set of the original CCDS group. These Centers primarily require access to space for the conduct of their work. The remainder of the initial Centers focus on the development of tools and infrastructure to support users of the space environment. It is in this arena that long term development for commercial use and infrastructure development will occur. This paper will provide a retrospective examination of the Commercial Centers, the variety of models employed, the lessons learned, and the progress to date. This review will provide the bases for how successful models can be employed to accelerate private investment in the development of the infrastructure necessary for the success of the HEDS enterprise.
Author
Space Commercialization; NASA Programs; Technology Utilization

13
ASTRODYNAMICS

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

20000034107 NASA Goddard Space Flight Center, Greenbelt, MD USA
New Developments in Quaternion Estimation from Vector Observations
Markley, F. Landis, NASA Goddard Space Flight Center, USA; Mortari, Daniele, Rome Univ., Italy; [2000]; 20p; In English; Richard H. Battin Astrodynamics Symposium, 20-21 Mar. 2000, College Station, TX, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper contains a critical comparison of estimators minimizing Wahba's loss function. Some new results are presented for the QUaternion ESTimator (QUEST) and EStimators of the Optimal Quaternion (ESOQ and ESOQ2) to avoid the computational burden of sequential rotations in these algorithms. None of these methods is as robust in principle as Davenport's q method or the Singular Value Decomposition (SVD) method, which are significantly slower. Robustness is only an issue for measurements with widely differing accuracies, so the fastest estimators, the modified ESOQ and ESOQ2, are well suited to sensors that track multiple stars with comparable accuracies. More robust forms of ESOQ and ESOQ2 are developed that are intermediate in speed.
Author
Estimating; Quaternions; Vector Analysis; Algorithms; Attitude (Inclination)

15
LAUNCH VEHICLES AND LAUNCH OPERATIONS

20000033987 Lockheed Martin Michoud Space Systems, New Orleans, LA USA
Establishing Hazardous Gas Launch Commit Criteria for the Space Shuttle External Tank Intertank Compartment
Baran, Adam J., Lockheed Martin Michoud Space Systems, USA; Piekarski, Brian, Lockheed Martin Michoud Space Systems, USA; Steinbock, Roy D., Lockheed Martin Michoud Space Systems, USA; Ferguson, Lyle W., Lockheed Martin Michoud Space Systems, USA; Lim, Kair-Chuan, Lockheed Martin Michoud Space Systems, USA; [2000]; 2p; In English; 36th, 16-19 Jul. 2000, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Until recently, the simultaneous detection and evaluation of multiple Space Transportation System (STS) element compartments for propellant leakage was not possible during the External Tank (ET) pre-pressurization (pre-press) phase of propellant loading; late in the loading sequence (T-3 min to T-0). There exist launch commit criteria (LCCS) designed to protect against leaks resulting in flammable mixtures in the intertank during the functional life of the ET; start of propellant loading through ET-Orbiter separation. However thus far, leak protection had relied on the premise that if a propellant supply system leak were to exist, it would be a leak of fixed area present at the start of propellant loading (dumb leak mode) and such a leak could be detected earlier in the loading sequence than the pre-press phase. No measures had ever been implemented which would protect against leaks potentially developing late in the loading sequence (smart leak mode), The STS community had baselined this situation as an accepted risk their decision supported by exhaustive hardware acceptance criteria and a history of many successful launches. With the recent development of improvements to the hazardous gas detection system (HGDS), an opportunity arose to monitor the intertank compartment for hazardous gas concentrations beyond the T-3 minute mark. In this timeframe the propellant supply system is pressurized for flight and protection was sought against potential leaks generated by this pressurization process. The challenge at hand was to develop LCCs in this timeframe that were not too conservative to unnecessarily prohibit a launch, yet not too liberal to endanger crew safety and mission success. Since essentially no measurement history existed in this timeframe, the LCCs would have to rely on analysis alone. At NASA's direction, Lockheed Martin Michoud Space Systems (LMMSS) developed requirements that would protect against a smart leak during pre-press. A smart leak protection strategy is noteworthy from an STS main propulsion system (NWS) community perspective. This paper presents the resultant requirements as well as the technical and program issues involved with establishing hazardous gas LCCs for the ET intertank compartment.
Author
Compartments; External Tanks; Space Shuttles; Hazardous Materials; Launching; Gas Composition; Gaseous Rocket Propellants

20000034267 Naval Postgraduate School, Monterey, CA USA
A Projectile for a Rectangular Barreled Rail Gun
Juanche, Francisco M.; Dec. 1999; 98p; In English
Report No.(s): AD-A374103; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The Physics Department at the Naval Postgraduate School is developing a concept to overcome the problems that keep present rail guns from being practical weapons. The rails must be replaced often if the rail gun operation is to be continuous. Replacing the rails in present rail gun configurations is time consuming. The Physics Department's design concept uses a rectangular barrel as part of the solution to the problem of replacing the rails. The projectile will require flat surfaces to maintain electrical contact with the flat rails and aerodynamic stabilization because of the lack of angular momentum. This thesis develops one possible model of a projectile for a rectangular barreled rail gun, which could be used to replace the standard five-inch gun found on most warships. The proposed projectile is successfully modeled as a five inch projectile with flat areas planed onto opposite sides and

long chord, short span fins attached in a cruciform configuration. The computer programs used to develop the projectile model are included to allow evaluation of alternate configurations.
DTIC
Hypervelocity Guns; Computer Programs; Projectiles; Rails

20000036592 NASA Marshall Space Flight Center, Huntsville, AL USA
Magnetically Actuated Propellant Orientation Experiment, Controlling Fluid Motion With Magnetic Fields in a Low-Gravity Environment *Final Report*
Martin, J. J., NASA Marshall Space Flight Center, USA; Holt, J. B., NASA Marshall Space Flight Center, USA; March 2000; 108p; In English
Contract(s)/Grant(s): Proj. 93-18
Report No.(s): NASA/TM-2000-210129; M-975; NAS 1.15:210129; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This report details the results of a series of fluid motion experiments to investigate the use of magnets to orient fluids in a low-gravity environment. The fluid of interest for this project was liquid oxygen (LO2) since it exhibits a paramagnetic behavior (is attracted to magnetic fields). However, due to safety and handling concerns, a water-based ferromagnetic mixture (produced by Ferrofluidics Corporation) was selected to simplify procedures. Three ferromagnetic fluid mixture strengths and a nonmagnetic water baseline were tested using three different initial fluid positions with respect to the magnet. Experiment accelerometer data were used with a modified computational fluid dynamics code termed CFX-4 (by AEA Technologies) to predict fluid motion. These predictions compared favorably with experiment video data, verifying the code's ability to predict fluid motion with and without magnetic influences. Additional predictions were generated for LO2 with the same test conditions and geometries used in the testing. Test hardware consisted of a cylindrical Plexiglas tank (6-in. bore with 10-in. length), a 6,000-G rare Earth magnet (10-in. ring), three-axis accelerometer package, and a video recorder system. All tests were conducted aboard the NASA Reduced-Gravity Workshop, a KC-135A aircraft.
Author
Experimentation; Propellants; Magnetic Fields; Fluid Flow; Microgravity; Computational Fluid Dynamics; Orientation

20000037751 NASA Goddard Space Flight Center, Greenbelt, MD USA
EOS Reference Handbook 1999: A Guide to NASA's Earth Science Enterprise and the Earth Observing System
King, M. D., Editor; Greenstone, R., Editor; 2000; 368p; In English
Report No.(s): PB2000-103310; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche

The content of this handbook includes Earth Science Enterprise; The Earth Observing System; EOS Data and Information System (EOSDIS); Data and Information Policy; Pathfinder Data Sets; Earth Science Information Partners and the Working Prototype-Federation; EOS Data Quality: Calibration and Validation; Education Programs; International Cooperation; Interagency Coordination; Mission Elements; EOS Instruments; EOS Interdisciplinary Science Investigations; and Points-of-Contact.
NTIS
Handbooks; Earth Observing System (EOS); EOS Data and Information System; Mission Planning; Project Planning

20000037777 NASA Marshall Space Flight Center, Huntsville, AL USA
Test Report for NASA MSFC Support of the Linear Aerospike SR-71 Experiment (LASRE)
Elam, S. K., NASA Marshall Space Flight Center, USA; February 2000; 140p; In English
Report No.(s): NASA/TM-2000-210076; NAS 1.15:210076; M-973; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The Linear Aerospike SR-71 Experiment (LASRE) was performed in support of the Reusable Launch Vehicle (RLV) program to help develop a linear aerospike engine. The objective of this program was to operate a small aerospike engine at various speeds and altitudes to determine how slipstreams affect the engine's performance. The joint program between government and industry included NASA!s Dryden Flight Research Center, The Air Force's Phillips Laboratory, NASA's Marshall Space Flight Center, Lockheed Martin Skunkworks, Lockheed-Martin Astronautics, and Rocketdyne Division of Boeing North American. Ground testing of the LASRE engine produced two successful hot-fire tests, along with numerous cold flows to verify sequencing and operation before mounting the assembly on the SR-71. Once installed on the aircraft, flight testing performed several cold flows on the engine system at altitudes ranging from 30,000 to 50,000 feet and Mach numbers ranging from 0.9 to 1.5. The program

was terminated before conducting hot-fires in flight because excessive leaks in the propellant supply systems could not be fixed to meet required safety levels without significant program cost and schedule impacts.
Author
Aerospike Engines; Reusable Launch Vehicles; SR-71 Aircraft; Liquid Propellant Rocket Engines; Propulsion System Performance; Engine Tests

16
SPACE TRANSPORTATION AND SAFETY

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

20000033783 NASA Kennedy Space Center, Cocoa Beach, FL USA
Apollo 11: The Twentieth Year, *1969 - 1989*
May 02, 1989; In English; Videotape: 30 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000036559; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS
Live footage shows the Apollo 11 crew, Commander Neil A. Armstrong, Lunar Module Pilot Edwin E. Aldrin, Jr., and Command Module Pilot Michael Collins, preparing for their mission. The crewmembers are seen getting their medical examinations, suiting up, and walking out to the Astro-van. Scenes include a brief view of the Launch Control Center (LCC), ignition, liftoff, and shell and engine skirt separation. The most important images are those of the moon landing and astronauts walk on the moon. Also shown are the parachute landing of the shuttle and the celebration of the world.
CASI
Apollo 11 Flight; Lunar Exploration; Lunar Flight; Lunar Landing

20000033784 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-33: At Pad B - IEA Removal; STS-32: In the VAB HB1 - IEA Removal
Nov. 14, 1989; In English; Videotape: 4 min. 6 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000039788; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS
The STS-33 at Pad B Integrated Electronic Assembly (I.E.A.) is shown. The STS-32 I.E.A. removal in the Vehicle Assembly Building (V.A.B) High Bay 1 (H.B.1) is also presented. The change out of the short they found in boosters is the purpose for the video.
CASI
Space Transportation System; Spacecraft Electronic Equipment

20000033785 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-33: Removal of the I.E.A. at Pad B and Inspection at the ARF
Nov. 15, 1989; In English; Videotape: 7 min. 19 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000039789; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS
Live footage of the removal of the Integrated Electronics Assembly (I.E.A.) from the STS-33 is presented. The I.E.A. is then inspected at United Space Boosters, Inc. (U.S.B.I).
CASI
Space Transportation System; Spacecraft Electronic Equipment

20000033819 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-35: ASTRO-1 Assembly at O&C
Apr. 03, 1989; In English; Videotape: 5 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000043345; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS
Live footage shows the assembly of the ASTRO-1 payload for STS-35. The assembly occurred in the Operations and Checkout Building.
CASI
Astro Missions (STS); Spaceborne Astronomy; Spaceborne Telescopes; Spacelab Payloads; Assembling

20000033833 NASA Dryden Flight Research Center, Edwards, CA USA
X-43 Composite Tape, *March 99 - March 00*
Dec. 16, 1999; In English; Videotape: 7 min. 26 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000045251; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

Live footage shows Project Manager Joel Sitz participating in an interview about the X-43 project. Sitz mentions several tests that will be performed on the X-43. He also mentions that the main objective of this project is to validate the design code for hypersonic air breathing vehicles. He discusses the projected data collection to prove that the predictions that were made in the laboratories and wind tunnels are correct. Scenes include the roll of the X-43 and an animation of the flight.
CASI
X-43 Vehicle; Hypersonic Flight; Air Breathing Boosters; Air Breathing Engines; Airframes

20000033861 NASA Dryden Flight Research Center, Edwards, CA USA
X-33, X-34, X-37 Press Conference (Tape 2)
Aug. 24, 1999; In English; Videotape: 34 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000043974; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

Live footage shows Project Managers Susan Turner, MSFC and David Manley, Boeing Co. participating in the X-37 Briefing. NASA's Public Affairs June Malone introduced these panelists who went on to discuss the vehicle and its secondary payload. Manley mentions the X-37 capabilities, main propulsion system, its lithium iron batteries, hot control surfaces, and its fly by wire system. Turner mentions the on-board operations, the deployment of the solar arrays, and the autonomous navigation and landing system. Also included is an animation of the X-37 vehicle during flight and the secondary payload release into orbit.
CASI
X-37 Vehicle; Reusable Launch Vehicles; Recoverable Launch Vehicles; Conferences

20000033991 NASA Marshall Space Flight Center, Huntsville, AL USA
X-33, Demonstrating Revolutionary Operations for VentureStar(TM)
Austin, Robert E., NASA Marshall Space Flight Center, USA; Ishmael, Stephen D., NASA Dryden Flight Research Center, USA; Lacefield, Cleon, Lockheed Martin Aeronautics Co., USA; [2000]; 1p; In English; 51st; Astronautical Congress, 2-6 Oct. 2000, Rio de Janeiro, Brazil; No Copyright; Avail: Issuing Activity; Abstract Only

The X-33, reusable space plane technology demonstrator is on course to begin the flights of the X-33 by the end of 2002 that will serve as a basis for industry and government decisions that could lead to VentureStar(Trademark). Lockheed Martin has placed the VentureStar LLC in it's Space Company and is now competing in an industry wide effort that will permit NASA to select a Second Generation RLV source by 2005. This move provides the focus for firm business planning needed to enable the decision by the time X-33 flies in mid 2002 and possibly with upgraded technologies a year or so later. The operations concept for the X-33 is an integration of launch vehicle and aircraft operations approaches. VentureStar is a Single Stage to Orbit (SSTO) and will therefore enable a new approach to Space Launch Operations that is more "aircraft like" and can produce substantially lower operating costs over current systems. NASA's initiatives over the past several years in Reusable Launch Vehicles (RLV) have had as a primary objective to demonstrate technologies that will result in significant reduction in costs of space access. Further, the end objective is to commercialize the development and operations of the next generation RLV. Hence, the X-33 and its operations demonstration is a major contributor to that next generation system.
Author
Aerospace Planes; Flight Operations; Single Stage to Orbit Vehicles; Venturestar Launch Vehicle; X-33 Reusable Launch Vehicle

20000033992 NASA Marshall Space Flight Center, Huntsville, AL USA
X-33 Leading the Way to VentureStar(Trademark) in this Decade
Austin, Robert E., NASA Marshall Space Flight Center, USA; Rising, Jerry J., Lockheed Martin Corp., USA; [2000]; 1p; In English; 51st; Astronautical Congress, 2-6 Oct. 2000, Rio de Janeiro, Brazil; No Copyright; Avail: Issuing Activity; Abstract Only

The X-33, reusable space plane technology demonstrator is on course to begin the flights of the X-33 by the end of 2002 that will serve as a basis for industry and government decisions that could lead to VentureStar(Trademark). Lockheed Martin has placed the VentureStar(Trademark) LLC in it's Space Company and is now competing in an industry wide effort that will permit NASA to select a Second Generation RLV source by 2005. This move provides the focus for firm business planning needed to enable the decision by the time X-33 flies in mid 2002 and possibly with upgraded technologies a year or so later. Since the IAF 50th Congress in Amsterdam, most of the major hardware elements of X-33 have been through their assembly and test. The flight liquid oxygen tank was the first major element to complete final assembly. Aerospike Engine qualification testing has progressed successfully through its test objectives and the two flight engines are in preparation to be delivered to the Assembly Facility in

Palmdale. All Thermal Protection System (TPS) metallic panels have completed qualification testing and have been delivered to Palmdale and all remaining TPS elements have been assembled and are ready for delivery. Flight Software and Avionics have been delivered and are in integration testing. In November 1999, the first graphite composite liquid hydrogen tank experienced a debond between the tank inner skin and the honeycomb core in testing. This tank had completed its third successful cryogenic and loads testing at MSFC. Replacement liquid hydrogen tanks have completed design and are in fabrication. The resulting delay from this change of design for the liquid hydrogen tank will be approximately two years.
Author
X-33 Reusable Launch Vehicle; Venturestar Launch Vehicle; Aerospace Planes; Aerospike Engines; Engine Tests

20000034043 NASA Kennedy Space Center, Lompoc, CA USA
STS-34: Mission Overview Briefing
Sep. 05, 1989; In English; Videotape: 43 min. 21 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000039782; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS
Live footage shows Milt Heflin, the Lead Flight Director participating in the STS-34 Mission Briefing. He addresses the primary objective, and answered questions from the audience and other NASA Centers. Heflin also mentions the Shuttle Solar Backscatter Ultraviolet secondary payload, and several experiments. These experiments include Growth Hormone Crystal Distribution (Plants), Polymer Morphology, Sensor Technology Experiment, Mesoscale Lightning Experiment, Shuttle Student Involvement Program ”Ice Crystals”, and the Air Force Maui Optical Site.
CASI
Space Transportation System; Space Transportation System Flights; Atlantis (Orbiter)

20000034044 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-31: Mission Highlights, Part 2
Jun. 21, 1990; In English; Videotape: 27 min. 25 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000039776; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS
Live footage shows the crewmembers of STS-31, Commander Loren J. Shriver, Pilot Charles F. Bolden, Jr., and Mission Specialists Steven A. Hawley, Bruce McCandless II, and Kathryn D. Sullivan, participating in a press conference. The crew is seen answering questions about the Hubble Space Telescope from participating audience as well as from various NASA Centers.
CASI
Space Transportation System; Space Transportation System Flights; Discovery (Orbiter); Teleconferencing; Telecommunication; Conferences

20000034072 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-35/Astro-1: Editors Work Tape
May 25, 1990; In English; Videotape: 53 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000043337; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS
Live footage shows preparation for the Astro-1 mission. Scenes include Payload Bay door closing, Rollover to the Vehicle Assembly Building (VAB) from OPF, the STS-35/Astro rollout to Pad-A, Broad Band X-Ray Telescope (BBXRT) Servicing, and crew arrival for the Terminal Countdown Demonstration Tests (TCDT). The crewmembers of STS-35, Commander Vance D. Brand, Pilot Guy S. Gardner, and Mission Specialists Jeffrey A. Hoffman, John M. Lounge, Robert A. Parker, Samuel T. Durrance, and Ronald A. Parise, are shown participating in various training activities. Activities include driving the M113 vehicle, participating in emergency training, and addressing the press upon arrival at Kennedy Space Center.
CASI
Crew Procedures (Preflight); Astronaut Training; Astro Missions (STS); Spacelab Payloads

20000034073 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-35/Astro-1: Launch T-20 Through Orbit with Replays (Tape 2 of 2)
Dec. 02, 1990; In English; Videotape: 35 min. 25 sec. playing time, in color, with some sound
Report No.(s): NONP-NASA-VT-2000043335; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS
Live footage shows the Launch Control Center (LCC) communicating with the STS-35 Space Shuttle. Scenes include various playback launch views of STS-35. Also shown are panoramic views of the Shuttle on the launch pad, main engine start, ignition, liftoff and booster separation and various Long Range Tracker views.
Author
Launching Bases; Communicating; Spacelab Payloads; Astro Missions (STS); Spaceborne Astronomy

20000034130 Boeing Co., Reusable Space Systems, Huntington Beach, CA USA
In-Space Transportation for GEO Space Solar Power Satellites ***Final Report, 22 Sep. - 22 Dec. 1999***
Martin, James A., Boeing Co., USA; Donnahue, Benjamin B., Boeing Co., USA; Henley, Mark W., Boeing Co., USA; Dec. 22, 1999; 68p; In English
Contract(s)/Grant(s): NAS8-98244
Report No.(s): NASA/CR-2000-210136; NAS 1.26:210136; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This report summarizes results of study tasks to evaluate design options for in-space transportation of geostationary Space Solar Power Satellites. Referring to the end-to-end architecture studies performed in 1988, this current activity focuses on transportation of Sun Tower satellite segments from an initial low Earth orbit altitude to a final position in geostationary orbit (GEO; i.e., 35,786 km altitude, circular, equatorial orbit). This report encompasses study activity for In-Space Transportation of GEO Space Solar Power (SSP) Satellites including: 1) assessment of requirements, 2) design of system concepts, 3) comparison of alternative system options, and 4) assessment of potential derivatives.
Author
Geosynchronous Orbits; Solar Power Satellites; Design Analysis; Autonomy; Space Transportation System

20000034858 NASA Johnson Space Center, Houston, TX USA
STS-35: Mission Highlights Resource Tape
Feb. 27, 1995; In English; Videotape: 1 hr. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000043350; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS
Live footage shows the crewmembers of STS-35, Commander Vance D. Brand, Pilot Guy S. Gardner, Mission Specialists Jeffrey A. Hoffman, John M. Lounge, and Robert A. Parker, and Payload Specialists Samuel T. Durrance, and Ronald A. Parise, participating in the traditional breakfast prior to launch. The crew is seen suiting up, and walking out to the Astro-Van for their 1 a.m. launch. Also shown are some beautiful panoramic shots of the shuttle on the launch pad, main engine start, ignition, liftoff, and various shots of the Launch Control Center (LCC). The crew is also shown during flight performing some routine functions such as operating the trash compactor, eating, and getting into and out of their sleeping quarters. The crew is seen taking part in a conversation with the Secretary of State, and the Foreign Minister of the Soviet Union. Footage also includes the landing of Columbia, its rollout on the runway, and its crew as they depart from the vehicle.
CASI
Space Transportation System; Space Transportation System Flights; Columbia (Orbiter); Astro Missions (STS); Spaceborne Astronomy; Spacelab Payloads

20000034909 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-34: Galileo TCDT, ***13-15 Sep. 1989***
Sep. 15, 1989; In English; Videotape: 38 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000039773; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS
Live footage shows the crewmembers of STS-34, Commander Donald E. Williams, Pilot Michael J. McCulley, and Mission Specialists Franklin R. Chang-Diaz, Shannon W. Lucid, and Ellen S. Baker, participating in Terminal Countdown and Demonstration Tests. The crew is seen arriving in the T-38 aircraft, driving the M113 vehicle. Upon arrival at Kennedy Space Center, Williams addresses the waiting audience. The Crew discusses some of the experiments for their mission. They mention Remote Sensing, Recrystallization and Ozone experiments.
CASI
Astronaut Training; T-38 Aircraft; Space Transportation System; Space Transportation System Flights; Atlantis (Orbiter)

20000034925 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-30: Mission Highlights Reel
Mar. 22, 1990; In English; Videotape: 58 min. 42 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000036555; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS
Live footage shows the crewmember of STS-30, Commander David M. Walker, Pilot Ronald J. Grabe, and Mission Specialists Norman E. Thagard, Mary L. Cleave, and Mark C. Lee, participating in the traditional breakfast, suiting up and walking out to the Astro-van. Scenes include the retraction of the orbiter access arm, main engine start, ignition, and liftoff. The crew is also shown doing in-flight procedures such as experiments and equipment changes. The landing of Atlantis at Edwards Air Force Base is also seen.
CASI
Crew Procedures (Inflight); Crew Procedures (Preflight); Spaceborne Experiments; Maintenance

20000036516 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-34: Galileo Payload Canister Doors Closing in VPF
Aug. 24, 1989; In English; Videotape: 9 min. 40 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000043348; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

Live footage shows the closing of the Payload Bay doors in the Vertical Processing Facility (VPF) at Kennedy Space Center.
CASI
Payloads; Bays (Structural Units); Doors; Aircraft Compartments; Closing

20000036570 NASA Marshall Space Flight Center, Huntsville, AL USA
Advances in Space Transportation Technology Toward the NASA Goals
Lyles, Garry M., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 51st; Astronautical Congress, 2-6 Oct. 2000, Rio de Janeiro, Brazil; No Copyright; Avail: Issuing Activity; Abstract Only

NASA has set goals to increase safety by one hundred times while reducing cost tenfold over the next decade. This dramatic increase in safety will come by departing from a past emphasis on cost and performance to a new paradigm of safety and reliability, which, in turn, will drive down cost. to accomplish this, vehicle systems must be inherently reliable, functionally redundant wherever practical and designed to minimize or eliminate catastrophic failure modes. Over the next twenty-five years, NASA has set goals to increase safety ten thousand times while reducing cost one hundred fold. Safety will increase towards today's airline safety and the low price per flight has the potential to enable a 15-fold increase in the size of the current projected space launch market. This level of improvement is comparable to the developments in the 1970s in the computer microprocessor when microchips went from hundreds of thousands to tens of thousands of dollars - hailing the era of the personal computer. In order to achieve such ambitious cost goals, today's partial and fully expendable rockets must be replaced by fully reusable systems. A RLV can eliminate assembly and checkout of the large number of complex interfaces on today's Space Shuttle. Full reusability will eliminate the necessity to throw away expensive hardware and the need for on-going production. Systems in ten years will have to accommodate 50 to 100 missions per year and could be commercially certified for hundreds of flights. In twenty-five years, the number of flights per year could jump to over 1,000, which will require certification for thousands of flights. The large increase in flights per year will demand that current operations and maintenance procedures be revolutionized. Unlike the current shuttle, which requires several thousand personnel over five months to process, the next generation system must be turned around in one week with less than one hundred personnel. In contrast to the rigorous disassembly and inspections required for the Space Shuttle's subsystems, the next generation vehicle's on-board health monitoring systems will could tell the ground crews which systems need replacement before landing. In twenty-five years, vehicles will be re-flown within one with crews numbering less than one hundred. Fully automated ground processing systems must require only a handful of personnel to launch the vehicle. Due to the increased intelligence of on-board systems, only cursory walk-around inspections would be required between flights An assessment of the progress in breakthrough technologies toward these goals by the NASA Advanced Space Transportation Program is presented. These breakthrough technologies include combined rocket and air breathing propulsion, high strength lightweight structures, high temperature materials, vehicle health management, and flight operations.
Author
NASA Programs; NASA Space Programs; Space Transportation; Technology Utilization; Improvement

20000036571 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-36: Breakfast / Suit-Up / C-7 Ex / Launch and Landing at Edwards
Mar. 05, 1990; In English; Videotape: 58 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000043344; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

Live footage shows the crew members of STS-36, Commander John O. Creighton, Pilot John H. Casper, and Mission Specialists Richard M. Mullane, David C. Hilmers, and Pierre J. Thuot, having the traditional breakfast, suiting up, and walking out to the Astro-Van. Scenes include panoramic views of the shuttle on the pad, main engine start, ignition, liftoff, and booster separation. The landing of Atlantis at Edwards Air Force Base is also seen. Several playback views from different cameras of both the launch and landing are also presented.
CASI
Space Transportation System; Space Transportation System Flights; Atlantis (Orbiter)

20000037725 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-36: Isolated Camera Breakfast Suit-up Walkout
Feb. 28, 1990; In English; Videotape: 3 min. 45 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000043343; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

Live footage shows the crewmembers of STS-36, Commander John O. Creighton, Pilot John H. Casper, Mission Specialists Richard M. Mullane, David C. Hilmers, and Pierre J. Thuot, having a traditional breakfast. The crew is also shown suiting up, and walking out to the Astronaut-van from the Operations and Checkout Building.
CASI
Spacecrews; Crew Procedures (Preflight); Preflight Operations

20000037771 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-31: Hubble Space Telescope Post Launch Press Conference from Kennedy Space Center
Apr. 24, 1990; In English; Videotape: 17 min. 34 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000039778; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS
This video presents a post-launch press conference on the STS-31 Hubble Space Telescope. Dick Young, Kennedy Space Center Public Affairs, introduces the panel. The panel consists of Robert Sieck, Kennedy Space Center Launch Director, and George T. SASsen, Director Shuttle Engineer. The STS-31 launch was accomplished with very few problems. Terminal count was started and then stopped at 31 seconds because the software sensed that a valve was not positioned correctly. The valve was positioned correctly, the count was resumed, and the launch was carried out safely and successfully. George T. SASsen explains, in detail, how the problem was corrected.
CASI
Hubble Space Telescope; Space Transportation System; Spacecraft Launching

20000037772 Lockheed Space Operations Co., Cocoa Beach, FL USA
STS-30: Flight Summary
Mar. 27, 1989; In English; Videotape: 1 hr. 2 min. 24 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000036557; No Copyright; Avail: CASI; B04, Videotape-Beta; V04, Videotape-VHS
Live footage shows Flight Director Milt Heflin, and the Magellan Project Manager, John Gerpheide, participating in a panel discussion. They discuss the objectives of the Magellan Project, the way in which Magellan will gather images, the Venus Orbiting Imaging Radar, and STS-30. Gerpheide presents an animation of Venus and discussed its variation to that of the Earth. Both Heflin and Gerpheide took turns answering the questions from the audience as well as those from NASA Headquarters, and Kennedy Space Center.
CASI
Magellan Project (NASA); Magellan Spacecraft (NASA); Imaging Radar; Radar Imagery; Space Exploration; Venus Orbiting Imaging Radar (Spacecraft); Venus Probes

20000037773 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-30: TGS Isolated Video Playbacks
May 04, 1989; In English; Videotape: 15 min. 20 sec. playing time, in color, with partial sound
Report No.(s): NONP-NASA-VT-2000036556; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS
Live footage shows isolated playbacks of the launch of STS-36 from various tracking cameras.
CASI
Playbacks; Tracking (Position); Spacecraft Tracking; Cameras

20000038055 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-71/MIR/Spacelab: Lightning Strikes at Pad 39A
Jun. 24, 1995; In English; Videotape: 1 min 30 sec. playing time, in color, without sound
Report No.(s): NONP-NASA-VT-2000036558; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS
This video presentation shows the STS-71 after lightning struck Pad 39A.
CASI
Lightning; Space Transportation System; Mir Space Station

20000038083 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-35/ASTRO-1: Breakfast/Suit-up /Depart O & C / Ingress / Launch with Isolated Views
Dec. 02, 1990; In English; Videotape: 34 min. 50 sec. running time, in color, with sound
Report No.(s): NONP-NASA-VT-2000043336; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS
The primary objective of the STS-35 mission was the round-the-clock observations of the celestial sphere in ultraviolet and X ray astronomy with ASTRO-1. The mission was commanded by Vance D. Brand. The crew consisted of the pilot Guy S.

Gardner, mission Specialists Jeffery Hoffman, John Lounge, and Robert Parker, and payload specialists Samuel Durrance, and Ronald Parise. This videotape opens with a view of the shuttle on the pad at night in preparation for a night launch. The astronauts are introduced as they finish their pre-launch breakfast. The next shots are those of the astronauts getting into their spacesuits, and boarding the bus to be taken to the pad. The astronauts are next shown climbing into the shuttle. The launch of the shuttle is shown from 19 different camera angles.
CASI
Launching; Spacecrews; Columbia (Orbiter)

17
SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

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

20000033995 NASA Glenn Research Center, Cleveland, OH USA
Satellite Communications Using Commercial Protocols
Ivancic, William D., NASA Glenn Research Center, USA; Griner, James H., NASA Glenn Research Center, USA; Dimond, Robert, Bolt, Beranek, and Newman, Inc., USA; Frantz, Brian D., Bolt, Beranek, and Newman, Inc., USA; Kachmar, Brian, Analex Corp., USA; Shell, Dan, Cisco Systems, USA; February 2000; 14p; In English; 18th; International Communication Satellite Systems, 10-14 Apr. 2000, Oakland, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 632-6E-51
Report No.(s): NASA/TM-2000-209796; E-12086; NAS 1.15:209796; AIAA Paper 2000-1185; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA Glenn Research Center has been working with industry, academia, and other government agencies in assessing commercial communications protocols for satellite and space-based applications. In addition, NASA Glenn has been developing and advocating new satellite-friendly modifications to existing communications protocol standards. This paper summarizes recent research into the applicability of various commercial standard protocols for use over satellite and space- based communications networks as well as expectations for future protocol development. It serves as a reference point from which the detailed work can be readily accessed. Areas that will be addressed include asynchronous-transfer-mode quality of service; completed and ongoing work of the Internet Engineering Task Force; data-link-layer protocol development for unidirectional link routing; and protocols for aeronautical applications, including mobile Internet protocol routing for wireless/mobile hosts and the aeronautical telecommunications network protocol.
Author
Satellite Communication; Protocol (Computers); Communication Networks; Asynchronous Transfer Mode; Product Development

18
SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls. 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.

20000034094 NASA Marshall Space Flight Center, Huntsville, AL USA
Microgravity Vibration Isolation for the International Space Station
Whorton, Mark S., NASA Marshall Space Flight Center, USA; [2000]; 6p; In English; Space Technology and Application International Forum (STAIF 2000), 30 Jan. - 3 Feb. 2000, Albuquerque, NM, USA
Contract(s)/Grant(s): RTOP 398-96-02; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The International Space Station (ISS) is being envisioned as a laboratory for experiments in numerous microgravity (micrograms) science disciplines. Predictions of the ISS acceleration environment indicate that the ambient acceleration levels ill exceed levels that can be tolerated by the science experiments. Hence, microgravity vibration isolation systems are being developed to attenuate the accelerations to acceptable levels. While passive isolation systems are beneficial in certain applications, active isolation systems are required to provide attenuation at low frequencies and to mitigate directly induced payload disturbances. to date, three active isolation systems have been successfully tested in the orbital environment. A fourth system called g-LIMIT is currently being developed for the Microgravity Science

Glovebox and is manifested for launch on the UF-1 mission. This paper presents an overview of microgravity vibration isolation technology and the g-LIMIT system in particular.
Author
Aerospace Environments; International Space Station; Microgravity; Vibration Isolators; Acceleration (Physics)

20000034257 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Real Time Digital Simulation of an Autonomous and Magnetic Attitude Control System of a Satellite ***Simulacao Digital em Tempo Real de um Sistema de Controle de Atitude Magnetico Autonomo de um Satelite***
Prudencio, Silvano Vargas, Instituto Nacional de Pesquisas Espacias, Brazil; 2000; 194p; In Portuguese
Report No.(s): INPE-7514-TDI/727; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche
This work discuss and does the project and the real time simulation of the Attitude Control Systems-ACS of satellites with geomagnetic attitude control. It has the first Brazilian Scientific Applications Satellite - SACI-1 as application, that will have an autonomous attitude control and will be spin-stabilized with active spin rate and precession control through magnetic torque coil interactions with the geomagnetic field. The work: 1) makes use of system integrated development tools such MATRIXx; 2) shows and builds the mathematical model development with the system dynamics and the controller project and analysis; and 3) shows and implements the system closed loop real time simulation process through language C software codification.
Author
Real Time Operation; Computerized Simulation; Automatic Control; Attitude Control; Geomagnetism

20000034926 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
The Use of Genetic Algorithms on a Fuzzy Controller for a Satellite Attitude Control During the Pointing Phase ***Uso de Algoritmos Geneticos na Construcao de Controlador Nebuloso Para o Controle de Atitude de um Satelite Artificial Durante a Fase de Apontamento***
Correa, Claudio, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 130p; In Portuguese
Report No.(s): INPE-7472-TDI/712; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
This work presents the application of genetic algorithms in the design of controllers for the attitude control of an artificial satellite, in the sun pointing phase. First, a PD controller is presented, whose gains were learned by a genetic algorithm. Then, two fuzzy controllers are presented, whose parameters were obtained using a genetic algorithm with the same fitness function employed for deriving of the PD controller. The fitness function used here is a global measure of the performance of each solution, in relation to an already existing simulator for this satellite model. This work also brings a comparative analysis of these controllers, in relation to a PD controller developed by the poles placement method.
Author
Genetic Algorithms; Satellite Attitude Control; Control Systems Design; Artificial Satellites

20000037700 Woollam (John A.) Co., Lincoln, NE USA
Spacecraft Thermal Control Management Using Electrochromics ***Final Report, 2 Feb. 1998-1 Feb. 2000***
Woollam, John A., Woollam (John A.) Co., USA; Trimble, Chris, Nebraska Univ., USA; Franke, Eve, Nebraska Univ., USA; Hale, Jeff, Woollam (John A.) Co., USA; DeVries, Mick, Woollam (John A.) Co., USA; Feb. 01, 2000; 67p; In English; Prepared in collaboration with Nebraska Univ., Lincoln, NE.
Contract(s)/Grant(s): DASG60-98-C-0054
Report No.(s): AD-A374650; BMDO-DI-MISC-80048/M; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy
Thin-film multilayer electrochromic coatings for thermal control of spacecraft were designed, built and tested. Design was for a 300 degrees K spacecraft. but coatings would also work well for warmer surface emittance control. Changes in emissivity of dE=0.2, and ratios of ”on” to ”off” emissivity were as high as 3.5. Further work is needed to improve reproducibility of results and long-term stability.
DTIC
Coatings; Temperature Control; Satellite Temperature; Spacecraft Control; Thermal Protection

20000037787 NASA Langley Research Center, Hampton, VA USA
Aerothermal Analysis and Design of the Gravity Recovery and Climate Experiment (GRACE) Spacecraft
Mazanek, Daniel D., NASA Langley Research Center, USA; Kumar, Renjith R., Analytical Mechanics Associates, Inc., USA; Qu, Min, Analytical Mechanics Associates, Inc., USA; Seywald, Hans, Analytical Mechanics Associates, Inc., USA; April 2000; 48p; In English
Contract(s)/Grant(s): RTOP 259-30-10-51

Report No.(s): NASA/TM-2000-210095; L-17946; NAS 1.15:210095; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Gravity Recovery and Climate Experiment (GRACE) primary mission will be performed by making measurements of the inter-satellite range change between two co-planar, low altitude near-polar orbiting satellites. Understanding the uncertainties in the disturbance environment, particularly the aerodynamic drag and torques, is critical in several mission areas. These include an accurate estimate of the spacecraft orbital lifetime, evaluation of spacecraft attitude control requirements, and estimation of the orbital maintenance maneuver frequency necessitated by differences in the drag forces acting on both satellites. The FREEMOL simulation software has been developed and utilized to analyze and suggest design modifications to the GRACE spacecraft. Aerodynamic accommodation bounding analyses were performed and worst-case envelopes were obtained for the aerodynamic torques and the differential ballistic coefficients between the leading and trailing GRACE spacecraft. These analyses demonstrate how spacecraft aerodynamic design and analysis can benefit from a better understanding of spacecraft surface accommodation properties, and the implications for mission design constraints such as formation spacing control.

Author

Aerothermodynamics; Design Analysis; Gravitation; Climate; Spacecraft Design; Thermal Analysis; Attitude Control; Orbital Lifetime; Spacecraft Control

20000037794 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Statistical Analysis of Nonimpulsive Orbital Maneuvers Under Thrust Vector Errors ***Analise Estatistica de Manobras Orbitais com Propulsao Continua Sujeita a Erros no Vetor Empuxo***

deJesus, Antonio Delson Conceicao, Instituto Nacional de Pesquisas Espacias, Brazil; 2000; 348p; In Portuguese; Sponsored in part by Programa de Capacitaco Docente e Tecnica (PICDT)

Report No.(s): INPE-7504-TDI/719; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

In this work we analyze statistically nonimpulsive orbital maneuvers under thrust vector errors. This study was conducted in three phases: the first one being the implementation of one method of trajectory optimization, under a thrust without errors; the second one being a numerical study on orbital transfers, under thrust vector errors; and finally, the third one being an algebraic explanation for the numerical results found. In the simulations of the first phase, besides the implementation of the method, the test results of its references were confirmed and improved with respect to the satisfaction of the constraints in the keplerian elements of the final orbits. In the simulations of the second phase two transfers were studied: a) a coplanar low thrust maneuver (theoretical example); b) a noncoplanar high thrust maneuver (practical example): (the 1st one of the EUTELSAT II-F2 satellite). These transfers were done under magnitude and direction (”pitch” and ”yaw”) thrust errors applied to the satellite. These were modelled as stochastic processes of the systematic (random bias) or operational (white or pink noises) types, with zero mean uniform or gaussian probability density functions. A graphical study of the 1st moment (mean) of the deviation in each final keplerian element (semi-major axis, eccentricity, etc.) was done as a function of the standard deviation in each thrust vector error. We found simple nonlinear relations between several pairs. Besides this, a correlation study between the causes and the effects in the final instant showed that the effect in a keplerian element is relationed not only with the external causes (thrust errors), but with the cumulative effects in the other keplerian elements. We found a linear relation between the mean deviations in the final semimajor axis due to the uniform and gaussian errors. There was a break of this linearity in nd the cases of the practical example and/or operational error. A numerical study of the 2nd moment of the deviation in the final semi-major axis was also done, showing a linear relation with the standard deviation of each thrust error. A preliminary study of correction maneuvers showed that the extra fuel used presents almost linear increasing relations with the standard deviation of the magnitude and direction thrust errors. In the algebraic phase, with approximations but without loss of generality, we found relations between the mean deviations in the final semi-major axis and final eccentricity with the standard deviation in ”pitch” error. The cases were this error is not correlationed with the velocity and with the radius vector were studied to get the mean deviations in the final semi-major axis and in the final eccentricity, respectively. The correlationed case was studied to get the mean deviation in the final semi-major axis only. In all cases, correlationed or not correlationed, the algebraic results confirmed the nonlinear dependences found numerically between each cause and each effect.

Author

Statistical Analysis; Stochastic Processes; Orbital Maneuvers; Thrust Vector Control; Errors

20000037797 NASA Glenn Research Center, Cleveland, OH USA

SAMS Acceleration Measurements on Mir from May 1997 to June 1998 (NASA Increments 5, 6, and 7)

DeLombard, Richard, NASA Glenn Research Center, USA; August 1999; 31p; In English; CD-ROM contains full text in pdf format

Contract(s)/Grant(s): RTOP 101-46-0A

Report No.(s): NASA/TM-1999-209282; NAS 1.15:209282; E-11750; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; C01, CD-ROM

During NASA Increments 5, 6, and 7 (May 1997 to June 1998), about eight gigabytes of acceleration data were collected by the Space Acceleration Measurement System (SAMS) onboard the Russian Space Station Mir. The data were recorded on twenty-seven optical disks which were returned to Earth on Orbiter missions STS-86, STS-89, and STS-91. During these increments, SAMS data were collected in the Priroda module to support various microgravity experiments. This report points out some of the salient features of the microgravity acceleration environment to which the experiments were exposed. This report presents an overview of the SAMS acceleration measurements recorded by 10 Hz and 100 Hz sensor heads. The analyses included herein complement those presented in previous Mir increment summary reports prepared by the Principal Investigator Microgravity Services project.

Author

Mir Space Station; Acceleration Measurement; Gravitational Effects; Space Transportation System

20000038012 NASA Lewis Research Center, Cleveland, OH USA

Summary Report of Mission Acceleration Measurement for STS-87: Launched November 19, 1997

Rogers, Melissa J. B., National Center for Microgravity Research on Fluids and Combusiton, USA; Hrovat, Kenneth, Tal-Cut Co., USA; McPherson, Kevin, NASA Lewis Research Center, USA; DeLombard, Richard, NASA Lewis Research Center, USA; Reckart, Timothy, Tal-Cut Co., USA; January 1999; 81p; In English; CD-ROM contains the full text of the Summary Report for STS-87, -62 and 075, plus plots of accelerometer data collected during STS-87

Contract(s)/Grant(s): RTOP 963-60-0D

Report No.(s): NASA/TM-1999-208647; NAS 1.15:208647; E-11364; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche; C01, CD-ROM

Two accelerometer systems, the Orbital Acceleration Research Experiment and the Space Acceleration Measurement System, were used to measure and record the microgravity environment of the Orbiter Columbia during the STS-87 mission in November-December 1997. Data from two separate Space Acceleration Measurement System units were telemetered to the ground during the mission and data plots were displayed for investigators of the Fourth USA Microgravity Payload experiments in near real-time using the World Wide Web. Plots generated using Orbital Acceleration Research Experiment data (telemetered to the ground using a tape delay) were provided to the investigators using the World Wide Web approximately twelve hours after data recording. Disturbances in the microgravity environment as recorded by these instruments are grouped by source type: Orbiter systems, on-board activities, payload operations, and unknown sources. The environment related to the Ku-band antenna dither, Orbiter structural modes, attitude deadband collapses, water dump operations, crew sleep, and crew exercise was comparable to the effects of these sources on previous Orbiter missions. Disturbances related to operations of the Isothermal Dendritic Growth Experiment and Space Acceleration Measurement Systems that were not observed on previous missions are detailed. The effects of Orbiter cabin and airlock depressurization and extravehicular activities are also reported for the first time. A set of data plots representing the entire mission is included in the CD-ROM version of this report.

Author

Acceleration Measurement; Space Transportation System; Gravitational Effects; Accelerometers; Crystal Growth; Data Recording; Extravehicular Activity

20000038015 NASA Glenn Research Center, Cleveland, OH USA

Summary Report of Mission Acceleration Measurements for STS-95: Launched October 19, 1998

McPherson, Kevin, NASA Glenn Research Center, USA; Hrovat, Kevin, Tal-Cut Co., USA; February 2000; 37p; In English; CD ROM contains the entire report including appendices presented in PDF format. Mission summary reports for STS-79 and -89 are also included as bonus reports; This report is a supplement to NASA report NASA/TM-1999-209677

Contract(s)/Grant(s): RTOP 101-46-0A

Report No.(s): NASA/TM-2000-209677; E-12109; NAS 1.15:209677; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; C01, CD-ROM

John H. Glenn's historic return to space was a primary focus of the STS-95 mission. The Hubble Space Telescope (HST) orbital Systems Test (HOST), an STS-95 payload, was an in-flight demonstration of HST components to be installed during the next HST servicing mission. One of the components under evaluation was the cryocooler for the Near Infrared Camera and Multi-Object Spectrometer (NICMOS). Based on concerns about vibrations from the operation of the NICMOS cryocooler affecting the overall HST line-of-sight requirements, the Space Acceleration Measurement System for Free-Flyers (SAMS-FF) was employed to measure the vibratory environment of the STS-95 mission, including any effects introduced by the NICMOS cryocooler. The STS-95 mission represents the first STS mission supported by SAMS-FF. Utilizing a Control and Data

Acquisition Unit (CDU) and two triaxial sensor heads (TSH) mounted on the HOST support structure in Discovery's cargo bay, the SAMS-FF and the HOST project were able to make vibratory measurements both on-board the vibration-isolated NICMOS cryocooler and off-board the cryocooler mounting plate. by comparing the SAMS-FF measured vibrations on-board and off-board the NICMOS cryocooler, HST engineers could assess the cryocooler g-jitter effects on the HST line-of-sight requirements. The acceleration records from both SAMS-FF accelerometers were analyzed and significant features of the microgravity environment are detailed in this report.
Author
Acceleration Measurement; Hubble Space Telescope; Space Transportation System Flights; Vibration Measurement

20000038124 NASA Goddard Space Flight Center, Greenbelt, MD USA
PM Science Working Group Meeting on Spacecraft Maneuvers
Parkinson, Claire L., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 249-250; Repr. from The Earth Observer, v. 9, no. 3 p 3-6; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

The EOS PM Science Working Group met on May 6, 1997, to examine the issue of spacecraft maneuvers. The meeting was held at NASA Goddard Space Flight Center and was attended by the Team Leaders of all four instrument science teams with instruments on the PM-1 spacecraft, additional representatives from each of the four teams, the PM Project management, and random others. The meeting was chaired by the PM Project Scientist and open to all. The meeting was called in order to untangle some of the concerns raised over the past several months regarding whether or not the PM-1 spacecraft should undergo spacecraft maneuvers to allow the instruments to obtain deep-space views. Two of the Science Teams, those for the Moderate-Resolution Imaging Spectroradiometer (MODIS) and the Clouds and the Earth's Radiant Energy System (CERES), had strongly expressed the need for deep-space views in order to calibrate their instruments properly and conveniently. The other two teams, those for the Advanced Microwave Scanning Radiometer (AMSR-E) and the Atmospheric Infrared Sounder (AIRS), the Advanced Microwave Sounding Unit (AMSU), and the Humidity Sounder for Brazil (HSB), had expressed concerns that the maneuvers involve risks to the instruments and undesired gaps in the data sets.
Author
Spacecraft Maneuvers; Deep Space; Spacecraft Equipment; Onboard Equipment; Infrared Instruments

20000038207 Alabama Univ., Center for Space Plasmas and Aeronomic Research, Huntsville, AL USA
The Development of a Dynamic Geomagnetic Cutoff Rigidity Model for the International Space Station ***Final Report, 1 Jun. 1998 - 31 Jul. 1999***
Smart, D. F., Alabama Univ., USA; Shea, M. A., Alabama Univ., USA; [1999]; 16p; In English
Contract(s)/Grant(s): NAG9-1011
Report No.(s): UAH-5-2026; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have developed a computer model of geomagnetic vertical cutoffs applicable to the orbit of the International Space Station. This model accounts for the change in geomagnetic cutoff rigidity as a function of geomagnetic activity level. This model was delivered to NASA Johnson Space Center in July 1999 and tested on the Space Radiation Analysis Group DEC-Alpha computer system to ensure that it will properly interface with other software currently used at NASA JSC. The software was designed for ease of being upgraded as other improved models of geomagnetic cutoff as a function of magnetic activity are developed.
Derived from text
Computerized Simulation; Geomagnetism; International Space Station; Magnetic Variations; Dynamic Models

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SPACECRAFT INSTRUMENTATION

For related information see also 06 Aircraft Instrumentation and 35 Instrumentation and Photography. and Astrionics

20000033815 NASA Goddard Space Flight Center, Greenbelt, MD USA
Performance and Results from a Space Borne, Uncooled Microbolometer Array Spectral Radiometric Imager
Spinhirne, James M, NASA Goddard Space Flight Center, USA; Scott, V. Stan, NASA Goddard Space Flight Center, USA; Lancaster, Redgie S., Science Systems and Applications, Inc., USA; Manizade, Kathrine, Science Systems and Applications, Inc., USA; Palm, Steven P., Science Systems and Applications, Inc., USA; [2000]; 7p; In English; 2000 Aerospace Conference: Plenery and Paper Schedule, 2000, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Infrared Spectral Imaging Radiometer experiment was flown on a space shuttle mission as a shuttle hitchhiker experiment in August of 1997. The goals of the experiment were to test uncooled array detectors for infrared spectral imaging from space and to apply for the first time retrieval from space of brightness temperatures of cloud, land and sea along with direct laser measurements of cloud top height. The instrument operates in 3 narrow and one broad spectral band, all between 7 and 13 microns in either stare or time-delay and integration mode. The nominal spatial resolution was 1/4 kilometer. Using onboard calibrations along with periodic views of deep space, radiometric calibration of imagery was carried out and performance analyzed. The noise equivalent temperature difference and absolute accuracy reported here varied with operating mode, spectral band and scene temperature but were within requirements. This paper provides a description of the instrument, its operating modes, the method of brightness temperature retrieval, the method of spectral registration and results from the flight.
Author
Infrared Imagery; Infrared Radiometers; Spaceborne Photography; Imaging Techniques; Brightness Temperature

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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, 44 Energy Production and Conversion, and 15 Launch Vehicles and Space Vehicles.

20000033702 NASA Lewis Research Center, Cleveland, OH USA
Space Photovoltaic Research and Technology 1995
Landis, Geoffrey, Compiler, NASA Lewis Research Center, USA; October 1995; 340p; In English; 14th, 24-26 Oct. 1995, Cleveland, OH, USA; See also 20000033703 through 20000033741
Contract(s)/Grant(s): RTOP 506-41-11
Report No.(s): NASA-CP-10180; E-9943; NAS 1.55:10180; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

The Fourteenth Space Photovoltaic Research and Technology conference was held at the NASA Lewis Research Center from October 24-26, 1995. The abstracts presented in this volume report substantial progress in a variety of areas in space photovoltaics. Technical and review papers were presented in many areas, including high efficiency GaAs and InP solar cells, GaAs/Ge cells as commercial items, high efficiency multiple bandgap cells, solar cell and array technology, heteroepitaxial cells, thermophotovoltaic energy conversion, and space radiation effects. Space flight data on a variety of cells were also presented.
Author
Photovoltaic Conversion; Conferences; Solar Cells; Gallium Arsenides; Indium Phosphides; Photovoltaic Cells

20000033703 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Planetary and Deep Space Requirements for Photovoltaic Solar Arrays
Bankston, C. P., Jet Propulsion Lab., California Inst. of Tech., USA; Bennett, R. B., Jet Propulsion Lab., California Inst. of Tech., USA; Stella, P. M., Jet Propulsion Lab., California Inst. of Tech., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 2-9; In English; See also 20000033702; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

In the past 25 years, the majority of interplanetary spacecraft have been powered by nuclear sources. However, as the emphasis on smaller, low cost missions gains momentum, more deep space missions now being planned have baselined photovoltaic solar arrays due to the low power requirements (usually significantly less than 100 W) needed for engineering and science payloads. This will present challenges to the solar array builders, inasmuch as planetary requirements usually differ from earth orbital requirements. In addition, these requirements often differ greatly, depending on the specific mission; for example,

inner planets vs. outer planets, orbiters vs. flybys, spacecraft vs. landers, and so on. Also, the likelihood of electric propulsion missions will influence the requirements placed on solar array developers. This paper will discuss representative requirements for a range of planetary and deep space science missions now in the planning stages. We have divided the requirements into three categories: Inner planets and the sun; outer planets (greater than 3 AU); and Mars, cometary, and asteroid landers and probes. Requirements for Mercury and Ganymede landers will be covered in the Inner and Outer Planets sections with their respective orbiters. We will also discuss special requirements associated with solar electric propulsion (SEP). New technology developments will be needed to meet the demanding environments presented by these future applications as many of the technologies envisioned have not yet been demonstrated. In addition, new technologies that will be needed reside not only in the photovoltaic solar array, but also in other spacecraft systems that are key to operating the spacecraft reliably with the photovoltaics.
Author
Solar Arrays; Photovoltaic Conversion; Solar Electric Propulsion; Low Cost; Electric Propulsion

20000033704 Angewandte Solar Energie G.m.b.H., Heilbronn, Germany
Development of Advanced Si and GaAs Solar Cells for Interplanetary Missions
Strobl, G., Angewandte Solar Energie G.m.b.H., Germany; Uebele, P., Angewandte Solar Energie G.m.b.H., Germany; Kern, R., Angewandte Solar Energie G.m.b.H., Germany; Roy, K., Angewandte Solar Energie G.m.b.H., Germany; Flores, C., Centro Informazioni Studi Esperienze, Italy; Campesato, R., Centro Informazioni Studi Esperienze, Italy; Signorini, C., European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; Bogus, K., European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; Coz, P., CRSC, Italy; Space Photovoltaic Research and Technology 1995; October 1995, pp. 10-20; In English; See also 20000033702; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The deep space and planetary exploration project have been acquiring more and more importance and some of them are now well established both in ESA and NASA programs. This paper presents the possibility to utilize both silicon and gallium arsenide solar cells as spacecraft primary power source for missions far from the Sun, in order to overcome the drawbacks related to the utilisation of radioisotope thermoelectric generators - such as cost, safety and social acceptance. The development of solar cells for low illumination intensity and low temperature (LILT) applications is carried out in Europe by ASE (Germany) and CISE (Italy) in the frame of an ESA programme, aimed to provide the photovoltaic generators for ROSETTA: the cometary material investigation mission scheduled for launch in 2003. The LILT cells development and testing objectives are therefore focused on the following requirements: insolation intensity as low as 0.03 Solar Constant, low temperature down to -150 C and solar flare proton environment. At this stage of development, after the completion of the technology verification tests, R has been demonstrated that suitable technologies are available for the qualification of both silicon and gallium arsenide cells and both candidates have shown conversion efficiencies over 25 % at an illumination of 0.03 SC and a temperature of -150 C. In particular, when measured at those LILT conditions, the newly developed ”H I-ErA/NR-LILT” silicon solar cells have reached a conversion efficiency of 26.3 %, that is the highest value ever measured on a single junction solar cell. A large quantity of both ”HI-ETA/NR-LILT ” silicon and ”GaAs/Ge-LILT” solar cells are presently under fabrication and they will be submitted to a qualification test plan, including radiation exposure, in order to verify their applicability with respect to the mission requirements. The availability of two valid options will minimise the risk for the very ambitious scientific project. The paper describes how the technical achievements have been possible with Si and GaAs LILT solar cells (including a comparison between measured and modelled I-V characteristics) and it presents the technology verification tests results.
Author
Fabrication; Silicon; Gallium Arsenides; Solar Cells; Technology Assessment; Energy Conversion Efficiency; Performance Tests

20000033707 Sharp Corp., Nara, Japan
Japanese Photovoltaic Power Generation for Space Application
Saga, T., Sharp Corp., Japan; Kiyota, Y., Sharp Corp., Japan; Matsutani, T., Sharp Corp., Japan; Suzuki, A., Sharp Corp., Japan; Kawasaki, O., National Space Development Agency, Japan; Hisamatsu, T., National Space Development Agency, Japan; Matsuda, S., National Space Development Agency, Japan; Space Photovoltaic Research and Technology 1995; October 1995, pp. 31-39; In English; See also 20000033702; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper describes Japanese activities on mainly silicon solar cell research, development and applications. The high efficiency thin silicon solar cells and the same kinds of solar cells with integrated bypass function (IBF cells) were developed and qualified for space applications. The most efficient cells (NRS/LBSF cells) showed average 18% at AMO and 28 C conditions. After electron irradiation, NRS/BSF cells showed higher efficiency than NRS/LBSF cells. The IBF cells do not suffered high

reverse voltage and can survive from shadowing. The designs and characteristics of these solar cell are presented. In the last section, our future plan for the solar cell calibration is presented.
Author
Photovoltaic Conversion; Solar Generators; Technology Utilization; Silicon

20000033722 AstroPower, Inc., Newark, DE USA
Lightweight, Light-Trapped, Thin GaAs Solar Cell for Spacecraft Applications: Progress and Results Update
Hannon, M. H., AstroPower, Inc., USA; Dashiell, M. W., AstroPower, Inc., USA; DiNetta, L. C., AstroPower, Inc., USA; Barnett, A. M., AstroPower, Inc., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 150-157; In English; See also 20000033702
Contract(s)/Grant(s): F29601-93-C-0188; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Progress is reported with respect to the development of ultra-lightweight, high performance, thin, light trapped GaAs solar cells for advanced space power systems. Conversion efficiencies of 17.9% (AM0, 1X) have been demonstrated for a 3 microns thick, 1 sq cm solar cell. This results in a specific power of over 1020 W/kg (with a 3- mil cover glass) and a power density of 240 W/sq m. Device parameters were 1.015 volts open circuit voltage, 80% fill factor, and a short-circuit current density of 29.54 mA/sq cm. In addition to silicone bonding, the use of electrostatic bonding to attach the cover glass support to the front surface enables an ultra-thin, all back contact design that survives processing temperatures greater than 750 C. This also results in a 10% reduction of the cell weight for a potential specific power of 1270 W/kg. All back contact, ultra-thin, electrostatically bonded GaAs solar cell prototypes have been fabricated demonstrating an open circuit voltage of 1 volt for a cell base thickness of 1 microns with a 0.5 microns emitter. This technology will result in a revolutionary improvement in survivability, performance, and manufacturability of lightweight GaAs solar cell products for future Earth-orbiting science and space exploration missions. The thin, electrostatically bonded, all back contact GaAs device technology has multiple uses for specialty high performance solar cells and other optoelectronic devices.
Author
Mass; Thickness; Gallium Arsenides; Solar Cells; Fabrication; Short Circuit Currents; Prototypes; Electrostatic Bonding

20000033723 Wayne State Univ., Detroit, MI USA
Laboratory Instrumentation and Techniques for Characterizing Multi-Junction Solar Cells for Space Applications
Woodyard, James R., Wayne State Univ., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 158-167; In English; See also 20000033702; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

An integrated system is described which consists of a spectral radiometer and dual-source solar simulator, and personal computer based current-voltage and quantum efficiency equipment. The spectral radiometer is calibrated using a tungsten-halogen standard lamp with a calibration based on NIST scales. The quantum efficiency apparatus includes a photodiode calibrated using NIST scales and a monochromatic probe beam. The apparatus is used to measure the dependence of the absolute external quantum efficiency of solar cells at various forward-bias voltages including the ma)dmum-power point under AM0 light bias. Quantum efficiencies of multi-junction cells were measured with both spectral-light bias and AM0 light bias. Measured spectral irradiances of the dual-source simulator were convoluted with cell quantum efficiencies to calculate cell currents as function of voltage. The calculated currents agree with measured currents at the I% level.
Author
Procedures; Calibrating; Radiometers; Solar Simulators; Solar Cells

20000033735 NASA Lewis Research Center, Cleveland, OH USA
One Year of Flight Data from the PASP Plus Experiment
Curtis, Henry, NASA Lewis Research Center, USA; Marvin, Dean, Aerospace Corp., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 268-273; In English; See also 20000033702; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Results from the first year of operation of the PASP Plus flight experiment are given. The experiment consists of sixteen individual solar cell modules on twelve different panels. Both planar and concentrator technologies are represented as well as several different cell types. The orbit is 363 x 2552 km at an inclination of 70 degrees. There are two main purposes of PASP Plus: (1) to determine the interactions between the space plasma and solar arrays biased to plus or minus 500 volts, and (2) to determine the long term radiation performance of a wide variety of solar cell types.
Author
Data Acquisition; Solar Arrays; Solar Cells; Space Plasmas; Nuclear Interactions

20000033736 Systems Science and Software, San Diego, CA USA

Parasitic Current Collection by PASP Plus Solar Arrays

Davis, V. A., Systems Science and Software, USA; Gardner, B. M., Systems Science and Software, USA; Guidice, D. A., Phillips Lab., USA; Severance, P. S., Phillips Lab., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 274-285; In English; See also 20000033702; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Solar cells at potentials positive with respect to a surrounding plasma collect electrons. Current is collected by the exposed high voltage surfaces: the interconnects and the sides of the solar cells. This current is a drain on the array power that can be significant for high-power arrays. In addition, this current influences the current balance that determines the floating potential of the spacecraft. One of the objectives of the Air Force (PL/GPS) PASP Plus (Photovoltaic Array Space Power Plus Diagnostics) experiment is an improved understanding of parasitic current collection. We have done computer modeling of parasitic current collection and have examined current collection flight data from the first year of operations.

Author

Solar Cells; Solar Arrays; Photovoltaic Cells; Computerized Simulation; Electric Current; Accumulators

20000033737 Phillips Lab., Geophysics Directorate, Hanscom AFB, MA USA

High Voltage Space-Plasma Interactions Measured on the PASP Plus Test Arrays

Guidice, D. A., Phillips Lab., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 286-295; In English; See also 20000033702; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Space systems of the late 1990s and beyond will require more efficient space-power sources. In providing electrical power for these new systems, consideration must be given to operating photovoltaic subsystems at higher voltage levels to minimize I(exp 2) R losses and/or reduce cable weight. New solar-cell materials are being developed for higher efficiency and less susceptibility to space radiation. Before using these new technologies on operational spacecraft, various environmental interactions questions must be answered by investigations in the actual space environment. The Photovoltaic Array pace Power Plus Diagnostics (PASP Plus) experiment was developed and flown for this purpose. In early 1990, the Air Force's Space Test Program (STP) offered PASP Plus a flight on a satellite put into orbit by a Pegasus launch vehicle. PASP Plus was to be part of the APEX (Advanced Photovoltaic and Electronics Experiments) mission, set up to fly it and two small "radiation effects on electronics" experiments, CRUX/CREDO and FERRO. to make PASP Plus suitable for APEX, a controller with increased functional capability and reduced weight was developed by AMPTEk, Inc. with the help of NASA Lewis personnel, twelve test arrays were mounted to the payload shelf and one of the deployed panels of the APEX satellite. Diagnostics sensors were incorporated into the experiment. PASP Plus successfully completed all functional and environmental testing, including "one sun simulated" thermal-vacuum tests at the Boeing facility at Kent, WA to give us preflight "array performance vs. temperature" characteristics for later comparison with flight data. The experiment was delivered to Orbital Sciences Corp. (OSC) for integration into APEX in July 1992. The APEX satellite was launched by a standard Pegasus rocket released from a NASA B-52 aircraft (based at Edwards AFB) on 3 August 1994 within the Western Test Range off the coast of California. The release from the B-52, the three stages of rocket firing, the satellite's lock-on to the sun, and the extension of its four deployable panels all occurred without problems. A 70 deg-inclination, 363 km x 2550 km orbit was achieved, satisfying PASP Plus's data-collecting requirements. The objectives of the PASP Plus experiment were: (a) to measure the plasma "leakage" current for different kinds of arrays subjected to positive biasing levels up to +500 V. (b) to measure the arcing parameters for different kinds of arrays subjected to negative biasing levels up to -500 V. and (c) to measure the long-term deterioration in the power output of arrays using different solar-cell materials when exposed to space radiation. In all cases, the concept was to establish cause-and-effect relationships between array interactions and environmental conditions. This paper will discuss some of the positive and negative biasing results; another paper at this conference will discuss the space radiation-induced deterioration aspects of the experiment.

Author

Data Acquisition; Deterioration; Diagnosis; Electric Potential; Panels; Photovoltaic Cells; Plasma Interaction Experiment; Solar Arrays; Solar Cells

20000033738 NASA Lewis Research Center, Cleveland, OH USA

Preliminary Chaotic Model of Snapover on High Voltage Solar Cells

Mackey, Willie R., NASA Lewis Research Center, USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 296-303; In English; See also 20000033702; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

High voltage power systems in space will interact with the space plasma in a variety of ways. One of these, Snapover, is characterized by a sudden enlargement of the electron current collection area across normally insulating surfaces. A power drain on solar array power systems will results from this enhanced current collection. Optical observations of the snapover phenomena in the laboratory indicates a functional relation between bia potential and surface glow area. This paper shall explore the potential

benefits of modeling the relation between current and bia potential as an aspect of bifurcation analysis in chaos theory. Successful characterizations of snapover as a chaotic phenomena may provide a means of snapover prevention and control through chaotic synchronization.
Author
Chaos; Solar Cells; Models; High Voltages; Space Plasmas; Mathematical Models; Electron Energy

20000033739 Able Engineering Co., Inc., Goleta, CA USA
A Linear Refractive Photovoltaic Concentrator Solar Array Flight Experiment
Jones, P. Alan, Able Engineering Co., Inc., USA; Murphy, David M., Able Engineering Co., Inc., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 304-312; In English; See also 20000033702; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Concentrator arrays deliver a number of generic benefits for space including high array efficiency, low cell area cost savings, protection from radiation effects, and minimized plasma interactions. The line-focus concentrator concept delivers two added advantages: (1) low-cost mass production of the lens material and (2) relaxation of precise array tracking requirements to only a single axis. New array designs emphasize light weight, high stiffness, stow-ability and ease of manufacture and assembly. The linear refractive concentrator can be designed to provide an essentially flat response over a wide range of longitudinal pointing errors for satellites having only single-axis tracking capability. In this paper we address the current status of the SCARLET linear concentrator program with special emphasis on hardware development of an array-level linear refractive concentrator flight experiment.
Author
Refractivity; Linearity; Concentrators; Photovoltaic Cells; Solar Arrays; Flight Tests

20000033816 GenCorp Aerojet, Sacramento, CA USA
The 260: The Largest Solid Rocket Motor Ever Tested
Crimmins, P., GenCorp Aerojet, USA; Cousineau, M., GenCorp Aerojet, USA; Rogers, C., GenCorp Aerojet, USA; Shell, V., GenCorp Aerojet, USA; [1999]; 11p; In English; 35th; 35th Joint Propulsion Conference and Exhibit, 20-24 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS3-6284
Report No.(s): AIAA Paper 99-2951; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Aerojet in the mid 1960s, under contract to NASA, built and static hot fire tested the largest solid rocket motor (SRM) in history for the purpose of demonstrating the feasibility of utilizing large SRMs for space exploration. This program successfully fabricated two high strength steel chambers, loaded each with approximately 1,68 million pounds of propellant, and static test fired these giants with their nozzles up from an underground silo located adjacent to the Florida everglades. Maximum thrust and total impulse in excess of 5,000,000 lbf and 3,470,000,000 lbf-sec were achieved. Flames from the second firing, conducted at night, were seen over eighty miles away. For comparative purposes: the thrust developed was nearly 100 times that of a Minuteman III second stage and the 260 in.-dia cross-section was over 3 times that of the Space Shuttle SRM.
Author
Solid Propellant Rocket Engines; Space Shuttle Boosters; Static Tests; Static Firing

20000033836 Michigan Univ., Dept. of Aerospace Engineering, Ann Arbor, MI USA
Development of a Methodology for Conducting Hall Thruster EMI Tests in Metal Vacuum Chambers of Arbitrary Shape and Size *Final Report*
Gallimore, Alec D., Michigan Univ., USA; [2000]; 24p; In English
Contract(s)/Grant(s): NAG3-2091; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

While the closed-drift Hall thruster (CDT) offers significant improvement in performance over conventional chemical rockets and other advanced propulsion systems such as the arcjet, its potential impact on spacecraft communication signals must be carefully assessed before widespread use of this device can take place. to this end, many of the potentially unique issues that are associated with these thrusters center on its plume plasma characteristics and the its interaction with electromagnetic waves. Although a great deal of experiments have been made in characterizing the electromagnetic interference (EMI) potential of these thrusters, the interpretation of the resulting data is difficult because most of these measurements have been made in vacuum chambers with metal walls which reflect radio waves emanating from the thruster. This project developed a means of assessing the impact of metal vacuum chambers of arbitrary size or shape on EMI experiments, thereby allowing for test results to be interpreted properly. Chamber calibration techniques were developed and initially tested at RIAME using their vacuum chamber. Calibration experiments were to have been made at Tank 5 of NASA GRC and the 6 m by 9 m vacuum chamber at the University

of Michigan to test the new procedure, however the subcontract to RIAME was cancelled by NASA memorandum on Feb. 26. 1999.
Author
Research and Development; Rocket Engines; Rocket Thrust; Plasmas (Physics); Plumes; Propulsion System Performance; Propulsion System Configurations

20000034015 NASA Glenn Research Center, Cleveland, OH USA
Spacecraft Impacts with Advanced Power and Electric Propulsion
Mason, Lee S., NASA Glenn Research Center, USA; Oleson, Steven R., NASA Glenn Research Center, USA; March 2000; 16p; In English; Aerospace, 18-25 Mar. 2000, Big Sky, MT, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA; Original contains color illustrations
Contract(s)/Grant(s): RTOP 632-6A-1K
Report No.(s): NASA/TM-2000-209912; E-12143; NAS 1.15:209912; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A study was performed to assess the benefits of advanced power and electric propulsion systems for various space missions. Advanced power technologies that were considered included multiband gap and thin-film solar arrays, lithium batteries, and flywheels. Electric propulsion options included Hall effect thrusters and Ion thrusters. Several mission case studies were selected as representative of future applications for advanced power and propulsion systems. These included a low altitude Earth science satellite, a LEO communications constellation, a GEO military surveillance satellite, and a Mercury planetary mission. The study process entailed identification of overall mission performance using state-of-the-art power and propulsion technology, enhancements made possible with either power or electric propulsion advances individually, and the collective benefits realized when advanced power and electric propulsion are combined. Impacts to the overall spacecraft included increased payload, longer operational life, expanded operations and launch vehicle class step-downs.
Author
Research; Propulsion System Performance; Service Life; Lithium Batteries; Ion Engines; Electric Propulsion

20000034030 NASA Glenn Research Center, Cleveland, OH USA
Technology Development for a Stirling Radioisotope Power System for Deep Space Missions
Thieme, Lanny G., NASA Glenn Research Center, USA; Qiu, Songgang, Stirling Technology Co., USA; White, Maurice A., Stirling Technology Co., USA; March 2000; 14p; In English; 34th; Intersociety Energy Conversion Engineering, 1-5 Aug. 1999, Vancouver, British Columbia, Canada; Sponsored by Society of Automotive Engineers, Inc., Unknown
Contract(s)/Grant(s): NAS3-98016; NAS3-27817; RTOP 632-1A-1K
Report No.(s): NASA/TM-2000-209767; E-12043; NAS 1.15:209767; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA Glenn Research Center and the Department of Energy (DOE) are developing a Stirling convertor for an advanced radioisotope power system to provide spacecraft on-board electric power for NASA deep space missions. NASA Glenn is addressing key technology issues through the use of two NASA Phase 2 SBIRs with Stirling Technology Company (STC) of Kennewick, WA. Under the first SBIR, STC demonstrated a 40 to 50 fold reduction in vibrations, compared to an unbalanced convertor, with a synchronous connection of two thermodynamically independent free-piston Stirling convertors. The second SBIR is for the development of an Adaptive Vibration Reduction System (AVRS) that will essentially eliminate vibrations over a mission lifetime, even in the unlikely event of a failed convertor. This paper discusses the status and results for these two SBIR projects and also presents results for characterizing the friction factor of high-porosity random fiber regenerators that are being used for this application.
Author
Technology Assessment; Radioisotope Batteries; Fabrication; Regenerators; Stirling Cycle

20000034903 NASA Marshall Space Flight Center, Huntsville, AL USA
NASA's Activity Cooled Composite Nozzle Materials Systems Development for Linear Aerospike Engine
Clinton, R. C., Jr., NASA Marshall Space Flight Center, USA; 20000302; 1p; In English; Space and Missile Materials Symposium, 27 Feb. - 2 Mar. 2000, San Diego, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A NASA-led team is developing high risk, high payoff cooled composite material systems for application on reusable launch vehicles (RLVs). The focus of the effort is the nozzle ramp for the linear aerospike engine targeted for the VentureStar launch vehicle. These composite nozzle material system structures are actively cooled with cooling channels within the panel. The hot face of the panel will be exposed to combustion gases and the coolant will be hydrogen at cryogenic temperature. Nozzle elements

being addressed include the panel's heat exchanger (HEX) structure with backing structure, the HEX cold wall support structure, and inlet and exit coolant manifolds. The development project was initiated through a competitive procurement process for the design, analysis, fabrication, testing, and technology maturity necessary to demonstrate material system concept feasibility for full scale development. The total project consists of the following eight tasks: 1) enabling technology demonstration (ETD), 2) preliminary design, 3) high pressure hydrogen containment and low cycle fatigue testing, 4) thermal performance (radiative) testing, 5) aeroconvective testing, 6) manufacturing technology demonstration, 7) material property database generation, and 8) design, fabrication, and hot fire testing of a large scale test article. Multiple concepts have been selected to complete the first two tasks. At the conclusion of these tasks (approximately 12 months), design reviews will be held for each concept. At that point, a final downselection will be made and the selected concept will proceed through the remaining tasks. This presentation will provide an overview of the project, operational requirements and the selected concepts (within the limits of the competition sensitive nature of the ongoing ETD tasks).
Author
Product Development; Cold Surfaces; Composite Materials; Coolants; Design Analysis; Fabrication; Fatigue Tests; Feasibility; Heat Exchangers; Performance Tests

20000036457 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Uji Statik dan Termodinamika, Jakarta, Indonesia
Management of Solid-State Rocket Motor Propulsion Static Testing Operations ***Manajemen Operasi Pengujian Statik Propulsi Motor Roket Propelan Padat***
Endang, Mugia G. S., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Handoko, S. R., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; September 1999; Volume 1, No. 3, pp. 33-44; In Malay-Indonesian; See also 20000036452; Copyright; Avail: Issuing Activity

The static test of rocket motor is a part of research cycles when it did on rocket motor propulsion system. to make a static test standard system, efficient, and accurate for measurement, it needs a suitable instrument, right management, work procedure effectively, and efficient. In this paper will describe the three matters of them, to get accurate data in static test system. Its data involves F (thrust), Pc (Chamber pressure), tb (burning time), and Isp (Impulse Specifics). Impulse Specifics (Isp) gain from F (bar) dot t (sub b) divided with Mp (propellant mass).
Author
Rocket Engines; Solid State; Static Tests; Propulsion System Performance

20000036511 NASA Marshall Space Flight Center, Huntsville, AL USA
Ceramic Matrix Composite Turbine Disk for Rocket Engines
Effinger, Mike, NASA Marshall Space Flight Center, USA; Genge, Gary, NASA Marshall Space Flight Center, USA; Kiser, Doug, NASA Glenn Research Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

NASA has recently completed testing of a ceramic matrix composite (CMC), integrally bladed disk (blisk) for rocket engine turbopumps. The turbopump's main function is to bring propellants from the tank to the combustion chamber at optimal pressures, temperatures, and flow rates. Advantages realized by using CMC blisks are increases in safety by increasing temperature margins and decreasing costs by increasing turbopump performance. A multidisciplinary team, involving materials, design, structural analysis, nondestructive inspection government, academia, and industry experts, was formed to accomplish the 4.5 year effort. This article will review some of the background and accomplishments of the CMC Blisk Program relative to the benefits of this technology.
Author
Ceramic Matrix Composites; Turbine Engines; Rocket Engines; Turbine Pumps; Fuel Pumps

20000036569 NASA Marshall Space Flight Center, Huntsville, AL USA
Development of a Vehicle Health Monitoring System for the Space Shuttle Solid Rocket Booster Program
Crawford, Kevin, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Digital Avionics Systems, 10-12 Oct. 2000, Philadelphia, PA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

During their brief flight, the space shuttle solid rocket boosters (SRBs) experience a severe environment. This environment in most cases is unknown. When the design engineers believe they understand the environments, something new occurs. For example, at water impact several SRBs have sustained noticeable structural damage. The severity of the damage is usually dependent upon the waves that the SRB encounter at splashdown. The space shuttle is presently scheduled to fly until 2030. to support the shuttle flight schedule, the avionics on the SRB's will need to be upgraded. The environments on the different sections of the SRB will need to be defined more completely to properly qualify the avionics for multiple flights. The combination of new avionics systems and unknown flight environments led Marshall Space Flight Center's (MSFC) SRB Project Office to request

the Science and Engineering (S&E) Directorate to develop a stand-alone data acquisition system that could collect data from any area of the booster. The Enhanced Data Acquisition System (EDAS) was developed to meet this request. However, the EDAS has some technical drawbacks that needed resolved. to answer the EDAS problems, the SRB Project Office has funded MSFC's Avionics Department to begin investigating a new vehicle health monitoring (VHM) system. The major requirements are the system shall have 64 channels, have programmable sample rates up to 10,000 samples per second, have sufficient memory for a twenty minute flight and not interfere with existing operational flight avionics hardware. This paper will describe the effort to develop a VHM system that can meet the SRB requirements.
Author
Space Shuttle Boosters; Monitors; Spacecraft Performance; Performance Prediction; Evaluation; NASA Programs

20000038198 Colorado Univ., Dept. of Chemistry and Biochemistry, Boulder, CO USA
Heterogeneous Reactions on Aluminum Oxide Surfaces Modeling Rocket Exhaust Particles ***Final Report, 15 Jan. 1996 - 14 Jan. 1999***
George, Steven M.; Jan. 14, 1999; 9p; In English
Contract(s)/Grant(s): F49620-96-1-0029
Report No.(s): AD-A374304; AFRL-SR-BL-TR-00-0042; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
This research was performed by a graduate student, and post-doctoral research fellow. Our studies for the hydroxylation and dehydroxylation of a-Al2O3 (001) led to two publications. The adsorption of H2O on a-Al2O3 (001) was accepted and published in the Journal of Physical Chemistry. The desorption of H2O from a-Al2O3 (001) was accepted and published in Surface Science. The study of HCl adsorption and desorption from a-Al1O3 (001) led to one publication in Surface Science. In addition, the study of HCl and H2O adsorption on a Al2O3 (001) and the displacement of Al-OH surface species by HCl and displacement of Al-Cl surface species by H2O led to one additional manuscript that is still under review. Since the conclusion of this research grant, we have continued to examine the surface chemistry of amorphous Al2O3 surfaces. Oxide surface chemistry is still a largely unexplored area. Our surface reactivity studies have helped to define this new territory in surface science. These studies have also improved our understanding of heterogeneous reactions on aluminum oxide rocket exhaust particles in the atmosphere.
DTIC
Aluminum Oxides; Surface Reactions; Particles; Chemical Reactions; Rocket Exhaust

20000038202 Alabama Univ., Huntsville, AL USA
RBCC Mixing Studies: Ejector Ramjet Design Optimization ***Final Report, 1 Oct. 1996 - 31 May 1999***
[1999]; 39p; In English
Contract(s)/Grant(s): NCC8-123; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The research project reported herein extended over a period from October 1997 through August 1999. The research resulted in three technical papers presented at the AIAA/SAE/ASME/ASEE 35th Joint Propulsion Conference in Los Angeles in July 1999. These three papers are attached to this Executive Summary to constitute the final report. Objective: The objective of this research was to determine the mixing characteristics between the primary rocket jets and the turbine exhaust stream in a simulated Rocket Based Combined Cycle propulsion concept operating in the air augmented rocket mode.
Derived from text
Rocket-Based Combined-Cycle Engines; Design Analysis; Optimization; Mixing; Ejectors; Turbine Engines; Ramjet Engines

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CHEMISTRY AND MATERIALS (GENERAL)

20000034034 National Center for Microgravity Research on Fluids and Combusiton, Cleveland, OH USA
Development and Characterization of Laser-Induced Incandescence Towards Nanoparticle (Soot) Detection ***Final Report***
VanderWal, Randy L., National Center for Microgravity Research on Fluids and Combusiton, USA; February 2000; 18p; In English; Nanoparticles, 10 Oct. 1999, Tacoma, WA, USA; Sponsored by National Science Foundation, USA
Contract(s)/Grant(s): NAS3-544; NAS3-27186; RTOP 963-70-0P
Report No.(s): NASA/CR-2000-209309; E-11854; NAS 1.26:209309; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The production of particulates, notably soot, during combustion has both positive and negative ramifications. Exhaust from diesel engines under load (for example, shifting gears), flickering candle flames and fireplaces all produce soot leaving a flame. From an efficiency standpoint, emission of soot from engines, furnaces or even a simple flickering candle flame represents a loss

of useful energy. The emission of soot from diesel engines, furnaces, power generation facilities, incinerators and even simple flames poses a serious environmental problem and health risk. Yet some industries intentionally produce soot as carbon black for use in inks, copier toner, tires and as pigments. Similarly, the presence of soot within flames can act both positively and negatively. Energy transfer from a combustion process is greatly facilitated by the radiative heat transfer from soot yet radiative heat transfer also facilitates the spread of unwanted fires. to understand soot formation and develop control strategies for soot emission/formation, measurements of soot concentration in both practical devices such as engines and controlled laboratory flames are necessary. Laser-induced incandescence (LII) has been developed and characterized to address this need, as described here.
Author
Soot; Energy Transfer; Exhaust Emission; Flames; Flicker; Incandescence; Incinerators; Particulates; Radiative Heat Transfer

20000034169 National Inst. of Standards and Technology, Technology Services, Gaithersburg, MD USA
National Voluntary Laboratory Accreditation Program (NVLAP) Chemical Calibration: Certifiers of Spectrophotometric NTRMs
Kramer, G. W.; Travis, J. C.; Faison, C. D.; Rasberry, S. D.; Feb. 2000; 80p; In English
Report No.(s): PB2000-103675; NIST/HB-150-21; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
NIST Handbook 150-21 presents the additional technical requirements of NVLAP for accreditation of laboratories that design, prepare, characterize, certify, and distribute NIST-traceable reference materials (NTRMs) for spectrophotometric filters. This handbook is intended for information and use by staff of accredited laboratories, those laboratories seeking accreditation, other laboratory accreditation systems, laboratory assessors, users of laboratory services, and others needed information on the accreditation requirements.
NTIS
Laboratories; Laboratory Equipment; Calibrating; Certification

20000034264 Colorado Univ., Boulder, CO USA
Ceramic Coatings on Metals Using Atomic Layer Controlled Chemical Vapor Deposition (ASSERT-96) ***Final Report, 1 Jun 1996-31 May 1999***
George, Steven M.; Feb. 16, 2000; 9p; In English
Contract(s)/Grant(s): F49620-96-1-0249
Report No.(s): AD-A374265; AFRL-SR-BL-TR-00-0043; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The ASSERT research projects that have focused on thin film growth on various substrates examined the adsorption and desorption kinetics of tetrakis and dimethylamine on TiN surfaces. The competition between TDMAYT and DMA for surface sites during TiN growth with TDMAT is a model system to understand reaction product inhibition that affects the conformal deposition of TiN. Studied the adsorption and decomposition of 1,4-disilabutane (DSB) and porous silicon surfaces. DSB is a possible new precursor for SiO2, SiC and Si growth. Explored atomic layer controlled chemical vapor deposition methods to deposit oxide and nitride thin films. Most of this work concentrated on Si3N4 deposition and the catalytic deposition of SiO2 at room temperature using ellipsometry techniques to monitor the film growth. Evaluated the conformality and surface roughness of Si3N4 and SiO2 films deposited with atomic layer controlled growth methods using atomic force microscopy (AFM) techniques. Studies the surface chemistry occurring during the chemical vapor deposition (CVD) of ZrO2 using tetra-tert-butoxy-zirconium (ZTB) as the molecular precursor. Examined ZrO2 films deposited using ZTB as the molecular precursor using AFM and Auger electron spectroscopy depth profiling. Utilized SiO2, TiO2 and Al2O3 atomic layer growth techniques to reduce pore diameters in porous membranes. This controlled reduction in pore size is important for fabricating a molecular sieving membrane for gas sparation applications. Another achievement of the research is the education of students. Several students were funded with the support through the ASSERT program. A former graduate student who continued to work as a post-doctoral fellow in the research group, also contributed to this ASSERT effort.
DTIC
Ceramic Coatings; Fabrication; Metals; Oxide Films; Tin; Thin Films; Vapor Deposition; Surface Reactions; Titanium Nitrides

20000034920 National Inst. of Standards and Technology, Materials Science and Engineering Lab., Gaithersburg, MD USA
Thermal Spray Coatings Workshop: Sensors, Modeling and Control Strategies. Summary of a Workshop held at National Institute of Standards and Technology
Nov. 1998; 118p; In English; Thermal Spray Coatings Workshop: Sensors, Modeling and Control Strategies, Nov. 1998, Gaithersburg, MD, USA
Report No.(s): PB2000-103353; NISTIR-6460; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The NIST Metallurgy Division has initiated a research program to investigate coatings produced by thermal spray (TS) techniques. The focus of this research is the development of measurement tools that will aid in the understanding and/or control of the plasma spray process. This process uses plasma jets (generated by either DC or AC arcs) to melt or soften coating feed-stocks and then propel this material onto various substrates. The geometry and operating parameters of the plasma jet hardware, or 'gun', depend on the intended function of the resulting TS coated part. Currently TS coatings are produced by skilled technicians, however, it is now being adapted for automatic control using robotics. Intelligent Processing incorporating expert systems will probably be employed in most advanced systems. This move to robotics is not only to reduce costs, but to improve the reliability of spray coatings and thus enable the use of coatings in high volume applications such as automotive components and property critical devices such as the proposed high-efficiency gas turbines. Recently a number of advances have been made in new measurement systems, sensors, and modeling techniques that can lead to improved design and control of thermal spray processes.
NTIS
Plasma Jets; Plasmas (Physics); Thermal Analysis; Protective Coatings; Sprayed Coatings

20000036523 Virginia Univ., Dept. of Materials Science and Engineering, Charlottesville, VA USA
Electron Beam - Directed Vapor Deposition of Low Cost Thermal Barrier Coatings ***Final Report, 1 Apr. 1997-31 Dec. 1999***
Wadley, Haydn N.; Parrish, Phillip A.; Mar. 06, 2000; 4p; In English
Contract(s)/Grant(s): N00014-97-1-0106
Report No.(s): AD-A374859; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
The objective of this research is the development of improved performance, more affordable thermal barrier coatings via electron beam - directed vapor deposition (EB-DVD), a high efficiency vapor deposition technology developed and patented by the principle investigator and graduate student in University of Virginia's Intelligent Processing of Materials laboratory. During the research effort, experiments and modeling efforts were directed at development of coating structures with ultralow thermal conductivities. Yttria-stabilized zirconia layers with "zig-zag" morphologies and fine pore microstructures were produced with measured thermal conductivities of 0.8 W/mK. These coatings are of significant interest to industry engaged in production of naval aircraft and marine turbine engine applications, and specimens have been produced for their evaluation.
DTIC
Gas Turbine Engines; Thermal Control Coatings; Marine Propulsion

20000036525 Department of the Navy, Washington, DC USA
Production of Hollow Metal Microcylinders from Lipids
Zabetakis, Dan, Inventor; Nov. 30, 1999; 15p; In English
Patent Info.: Filed 30 Nov. 1999; US-Patent-Appl-SN-09,450,439
Report No.(s): AD-D019611; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche
This invention pertains to hollow metal microcylinders produced from diacetylenic lipids by self-assembly and to process for making same. Process for making metallic microcylinders from pre-treated diacetylenic lipid tubules which includes placing the tubules into an electroless plating bath containing a metal plating reagent, depositing by electroless plating on the surfaces of the tubules enough of a metal to make, the tubules electrically conducting, separating the tubules from the plating bath, treating the tubules to remove the lipid and form the metal microcylinders, washing and driving the microcylinders to produce the metal microcylinders having aspect radio of about 12, weight average length of about 20 microns, weight average outside diameter of about 1.5 microns, and weight average wall thickness of about a quarter of one micron
DTIC
Electroless Deposition; Plating; Lipids

20000037741 Naval Facilities Engineering Service Center, Port Hueneme, CA USA
Investigation into Acrylic Paint Cracking (APC) on Asphaltic Pavements ***Final Report, Jan. 1997-Dec. 1999***
Gaughen, C. D.; Jan. 2000; 27p; In English
Report No.(s): AD-A374902; TM-2328-SHR; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The objective of this effort was to investigate Acrylic Paint Cracking (APC) on asphaltic pavements and to identify an APC coating solution. The investigation consisted of the following: 1) Site visits to asphaltic airfields, roads, and parking lots, 2) Field testing of Asphaltic Concrete (AC) and AC wearing surfaces, 3) Field and laboratory testing of six acrylic paints, and 4) Analysis of paint stresses. Findings for acrylic marking paints are as follows: 1) High adhesion to asphaltic wearing surfaces, 2) High overcoat adhesion, 3) Poor flexibility, 4) High abrasion resistance, 5) High rates of thermal expansion, 6) Moderate paint cracking thickness, 7) High Residual Cure Stress, 8) High water absorption, 9) Moderate asphaltic bleed resistance, and 10) Coatings contribute to Acrylic Paint Cracking. Findings for elastomeric/acrylic blends are as follows: A) High adhesion to asphaltic

wearing surfaces, B) Excellent flexibility, C) Moderate abrasion resistance, D) Low rates of thermal expansion, E) Moderate paint cracking thickness, F) Low Residual Cure Stress, 0) Low water absorption, H) Excellent asphaltic bleed resistance, and I) Blends should decrease Acrylic Paint Cracking. Until new paints become commercially available, asphaltic pavements (asphaltic airfields) may be marked using TT-P-1952D formulated with a second generation acrylic resin.
DTIC
Acrylic Resins; Asphalt; Coatings; Paints

20000037755 NASA Glenn Research Center, Cleveland, OH USA
Preparation of Ion Exchange Films for Solid-Phase Spectrophotometry and Solid-Phase Fluorometry
Hill, Carol M., Goodyear Tire and Rubber Co., USA; Street, Kenneth W., NASA Glenn Research Center, USA; Tanner, Stephen P., University of West Florida, USA; Philipp, Warren H., NASA Glenn Research Center, USA; March 2000; 16p; In English
Contract(s)/Grant(s): RTOP 910-30-11
Report No.(s): NASA/TM-2000-209291; NAS 1.15:209291; E-11763; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Atomic spectroscopy has dominated the field of trace inorganic analysis because of its high sensitivity and selectivity. The advantages gained by the atomic spectroscopies come with the disadvantage of expensive and often complicated instrumentation. Solid-phase spectroscopy, in which the analyte is preconcentrated on a solid medium followed by conventional spectrophotometry or fluorometry, requires less expensive instrumentation and has considerable sensitivity and selectivity. The sensitivity gains come from preconcentration and the use of chromophore (or fluorophore) developers and the selectivity is achieved by use of ion exchange conditions that favor the analyte in combination with speciative chromophores. Little work has been done to optimize the ion exchange medium (IEM) associated with these techniques. In this report we present a method for making ion exchange polymer films, which considerably simplify the solid-phase spectroscopic techniques. The polymer consists of formaldehyde-crosslinked polyvinyl alcohol with polyacrylic acid entrapped therein. The films are a carboxylate weak cation exchanger in the calcium form. They are mechanically sturdy and optically transparent in the ultraviolet and visible portion of the spectrum, which makes them suitable for spectrophotometry and fluorometry.
Author
Fluorescence; Ion Exchanging; Solid Phases; Spectrophotometry; Polymeric Films

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COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials. For ceramic materials see 27 Nonmetallic Materials.

20000033829 NASA Glenn Research Center, Cleveland, OH USA
A Study of Influencing Factors on the Tensile Response of a Titanium Matrix Composite With Weak Interfacial Bonding
Goldberg, Robert K., NASA Glenn Research Center, USA; Arnold, Steven M., NASA Glenn Research Center, USA; March 2000; 32p; In English
Contract(s)/Grant(s): RTOP 242-23-52
Report No.(s): NASA/TM-2000-209798; E-12089; NAS 1.15:209798; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The generalized method of cells micromechanics model is utilized to analyze the tensile stress-strain response of a representative titanium matrix composite with weak interfacial bonding. The fiber/matrix interface is modeled through application of a displacement discontinuity between the fiber and matrix once a critical debonding stress has been exceeded. Unidirectional composites with loading parallel and perpendicular to the fibers are examined, as well as a cross-ply laminate. For each of the laminates studied, analytically obtained results are compared to experimental data. The application of residual stresses through a cool-down process was found to have a significant effect on the tensile response. For the unidirectional laminate with loading applied perpendicular to the fibers, fiber packing and fiber shape were shown to have a significant effect on the predicted tensile response. Furthermore, the interface was characterized through the use of semi-emperical parameters including an interfacial compliance and a ”debond stress;” defined as the stress level across the interface which activates fiber/matrix debonding. The results in this paper demonstrate that if architectural factors are correctly accounted for and the interface is

appropriately characterized, the macro-level composite behavior can be correctly predicted without modifying any of the fiber or matrix constituent properties.
Author
Metal Matrix Composites; Titanium; Micromechanics; Tensile Stress; Bonding; Interfacial Tension

20000033848 Sest, Inc., North Royalton, OH USA
Enhancement of the Probabilistic CEramic Matrix Composite ANalyzer (PCEMCAN) Computer Code ***Final Report***
Shah, Ashwin, Sest, Inc., USA; February 2000; 38p; In English
Contract(s)/Grant(s): NASA Order C-78019-J; RTOP 505-23-1B
Report No.(s): NASA/CR-2000-209786; E-12069; NAS 1.26:209786; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report represents a final technical report for Order No. C-78019-J entitled ”Enhancement of the Probabilistic Ceramic Matrix Composite Analyzer (PCEMCAN) Computer Code.” The scope of the enhancement relates to including the probabilistic evaluation of the D-Matrix terms in MAT2 and MAT9 material properties card (available in CEMCAN code) for the MSC/NASTRAN. Technical activities performed during the time period of June 1, 1999 through September 3, 1999 have been summarized, and the final version of the enhanced PCEMCAN code and revisions to the User’s Manual is delivered along with. Discussions related to the performed activities were made to the NASA Project Manager during the performance period. The enhanced capabilities have been demonstrated using sample problems.
Author
Ceramic Matrix Composites; Computer Programs; Applications Programs (Computers); Probability Distribution Functions; Mechanical Properties

20000033857 NASA Marshall Space Flight Center, Huntsville, AL USA
Sandwich Composite, Syntactic Foam Core Based, Application for Space Structures
Hodge, Andrew J., NASA Marshall Space Flight Center, USA; Kaul, Raj K., NASA Marshall Space Flight Center, USA; McMahon, William M., NASA Marshall Space Flight Center, USA; Reinarts, Thomas, United Space Alliance, USA; [2000]; 12p; In English; 45th; 45th SAMPE Symposium, 21-25 May 2000, Long Beach, CA, USA; Sponsored by Society for the Advancement of Materials and Process Engineering, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The current Solid Rocket Booster (SRB) launch vehicle has several metal based components that require a Thermal Protective System (TPS) be applied to the exterior surface to ensure its structural integrity and to protect the interior hardware from aerodynamic heating. TPS materials have distinct disadvantages associated with their use. One disadvantage to the application of TPS is that it can act as a debris source to the Space Shuttle Orbiter during flight and it also adds weight to the system without directly contributing any structural strength. One of the specific areas examined under this program was to replace a metal/TPS system with polymer based composites. A polymer matrix based sandwich composite was developed which had both structural and insulative properties to meet the high aerodynamic structural and heating load survival requirements. The SRB Nose Cap was selected as a candidate for this application. The sandwich system being qualified for this application is a carbon/epoxy outer and inner skin with a high strength-low thermal conductivity syntactic foam core.
Author
Sandwich Structures; Epoxy Matrix Composites; Polymer Matrix Composites; Foams; Thermal Protection; Heat Shielding; Aerodynamic Heating

20000034001 Georgia Inst. of Tech., School of Mechanical Engineering, Atlanta, GA USA
Fatigue Damage Mechanisms of Advanced Hybrid Titanium Composite Laminates
Rhymer, Donald W.; Nov. 1999; 133p; In English
Report No.(s): AD-A374144; AFIT-FY00-60; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The objective of this thesis is to compare the mechanical response of this advanced Hybrid Titanium Composite Laminates (HTCL) to the first generation material. Specifically, the effect of a stronger bondline at the titanium/ Polymer Matrix Composites (PMC) interface in constant amplitude fatigue will be investigated, particularly in the event that titanium ply cracking induces the delamination. Therefore, the focus of this research is to closely monitor and analyze the damage progression of this modified HTCL during fatigue testing to ultimately determine the specific damage evolution and mechanisms present. While tension-tension fatigue is conducted and compared to the previous HTCL testing, tension-compression fatigue is conducted on both laminates in this research as delamination effects are enhanced under compressive stresses.
DTIC
Laminates; Metal Matrix Composites; Damage; Degradation; Delaminating; Fatigue (Materials); Fatigue Tests; Titanium Compounds

20000034026 Massachusetts Inst. of Tech., Engineering Internship Program, Cambridge, MA USA
Mechanical Properties of Degraded PMR-15 Resin ***Final Report***
Tsuji, Luis C., Massachusetts Inst. of Tech., USA; February 2000; 82p; In English
Contract(s)/Grant(s): NAG3-2054; RTOP 523-31-13
Report No.(s): NASA/CR-1000-209920; NAS 1.26:209920; E-12157; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Thermo-oxidative aging produces a nonuniform degradation state in PMR-15 resin. A surface layer, usually attributed to oxidative degradation, forms. This surface layer has different properties from the inner material. A set of material tests was designed to separate the properties of the oxidized surface layer from the properties of interior material. Test specimens were aged at 316 C in either air or nitrogen, for durations of up to 800 hr. The thickness of the oxidized surface layer in air aged specimens, and the shrinkage and coefficient of thermal expansion (CTE) of nitrogen aged specimens were measured directly. The nitrogen-aged specimens were assumed to have the same properties as the interior material in the air-aged specimens. Four-point-bend tests were performed to determine modulus of both the oxidized surface layer and the interior material. Bimaterial strip specimens consisting of oxidized surface material and unoxidized interior material were constructed and used to determine surface layer shrinkage and CTE. Results confirm that the surface layer and core materials have substantially different properties.
Author
Degradation; Mechanical Properties; Polyimide Resins; Surface Layers

20000034028 Massachusetts Inst. of Tech., Lab. for Advanced Composites, Cambridge, MA USA
Long Term Degradation of Resin for High Temperature Composites
Patekar, Kaustubh A., Massachusetts Inst. of Tech., USA; February 2000; 116p; In English
Contract(s)/Grant(s): NAS3-2054; RTOP 714-04-40
Report No.(s): NASA/CR-2000-209918; NAS 1.26:209918; E-12155; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The durability of polymer matrix composites exposed to harsh environments is a major concern. Surface degradation and damage are observed in polyimide composites used in air at 125 to 300 C. It is believed that diffusion of oxygen into the material and oxidative chemical reactions in the matrix are responsible. Previous work has characterized and modeled diffusion behavior, and thermogravimetric analyses (TGAs) have been carried out in nitrogen, air, and oxygen to provide quantitative information on thermal and oxidative reactions. However, the model developed using these data was not able to capture behavior seen in isothermal tests, especially those of long duration. A test program that focuses on lower temperatures and makes use of isothermal tests was undertaken to achieve a better understanding of the degradation reactions under use conditions. A new low-cost technique was developed to collect chemical degradation data for isothermal tests lasting over 200 hr in the temperature range 125 to 300 C. Results indicate complex behavior not captured by the previous TGA tests, including the presence of weight-adding reactions. Weight gain reactions dominated in the 125 to 225 C temperature range, while weight loss reactions dominated beyond 225 C. The data obtained from isothermal tests was used to develop a new model of the material behavior. This model was able to fully capture the behavior seen in the tests up to 275 C. Correlation of the current model with both isothermal data at 300 C and high rate TGA test data is mediocre. At 300 C and above, the reaction mechanisms appear to change. Attempts (which failed) to measure non-oxidative degradation indicate that oxidative reactions dominate the degradation at low temperatures. Based on this work, long term isothermal testing in an oxidative atmosphere is recommended for studying the degradation behavior of this class of materials.
Author
Degradation; Polymer Matrix Composites; Resins; Thermogravimetry; Mechanical Properties; High Temperature

20000034033 NASA Glenn Research Center, Cleveland, OH USA

Parametric Study of Reactive Melt Infiltration

Nelson, Emily S., NASA Glenn Research Center, USA; Colella, Phillip, California Univ., Lawrence Berkeley Lab., USA; March 2000; 16p; In English; International Mechanical Engineering Congress and Exposition, 14-19 Nov. 1999, Nashville, TN, USA; Sponsored by American Society of Mechanical Engineers, USA

Contract(s)/Grant(s): RTOP 101-43-0C

Report No.(s): NASA/TM-2000-209802; E-12107; NAS 1.15:209802; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Reactive melt infiltration is viewed as a promising means of achieving near-net shape manufacturing with quick processing time and at low cost. Since the reactants and products are, in general, of varying density, overall conservation of mass dictates that there is a force related to chemical conversion which can directly influence infiltration behavior. In effect, the driving pressure forces may compete with the forces from chemical conversion, affecting the advancement of the front. We have developed a two-dimensional numerical code to examine these effects, using reaction-formed silicon carbide as a model system for this process. We have examined a range of initial porosities, pore radii, and reaction rates in order to investigate their effects on infiltration dynamics.

Author

Infiltration; Melting; Porosity; Reactivity; Manufacturing; Silicon Carbides

20000034081 Naval Surface Warfare Center, Carderock Div., Bethesda, MD USA

Micromechanics Based Failure Analysis of Composite Structural Laminates ***Final Report***

Mayes, J. S.; Sep. 1999; 227p; In English

Report No.(s): AD-A373962; NSWCCD-65-TR--1999/15; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

A micromechanics based multicontinuum theory and associated numerical algorithm was used to extract, virtually without a time penalty, the stress and strain fields for a composites' constituents during routine structural finite element analysis. Using this constituent information, a stress-based failure criterion was developed and used to construct a progressive failure algorithm for investigating the material failure strengths of composite structural laminates. The criterion is fully three-dimensional and requires a minimum number of experimentally derived constants. The failure prediction methodology attempts to maintain high computational efficiency, ease of input, and numerical accuracy. A finite element based analysis tool was developed and used to predict failure of a variety of laminates under uniaxial and biaxial loads. Two-dimensional failure surfaces for laminates under biaxial loads are generated and compared against those developed from using the Tsai-Wu failure criterion and from experimental data. The proposed failure criterion was shown to be superior to Tsai-Wu and in good agreement with experimentally determined failure loads.

DTIC

Failure Analysis; Finite Element Method; Laminates; Structural Analysis; Micromechanics; Composite Materials; Composite Structures; Continuum Mechanics

20000037775 Department of the Navy, Washington, DC USA

Oxidation Resistant Fiber-Reinforced Composites with Poly (Carborane-Siloxane/Silane-Acetylene)

Keller, Teddy M., Inventor; Son, David Y., Inventor; Aug. 03, 1999; 10p; In English; Supersedes US-Patent-Appl-SN-08775486, AD-D018378.

Patent Info.: Filed 31 Dec. 96,; US-Patent-Appl-SN-08,775,486; US-Patent-5,932,335

Report No.(s): AD-D019554; No Copyright; Avail: Defense Technical Information Center (DTIC)

An oxidation resistant fiber-reinforced composite is made by impregnating a fibrous material with a resin containing a linear polymer having a repeating unit with at least one carboranyl group, at least one silyl or siloxyl group and at least one acetylenic group. The linear polymer may then be cured to form a fiber-reinforced thermoset or may be pyrolyzed to form a fiber-reinforced ceramic. For additional protection of the fibrous material against oxidation, the fibrous material may be prewetted or coated, also with a linear polymer containing a linear polymer having a repeating unit with at least one carboranyl group, at least one silyl or siloxyl group and at least one acetylenic group, prior to being impregnated. The coating on the fibrous material may be cured to form a thermoset coating on the fibers or may be pyrolyzed to form a ceramic coating on the fibers.

DTIC

Ceramic Matrix Composites; Fiber Composites; Oxidation Resistance; Coating; Ceramic Coatings

20000033769 Corps of Engineers, Champaign, IL USA
Electrochemical Reduction of Dinitrotoluene ***Final Report***
Pehkonen, Simo, Corps of Engineers, USA; Jolas, Jennifer L., Corps of Engineers, USA; Meenakshisundaram, Devakumaran, Corps of Engineers, USA; Maloney, Stephen W., Corps of Engineers, USA; Nov. 1999; 36p; In English; Prepared in cooperation with University of Cincinnati, Cincinnati, OH.
Contract(s)/Grant(s): Proj-IB64A161102BT25
Report No.(s): AD-A372795; CERL-TR-99/89; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This study evaluated electrochemical reduction of a model nitro aromatic (dinitrotoluene, or DNT) that has shown the tendency to undergo reduction reactions. Objectives were to investigate the effect of stirring rate and the identity of the cathode material on the rate of DNT degradation, and to evaluate the fate of by-products, with specific attention to the mass balance and the potential formation of polymers of the reduced compounds and the parent compound. A bench-scale study was done of the degradation of 2,4-DNT in an electrochemical reactor. The rate of the degradation was measured under various experimental conditions. The by-products of degradation were identified by gas chromatography-mass spectrometry (GC-MS) and GC. A mass balance for the products was obtained under a variety of experimental conditions, both in the aqueous and solid phases. The stirring rate was found to affect the overall rate of degradation in some cases. A satisfactory mass balance for the products was achieved with 2,4-diaminotoluene (DAT) dominating in deoxygenated experiments and the dimers being important in the precipitating solid in the oxygenated experiments.
DTIC
Electrochemistry; Toluene; Ground Water; Water Pollution; Gas Chromatography; Nitro Compounds; Environment Protection

20000034245 National Inst. of Standards and Technology, Chemical Science and Technology Lab., Gaithersburg, MD USA
Standard Reference Materials (Trade Name): Primary Standards and Standard Reference Materials for Electrolytic Conductivity
Jameel, R. H.; Wu, Y. C.; Pratt, K. W.; Feb. 2000; 56p; In English
Report No.(s): PB2000-103854; NIST/SP-260-142; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report describes the principles and methods for measuring the electrolytic conductivity of primary standards and NIST Standard Reference Materials (SRMs). There are two methods for measuring conductivity: the direct current (DC) method, and the alternating current (AC) method. NIST has redetermined the conductivity of the primary standards, and determined a set of molality-based primary standards over a temperature range 0 deg C to 50 deg C. The conductivities of the primary standards were determined using two uniquely designed conductivity cells for measuring resistance with the AC and DC methods. The primary standards are used to determine the cell constants of conductivity cells. In the authors' laboratory, the authors used both Jones and Daggett cells for measuring conductivity. NIST issues a set of Standard Reference Materials (SRMs) available in nominal conductivity values of 5 microS/cm, 15 microS/cm, 100 microS/cm, 1000 microS/cm, 10000 microS/cm, and 2000 microS/cm, and 100000 microS/cm. The certified conductivity values for the SRMs include the solvent conductivity.
NTIS
Standards; Celestial Reference Systems; Inertial Reference Systems; Electrolytic Cells; Electrolytes; Electrical Resistivity

20000034269 California Univ., Dept. of Civil and Environmental Engineering, Berkeley, CA USA
Impact of Reformulated Fuels on Particle and Gas-Phase Emissions From Motor Vehicles ***Final Report***
Mar. 1999; 202p; In English
Contract(s)/Grant(s): CARB-95-330
Report No.(s): PB2000-103871; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

A major air pollution control strategy in California in the 1990s has been the reformulation of gasoline and diesel fuel to reduce vehicle emissions. A multi-year field study was conducted in northern California at the Caldecott tunnel to assess the impact of reformulated fuels on vehicle emissions, and to provide an updated characterization of gas and particle-phase emissions from on-road vehicles. The introduction of reformulated gasoline (RFG) in California led to large changes in gasoline composition. The combined effects of RFG and fleet turnover between summers 1994 and 1997 were large decreases in exhaust emissions of carbon monoxide (CO), non-methane organic compounds (NMOC), and nitrogen oxides (NOx). Per mass of fuel burned, heavy-duty diesel trucks emit about 5 times the NOx, 25 times more fine particle (PM2.5) mass and 15-20 times the number of fine particles compared to light-duty vehicles. Results of this study suggest that diesel vehicles in California are responsible for nearly half of NOx emissions and greater than three quarters of exhaust fine particle emissions from on-road motor

vehicles. Size-resolved measurements were made to determine the distribution of particulate PAH across the ultrafine and accumulation size modes.
NTIS
Indoor Air Pollution; Air Sampling; Pollution Control; Vapor Phases; Particulates; Biomass Burning; California

20000034851 LyTec, LLC, Tullahoma, TN USA
Laboratory Demonstrations for PDE and Metals Combustion at NASA MSFC's Advanced Propulsion Laboratory ***Final Report, 1-31 Dec. 1999***
Apr. 19, 2000; 15p; In English; Original contains color illustrations
Contract(s)/Grant(s): NASA Order H-30549-D
Report No.(s): LyTec-R-99-005; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Report provides status reporting on activities under order no. H-30549 for the period December 1 through December 31, 1999. Details the activities of the contract in the coordination of planned conduct of experiments at the MSFC Advanced Propulsion Laboratory in pulse detonation MHD power production and metals combustion.
Author
Propulsion; Metals; Combustion; Partial Differential Equations

20000036541 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Detailed Combustion Modeling as an Aid to Propellant Formulation: Two New Strategies ***Final Report, 1 Jul. 1998-1 Jul. 1999***
Miller, Martin S.; Anderson, William R.; Mar. 2000; 49p; In English
Contract(s)/Grant(s): Proj-611102AH43
Report No.(s): AD-A374698; ARL-TR-2167; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
There has been considerable progress recently in the development and use of elementary chemical reaction mechanisms to describe the gas phase energy release of energetic materials. Such advances present an opportunity to examine the extent to which these models might be used to provide guidance to the propellant formulator. In this report, we develop two methodologies that may prove helpful to the development of propellant formulations with tailored combustion characteristics. First, the dependence of the burning rate on the path of condensed phase decomposition was computed for nitroglycerine (NG) combustion. It was found that some sets of decomposition products lead to nearly an order of magnitude higher burning rate than is observed experimentally. This indicates that efforts to influence the path of decomposition might be a novel and powerful approach to tailoring burning rate. Second, a methodology for calculating the effectiveness of different chemical additives on the burning rate was developed and demonstrated for several chemical additives added to NG. Burning rates were calculated for the additives H2, CH2O, and NH3 and flame structure calculations made for HNCO as an additive. NH3 accelerates the burning rate of NO, and HNCO is expected to retard it; both reduce the dark zone length and thus may reduce ignition delays in guns.
DTIC
Burning Rate; Ignition; Chemical Reactions; Combustion Chemistry

20000037781 Queensland Univ., Dept. of Mechanical Engineering, Brisbane, Australia
HyShot-T4 Supersonic Combustion Experiments
Paull, A., Queensland Univ., Australia; Frost, M., Queensland Univ., Australia; Alesi, H., Queensland Univ., Australia; [2000]; 32p; In English
Contract(s)/Grant(s): NAG1-2113; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A series of experiments were initiated to investigate the operation of a two-dimensional, hypersonic, airbreathing engine (scramjet) inclined at angles of attack to the freestream. The experiments were undertaken to obtain data for use in the Hyshot flight test program. Experiments on the Hyshot scramjet were under taken in the T4 shock tunnel. Experiments were made at a nominal total enthalpy of 3.0MJkg (exp -1) using a nozzle that produced flows with a Mach number of approximately 6.5. The conditions produced correspond to flight at Mach 7.6 at an altitude range of 35.7-21.4km. A summary of the flow conditions is included. The scramjet was tested at 0, plus 2, plus 4, minus 2 and minus 4 degrees angle of attack. Experiments were also undertaken at 2 and 4 degrees angle of skew.
Derived from text
Air Breathing Engines; Hypersonic Speed; Shock Tunnels; Supersonic Combustion Ramjet Engines; Two Dimensional Models; Angle of Attack

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METALS AND METALLIC MATERIALS

20000033828 NASA Glenn Research Center, Cleveland, OH USA
Nonprotective Alumina Growth in Sulfur-Doped NiAl(Zr)
Smialek, James L., NASA Glenn Research Center, USA; March 2000; 22p; In English; Microscopy of Oxidation, 20-22 Sep. 1999, UK, UK; Sponsored by Institute of Materials, UK
Contract(s)/Grant(s): RTOP 714-04-20
Report No.(s): NASA/TM-2000-209800; E-12100; NAS 1.15:209800; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The 1200 C oxidation behavior of NiAl was examined at various levels of sulfur and zirconium dopants to test the possibility of a critical S/Zr ratio required for adhesion. Cyclic furnace testing for 200 1 -hr cycles and interrupted testing for 500 hr were used as screening tests. Pure NiAl and NiAl(Zr) with 0. 14 at.% Zr were chosen as model base compositions; they exhibited normal, slow-growing scales (3 Mg/sq cm) with excellent adhesion for the Zr-doped alloys. NiAl with about 120 ppma S exhibited a substantial weight loss (-20 Mg/sq cm) in cyclic tests and a very large weight gain (+60 Mg/sq cm) in interrupted tests. The major surface phase remained as alpha -Al2O3. Sulfur doping the NiAl(Zr) alloy caused massive weight gains of 80 - 100 Mg/sq cm, swelling, cracking, and nearly complete conversion into NiAl2O4, and alpha- Al2O3. The initial objective of determining critical S/Zr ratios for adhesion was therefore unattainable. Initiation of the catastrophic attack was examined after a 10 hr exposure, revealing a few sites of broad, raised, and cracked ridges. In cross-section, the ridges appeared as modular intrusions, with a complex, fractal, oxide-metal interface. They were primarily alumina (with occasional entrapped islands of NiAl2O4 or pure Ni metal). They possessed a unique microstructure consisting of 0.3 microns lamellae, separated by 0.1 microns open channels. This allowed for rapid growth controlled by gaseous diffusion. The microstructure is discussed in terms of SO2 evolution and a sulfur-driven de-passivation process.
Author
Nickel Aluminides; Oxidation; Sulfur Dioxides; Zirconium; Adhesion; Doped Crystals

20000033849 NASA Glenn Research Center, Cleveland, OH USA
Cyclic Oxidation Testing and Modelling: A NASA Lewis Perspective
Smialek, J. L., NASA Glenn Research Center, USA; Nesbitt, J. A., NASA Glenn Research Center, USA; Barrett, C. A., NASA Glenn Research Center, USA; Lowell, C. E., NASA Glenn Research Center, USA; February 2000; 24p; In English; Cyclic Oxidation, 25-26 Feb. 1999, Frankfurt, Germany; Sponsored by European Federation of Corrosion, Unknown
Contract(s)/Grant(s): RTOP 523-42-13
Report No.(s): NASA/TM-2000-209769; E-12048; NAS 1.15:12048; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Materials Division of the NASA Lewis Research Center has been heavily involved in the cyclic oxidation of high temperature materials for 30 years. Cyclic furnace and burner rig apparati have been developed, refined, and replicated to provide a large scale facility capable of evaluating many materials by a standard technique. Material behavior is characterized by weight change data obtained throughout the test, which has been modelled in a step-wise process of scale growth and spallation. This model and a coupled diffusion model have successfully described cyclic behavior for a number of systems and have provided insights regarding life prediction and variations in the spalling process. Performance ranking and mechanistic studies are discussed primarily for superalloys and coating alloys. Similar cyclic oxidation studies have been performed on steels, intermetallic compounds, thermal barrier coatings, ceramics, and ceramic composites. The most common oxidation test was performed in air at temperatures ranging from 800 deg. to 1600 C, for times up to 10000 h, and for cycle durations of 0.1 to 1000 h. Less controlled, but important, test parameters are the cooling temperature and humidity level. Heating and cooling rates are not likely to affect scale spallation. Broad experience has usually allowed for considerable focus and simplification of these test parameters, while still revealing the principal aspects of material behavior and performance. Extensive testing has been performed to statistically model the compositional effects of experimental alloys and to construct a comprehensive database of complex commercial alloys.
Author
Oxidation; Refractory Materials; Furnaces; Cycles; Mathematical Models; High Temperature Tests

20000034023 NASA Glenn Research Center, Cleveland, OH USA
Assessment of Low Cycle Fatigue Behavior of Powder Metallurgy Alloy U720
Gabb, Tomothy P., NASA Glenn Research Center, USA; Bonacuse, Peter J., Army Research Lab., USA; Ghosn, Louis J., NASA

Glenn Research Center, USA; Sweeney, Joseph W., Gilcrest Electric, USA; Chatterjee, Amit, Allison Engine Co., USA; Green, Kenneth A., Allison Engine Co., USA; March 2000; 26p; In English
Contract(s)/Grant(s): RTOP 523-24-13
Report No.(s): NASA/TM-2000-209418; E-12061; NAS 1.15:209418; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The fatigue lives of modem powder metallurgy disk alloys are influenced by variabilities in alloy microstructure and mechanical properties. These properties can vary as functions of variables the different steps of materials/component processing: powder atomization, consolidation, extrusion, forging, heat treating, and machining. It is important to understand the relationship between the statistical variations in life and these variables, as well as the change in life distribution due to changes in fatigue loading conditions. The objective of this study was to investigate these relationships in a nickel-base disk superalloy, U720, produced using powder metallurgy processing. Multiple strain-controlled fatigue tests were performed at 538 C (1000 F) at limited sets of test conditions. Analyses were performed to: (1) assess variations of microstructure, mechanical properties, and LCF failure initiation sites as functions of disk processing and loading conditions; and (2) compare mean and minimum fatigue life predictions using different approaches for modeling the data from assorted test conditions. Significant variations in life were observed as functions of the disk processing variables evaluated. However, the lives of all specimens could still be combined and modeled together. The failure initiation sites for tests performed at a strain ratio R(sub epsilon) = epsilon(sub min)/epsilon(sub max) of 0 were different from those in tests at a strain ratio of -1. An approach could still be applied to account for the differences in mean and maximum stresses and strains. This allowed the data in tests of various conditions to be combined for more robust statistical estimates of mean and minimum lives.
Author
Fatigue Life; Extruding; Heat Resistant Alloys; Mechanical Properties; Metal Fatigue; Nickel Alloys; Powder Metallurgy

20000034045 Naval Surface Warfare Center, Indian Head Div., Indian Head, MD USA
Mechanical Threshold Stress Constitutive Strength Model Description of HY-100 Steel ***Final Report***
Goto, D. M., Naval Surface Warfare Center, USA; Bingert, J., Naval Surface Warfare Center, USA; Garrett, R. K., Jr., Naval Surface Warfare Center, USA; Chen, Shuh-Rong, Naval Surface Warfare Center, USA; Gray, George T., III, Naval Surface Warfare Center, USA; Apr. 16, 1999; 46p; In English
Report No.(s): AD-A372816; NSWC-IH-TR-2168; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The mechanical threshold stress (MTS) approach is employed to characterize the constitutive stress-strain response of HY-100 steel. A generalized, three-term MTS strength model currently considers athermal, thermal, and strain-hardening contributions to flow stress. Aspects of the MTS framework pertinent to Navy HY steels are discussed, and a calibration methodology is presented for determining MTS strength model parameters. In addition, a linear strain-hardening modification to the existing structure evolution expression (flow stress saturation) is proposed to better describe the large-strain, strain-hardening behavior. Polycrystalline plasticity calculations suggest the linear-like hardening behavior is a consequence of deformation-path-dependent texture evolution. Calculation results are applied to MTS model stress-strain predictions and, in part, help explain the differences between compression and torsion test data.
DTIC
Stress-Strain Relationships; Mechanical Properties; High Strength Alloys; Stress Analysis; Polycrystals; Plastic Properties; Hulls (Structures); Steels

20000034114 International Centre for Theoretical Physics, Trieste, Italy
Low temperature thermal conductivity in metallic glasses
Bhuiyan, G. M.; Schmidt, R.; Nowak, H. J.; Haeussler, P.; Aug. 31, 1999; 17p; In English
Report No.(s): DE99-634854; IC-99/92; No Copyright; Avail: Department of Energy Information Bridge

Experimental data for low temperature thermal conductivity of Cu(sub x) Sn(sub 1-x) metallic glasses for different concentrations are analysed by using the well documented two level tunneling model. The model parameters are determined by using the least square fitting procedure. Results derived from the parameters allow us to predict different low temperature properties of metallic glasses. These properties are compared with those of the non-metallic glasses, and both common and uncommon features that exist between them are discussed.
NTIS
Thermal Conductivity; Metallic Glasses

20000038233 NASA Langley Research Center, Hampton, VA USA

A Practical Engineering Approach to Predicting Fatigue Crack Growth in Riveted Lap Joints

Harris, C. E., NASA Langley Research Center, USA; Piascik, R. S., NASA Langley Research Center, USA; Newman, J. C., Jr., NASA Langley Research Center, USA; May 2000; 26p; In English

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

Report No.(s): NASA/TM-2000-210106; NAS 1.15:210106; L-17956; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An extensive experimental database has been assembled from very detailed teardown examinations of fatigue cracks found in rivet holes of fuselage structural components. Based on this experimental database, a comprehensive analysis methodology was developed to predict the onset of widespread fatigue damage in lap joints of fuselage structure. Several computer codes were developed with specialized capabilities to conduct the various analyses that make up the comprehensive methodology. Over the past several years, the authors have interrogated various aspects of the analysis methods to determine the degree of computational rigor required to produce numerical predictions with acceptable engineering accuracy. This study led to the formulation of a practical engineering approach to predicting fatigue crack growth in riveted lap joints. This paper describes the practical engineering approach and compares predictions with the results from several experimental studies.

Author

Crack Propagation; Fatigue (Materials); Rivets; Predictions; Numerical Analysis; Lap Joints

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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.

20000033721 NASA Lewis Research Center, Cleveland, OH USA

Design of a Three-Layer Antireflection Coating for High Efficiency Indium Phosphide Solar Cells Using a Chemical Oxide as First Layer

Moulot, Jacques, Cleveland State Univ., USA; Faur, Mircea, Cleveland State Univ., USA; Faur, Maria, NASA Lewis Research Center, USA; Goradia, Chandra, Cleveland State Univ., USA; Goradia, Manju, Cleveland State Univ., USA; Bailey, Sheila, NASA Lewis Research Center, USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 142-149; In English; See also 20000033702; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

It is well known that the behavior of III-V compound based solar cells is largely controlled by their surface, since the majority of light generated carriers (63% for GaAs and 79% for InP) are created within 0.2 microns of the illuminated surface of the cell. Consequently, the always observed high surface recombination velocity (SRV) on these cells is a serious limiting factor for their high efficiency performance, especially for those with the p-n junction made by either thermal diffusion or ion implantation. A good surface passivation layer, ideally, a grown oxide as opposed to a deposited one, will cause a significant reduction in the SRV without adding interface problems, thus improving the performance of III-V compound based solar cells. Another significant benefit to the overall performance of the solar cells can be achieved by a substantial reduction of their large surface optical reflection by the use of a well designed antireflection (AR) coating. In this paper, we demonstrate the effectiveness of using a chemically grown, thermally and chemically stable oxide, not only for surface passivation but also as an integral part of a 3- layer AR coating for thermally diffused p(+)n InP solar cells. A phosphorus-rich interfacial oxide, In(PO3)3, is grown at the surface of the p(+) emitter using an etchant based on HNO3, o-H3PO4 and H2O2. This oxide has the unique properties of passivating the surface as well as serving as a fairly efficient antireflective layer yielding a measured record high AM0, 25 C, open-circuit voltage of 890.3 mV on a thermally diffused InP(Cd,S) solar cell. Unlike conventional single layer AR coatings such as ZnS, Sb2O3, SiO or double layer AR coatings such as ZnS/MgF2 deposited by e-beam or resistive evaporation, this oxide preserves the stoichiometry of the InP surface. We show that it is possible to design a three-layer AR coating for a thermally diffused InP solar cell using the In(PO3)3 grown oxide as the first layer and Al2O3, MgF2 or ZnS, MgF2 as the second and third layers respectively, so as to yield an overall theoretical reflectance of less than 2%. Since chemical oxides are readily grown on III-V semiconductor materials, the technique of using the grown oxide layer to both passivate the surface as well as serve as the first of a multilayer AR coating, should work well for essentially all III-V compound-based solar cells.

Author

Design Analysis; Antireflection Coatings; Indium Phosphides; Solar Cells; Phosphorus Oxides; Ion Implantation; Magnesium Fluorides; P-N Junctions; Thermal Diffusion

20000033854 NASA Glenn Research Center, Cleveland, OH USA

The Effect of Stress and TiC Coated Balls on Lifetime of a Perfluoropolyalkylether Using a Vacuum Rolling Contact Tribometer

Jones, William R., Jr., NASA Glenn Research Center, USA; Pepper, Stephen, NASA Glenn Research Center, USA; Jansen, Mark J., AYT Corp., USA; Nguyen, QuynhGiao, AYT Corp., USA; Wheeler, Donald R., NASA Glenn Research Center, USA; Schroeer, Achim, Centre Suisse d'Electronique et de Microtechnique S.A., Switzerland; March 2000; 10p; In English; Joint Tribology, 1-4 Oct. 2000, Seattle, WA, USA; Sponsored by Society of Tribologists and Lubrication Engineers, USA

Contract(s)/Grant(s): RTOP 251-30-2E

Report No.(s): NASA/TM-2000-209925; E-12164; NAS 1.15:209925; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A vacuum spiral orbit tribometer (SOT) was used to determine the relative lifetimes of a branched perfluoropolyalkylether (PFPAE) on 440 C stainless steel. The effect of varying the mean Hertzian stress (0.75, 1.0, 1.5 and 2.0 GPa) and the use of TiC coated balls on lubricant lifetime was studied. Other conditions included: approx. 100 rpm, approx. 50 micro-g of lubricant, an initial vacuum level of less than 1.3 x 10(exp -6) Pa (less than 10 x 10(exp -8) Torr), and room temperature (approx. 23 C). Increasing the mean Hertzian stress from 0.75 to 2.0 GPa results in an exponential decrease in lubricant lifetime for both material combinations. However, substituting a TiC ball for the 440 C ball quadrupled lifetime at low stress levels (0.75 and 1.0 GPa) and doubled life at higher stresses (1.5 and 2.0 GPa), The reduced reactivity of the TiC surface with the PFPAE lubricant is considered to be the reason for this enhancement. Decreasing lifetime with increasing stress levels correlated well with energy dissipation calculations.

Author

Stress Functions; Titanium Carbides; Coatings; Ball Bearings; Tribology; Vacuum

20000034002 Texas Technological Univ., Dept. of Civil Engineering, Lubbock, TX USA

Investigation of the Mechanics of Windborne Missile Impact on Window Glass

Bole, Scott A.; Dec. 1999; 146p; In English

Report No.(s): AD-A374152; AFIT-FY00-2; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Engineers have recognized that failure of the building envelope is one mechanism that can lead to severe damage of structures during windstorms. The building envelope consists of the roof, doorways, windows, and cladding components that form the exterior wall system of a building. Failure of the building envelope results in internal pressurization of the structure which may lead to structural failure. For this reason, engineers have begun to focus on ways to make the building envelope resistant to the effects of severe windstorms. Window glass is one type of cladding material. of the threats posed by a windstorm, the major threat to window glass consists of windborne debris. ASTM E1886, ASTM E1996, and SSTD 12-99 address the issue of resistance to windborne missile impacts. This thesis concludes that a simple statement of an object's kinetic energy upon impact by itself cannot serve to predict the outcome of the impact. Conservation of angular momentum occurs during a missile impact on window glass. Finally, energy is lost during a missile impact on window glass.

DTIC

Glass; Missiles; Guidance (Motion); Windows (Apertures)

20000034017 NASA Glenn Research Center, Cleveland, OH USA

Testing and Selection of Fire-Resistant Materials for Spacecraft Use

Friedman, Robert, NASA Glenn Research Center, USA; Jackson, Brian, NASA Glenn Research Center, USA; Olson, Sandra, NASA Glenn Research Center, USA; March 2000; 20p; In English; SAMPE 2000, 21-25 May 2000, Long Beach, CA, USA; Sponsored by Society for the Advancement of Materials and Process Engineering, USA

Contract(s)/Grant(s): RTOP 101-52-00

Report No.(s): NASA/TM-2000-209773; NAS 1.15:209773; E-12052; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Spacecraft fire-safety strategy emphasizes prevention, mostly through the selection of onboard items classified accord- ing to their fire resistance. The principal NASA acceptance tests described in this paper assess the flammability of materials and components under "worst-case" normal-gravity conditions of upward flame spread in controlled-oxygen atmospheres. Tests conducted on the ground, however, cannot duplicate the unique fire characteristics in the nonbuoyant low-gravity environment of orbiting spacecraft. Research shows that flammability an fire-spread rates in low gravity are sensitive to forced convection

(ventilation flows) and atmospheric-oxygen concentration. These research results are helping to define new material-screening test methods that will better evaluate material performance in spacecraft.
Author
Aerospace Safety; Aerospace Vehicles; Fires; Flammability; Spacecraft Construction Materials

20000034018 Clemson Univ., Gilbert C. Robinson Dept. of Ceramic and Materials Engineering, SC USA
Modeling and Characterization of Geometric Effects on the Performance of Rainbow and Thunder Actuators ***Final Report***
Schwartz, Robert W., Clemson Univ., USA; Ballato, J., Clemson Univ., USA; Northwang, W. D., Clemson Univ., USA; Laoratanakul, P., Clemson Univ., USA; Apr. 11, 2000; 29p; In English
Contract(s)/Grant(s): NCC1-283; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Dome formation in Rainbow and Thunder actuators occurs to relieve thermal expansion mismatch stress between the metallic and piezoelectric layers during cooling from device fabrication temperatures. Accompanying this process is the generation of an internal stress profile within the devices and the development of significant tensile stresses within the surface region of the piezoelectric. These tensile stresses affect the domain configuration (ratio of c-to-a domains), and improve the 90 deg. domain wall movement response of the device in this region of the piezoelectric. This results in improved electromechanical performance compared to standard direct extensional and flextensional devices, presumably because of the contributions of stress to the non-linearity of the piezoelectric d-coefficients. 1 Interestingly, this improvement in response seems counterintuitive; a stress perpendicular to the direction of the applied electric field should impede, not contribute to 90' domain switching. Further consideration of the lower region of the piezoelectric that is under compressive stress thus appears warranted. The specified objectives of the research were to: 1. Conduct finite element and equivalent circuit simulation-based investigations to understand the effects of actuator geometry on internal stress distribution and actuator performance (displacement and load-bearing capabilities). 2. Use the results of the modeling studies to predict the processing conditions (geometry and thickness ratio) required for the fabrication of Rainbow ceramics with optimized performance.
Derived from text
Actuators; Piezoelectricity; Mathematical Models; Computerized Simulation; Geometry; Performance Prediction

20000034905 NASA Marshall Space Flight Center, Huntsville, AL USA
\A Gravity-Related Transport in Reactive Off-Axis Sputtering Deposition
Zhu, Shen, Universities Space Research Association, USA; Su, C.-H., NASA Marshall Space Flight Center, USA; Lehozeky, S. L., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English
Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only

An experiment was designed to investigate the transport characterization of reactive off- axis sputtering deposition. Three transport regions were observed when the growth pressures vary from 5 mtorr to 150 mtorr. A new gravity-related phenomenon was revealed in film growth at relatively high growth pressures. This effect is related to the collision process or thermalization of transport species. This study also suggests a design for the substrate holder orientation in the off-axis sputtering system.
Author
Experiment Design; Research; Substrates; Deposition

20000034921 National Inst. of Standards and Technology, Materials Science and Engineering Lab., Gaithersburg, MD USA
Ceramics: 1999 Programs and Accomplishments
Jan. 2000; 172p; In English
Report No.(s): PB2000-103351; NISTIR-6433; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Contents include the following: Executive Summary; Ceramic Coatings; Ceramic Manufacturing Program; Ceramic Thin Film Measurements and Standards; Dental and Medical Materials; Magnetic Materials; Mechanical Properties of Brittle Materials; Phase Equilibria for Ceramics and Metals; Synchrotron Radiation Characterization; Other; Research Staff; Appendix.
NTIS
Ceramic Coatings; Mechanical Properties; Manufacturing; Sprayed Coatings

20000036596 Saint Louis Univ., Dept. of Aerospace and Mechanical Engineering, MO USA
Investigation of Potential Thermal Processing Techniques for the Enhancement of PS300 High Temperature Solid Lubricant Coatings ***Final Report***
Benoy, Patricia A., Saint Louis Univ., USA; [2000]; 27p; In English
Contract(s)/Grant(s): NAG3-2245; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Contemporary trends in rotating machinery development have produced a continuous evolution towards ever increasing speeds and higher operating temperatures. This process has been particularly evident in aerospace and automotive applications such as turbochargers. The combination of high temperature and high speed has exceeded the capacity of mainstream liquid lubrication technology. The NASA Glenn Research Center has been at the forefront in developing innovative solid lubricants for the oil free protection of rotating machinery under these extreme environmental conditions. The most recent of these is the PS 300 series of plasma sprayed solid lubricant coatings. St Louis University and NASA Glenn Research Center entered into this cooperative agreement to investigate potential thermal processing techniques for the enhancement of the PS 304 solid lubricant. Author

Research; Thermal Analysis; Augmentation; High Temperature Lubricants; Lubrication; Oils; Rotation; Solid Lubricants; Sprayed Coatings

28
PROPELLANTS AND FUELS

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

20000033847 NASA Glenn Research Center, Cleveland, OH USA

Recent Advances and Applications in Cryogenic Propellant Densification Technology

Tomsik, Thomas M., NASA Glenn Research Center, USA; March 2000; 14p; In English; 12th; Intersociety Cryogenic, 5-9 Mar. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Chemical Engineers, USA

Contract(s)/Grant(s): RTOP 242-33-0C

Report No.(s): NASA/TM-2000-209941; E-12189; NAS 1.15:209941; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This purpose of this paper is to review several historical cryogenic test programs that were conducted at the NASA Glenn Research Center (GRC), Cleveland, Ohio over the past fifty years. More recently these technology programs were intended to study new and improved denser forms of liquid hydrogen (LH2) and liquid oxygen (LO2) cryogenic rocket fuels. of particular interest are subcooled cryogenic propellants. This is due to the fact that they have a significantly higher density (eg. triple-point hydrogen, slush etc.), a lower vapor pressure and improved cooling capacity over the normal boiling point cryogen. This paper, which is intended to be a historical technology overview, will trace the past and recent development and testing of small and large-scale propellant densification production systems. Densifier units in the current GRC fuels program, were designed and are capable of processing subcooled LH2 and L02 propellant at the X33 Reusable Launch Vehicle (RLV) scale. One final objective of this technical briefing is to discuss some of the potential benefits and application which propellant densification technology may offer the industrial cryogenics production and end-user community. Density enhancements to cryogenic propellants (LH2, LO2, CH4) in rocket propulsion and aerospace application have provided the opportunity to either increase performance of existing launch vehicles or to reduce the overall size, mass and cost of a new vehicle system.

Author

Cryogenic Rocket Propellants; Densification; Technology Assessment; Liquid Hydrogen; Liquid Oxygen

20000036545 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

Dynamics and Thermodynamics of Simple Two-Phase Reacting Mixtures for Application to Explosive Initiation Modeling*, of Oct. 1997-Sep. 1999*

Starkenberg, John; Mar. 2000; 106p; In English

Contract(s)/Grant(s): Proj-1L162618AH43

Report No.(s): AD-A374710; ARL-TR-2161; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The front tracking hydrocode FronTier limits finite difference solution of the dynamic continuum mechanics equations to regions bounded by tracked fronts (shock waves, contact discontinuities, and gradient discontinuities) and uses local solutions of the Riemann problem to advance the positions of these fronts. This solution method places stringent requirements on the availability of thermodynamics information. With the addition of an appropriate reacting mixture model, the code can be applied to solid explosive initiation problems. The required thermodynamic functions are more difficult to obtain for reacting mixtures even though the equations of state for each of the phases present are known. We have developed a mixture model based on

assumptions of mechanical equilibrium and thermal isolation that can be used independent of the choice of equations of state for the phases, and we have derived expressions for the necessary thermodynamic functions.
DTIC
Continuum Mechanics; Two Phase Flow; Discontinuity

29
SPACE PROCESSING

20000036509 NASA Marshall Space Flight Center, Huntsville, AL USA
Microgravity Research Results and Experiences from the NASA Mir Space Station Program
Schagheck, R. A., NASA Marshall Space Flight Center, USA; Trach, B., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 51st; Astronautical Congress, 2-6 Oct. 2000, Rio de Janeiro, Brazil; No Copyright; Avail: Issuing Activity; Abstract Only

The Microgravity Research Program Office (MRPO) participated aggressively in Phase I of the International Space Station Program using the Russian Mir Space Station. The Mir Station offered an otherwise unavailable opportunity to explore the advantages and challenges to long duration microgravity space research. Payloads with both NASA and commercial backing were included as well as cooperative research with the Canadian Space Agency (CSA). From this experience, much was learned about dealing with long duration on orbit science utilization and developing new working relationships with our Russian partner to promote efficient planning, operations, and integration to solve complexities associated with a multiple partner program. Microgravity participation in the NASA Mir Program began with the first joint NASA Mir flight to the Mir Space Station. The earliest participation setup acceleration measurement capabilities that were used throughout the Program. Research, conducted by all Microgravity science disciplines, continued on each subsequent increment for the entire three-year duration of the Program. The Phase I Program included the Microgravity participation of over 30 Fluids, Combustion, Materials, and Biotechnology Sciences and numerous commercially sponsored research payloads. In addition to the research gained from Microgravity investigations, long duration operation of facility hardware was tested. Microgravity facilities operated on Mir included the Space Acceleration Measurement System (SAMS), the Microgravity Glovebox (MGBX), the Biotechnology System (BTS) and the Canadian Space Agency sponsored Microgravity Isolation Mount (MIM). The Russian OPTIZONE Furnace was also incorporated into our material science research. All of these efforts yielded significant and useful scientific research data. This paper focuses on the microgravity research conducted onboard the Mir space station. It includes the Program preparation and planning necessary to support this type of cross increment research experience; the payloads which were flown; and summaries of significant microgravity science findings. Most importantly this paper highlights the various disciplines of microgravity research conducted during the International Space Station, Phase 1 Program onboard the Mir Station. A capsulation of significant research and the applicability of our findings are provided. In addition, a brief discussion of how future microgravity science gathering capabilities, hardware development and payload operations techniques have enhanced our ability to conduct long duration microgravity research.
Author
Microgravity; Weightlessness; Research; NASA Space Programs; Canadian Space Program; Mir Space Station; International Space Station

20000038224 Alabama Univ., Huntsville, AL USA
Design and Analysis of Precise Pointing Systems ***Final Report, 1 Apr. 1999 - 31 Mar. 2000***
Kim, Young K., Alabama Univ., USA; Mar. 31, 2000; 79p; In English
Contract(s)/Grant(s): NAS8-97095; NASA Order H-30200-D
Report No.(s): UAH-5-20542; UAH-5-20543; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The mathematical models of Glovebox Integrated Microgravity Isolation Technology (g- LIMIT) dynamics/control system, which include six degrees of freedom (DOF) equations of motion, mathematical models of position sensors, accelerometers and actuators, and acceleration and position controller, were developed using MATLAB and TREETOPS simulations. Optimal control parameters of G-LIMIT control system were determined through sensitivity studies and its performance were evaluated with the TREETOPS model of G-LIMIT dynamics and control system. The functional operation and performance of the Tektronix DTM920 digital thermometer were studied and the inputs to the crew procedures and training of the DTM920 were documented.
Author
Mathematical Models; Design Analysis; Microgravity; Pointing Control Systems; Optimal Control; Dynamic Control

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ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

20000033821 Hong Kong Univ. of Science and Technology, Kowloon, Hong Kong
Proceedings of Symposium on Energy Engineering in the 21st Century (SEE 2000), Volume 1
Cheng, Ping, Editor, Hong Kong Univ. of Science and Technology, Hong Kong; Jan. 13, 2000; 424p; In English, 9-13 Jan. 2000, Hong Kong
Contract(s)/Grant(s): F62562-99-M-9146
Report No.(s): AD-A373944; AOARD-CSP-991002-Vol-1; ISBN 1-56700-132-7; No Copyright; Avail: CASI; A18, Hardcopy; A04, Microfiche

Topics of this symposium includes: Forced Convection, Natural Convection, and Boiling and Condensation, Two-Phase Flow, Porous Media, Heat Pipes and Thermosyphons, Conduction and Radiation, Microscale Heat Transfer, Heat Transfer Enhancement, Solar Energy & Nuclear Energy, Thermal Storage, Melting & Solidification, Drying & Food Processing, Heat Exchangers, Air-Conditioning and Refrigeration, Cryogenic Engineering, Energy and Environment, Combustion and Fire, Cycle Analysis, Engine Combustion, Waste Treatment by Thermal Methods, Fuel Cells, Clean Combustion Technology, and Coal Combustion.
DTIC
Conferences; Fuel Cells; Energy Storage

20000033835 GenCorp Aerojet, Azusa, CA USA
Integrated Advanced Microwave Sounding Unit-A (AMSU-A). Engineering Test Report: METSAT AMSU-A1 S/N 108, Weight and Center of Gravity Measurements
Bahng, R., GenCorp Aerojet, USA; Mar. 23, 2000; 17p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): AEROJET-11642; CDRL-207; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is the Engineering Test Report, METSAT AMSU-AL S/N 108 Weight and Center of Gravity Measurements, for the Integrated Advanced Microwave Sounding Unit-A (AMSU- A).
Author
Advanced Microwave Sounding Unit; Center of Gravity; Earth Observing System (EOS); Meteorological Satellites; Weight Measurement

20000033933 Fujitsu Computer Products of America, Inc., Longmont, CO USA
Using Track-Following Servo Technology on LTO Tape Devices
Glissman, Randy, Fujitsu Computer Products of America, Inc., USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 259-264; In English; See also 20000033909; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Fall COMDEX was the center of numerous showings of new tape technologies offering significant increases in tape capacity and performance. of interest to users of midrange tape technology was the showing of Linear Tape Open (LTO) tape drives. Just as the upstart Linux operating system is nurturing a small but growing base of users, LTO-compliant products promise to secure a significant portion of the backup marketplace. The strength of LTO is in its organization and its technology. This paper will highlight these strengths and compare them to other tape products.
Author
Computer Storage Devices; Data Transfer (Computers); Architecture (Computers); Magnetic Tapes

20000033935 TurboLinux, Inc., Brisbane, CA USA
A Portable Tape Driver Architecture
Anderson, Curtis, TurboLinux, Inc., USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 275-294; In English; See also 20000033909; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper describes a new architecture for device drivers for tape drives attached to UNIX-like systems. The design goals are presented, some current architectures are measured against the requirements, and a new architecture is described along with its advantages and disadvantages. This architecture was developed, and this paper was written, while the author was at Silicon

Graphics. The work continues at SGI for IRIX, SGI's variant of UNIX, and for Linux. The resulting Linux software will be licensed as Open Source.
Author
Architecture (Computers); Computer Systems Programs

20000036526 Department of the Navy, Washington, DC USA
Particle Sizing Technique
Swanson, Nancy L., Inventor; Billard, Barton D., Inventor; Jan. 10, 2000; 30p; In English
Patent Info.: Filed 10 Jan. 2000; US-Patent-Appl-SN-09,480,535
Report No.(s): AD-D019612; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

The present invention relates to a method and apparatus for determining a particle size within a given medium. The particle size within a given medium is determined using a single wavelength to confirm the known particles sizes within a dispersion, or determined from two wavelengths to calculate the unknown particle sizes of a dispersion. Three wavelengths may be used to determine the unknown particle size of a dispersion of unknown concentration within a medium. The method and apparatus may be used for mono-dispersions and poly-dispersions.
DTIC
Particle Size Distribution; Optical Properties; Test Equipment

20000037724 Tokyo Univ., Inst. of Space and Aeronautical Science, Japan
Cryocoolers for Space
Castles, Stephen, Tokyo Univ., Japan; [2000]; 21p; In English; Mid and Far Infrared Astronomy for Future Space Missions, 17-18 Apr. 2000, Japan; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents Cryocoolers for Space in viewgraph form. The topics include: 1) U.S. Cryocoolers for 4 to 6 Kelvin; 2) Turbo Brayton Cryocooler-Features; 3) HST/NICMOS (Hubble Space Telescope/Near Infrared Camera and Multiobject Spectrometer) 75 Kelvin Cryocooler; 4) Turbo-Brayton Cryocooler-NGST Design; and 5) Two-stage Sorption J-T Cryocooler.
CASI
Space Missions; Design Analysis; Cryogenic Cooling; Cryogenics

20000037841 Hall (B.) Industries, Inc., Toronto, Ontario Canada
Miniature Remote Eye/Ear Land Vehicle
Hall, B., Hall (B.) Industries, Inc., Canada; Grodski, J. J., Defence and Civil Inst. of Environmental Medicine, Canada; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B23-1 - B23-8; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

A miniature remote surveillance land vehicle was developed for experimental real-time video/audio data acquisition in air defence live-fire training. A mobile sensing platform was needed to acquire the video/audio data at a close proximity to the gunners, without breaching safety requirements. The platform was designed to be small, conforming to the need to transport it as a passenger luggage on a commercial airline. A commercially available ready-made largest 1/10 scale Radio Control (R/C) hobby vehicle with 4 wheel drive system was chosen as the platform. It incorporated pre-built drive, suspension and steering systems. The chassis was fitted with 4 kg payload for a total weight of 8 kg. It was very stable after adding damping shocks and extending the chassis. It was capable of climbing 15 cm sidewalk curbs, driving down off 20 cm ledges, climbing 10 to 20 deg. slopes and through about 10 cm of light to medium snow with its original rubber tires. Its total travel range was shown to be over 800 m. The control function for the vehicle and its sensing system was achieved using an R/C unit whereby a channel-select plus channel signal multiplexing system was developed to operate one selected channel of 7 possible at a time using only two radio channels. The sensing capability of the vehicle involved a digital video/audio recorder positioned at the front of the platform and a miniature camera and microphone assembly placed on the top of a telescoping mast with an ultralight pan-tilt unit based on a micro R/C servos. The video and audio signals from the mast-mounted package were transmitted to the control station using a repackaged commercial transmitter. Testing and use of the vehicle determined operational limits of its performance and led to its modifications and enhancements.
Author
Air Defense; Test Firing; Surveillance; Remote Control; Audio Equipment; Video Data; Miniaturization

32
COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications. 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.

20000033774 Physics and Electronics Lab. TNO, The Hague Netherlands
Visual Interpretation of SAR Images ***Final Report Visuele Interpretatie van SAR Beelden***
Smith, A. J., Physics and Electronics Lab. TNO, Netherlands; vandenBroek, A. C., Physics and Electronics Lab. TNO, Netherlands; Lourens, T., Physics and Electronics Lab. TNO, Netherlands; Toet, A., Physics and Electronics Lab. TNO, Netherlands; Nov. 1999; 74p; In Dutch
Report No.(s): AD-A372734; TNO-TM-99-A078; FEL-99-A211; TDCK-TD99-0272; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

SAR images are difficult to interpret for non-trained persons because these images are fundamentally different from optical images. The goal of the project was to find out how SAR images should be displayed in order to facilitate the interpretation of these images for terrain interpretation and target acquisition. This project was a combined effort by TNO-FEL and TNO-TM. In the project polarimetric PHARUS images and high resolution RAMSES images were used for two experiments where people were tested for their ability to find targets and to interpret the terrain. The PHARUS data were displayed in grey tones and false colours. The false colours were obtained by displaying two or more polarisation channels in the colour channels of the screen. In this way a single, two and three channel presentation was obtained. The experiments showed that the two-channel presentation is more effective than the single channel presentation for visual interpretation of the images. The three-channel presentation did not improve the scores of the experiments significantly. This result is important when a SAR is used on a UAV, since it is clearly easier to mount a two-channel than a three-channel SAR on a UAV.
DTIC
Synthetic Aperture Radar; Radar Data; Target Recognition; Target Acquisition; Visual Perception; Radar Imagery; Polarimetry; Images

20000033845 NASA Glenn Research Center, Cleveland, OH USA
A Theoretical Model for Thin Film Ferroelectric Coupled Microstripline Phase Shifters
Romanofsky, R. R., NASA Glenn Research Center, USA; Quereshi, A. H., Cleveland State Univ., USA; March 2000; 10p; In English; Magnetics, 9-13 Apr. 2000, Toronto, Canada; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): RTOP 632-6E-51
Report No.(s): NASA/TM-2000-209919; E-12156; NAS 1.15:209919; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Novel microwave phase shifters consisting of coupled microstriplines on thin ferroelectric films have been demonstrated recently. A theoretical model useful for predicting the propagation characteristics (insertion phase shift, dielectric loss, impedance, and bandwidth) is presented here. The model is based on a variational solution for line capacitance and coupled strip transmission line theory.
Author
Ferroelectricity; Mathematical Models; Phase Shift; Thin Films; Microstrip Transmission Lines

20000034016 NASA Glenn Research Center, Cleveland, OH USA
On-Board Fiber-Optic Network Architectures for Radar and Avionics Signal Distribution
Alam, Mohammad F., Dayton Univ., USA; Atiquzzaman, Mohammed, Dayton Univ., USA; Duncan, Bradley B., Dayton Univ., USA; Nguyen, Hung, NASA Glenn Research Center, USA; Kunath, Richard, NASA Glenn Research Center, USA; March 2000; 18p; In English; Radar, 7-12 May 2000, Alexandria, VA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): RTOP 576-01-21
Report No.(s): NASA/TM-2000-209776; E-12056; NAS 1.15:209776; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Continued progress in both civil and military avionics applications is overstressing the capabilities of existing radio-frequency (RF) communication networks based on coaxial cables on board modem aircrafts. Future avionics systems will require high-bandwidth on- board communication links that are lightweight, immune to electromagnetic interference, and highly reliable. Fiber optic communication technology can meet all these challenges in a cost-effective manner. Recently, digital

fiber-optic communication systems, where a fiber-optic network acts like a local area network (LAN) for digital data communications, have become a topic of extensive research and development. Although a fiber-optic system can be designed to transport radio-frequency (RF) signals, the digital fiber-optic systems under development today are not capable of transporting microwave and millimeter-wave RF signals used in radar and avionics systems on board an aircraft. Recent advances in fiber optic technology, especially wavelength division multiplexing (WDM), has opened a number of possibilities for designing on-board fiber optic networks, including all-optical networks for radar and avionics RF signal distribution. In this paper, we investigate a number of different novel approaches for fiber-optic transmission of on-board VHF and UHF RF signals using commercial off-the-shelf (COTS) components. The relative merits and demerits of each architecture are discussed, and the suitability of each architecture for particular applications is pointed out. All-optical approaches show better performance than other traditional approaches in terms of signal-to-noise ratio, power consumption, and weight requirements.
Author
Fiber Optics; Network Analysis; Architecture (Computers); Radio Frequencies; Communication Networks; Millimeter Waves; Electromagnetic Interference; Digital Data; Coaxial Cables

20000034046 Defence Research Establishment Ottawa, Ottawa, Ontario Canada
Mitigation of Transient Doppler Artifacts In Airborne Pulse Doppler Radar
Hughes, Steven J., Defence Research Establishment Ottawa, Canada; Dec. 1999; 36p; In English
Report No.(s): AD-A372817; DREO-TR-1999-125; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
The Defence Research Establishment Ottawa has developed a Digital Radar Receiver and Data Acquisition System as part of an experimental air-to-air surveillance radar that will be used to demonstrate an air-to-air surveillance capability for the Canadian Forces CP-140 Maritime Patrol Aircraft. The report presents an analysis of the radar return signal expected from a point target, and predicts the existence of transient Doppler artifacts associated with the leading and trailing edges of the radar pulses. A software simulation also produces transient Doppler artifacts, and experimental measurements of a simulated target signal confirm their existence. The potential impact of the artifacts on radar performance is discussed, as are techniques to mitigate their deleterious effects.
DTIC
Airborne Equipment; Digital Radar Systems; Surveillance Radar; Doppler Radar; Data Acquisition; Target Acquisition

20000034047 Air Force Research Lab., Information Directorate, Rome, NY USA
A Signal Energy Detection Implementation
Hughes, Timothy M., Air Force Research Lab., USA; Dec. 1999; 30p; In English
Contract(s)/Grant(s): AF Proj. 4594
Report No.(s): AD-A372823; AFRL-IF-RS-TM-1999-6; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
The Adjustable Bandwidth Concept (ABC) signal energy detector has been implemented in the Mathwork's MATLAB environment, with a graphical user interface. The ABC algorithm, U.S. patent #5,257,211 can be applied to a variety of digitized signals, including both audio and basebanded RF communications signals. The implementation allows for easy re-configuration of the algorithm through graphical parameter control, which facilitates signal energy detection tests.
DTIC
Signal Processing; Radio Communication; Communication Equipment; Signal Detection; Signal Detectors

20000034052 Prediction Systems, Inc., Spring Lake, NJ USA
High Throughput Terminal/CDMA Modem for Satellite Communications *Final Report*
Irvine, Kenneth, Prediction Systems, Inc., USA; Cave, William C., Prediction Systems, Inc., USA; Jan. 14, 2000; 72p; In English
Contract(s)/Grant(s): F30602-99-C-0110
Report No.(s): AD-A372865; PSI-99002; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy
Communications on the battlefield can benefit from the use of satellites to support connectivity over widely dispersed deployments and rugged terrain. It appears that satellite communications for military purposes will be enhanced using Code Division Multiple Access (CDMA). The spread spectrum technology used for CDMA has provided terrestrial military communication systems with many positive features including anti-jamming, Low Probability of Detection (LPD), and Low Probability of Interception (LPI). CDMA can also be used to gain increased capacity, improved coverage, reduced transmission power, and extended range. This proposal describes a CAD approach to rapid analysis and design of communications systems. Based upon PSI's real time control and simulation environment, it has been used for development of dynamic real time data and communication systems. This environment consists of the General Simulation System (GSS) for discrete event simulation and the Visual Software Environment (VSE) for building real time control systems. On top of these tools, PSI has developed a new

Run Time Graphics (RTG) system that allows the analyst to graphically monitor and interact with the live system as well as a simulation. This environment is directly applicable to the rapid development of CDMA technology for use in satellite communications.
DTIC
Code Division Multiple Access; Spread Spectrum Transmission; Satellite Communication; Real Time Operation

20000034082 Space and Naval Warfare Systems Center, San Diego, CA USA
A Maximum-Likelihood-Based Frequency Synchronizer for Dual-H Full-Response 4-ARY Continuous-Phase Modulation (CPM) ***Final Report, Oct. 1998-Sep. 1999***
Pettit, R. H.; Wahlen, B. E.; Feb. 2000; 21p; In English; Prepared in collaboration with California State Univ., Northridge, CA.
Report No.(s): AD-A374027; TD-3094; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Maximum-likelihood techniques are useful in finding structures for synchronizers for various cases. Synchronizers for frequency, phase, and timing have been found for various bandpass signaling techniques such as PSK, DPSK, QAM, MSK, and CPM. These include data-aided, decision-directed, clock-aided cases. For Continuous-Phase Modulation (CPM), however, apparently only the single modulation index case has ML-based synchronizers. This report describes a new non-data-aided, non-decision-directed ML-based frequency synchronizer (with no phase or timing information) derived for a full-response, dual-h (two modulation indexes), 4-ary CPM signaling scheme. The derived structure will be incorporated into future simulations to compare performance among several possible frequency synchronizers.
DTIC
Frequency Shift Keying; Maximum Likelihood Estimates; Phase Modulation; Signal Processing; Quadrature Amplitude Modulation; Synchronizers

20000034221 California Univ., Electronics Research Lab., Berkeley, CA USA
Device & System Research in Millimeter Wave Fiber-Optic Link & Distributed Antenna Networks for Cellular and Personal Communications ***Final Report, Jun. 1995-Dec. 1998***
Lau, Kam; Jan. 2000; 62p; In English
Contract(s)/Grant(s): F30602-95-C-0116; AF Proj. C552
Report No.(s): AD-A374268; AFRL-SN-RS-TR-1999-260; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Device and system aspect of distributed antenna systems were investigated for supporting wireless communications in an in building environment. The infrastructure is fiber based, but with the key criterion of being low cost. From the device end, VCSELs were investigated as optical sources for the fiber optic network, since these devices are being mass manufactured for fiber network applications. From the systems end, a saturated antenna architecture was investigated for bringing about highest cost/performance ratio. This architecture negates the need for performing site specific planning and survey, thus greatly reducing the cost of installation of the system. The experimental, simulation and analytical approaches employed in these studies led to a solid understanding of the performance of such a network and its dependence on various parameters of the devices and systems.
DTIC
Communication Equipment; Fiber Optics; Millimeter Waves; Wireless Communication; Antenna Design

20000037832 Marconi Communications S.p.A., Defence Communications Div., Genoa, Italy
Advances in UAV Data Links: Analysis of Requirement Evolution and Implications on Future Equipment
Baiotti, S., Marconi Communications S.p.A., Italy; Scazzola, G. L., Marconi Communications S.p.A., Italy; Battaini, G., Marconi Communications S.p.A., Italy; Crovari, E., Marconi Communications S.p.A., Italy; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B10-1 - B10-13; In English; See also 20000037804; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper resumes the fundamental operational requirements that a UAV must accomplish to be effectively performant in a military and civil environment. Moving from these considerations, a list of technical requirements for Data Link systems to be employed is derived and a suitable Data Link architecture, based on the evolution of current Marconi's J-Band Data Link for CATRIN-SORAO programme is presented.
Author
Data Links; Pilotless Aircraft; Military Technology

20000037833 California Univ., Dept. of Electrical and Computer Engineering, Irvine, CA USA
Signal Processing for Micro Inertial Sensors
Stubberud, Allen R., California Univ., USA; Yu, Xiao-Hua, California Univ., USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B11-1 - B11-7; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

In the development of the guidance and control packages for unmanned vehicles, it is highly desirable to have inertial measurement sensors which are small, inexpensive, low power, reliable and accurate new technological advances in the design and construction of micro inertial sensors, such as accelerometers and gyroscopes. have much promise in providing small, inexpensive, and low power devices; however, much improvement in the reliability and, especially. the accuracy of these micro devices is still necessary Further major improvements in these two properties will probably not be accomplished in the near future, thus it will be necessary to use special signal processing methods to provide the accuracy One way which has been proposed to improve the accuracy, and concurrently the reliability. of micro sensors is to use many. perhaps one hundred or more, micro sensors on a single chip (or a few chips) and using statistical methods to combine the individual outputs of these sensors to provide an accurate measurement One method of performing such a combination is through an extended Kalman filter (EKF). A standard application of an EKF to an array of gyroscopes would involve at least six state equations per gyroscope and the number of covariance equations would be in the order of the square of the product of six times the number of gyroscopes Obviously, the curse of dimensionality very quickly limits the number of sensors (gyroscopes) which can be used Even if the EKF for each individual gyroscope is uncoupled from the rest. the number of covariance equations is of the order of the number of gyroscopes times six squared This can still lead to a formidable computational burden In this paper, a new technique of applying an EKF to this problem of combining many sensors is proposed. by using the common nominal model for each of the micro sensors and developing a single EKF. improved accuracy is achieved by a single EKF with the dimension of one sensor. For cases in which the micro sensors are corrupted by correlated noise (between the sensors) an artificial neural network could be added to the EKF dynamics to track the noise. Simulated examples will be discussed.

Author

Signal Processing; Inertial Platforms; Microelectromechanical Systems

20000037834 Office of Naval Research, Arlington, VA USA

Distributed Intelligence, Sensing, and Control for Fully Autonomous Agents

Moshfegh, Allen, Office of Naval Research, USA; Siegel, David S., Office of Naval Research, USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B12-1 - B12-9; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

Future naval missions at sea or shore will require effective and intelligent utilization of real-time information and sensory data to assess unpredictable situations, identify and track hostile targets, make rapid decisions, and robustly influence, control, and monitor various aspects of the theater of operation. Littoral missions and operations are expected to be highly dynamic and extremely uncertain. Communication interruption and delay are likely, and active deception and jamming are anticipated. There is an evolving need for a new generation of unmanned aerial vehicles (UAVs) to perform the tasks traditionally attributed to manned aircraft. For example, UAVs such as Global Hawk are rapidly becoming integral part of military surveillance and reconnaissance operations. UAVs are economical, capable of carrying powerful sensors, and complement manned aircraft missions. Other inherent advantages are (a) removal of personnel from hazardous environments; (b) elimination of error-prone repetitive tasks; (c) reduction of cost associated with operational safety and training; (d) expansion of operational envelope; and (e) performing long endurance mission. Recent advances in high speed computing, information processing, sensors, wireless communications, Internet technologies, and mobile telecommunications have led to emergence of network-centric systems. The technology focus is shifting from individual platforms with limited number of agents to multiple platforms with transparent agents. The software and hardware agents are becoming smarter and capable of continuously adapting to changes in the operational environment. The agents can strategize and make decisions to achieve the desired objectives of mission. At the Office of Naval Research (ONR) we envision airborne intelligent autonomous agents will have the ability to collect, process, fuse, and disseminate real- time information while exploiting and/or denying an enemy similar opportunities. These airborne intelligent autonomous agents are referred to as unmanned combat the notion of network-centric warfare. It is well understood that network-centric operations can deliver to the US military a distinct edge over the enemy. At the strategic level it provides, not simply raw data but a detailed understanding and situational awareness of the appropriate competitive space. At the tactical level, network-centric warfare allows forces to develop rapid response capability and the ability to command and control the littoral environment in real-time settings.

Derived from text

Autonomy; Distributed Parameter Systems; Pilotless Aircraft; Control Theory; Artificial Intelligence

20000037835 Bundesamt fuer Wehrtechnik und Beschaffung, Koblenz, Germany

Command and Control System of Unmanned Surface Drones for Sea Mine Disposal: The Automation of Minesweeping Operations by Means of the Command and Control System (C exp 2 System) for the Remote-Controlled Mine Countermeasures System TROIKA

Brueckner, Gunther, Bundesamt fuer Wehrtechnik und Beschaffung, Germany; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B13-1 - B13-9; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

The following presentation gives an overview about the concept and the capabilities of the new command and control system for remote controlled unmanned surface drones which will be used for disposal of seamines. The presentations shows that a reasonable automation of minesweeping operations with unmanned drones under heterogeneous operating conditions is possible and will improve the sweeping performance significantly.

Derived from text

Command and Control; Drone Vehicles; Remote Control; Countermeasures; Seas; Mines

20000037839 Thomson-CSF Detexis, Elancourt, France

CRECUS: A Radar Sensor for Battlefield Surveillance UAVs

Boucard, H., Thomson-CSF Detexis, France; Gach, T., Thomson-CSF Detexis, France; Sicsik-Pare, E., SPOT/ST/OER, France; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B19-1 - B19-11; In English; See also 20000037804; Copyright Waived; Avail: CASI; A03, Hardcopy

The paper describes a SAR/MTI radar sensor for Air-to- Ground Surveillance UAVs designed as a slow-flying, medium-altitude UAV payload. We present experimental results and emphasize salient conclusions obtained following the developmental flight test phase.

Derived from text

Moving Target Indicators; Radar Detection; Surveillance; Pilotless Aircraft; Synthetic Aperture Radar

20000037890 Remote Services Ltd., Northwood, UK

Communications Command and Control: The Crowded Spectrum

Clot, Andre J., Remote Services Ltd., UK; Development and Operation of UAVs for Military and Civil Applications; April 2000, pp. 2B-1 - 2B-8; In English; See also 20000037887; Copyright Waived; Avail: CASI; A02, Hardcopy

Two key issues arise when the crew are removed from the aircraft. The first is how to get data to and from the aircraft (communications); and the second is how to operate the aircraft effectively (Command and Control). All the various methods used rely on the electromagnetic spectrum and useable space in this spectrum is becoming increasingly scarce. The provision and protection of this resource for the aviation community is an important issue. For UAV systems it could be the difference between success and failure. Whilst the number of UAVs remains small the problem may be contained. However if the UAV industry is to experience the growth it expects, this may well be the most limiting factor.

Author

Aircraft Communication; Command and Control; Electromagnetic Spectra; Pilotless Aircraft

20000037893 DaimlerChrysler Aerospace A.G., Ulm, Germany

UAV Data-Links: Tasks, Types, Technologies and Examples

Rochus, Wolfgang W., DaimlerChrysler Aerospace A.G., Germany; Development and Operation of UAVs for Military and Civil Applications; April 2000, pp. 5-1 - 5-43; In English; See also 20000037887; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper provides an overview of Data-Links for UAVs. Based on the functions, which have to be performed in different UAV missions, requirements for data-links are identified. After highlighting the basic variants of data-links and their general advantages and disadvantages a detailed discussion of some important design aspects is provided. Some real-world examples of data-links show how theory has been put to use, namely: (1) Global Hawk SATCOM Data-Link as an example for an off-the-shelf solution; (2) HF Data-Link for Mucke UAV System as an example for the adaptation of MOTS hardware to a small UAV; and (3) The BREVEL Microwave DATA-Link as an example for a solution to a specific requirement. The BREVEL Data-Link is one of the most advanced solutions available today. It was developed jointly between DaimlerChrysler Aerospace AG and MATRA SYSTEM and Information until 1998 and is expected to go into production in Germany in 1999.

Author

Pilotless Aircraft; Communication Satellites; Data Links

20000037949 Communications Research Lab., Tokyo, Japan

Research and Development on High Data Rate Satellite Communication Systems

Kadowaki, Naoto, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Sep. 1994; ISSN 0914-9279; Volume 40, No. 3, pp. 321-332; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Research and development of high data rate (HDR) networks is one of the most rapidly growing topics in the communications technology world. Many experimental or operational projects to develop HDR networks are planned in the USA, Europe and Japan. Although the most of such projects are based on fiber-optic-network technology, communication will play an important role in HDR networks. The satellite system's advantages such as wide area coverage, flexible and quick node deployment capability, and multi-casting capability are recognized to be very important for constructing global information infrastructures in conjunction with terrestrial networks. On the other hand, unresolved issues remain in a broadband satellite transponder, HDR, MODEM, error correction CODEC, and networking protocols. to promote the development of such kinds of technologies, an HDR transmission experiment using ETS-VI is planned. In addition, a transpacific demonstration experiment using ACTS and Intelsat is proposed. Also proposed is the concept of the Advanced Asia Pacific Telecommunications Satellite System. The satellite-based HDR systems will provide flexibility of network configuration and services, and a cost effective way of constructing an information infrastructure.

Author

Satellite Communication; Rates (Per Time); Communication Networks; Telecommunication; Satellite Transmission

20000037950 Communications Research Lab., Tokyo, Japan

Complexity Reduced Decision Feedback Equalizer Using Interpolation for Land Mobile Communication Systems

Sampei, Seiichi, Communications Research Lab., Japan; Kamio, Yukiyoshi, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Sep. 1994; ISSN 0914-9279; Volume 40, No. 3, pp. 311-318; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper proposes a method that can be used to reduce the number of computations needed for a decision feedback equalizer (DFE) in land mobile communication systems. With this method, the initial acquisition process is carried out at both preamble and postamble for each burst. Optimum tap gain vectors C(pre) and C(post) are obtained at the end of the preamble and postamble using the conventional least squares (RLS) algorithm. The optimum tap gains for information symbols located between the preamble and postamble are estimated by linearly interpolating C(pre) and C(post). This method is applied to a 512-ksymbol/s and QPSK/TDMA system and is evaluated by computer simulation. The results show that the performance of this scheme is almost that of a conventional RLS-DFE with only 1/7 the number of computations needed.

Author

Mobile Communication Systems; Algorithms; Least Squares Method; Selective Fading; Feedback

20000037951 Communications Research Lab., Tokyo, Japan

Communication Channel Simulator for Digital Land Mobile Radio, Part 1, Study of Model for Generating Error Sequence

Sasaoka, Hideichi, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Sep. 1994; ISSN 0914-9279; Volume 40, No. 3, pp. 303-309; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

For digital communication channels with memory, the performance of error control schemes such as feed forward error correction and automatic repeat request - depends not only on the bit error but also on the error sequence. The error sequence data is therefore important to precisely evaluate the performance of communication systems with error control schemes. This paper discusses methods of obtaining the error sequence data in digital land mobile radio channels and proposes the new concept of digital communication channel simulator. The simulator is an error sequence generator that implements the algorithm based on an error generation model and operates in real time using digital signal processors. The investigation is focused on the error generation algorithm, which represents a finite Markov chain model, and its suitability for digital land mobile radio communications. This paper examines the availability of a new model for error sequence generation and shows the method of determining simulation parameters.

Author

Error Analysis; Markov Chains; Data Transmission; Radio Communication; Pulse Communication; Signal Analyzers; Simulators; Signal Processing; Real Time Operation

20000037956 Communications Research Lab., Tokyo, Japan

Simulation Method for Correlated Multi-Path Fading Waves in Space Diversity Systems

Sasaoka, Hideichi, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Mar. 1994; ISSN 0914-9279; Volume 40, No. 1, pp. 53-59; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper introduces a multipath fading simulator for space diversity in land mobile radio communication systems. The cross-correlation between two received waves is studied theoretically by using the extended correlation function for the parameters of time and distance in space. A theoretical analysis shows that the cross-correlation function between two generated fading waves in conventional simulator does not agree with theoretical results. This paper discusses a more exact approach for simulating two correlated fading waves as well as an implementation method using multitone generator.

Author

Mobile Communication Systems; Multipath Transmission; Reception Diversity; Simulation; Signal Fading

20000037957 Communications Research Lab., Tokyo, Japan

Adjacent-Channel Interference Elimination Performance of a Nonlinear Equalizer

Nagayasu, Takayuki, Communications Research Lab., Japan; Sampei, Seiichi, Communications Research Lab., Japan; Sasaoka, Hideichi, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Mar. 1994; ISSN 0914-9279; Volume 40, No. 1, pp. 45-51; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper proposes a nonlinear adaptive equalizer for eliminating adjacent-channel interference in digital radio communications. The proposed equalizer is constructed by adding the nonlinear section of processing cubed signals to a conventional linear adaptive equalizer. The characteristics of the proposed equalizer are investigated by computer simulation, and are compared with those of a conventional equalizer. Simulation results shows that the proposed equalizer is more effective than other equalizers, especially when channel separation is narrow. It is confirmed that the proposed equalizer is useful for eliminating adjacent-channel interference.

Author

Electromagnetic Interference; Equalizers (Circuits); Pulse Communication; Nonlinearity; Signal Processing

20000037958 Communications Research Lab., Tokyo, Japan

Evaluation of a Near-Field Antenna Measurement Technique as a Means of Cross-Polarization Characteristics Measurement: Cross-Polarization Patterns for 14.35 GHZ Offset Parabolic Antennas

IIgusa, Kyouichi, Communications Research Lab., Japan; Hori, Yoshiaki, Communications Research Lab., Japan; Schmidt, J. R., Communications Research Lab., Japan; Review of the Communications Research Laboratory; Mar. 1994; ISSN 0914-9279; Volume 40, No. 1, pp. 11-23; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We reported in a previous paper that data reproducibility for a CRL planar near-field antenna measurement (NFAM) system as improved by adjusting its hardware and measurement procedures. We have measured cross-polarization characteristics of two offset-parabolic antennas at a frequency of 14.35 GHz with the planar NFAM technique. These antennas are used in CRL dual-polarization radar for transmission and reception. Their polarization direction can be chosen to be horizontal or vertical, and their cross polarization discrimination is fairly high (above 35 dB). Therefore, we can check the ability of the NFAM technique to measure cross-polarization characteristics with these antennas as test antennas. This paper discusses the influence of probe displacement between two orthogonal polarization measurements. The importance of correction for data analysis is demonstrated by the experiment for accurate antenna measurements. Cross polarization patterns vary depending on the selection of polarization direction and the planes along which the patterns are displayed. After appropriate choice of the parameters, we calculate the average and standard deviations of the patterns from the measurements and show good data reproducibility, except for a weak signal. Comparing the patterns measured in different antenna conditions shows that mount structure does not affect pattern measurements and that the horizontal and vertical polarization patterns are slightly different from each other. We then compare patterns measured with the NFAM technique to those measured in a far field. The co-polarization patterns agree with each other. The cross-polarization patterns however do not always coincide with each other. One reason for this could be differences in polarization direction and the planes along which the patterns are displayed by NFAM and far field measurements. We then discuss how cross-polarization pattern errors for a probe can affect the calculated cross-polarization pattern for a test antenna.

Author

Parabolic Antennas; Antenna Design; Cross Polarization; Near Fields

20000038135 NASA Goddard Space Flight Center, Greenbelt, MD USA

Synthetic Data for Testing TRMM Radar Algorithms

Jones, Jeffrey A., Hughes STX, Inc., USA; Meneghini, Robert, NASA Goddard Space Flight Center, USA; Iguchi, Toshio,

Communications Research Lab., Japan; Tao, Wei-Kuo, NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 225-226; Repr. from 28th Conference on Radar Meteorology (American Meteorological Society) p 196-197,; In English; 28th; Radar Meteorology, 7-12 Sep. 1997, Austin, TX, USA
Report No.(s): P2.26; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Test data are required to test algorithms for the TRMM Precipitation Radar. These data are needed to test the design of the computer codes under development for the operational phase of the mission, and also to test and evaluate alternative or improved precipitation retrieval algorithms. Over a number of years we have developed and used a 3-dimensional radar model for simulating spaceborne precipitation radars. We have adapted this code to produce data files as close as possible to the TRMM file specifications. In this paper, we will describe the model as it is currently implemented, and show some samples of the synthetic data sets.
Author
Meteorological Radar; Precipitation (Meteorology); Radar Data; Trmm Satellite; Algorithms; Climate Models

20000038140 NASA Wallops Flight Facility, Wallops Island, VA USA
TOPEX Radar Altimeter Engineering Assessment Report. Update: Launch to January 1, 1997
Hancock, D. W., III, NASA Wallops Flight Facility, USA; Hayne, G. S., NASA Wallops Flight Facility, USA; Brooks, R. L., NASA Wallops Flight Facility, USA; Lee, J. E., NASA Wallops Flight Facility, USA; Lockwood, D. W., NASA Wallops Flight Facility, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 215-216; Repr. from TOPEX Radar Altimeter Engineering Assessment Report. Update: Launch to January 1, 1997, Mar. 1997 72 p; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771); Abstract Only, Hardcopy, Microfiche

The initial TOPEX Mission Radar Altimeter Engineering Assessment Report, in February 1994, presented performance results for the NASA Radar Altimeter on the TOPEX/POSEIDON spacecraft, from its launch in August 1992 to February 1994. There have been supplemental Engineering Assessment Reports, issued in March 1995 and again in May 1996, which updated the performance results through the end of calendar years 1994 and 1995, respectively. This supplement updates the altimeter performance to the end of calendar year 1996, and describes significant events that occurred during 1996. As the performance data base has expanded, and as analysis tools and techniques continue to evolve, the longer-term trends of the altimeter data have become more apparent. The updated findings are presented here.
Author
Radar Measurement; Radio Altimeters; Remote Sensing; TOPEX; Onboard Equipment

20000038183 Communications Research Lab., Tokyo, Japan
Geometric Modeling for Communication Using Three-Dimensional Virtual Worlds
Arakawa, Yoshiki, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Mar. 1994; ISSN 0914-9279; Volume 40, No. 1, pp. 25-35; In Japanese; Original contains color illustrations; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper describes a geometric modeling method for realizing three dimensional virtual worlds on a computer to facilitate efficient transmission by communication networks. For such virtual worlds, a multi-purpose geometric modeler is needed which can process both image and figure data. Geometric models can be divided into space-oriented and object-oriented models. Essentially, they have quite different characteristics and can be considered to be complementary to each other. A hybrid model combining these two models is necessary to efficiently realize and transmit 3-D virtual worlds. In this paper, we propose such a model which uses a Runlength as the space-oriented model and a BRep based on quasi-disjointed triangular faces as the object-oriented model. It turns out that a Runlength has a high data-compression rate and the ability to convert data efficiently to/from the object-oriented model; two properties not found in a Voxel or an Octree. Using a BRep with quasidisjointed triangular faces results in a simple data structure with fixed data length, as well as simple, reliable processing algorithms. Therefore, our newly developed hybrid modeler based on a Runlength and a BRep using quasidisjointed triangular is suitable for the realization and transmission of 3-D virtual worlds.
Author
Virtual Reality; Mathematical Models; Communication Networks

20000038219 Institute for Human Factors TNO, Soesterberg, Netherlands

Speech Communication Quality on Board Hr. Ms. Van Amstel ***Final Report De Kwaliteit van de Spraakcommunicatie aan Boord van Hr. Ms. Van Amstel***

Steeneken, H. J. M., Institute for Human Factors TNO, Netherlands; Kriekaard, J. J., Institute for Human Factors TNO, Netherlands; Mar. 08, 1999; 30p; In Dutch; Original contains color illustrations

Contract(s)/Grant(s): A98/KM/355; TNO Proj. 786.4

Report No.(s): TD-98-0017; TM-99-A015; Copyright; Avail: Issuing Activity

The speech transmission quality and the noise dose were determined for a number of communications. Especially communications with the FOCON system from the command room to the helicopter deck, helicopter and gun-tower were included. It was found that without environmental noise, communications of good quality are obtained. With environmental noise however, the quality depends on the noise attenuation of the headset. Especially for helicopter operations a bad-to-poor quality is observed. For twelve headsets a laboratory evaluation was performed. For use in combination with high background noise levels only four systems offer sufficient hearing protection and communication quality.

Author

Background Noise; Hearing; Noise Intensity; Speech Recognition; Transmission Rate (Communications)

20000038221 Physics and Electronics Lab. TNO, The Hague, Netherlands

Crow's Nest Antenna Polarizing Radome First Preliminary Study ***Final Report***

Scholz, J. A., Physics and Electronics Lab. TNO, Netherlands; Strijbos, J. H. M., Physics and Electronics Lab. TNO, Netherlands; December 1998; 50p; In English

Contract(s)/Grant(s): A98/KM/837; TNO Proj. 28239

Report No.(s): TD-98-0204; FEL-98-A178; Copyright; Avail: Issuing Activity

An investigation is being conducted into the feasibility of modifying the Air Defence and Command Frigate (ADCF) and F124 sensor suite for ballistic missile defense (TBMD). This defense capability requires the use of a new missile, the SM-2 Block IVA, which depends on uplink/downlink command guidance. A crow's nest antenna (CNA) is under consideration for the uplink/downlink system (UDLS) between the ADCF or the F 124 and the SM-2 Block IVA missile. Design constraints on the CNA result in a horizontally polarized electric field. This field must be rotated into vertical polarization to accommodate the vertical polarization used by the SM-2 Block IVA. The polarization rotation can be accomplished by means of a multiple wire grid polarizing radome, which covers the CNA. This preliminary report covers the operating principle of the radome, and includes both simulated and measured performance results, which are in good agreement. CNA radome aspects such as stealth, electromagnetic compatibility, electronic countermeasures, mast integration, and manufacturing are also discussed.

Author

Research; Feasibility Analysis; Revisions; Measuring Instruments; Manufacturing; Electronic Countermeasures; Design Analysis

33
ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry. For related information see also 60 Computer Operations and Hardware and 76 Solid-State Physics.

20000033770 Pro-Tech, Walnut Creek, CA USA

High-Power Triggered Gas Switches ***Final Report, 1 May 1998 - 28 Jun. 1999***

Giri, David V., Pro-Tech, USA; Carboni, Vic, Pro-Tech, USA; Smith, Ian, Pro-Tech, USA; Jun. 28, 1999; 45p; In English

Contract(s)/Grant(s): F29601-98-C-0151; AF Proj. 3005

Report No.(s): AD-A372791; PT/DFR,99-01; AFRL-DE-TR-1999-1026; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Examples of ultrawide band sources using self-closing spark-gap type of gas switches are the H-series systems at Air Force Research Laboratory. There are several reasons to build triggered versions of the basic high-voltage spark gap. They include synchronization with an external event, timed-array antenna for steering directed energy systems etc. Phase I includes a systematic formulization of a short pulse testbed facility. The fabrication and delivery of the facility is proposed for a Phase II effort. The designed facility is modular and capable of studying different types of electrical and laser triggering, gas mixes, electrode geometries, etc. The conceptual layouts and electrical field calculations have been completed in the critical stressed regions of

the system. The 2-D transmission line code was used to model the circuit and preliminary runs were made. The contractor intends to develop this further in the Phase II effort and predict waveshapes.
DTIC
Trigger Circuits; Spark Gaps; Switching Circuits; Antenna Arrays; Fabrication; High Voltages

20000033773 International Society for Optical Engineering, Bellingham, WA USA
Laser Applications in Microelectronic and Optoelectronic Manufacturing IV ***Final Report, 1 Jan.-31 Dec. 1999***
Dubowski, Jan J., International Society for Optical Engineering, USA; Helvajian, Henry, International Society for Optical Engineering, USA; Kreufz, Ernst W., International Society for Optical Engineering, USA; Sugioka, Koji, International Society for Optical Engineering, USA; Jul. 15, 1999; 547p; In English; Presented at the conference on Laser Applications in Microelectronic and Optoelectronic Manufacturing, SPIE - The International Society for Optical Engineering, 25-27 Jan 99, San Jose, CA.
Contract(s)/Grant(s): F49620-99-1-0078; AF Proj. 2301
Report No.(s): AD-A372739; VOL-3618; No Copyright; Avail: CASI; A04, Microfiche; A23, Hardcopy

This proceedings contains papers on the following topics: Laser Nanotechnology; Fundamental Processes and Diagnostics of Laser Ablation; Ultrashort Pulse Laser Processing; Laser-induced Modification of Surface and Subsurface Properties of Materials; Innovative Laser Technology for Industrial Applications; Laser Surface Cleaning and Crystallization; Laser Microfabrication and Micromachining; Novel Methods and New Tools for Photon Processing; Pulsed Laser Deposition, Nanoclusters, Trybological and Diamond Films.
DTIC
Conferences; Electro-Optics; Laser Applications; Microelectronics

20000033844 NASA Glenn Research Center, Cleveland, OH USA
600 C Logic Gates Using Silicon Carbide JFET's
Neudeck, Philip G., NASA Glenn Research Center, USA; Beheim, Glenn M., NASA Glenn Research Center, USA; Salupo, Carl S.a, Cortez 3 Service Corp., USA; March 2000; 10p; In English; Government Microcircuit Applications, 20-24 Mar. 2000, Anaheim, CA, USA; Sponsored by Department of Defense, USA
Contract(s)/Grant(s): RTOP 519-20-53
Report No.(s): NASA/TM-2000-209928; E-12172; NAS 1.15:209928; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Complex electronics and sensors are increasingly being relied on to enhance the capabilities and efficiency of modernjet aircraft. Some of these electronics and sensors monitor and control vital engine components and aerosurfaces that operate at high temperatures above 300 C. However, since today's silicon-based electronics technology cannot function at such high temperatures, these electronics must reside in environmentally controlled areas. This necessitates either the use of long wire runs between sheltered electronics and hot-area sensors and controls, or the fuel cooling of electronics and sensors located in high-temperature areas. Both of these low-temperature-electronics approaches suffer from serious drawbacks in terms of increased weight, decreased fuel efficiency, and reduction of aircraft reliability. A family of high-temperature electronics and sensors that could function in hot areas would enable substantial aircraft performance gains. Especially since, in the future, some turbine-engine electronics may need to function at temperatures as high as 600 C. This paper reports the fabrication and demonstration of the first semiconductor digital logic gates ever to function at 600 C. Key obstacles blocking the realization of useful 600 C turbine engine integrated sensor and control electronics are outlined.
Author
Silicon Carbides; Field Effect Transistors; Logic Circuits; Threshold Gates; High Temperature

20000033860 California Inst. of Tech., Dept. of Electrical Engineering, Pasadena, CA USA
A Dual Polarized Quasi-Optical SIS Mixer at 550-GHz
Chattopadhyay, Goutam, California Inst. of Tech., USA; Miller, David, California Inst. of Tech., USA; LeDuc, Henry G., Jet Propulsion Lab., California Inst. of Tech., USA; Zmuidzinas, Jonas, California Inst. of Tech., USA; [2000]; 10p; In English
Contract(s)/Grant(s): NAG5-4890; NAGW-107; NAG2-1068; NSF AST-96-15025
Report No.(s): Rept-2000-04; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We describe the design, fabrication, and the performance of a low-noise dual-polarized quasi-optical superconductor insulator superconductor (SIS) mixer at 550 GHz. The mixer utilizes a novel cross-slot antenna on a hyperhemispherical substrate lens, two junction tuning circuits, niobium trilayer junctions, and an IF circuit containing a lumped element 180 deg hybrid. The antenna consists of an orthogonal pair of twin-slot antennas, and has four feed points, two for each polarization. Each feed point

is coupled to a two-junction SIS mixer. The 180 deg IF hybrid is implemented using a lumped element/microstrip circuit located inside the mixer block. Fourier transform spectrometer (FTS) measurements of the mixer frequency response show good agreement with computer simulations. The measured co-polarized and cross-polarized patterns for both polarizations also agree with the theoretical predictions. The noise performance of the dual-polarized mixer is excellent, giving uncorrected receiver noise temperature of better than 115 K (DSB) at 528 GHz for both the polarizations.
Author
SIS (Superconductors); Polarization Characteristics; Design Analysis; Fabrication; Performance Prediction; Low Noise; Computerized Simulation

20000034051 Institute for Postdoctoral Studies, Scottsdale, AZ USA
Conference on the Physics and Chemistry of Semiconductor Interfaces of Semiconductor Interfaces: Microelectronics and Nanometer Structures: Processing, Measurement, and Phenomena ***Final Report, 1 Oct. 1998-30 Sep. 1999***
Schulte, C. R., Institute for Postdoctoral Studies, USA; Jan. 27, 2000; 613p; In English; 26th, 17-21 Jan. 1999, San Diego, CA, USA; Pub in the Journal of Vacuum Science and Technology B, Second Series, Volume 17, Number 4, Jul/Aug 1999. Preface is on p324.
Contract(s)/Grant(s): N00014-99-1-0145
Report No.(s): AD-A372862; F1-1999; No Copyright; Avail: CASI; A06, Microfiche; A99, Hardcopy

The Proceedings of the 26th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces (PCSI-26) are contained in this volume. The Conference was held at the Catamaran Resort Hotel in Pacific Beach, San Diego, California from Sunday evening, 17 January 1999 to noon on Thursday 21 January 1999 A total of 18 invited and 69 contributed papers were presented, with 113 attendees. This year's Conference saw a large number of papers relating to nitride semiconductor interfaces and piezoelectric effects (41) reflecting the increasing interest in that field worldwide. Besides the traditional emphasis on growth and characterization of other compound semiconductor interfaces (35) a significant number of papers addressed the chemistry and physics of SiO2/Si interfaces (23). There were also a small but significant number of papers dealing with magnetic materials, and spin transport (6), an area that the PCSI Committee believes will increase in the future. Carol Ashby presented some interesting new results on the role of As in oxidation of AlGaAs layers. Steve Streiffer gave an overview of recent work on Perovskite structure ferroelectric films for possible gate dielectrics in transistors. Other exciting advances reported at the Conference include: silicon substrate-based optoelectronic structures predicted by John Joannopoulos from MIT, MBE studies of GaN growth, impurity and surfactant effects in GaN total energy calculations, and real-time x-ray scattering studies of MOCVD growth of GaN films. The Tuesday "Rump" session's theme this year was piezoelectric effects at semiconductor interfaces and included stimulating talks by D. L. Smith and a number of others.
DTIC
Semiconductors (Materials); Microelectronics; Conferences; Interfaces; Ferroelectric Materials; Crystal Growth; Nanostructure (Characteristics); Real Time Operation; Fabrication

20000034074 Boston Univ., Boston, MA USA
High-Performance Ultrafast Photodetectors ***Final Report, Jun. 1996-Aug. 1999***
Unlu, M. S.; Dec. 1999; 11p; In English
Contract(s)/Grant(s): N00014-96-1-0652
Report No.(s): AD-A373824; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This project concentrates on the design, fabrication, and characterization of compound semiconductor photodetectors in various material systems operating at near-IR wavelengths. We utilize resonant cavity enhanced (RCE) detection scheme to optimize speed and responsivity of photodetectors. It is also desirable to combine multiple functions in a single photodetector structure. In addition to wavelength selectivity of RCE photodetectors, we have demonstrated that RCE detectors vertically integrated with one-pass detectors can be used for polarization sensing. We have fabricated RCE photodetectors working at 800 to 900 nm wavelength range with record bandwidth-efficiency products. RCE Schottky photodiodes with 100 GHz bandwidth, p-i-n photodiodes with 50 GHz bandwidth and near-unity quantum efficiency have been demonstrated.
DTIC
Photometers; P-I-N Junctions; Cavity Resonators; Fabrication; Photodiodes

20000034170 National Inst. of Standards and Technology, Electronics and Electrical Engineering Lab., Gaithersburg, MD USA
NIST Measurement Services: Error Analysis and Calibration Uncertainty of Capacitance Standards at NIST
Chang, Y. M.; Jan. 2000; 120p; In English
Report No.(s): PB2000-103674; NIST/SP-250-52; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This document presents the analysis of error sources that contribute to the total uncertainty of capacitance calibrations at the National Institute of Standards and Technology (NIST). Based on considerations of the measuring systems and calibration procedures, the data taken on NIST working and check standards and customer's standards, uncertainties in the calibrations for each model and nominal value of capacitor are estimated. The results of the analysis are expressed as expanded uncertainties using the coverage factor k = 2, in accordance with NIST Technical Note 1297. Also included are a detailed description and analysis for each component of error in the evaluation of Type A and Type B standard uncertainties.
NTIS
Error Analysis; Capacitance; Calibrating; Standards

20000034242 Pennsylvania State Univ., Dept. of Electrical Engineering, University Park, PA USA
Analysis of Zero-Current Switching Topologies and Strategies for the Power Electronic Building Block ***Final Report, 15 Jul. 1998-14 Jul. 1999***
Mayer, Jeffrey; Kriventsov, Stanislav; Feb. 2000; 146p; In English
Contract(s)/Grant(s): N00014-98-1-0780; Proj-98PR06906-00
Report No.(s): AD-A374101; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
A zero current switching (ZCS) topology that provides zero current turn off but full load turn on of the main switches is analyzed for switching losses. State space models of a non-punch through insulated gate bipolar transistor and a power p-i-n diode are used to simulate the circuit response. The switching energy is compared to that for hard switching and for an auxiliary resonant commutated pole. A more general analysis of other ZCS circuit topologies and switching strategies is included in an appendix.
DTIC
Thyristors; Bipolar Transistors; P-I-N Junctions; Trigger Circuits; Switches

20000034253 Naval Postgraduate School, Monterey, CA USA
Analysis, Simulation, and Fabrication of Current Mode Controlled DC-DC Power Converters
Hekman, Thomas P.; Dec. 1999; 104p; In English
Report No.(s): AD-A374067; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
A modular DC Zonal Electrical Distribution System (DC ZEDS) offers advantages in both cost and weight over traditional radial shipboard distribution. In order to equip the next class of surface combatant with DC ZEDS, preparative research includes the design of autonomous DC-DC power converter modules having robust load sharing capability. This thesis examines the utility of current-mode switch control applied to high-voltage DC-DC power converters. A state-space representation for a current-mode controlled buck converter is developed. The system is modeled dynamically using the Advanced Continuous Simulation Language (ACSL). System stability and frequency response is modeled using MATLAB. A hardware controller is fabricated to implement current-mode control using available laboratory equipment.
DTIC
Voltage Converters (DC to DC); Laboratory Equipment; High Voltages; Fabrication; Controllers; Systems Engineering

20000036489 Mission Research Corp., Valpariso, FL USA
Focused Application Software for Ferrite Patch Antennas ***Final Report, 1 Jul. 1997-30 Jun. 1999***
Trott, Keith D.; Guidry, Rene D.; Repesh, Christopher G.; Oct. 01, 1999; 116p; In English
Contract(s)/Grant(s): F49620-97-C-0022
Report No.(s): AD-A374635; AFRL-SR-BL-TR-00-0061; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
The objective of this Phase 2 effort was to develop computational electromagnetic (CEM) codes capable of modeling the radiation properties (pattern, input impedance, efficiency, and bandwidth) of conformal arrays printed on ferrite substrates or superstrates. The codes developed under this effort model inhomogeneous ferrites and dielectrics, non-planar surfaces, heterogeneous elements, complex feed mechanisms, and performance control devices such as shorting pins and lumped loads. The FE-BI codes (brick and tetrahedral elements) are combined by MRC via a graphical user interface (GUI) into a user friendly code capable of modeling conformal antennas with ferrite sub and superstrates recessed in planar surfaces.
DTIC
Dielectrics; Antenna Arrays; Ferrites; Bandwidth

20000036492 Georgia Inst. of Tech., Office of Sponsored Research, Atlanta, GA USA
Growth and Fabrication of GaN-Based Heterojunction Biopolar Transistors ***Annual Report, Jan. 1999-2000***
Brown, April S.; Mar. 06, 2000; 10p; In English
Contract(s)/Grant(s): N00014-98-1-0209
Report No.(s): AD-A374611; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In this progress report, we summarize the results to date of experiments to prove the existence of a two dimensional hole gas. If possible, this hole gas will result in enhanced performance Heterojunctions bipolar transistors for military and commercial applications. Also summarized is the background work required to achieve the two dimensional hole gas including several never before reported results on the behavior of p-type dopants in III-Nitrides.
DTIC
Bipolar Transistors; Heterojunctions; Epitaxy

20000036524 New Mexico Univ., Dept. of Electrical Engineering and Computer Science, Albuquerque, NM USA
Workshop and Publication Working Group on High Power Microwave Sources and Technologies ***Final Report, 1 Jan.-30 Nov. 1999***
Schamiloglu, Edl; Feb. 22, 2000; 26p; In English
Contract(s)/Grant(s): F49620-99-1-0087
Report No.(s): AD-A374865; AFRL-SR-BL-TR-00-0048; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A workshop was convened from June 3-12, 1999 at the University of New Mexico's Maui High Performance Computing Center. The purpose of the workshop was to bring together contributors to an IEEE Press Book entitled Advances in High Power Microwave Sources and Technologies in order to draft the initial manuscript. Workshop participants discussed competing ideas and converged on an initial draft. The scientific papers presented at the workshop thus comprise the book draft. Goals were then made for finalizing the book, having assigned tasks to each of the contributors. There will be 12 chapters describing recent advances in AFOSR-funded high power microwave research. Each chapter is led by a Chapter Master whose task is to coordinate the contributions from the chapter coauthors. In addition to this aspect of the workshop, technical sessions discussing the role of high performance computing on high power microwave tube design were also held. There were 29 registered attendees at the workshop.
DTIC
Microwaves; Traveling Wave Tubes; Radiation Sources; Microwave Tubes; Plasmas (Physics)

20000036529 Department of the Navy, Washington, DC USA
Flexible Cable Providing EMI Shielding
Prysner, William J., Inventor; Jun. 07, 1999; 23p; In English
Patent Info.: Filed 7 Jun. 1999; US-Patent-Appl-SN-09/337,222
Report No.(s): AD-D019616; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A flexible cable which includes a Faraday shield sheath formed of a high permeability ferrous alloy filled matrix binder of conductive elastomers, to provide electromagnetic interference (EMI) isolation between the ambient environment about the cable and a conductor line or lines within the cable, or vice versa is discussed. The flexible cable shield may be embodied as a flexible electrical cable that comprises at least the elements of a single electrically conductive core, an insulator sheath, and a Faraday shield sheath, and may be manufactured as a single extruded cable. The conductive property of the matrix binder provides isotropic conductivity within the sheath, which is requisite of an effective Faraday shield. In the alternative, the flexible cable shield may be embodied as a multiple conductor flexible electrical cable that comprises two or more inner cables as described, and a pile of alternating insulator and a Faraday shield sheaths about the inner cables.
DTIC
Electromagnetic Shielding; Matrix Materials; Power Lines; Magnetic Permeability

20000036538 New Mexico Univ., Dept. of Electrical Engineering and Computer Science, Albuquerque, NM USA
Studies of a Radially-Symmetric Transit Time Oscillator - The Radial Acceletron ***Final Report, 1 Jun. 1996-30 Nov. 1999***
Schamiloglu, Edl; Feb. 21, 2000; 17p; In English
Contract(s)/Grant(s): F49620-96-1-0192
Report No.(s): AD-A374649; AFRL-SR-BL-TR-00-0049; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The transit-time effect in a coaxial structure has been exploited to design and test a low impedance high power microwave source that uses no externally generated magnetic field and has no confining foil. An analytic model is used to extend a circuit model and estimate the values of the free parameters used in the circuit model and compares the analytical values to those obtained

using two-dimensional (2D) particle-in-cell simulations. Further comparisons are made of the results of numerical solutions of the 1D circuit equations, 2D simulations, and initial experimental data. The Gemini pulser fitted with an extended Blumlein transmission line and located at the Air Force Research Laboratory/Phillips Research Site was used in the experiments to drive the Radial Acceletron. It is shown that the nonlinear relationship between voltage and current emission in a space-charge-limited diode drives an rf oscillation whose frequency is determined by the resonant characteristics of the annular diode cavity. The results from the 1D analysis and 2D particle-in-cell (PIC) simulation are shown to be in excellent agreement, and both are in agreement with the experimental data analyzed to-date.
DTIC
Electron Beams; Microwave Oscillators; Numerical Analysis; Electric Potential; Oscillators

20000037701 Villanova Univ., Dept. of Electrical and Computer Engineering, PA USA
High Power Gallium Nitride Devices for Microwave and RF Control Applications ***Final Report, Sep. 1998-Dec. 1999***
Caverly, Robert H., Villanova Univ., USA; Mar. 10, 2000; 35p; In English
Contract(s)/Grant(s): N00014-98-1-0895
Report No.(s): AD-A374652; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Gallium Nitride devices were studied for use in microwave and RF control applications, primarily as electronic switch elements. For the test devices studied, broadband switch cutoff frequencies in excess of 130 GHz were seen, with cutoff frequencies as high as 400 GHz possible with the next generation devices. Second order distortion intercept points of greater than 50 dBm should be achievable with current gallium nitride technologies.
DTIC
Microwave Equipment; Field Effect Transistors; Gallium Nitrides; Electric Switches; Control Equipment

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FLUID MECHANICS AND THERMODYNAMICS

20000033825 NASA Glenn Research Center, Cleveland, OH USA
The Effects of Blade Count on Boundary Layer Development in a Low-Pressure Turbine
Dorney, Daniel J., Virginia Commonwealth Univ., USA; Flitan, Horia C., Virginia Commonwealth Univ., USA; Ashpis, David E., NASA Glenn Research Center, USA; Solomon, William J., Ohio Aerospace Inst., USA; January 2000; 22p; In English; 38th; Aerospace Sciences, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations
Contract(s)/Grant(s): NCC3-645; RTOP 523-26-33
Report No.(s): NASA/TM-2000-209911; E-12138; NAS 1.15:209911; AIAA Paper 2000-0742; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Experimental data from jet-engine tests have indicated that turbine efficiencies at takeoff can be as much as two points higher than those at cruise conditions. Recent studies have shown that Reynolds number effects contribute to the lower efficiencies at cruise conditions. In the current study numerical simulations have been performed to study the boundary layer development in a two-stage low-pressure turbine, and to evaluate the models available for low Reynolds number flows in turbomachinery. In a previous study using the same geometry the predicted time-averaged boundary layer quantities showed excellent agreement with the experimental data, but the predicted unsteady results showed only fair agreement with the experimental data. It was surmised that the blade count approximation used in the numerical simulations generated more unsteadiness than was observed in the experiments. In this study a more accurate blade approximation has been used to model the turbine, and the method of post-processing the boundary layer information has been modified to more closely resemble the process used in the experiments. The predicted results show improved agreement with the unsteady experimental data.
Author
Boundary Layers; Turbines; Low Pressure; Experimentation; Data Acquisition; Jet Engines; Engine Tests; Rotor Blades (Turbomachinery)

20000033988 NASA Marshall Space Flight Center, Huntsville, AL USA
Effects of End-Wall Vibration on Oscillatory Thermocapillary Flow
Bhowmick, J., Vanderbilt Univ., USA; Kou, Q., Vanderbilt Univ., USA; Anilkumar, A., Vanderbilt Univ., USA; Grugel, R., NASA Marshall Space Flight Center, USA; Wang, T., Vanderbilt Univ., USA; [2000]; 1p; In English, 13 Mar. 2000, Nashville, TN, USA; Sponsored by Metallurgical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Our previous float zone experiments 1,2 with NaNO3 revealed that steady thermocapillary flow (TC flow) can be balanced/offset by the controlled surface streaming flow (CSS flow), induced by end-wall vibration. In the current experiments, we are examining the effects of surface streaming flow on steadying/stabilizing oscillatory thermocapillary flow. to this effect, we have set up a controlled NaNO3 half-zone experiment, where the processing parameters like zone dimensions and temperature gradients scan be easily varied to achieve oscillatory TC flow. In the present paper, we discuss the thermal signature of the TC flow, and how it is affected by imposition of CSS flow. The results will also include a comparison of the microstructure of a NaNO3- BaNO3 eutectic, processed under oscillatory TC conditions, with and without imposed CSS flow.
Author
Oscillations; Vibration; Stabilization; Capillary Flow; Thermal Analysis

20000034127 Saclay Research Centre, INSTN, Institut National des Sciences et Techniques Nucleaires, Gif-sur-Yvette, France
Study of the influence of pressure drop coefficients variation on the instability of the structure
Bureau, C.; Dec. 31, 1998; 48p; In French; In English
Report No.(s): DE99-635210; FRCEA-TH-674; No Copyright; Avail: Department of Energy Information Bridge

The aim of this study is the analysis of the influence of pressure drop fluctuations induced by a fluid flow on the mechanical vibrations of a structure. This fluid-elastic coupling can be encountered in several components of a nuclear power plant. In the first par of this study, the problem of fluid-elastic stresses calculation is described. A general method defined for a 2-D system comprising a fluid space with any geometry and several degrees of freedom is used to determine the fluid-elastic stresses. Then, an analytical study of a structure with an annular fluid space and 2 degrees of freedom is performed taking into account the variation of pressure drop coefficients. The aim of this part is to determine the stress matrices. Part 2 is devoted to the determination of the various possible instabilities with respect to the boundaries defined upstream and downstream of the domain. Then, reasonable variations of these coefficients are determined for simple example of structures.
NTIS
Pressure Effects; Structural Stability; Pressure Reduction

20000034862 Oregon State Univ., Coll. of Oceanic and Atmospheric Sciences, Corvallis, OR USA
Surface Flux Formulations in the Coastal Zone *Final Report*
Mahrt, Larry; Feb. 14, 2000; 82p; In English
Contract(s)/Grant(s): N00014-P-98-1-0282
Report No.(s): AD-A373790; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Surface Flux Formulations in the Coastal Zone Eddy correlation and wave data from an offshore tower is analyzed. The data was collected during the Risoe Air Sea Experiment (RASEX). Interpretation of data analysis is made difficult by the fact that different influences are interrelated so that one can find significant, misleading, correlation through indirect relationships. The results do unambiguously indicate that shallow convective internal boundary layers in offshore flow suppress well developed convective eddies so that the heat flux is less than predicted by existing formulations; that is, the thin boundary layer depth influences the flux radiant relationship at the surface, requiring generalization of Monin-Obukhov similarity theory. The nature of the turbulence over land exerts a strong influence on both the boundary layer structure over the sea and the surface stress and fluxes through advection of turbulence energy. These effects are significant in the near coastal zone, typically the first 5 or 10 km offshore. Confused multimodel seas without a dominate spectral peak is a better indicator of large stress (large roughness length and large Chamock coefficient) than wave age. On the other hand, Monin-Obukhov similarity theory was a good approximation for the flux radiant relationship for onshore flow. In general, there is no fundamental difficulty with Monin-Obukhov similarity.
DTIC
Turbulent Flow; Air Water Interactions; Turbulent Boundary Layer; Boundary Layer Flow; Ocean Surface; Advection

20000034896 NASA Ames Research Center, Moffett Field, CA USA
Steady Secondary Flows Generated by Periodic Compression and Expansion of an Ideal Gas in a Pulse Tube
Lee, Jeffrey M., NASA Ames Research Center, USA; September 1999; 166p; In English
Contract(s)/Grant(s): UPN-632-20
Report No.(s): NASA/TM-1999-208769; NAS 1.15:208769; A-9901168; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This study establishes a consistent set of differential equations for use in describing the steady secondary flows generated by periodic compression and expansion of an ideal gas in pulse tubes. Also considered is heat transfer between the gas and the tube wall of finite thickness. A small-amplitude series expansion solution in the inverse Strouhal number is proposed for the two-dimensional axisymmetric mass, momentum and energy equations. The anelastic approach applies when shock and acoustic

energies are small compared with the energy needed to compress and expand the gas. An analytic solution to the ordered series is obtained in the strong temperature limit where the zeroth-order temperature is constant. The solution shows steady velocities increase linearly for small Valensi number and can be of order I for large Valensi number. A conversion of steady work flow to heat flow occurs whenever temperature, velocity or phase angle gradients are present. Steady enthalpy flow is reduced by heat transfer and is scaled by the Prandtl times Valensi numbers. Particle velocities from a smoke-wire experiment were compared with predictions for the basic and orifice pulse tube configurations. The theory accurately predicted the observed steady streaming.
Author
Steady Flow; Secondary Flow; Anelasticity; Ideal Gas; Pipes (Tubes)

20000034900 Maryland Univ., Dept. of Mechanical Engineering, College Park, MD USA
Large-Eddy Simulation: Achievements and Challenges
Piomelli, U., Maryland Univ., USA; Progress in Aerospace Sciences; 1999; ISSN 0376-0421; Volume 35, pp. 335-362; In English
Contract(s)/Grant(s): N00014-91-J-1638; NAG1-1828; NAG1-1880; Copyright; Avail: Issuing Activity

In this paper, the present state of the large-eddy simulation (LES) technique is discussed. Modeling and numerical issues that are under study will be described, and results of state-of-the-art calculations will be presented to highlight the response of the subgrid-scale models to important features of the flow field. Finally, some challenges for research and applications of LES in the near future will be discussed.
Author
Large Eddy Simulation; Mathematical Models; Numerical Analysis; Flow Distribution

20000036543 Brown Univ., Div. of Applied Mathematics, Providence, RI USA
Measurements of Skin Friction in Channel Flow ***Final Report, 1 Mar.-31 Nov. 1998***
Sirovich, Lawrence; Karlsson, Sture; Apr. 26, 1999; 2p; In English
Contract(s)/Grant(s): F49620-98-1-0294
Report No.(s): AD-A374704; TR-2; AFRL-SR-BL-TR-00-0066; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The purpose of these experiments have been to measure the effect of passive means for affecting the skin friction in channel flow. Early measurements indicated that a semi-random distribution of chevrons with a thickness of 5 to 6 wall units could reduce the overall friction in the channel by as much as 12%, whereas the same type of chevrons uniformly spaced increased the channel friction by 20%. The measurements where these results were obtained were made in a portion of the channel that had not yet reached fully developed channel flow properties.
DTIC
Channel Flow; Skin Friction; Flow Characteristics

20000037681 NASA Langley Research Center, Hampton, VA USA
Acoustic Receptivity of a Blasius Boundary Layer with 2-D and Oblique Surface Waviness
King, Rudolph A., NASA Langley Research Center, USA; Breuer, Kenneth S., Brown Univ., USA; [2000]; 16p; In English; Fluids 2000, 19-22 Jun. 2000, Denver, CO, USA
Report No.(s): AIAA Paper 2000-2538; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An experimental investigation was conducted to examine acoustic receptivity and subsequent boundary-layer instability evolution for a Blasius boundary layer formed on a flat plate in the presence of two-dimensional (2-D) and oblique (3-D) surface waviness. The effect of the non-localized surface roughness geometry and acoustic wave amplitude on the receptivity process was explored. The surface roughness had a well defined wavenumber spectrum with fundamental wavenumber k (sub w). A planar downstream traveling acoustic wave was created to temporally excite the flow near the resonance frequency of an unstable eigenmode corresponding to k (sub ts) = k (sub w). The range of acoustic forcing levels, epsilon, and roughness heights, DELTA h, examined resulted in a linear dependence of receptivity coefficients; however, the larger values of the forcing combination epsilon dot DELTA h resulted in subsequent nonlinear development of the Tollmien-Schlichting (T-S) wave. This study provided the first experimental evidence of a marked increase in the receptivity coefficient with increasing obliqueness of the surface waviness in excellent agreement with theory. Detuning of the 2-D and oblique disturbances was investigated by varying the streamwise wall-roughness wavenumber a,, and measuring the T-S response. For the configuration where laminar-to-turbulent breakdown occurred, the breakdown process was found to be dominated by energy at the fundamental and harmonic frequencies, indicative of K-type breakdown.
Author
Acoustic Measurement; Boundary Layers; Obliqueness; Wind Tunnel Tests; Blasius Flow; Two Dimensional Flow; Sound Waves

20000037694 Naval Research Lab., Center for Reactive Flow and Dynamical Systems, Washington, DC USA
Advanced Simulation Tool for Improved Damage Assessment, 1, A Multiblock Technique for Simulating Fire and Smoke Spread in Large Complex Enclosures
Prasad, Kuldeep, Science Applications International Corp., USA; Patnaik, Gopal, Naval Research Lab., USA; Kailasanath, K., Naval Research Lab., USA; Feb. 21, 2000; 31p; In English
Report No.(s): AD-A375000; NRL/MR/6410--00-8428; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Several recent developments in computational techniques have been combined to develop a tool for simulating the reactive flow field inside large complex enclosures. The multiblock technique was adopted to solve the unsteady compressible Navier Stokes equations inside a large fire compartment. Numerical simulations of a 330 kW and a 980 kW fire in a single uncluttered compartment have been performed. Peak ceiling jet temperature of 430 deg C and 910 deg C was computed, for the two fires, respectively. The multiblock approach efficiently grids regions of high heat release with a fine mesh embedded in a coarser mesh covering the larger compartment. It also allows flow field information to be exchanged with the surrounding air through the doorway. Temperature contours and instantaneous velocity vectors provide a detailed understanding of air entrainment into the fire and the flow of hot gases through the door. Numerical results have been found to compare favorably with experimental data. Computations are also reported for a 1310 kW fire in a multi-compartment geometry that replicates the ex-USS Shadwell. Peak temperatures of 320 deg C are obtained in this case. Our results predict a continuously evolving flow field as unsteady vortical structures are generated in the fire plume and convect through the various compartments via the doors and hatches.
DTIC
Computerized Simulation; Damage Assessment; Safety; Simulation; Fire Control

20000037738 Cornell Univ., Sibley School of Mechanical and Aerospace Engineering, Ithaca, NY USA
Interaction between Near-Wall Turbulent Flows and Compliant Surfaces ***Final Report, 1 Oct. 1998-30 Sep. 1999***
Lumley, John, Cornell Univ., USA; Rempfer, Dietmar, Cornell Univ., USA; Feb. 18, 2000; 12p; In English
Contract(s)/Grant(s): F49620-99-1-0012; AF Proj. 2307
Report No.(s): AD-A374877; AFRL-SR-BL-TR-00-064; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The general aim of this project is to get an improved understanding of the interaction between wall-generated turbulence and compliant surface coatings using analysis and direct numerical simulation in an integrated approach, with a view towards the reduction of turbulent sound production and turbulent drag. For this purpose, in a first step that is targeted at identifying interesting domains in the space of parameters describing properties of a compliant wall coating, we are developing low-dimensional models based on Galerkin projection of the Navier-Stokes equations onto systems of eigenfunction obtained via Proper Orthogonal Decomposition. Because of the relatively small effort involved in simulating and analyzing such models, this will allow us to scan large regions of parameter space, allowing us to find regions that lead to a reduction of turbulent drag and turbulent sound production. Among the ultimate goals of this project are thus, first, to obtain a fundamental understanding of flow-structure interaction phenomena for the case of the compliant- wall/turbulence interaction, and second, to use this understanding to enhance the flight performance of air vehicles by increasing their lift-to-drag ratio.
DTIC
Turbulent Flow; Aerodynamic Drag; Direct Numerical Simulation; Displacement; Domains; Navier-Stokes Equation

20000037739 Michigan Univ., Dept. of Aerospace Engineering, Ann Arbor, MI USA
A High Resolution Four-Dimensional Imaging Measurement System to Investigate Molecular Mixing in Gaseous Turbulent Shear Flows ***Final Report***
Dahm, W. J.; Aug. 28, 1999; 8p; In English
Contract(s)/Grant(s): F49620-98-1-0332; AF Proj. 3484
Report No.(s): AD-A374878; AFRL-SR-BL-TR-00-0068; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A state-of-the-art two-frequency cross-polarized Rayleigh imaging system was assembled to allow the first fully-resolved four-dimensional (three space dimensions plus time) non-invasive measurements of conserved scalar mixing in a gaseous turbulent shear flow.
DTIC
Turbulent Flow; Shear Flow; Imaging Techniques

20000037782 George Washington Univ., School of Engineering and Applied Science, Hampton, VA USA
Joint Institute for Advancement of Flight Sciences ***Final Report, Sep. 1995 - Nov. 1999***
Cutler, Andrew D., George Washington Univ., USA; [1999]; 8p; In English
Contract(s)/Grant(s): NCC1-217; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Experiments were designed, implemented, and evaluated in the thermal and fluid sciences at the NASA Langley Research Center. This research was conducted cooperatively with NASA employees using, where necessary, equipment and facilities provided by the U.S. Government. The research fell within the scope of the University Agreement between the NASA Langley Research Center and The George Washington University for Joint Research and Education Projects dated June 7, 8, 1994, which continues the Joint Institute for the Advancement of Flight Sciences (JIAFS).
Author
Flight Mechanics; Aerothermodynamics; Education

35
INSTRUMENTATION AND PHOTOGRAPHY

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

20000033740 Ohio Aerospace Inst., Cleveland, OH USA
Development of a Solar-Cell Dust Opacity Measurement Instrument for Mars Pathfinder
Landis, Geoffrey A., Ohio Aerospace Inst., USA; Jenkins, Phillip P., NYMA, Inc., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 313-317; In English; See also 20000033702; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

The atmosphere of Mars has a considerable load of suspended dust. Over time, this dust is deposits out of the atmosphere. The mechanism and the temporal and geographical variation of this deposition are not well characterized. Measurements of settling rates and dust properties are of considerable scientific interest. Atmospheric dust affects the atmospheric solar absorption and thus the heat balance of Mars, as well as serving as nucleation sites for water and CO2 frost. Knowledge of dust properties is of critical interest to design and prediction of the lifetime and power output of solar arrays, and also to design of mechanical mechanisms and radiators. An instrument has been designed and fabricated to measure the dust accumulation during the course of the Mars Pathfinder rover mission. The solar-cell coverglass transmission experiment will measure the change in optical opacity of a transparent coverglass as dust settles on the surface, and a quartz crystal monitor will measure the mass deposited.
Author
Fabrication; Solar Cells; Dust; Opacity; Measuring Instruments; Mars Atmosphere; Solar Arrays; Atmospheric Attenuation

20000033945 California Inst. of Tech., Dept. of Electrical Engineering, Pasadena, CA USA
Compact Holographic Read/Write Memory
Liu, Wenhai, California Inst. of Tech., USA; Psaltis, Demetri, California Inst. of Tech., USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 443-456; In English; See also 20000033909; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Abstract- We examine the primary challenges for building a practical and competitive holographic random access memory (HRAM) system, specifically size, speed, and cost. We show that a fast HRAM system can be implemented with a compact architecture by incorporating conjugate readout, a smart-pixel array, and a linear array of laser diodes. It provides faster random access time than hard disk (100 microseconds or less) and similar bandwidth as silicon storage with lower cost. Preliminary experimental results support the feasibility of this architecture. Our analysis shows that in order for the HRAM to become competitive, the principal tasks will be to reduce spatial light modulator (SLM) and detector pixel sizes to 1 micron, increase the output power of compact visible-wavelength lasers to several hundred milliwatts, and develop ways to raise the sensitivity of holographic media to the order of 1 cm/J.
Author
Holography; Random Access Memory; Data Storage

20000033946 Lucent Technologies, Bell Labs., Murray Hill, NJ USA

High Density Holographic Data Storage

Dhar, Lisa, Lucent Technologies, USA; Curtis, Kevin, Lucent Technologies, USA; Hale, Arturo, Lucent Technologies, USA; Schnoes, Melinda, Lucent Technologies, USA; Wilson, William, Lucent Technologies, USA; Tackitt, Michael, Lucent Technologies, USA; Hill, Adrian, Lucent Technologies, USA; Schilling, Marcia, Lucent Technologies, USA; Katz, Howard, Lucent Technologies, USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 457-466; In English; See also 20000033909; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The demand for increases in the capacity and speed of data storage tests the limits of conventional technologies and drives the search for new approaches. Optical holography has long held the promise of storage densities and data transfer rates far greater than those of traditional magnetic and optical systems. In the past, its realization has been frustrated by the lack of availability of suitable system components, the complexity of holographic multiplexing strategies, and perhaps most importantly, the absence of recording materials that satisfied the stringent requirements of holographic data storage. Here we report on the design and development of a high-performance photopolymer recording medium and on advances in the design of a holographic storage system that have enabled demonstrations of storage densities as high as 31.5 channel Gbits/sq in . We believe these results will provide the foundation for a practically realizable, high capacity storage system with fast transfer rates and low-cost, removable recording media.

Author

Data Storage; Holography

20000033985 NASA Marshall Space Flight Center, Huntsville, AL USA

Two Fiber Optical Fiber Thermometry

Jones, Mathew R., Arizona Univ., USA; Farmer, Jeffery T., NASA Marshall Space Flight Center, USA; Breeding, Shawn P., Tec-Masters, Inc., USA; Jan. 25, 2000; 1p; In English; Mechanical Engineering, 05 Nov. 2000, Orlando, FL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

An optical fiber thermometer consists of an optical fiber whose sensing tip is given a metallic coating. The sensing tip of the fiber is essentially an isothermal cavity, so the emission from this cavity will be approximately equal to the emission from a blackbody. Temperature readings are obtained by measuring the spectral radiative heat flux at the end of the fiber at two wavelengths. The ratio of these measurements and Planck's Law are used to infer the temperature at the sensing tip. Optical fiber thermometers have high accuracy, excellent long-term stability and are immune to electromagnetic interference. In addition, they can be operated for extended periods without requiring re-calibration. For these reasons. it is desirable to use optical fiber thermometers in environments such as the International Space Station. However, it has recently been shown that temperature readings are corrupted by emission from the fiber when extended portions of the probe are exposed to elevated temperatures. This paper will describe several ways in which the reading from a second fiber can be used to correct the corrupted temperature measurements. The accuracy and sensitivity to measurement uncertainty will be presented for each method.

Author

Optical Fibers; Temperature Measurement; Thermometers

20000034009 NASA Glenn Research Center, Cleveland, OH USA

Durability Evaluation of a Thin Film Sensor System With Enhanced Lead Wire Attachments on SiC/SiC Ceramic Matrix Composites

Lei, Jih-Fen, NASA Glenn Research Center, USA; Kiser, J. Douglas, NASA Glenn Research Center, USA; Singh, Mrityunjay, DYNACS Engineering Co., Inc., USA; Cuy, Mike, DYNACS Engineering Co., Inc., USA; Blaha, Charles A., Akima Corp., USA; Androjna, Drago, Akima Corp., USA; March 2000; 14p; In English

Contract(s)/Grant(s): RTOP 523-31-13

Report No.(s): NASA/TM-2000-209917; E-12154; NAS 1.15:209917; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An advanced thin film sensor system instrumented on silicon carbide (SiC) fiber reinforced SiC matrix ceramic matrix composites (SiC/SiC CMCs), was evaluated in a Mach 0.3 burner rig in order to determine its durability to monitor material/component surface temperature in harsh environments. The sensor system included thermocouples in a thin film form (5 microns thick), fine lead wires (75 microns diameter), and the bonds between these wires and the thin films. Other critical components of the overall system were the heavy, swaged lead wire cable (500 microns diameter) that contained the fine lead wires and was connected to the temperature readout, and ceramic attachments which were bonded onto the CMCs for the purpose of securing the lead wire cables, The newly developed ceramic attachment features a combination of hoops made of monolithic SiC

or SiC/SiC CMC (which are joined to the test article) and high temperature ceramic cement. Two instrumented CMC panels were tested in a burner rig for a total of 40 cycles to 1150 C (2100 F). A cycle consisted of rapid heating to 1150 C (2100 F), a 5 minute hold at 1150 C (2100 F), and then cooling down to room temperature in 2 minutes. The thin film sensor systems provided repeatable temperature measurements for a maximum of 25 thermal cycles. Two of the monolithic SiC hoops debonded during the sensor fabrication process and two of the SiC/SiC CMC hoops failed during testing. The hoops filled with ceramic cement, however, showed no sign of detachment after 40 thermal cycle test. The primary failure mechanism of this sensor system was the loss of the fine lead wire-to-thin film connection, which either due to detachment of the fine lead wires from the thin film thermocouples or breakage of the fine wire.
Author
Durability; Thin Films; Fiber Composites; Ceramic Fibers; Ceramics; Ceramic Matrix Composites; Silicon Carbides

20000034106 NASA Goddard Space Flight Center, Greenbelt, MD USA
Photogrammetrically Measured Distortions of Composite Structure Microwave Reflectors at -90K
Mule, Peter, NASA Goddard Space Flight Center, USA; Hill, Michael D., NASA Goddard Space Flight Center, USA; Sampler, Henry P., NASA Goddard Space Flight Center, USA; [2000]; 13p; In English; SPIE International Symposium, 2 Aug. 2000, USA; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Microwave Anisotropy Probe (MAP) Observatory, scheduled for a late 2000 launch, is designed to measure temperature fluctuations (anisotropy) and produce a high sensitivity and high spatial resolution (better than 0.3 deg. at 90 GHz.) map of the Cosmic Microwave Background (CMB) radiation over the entire sky between 22 and 90 GHz. MAP utilizes back-to-back composite Gregorian telescopes supported on a composite truss structure to focus the microwave signals into 10 differential microwave receivers. Proper position and shape of the telescope reflectors at the operating temperature of -90 K is a critical element to ensure mission success. We describe the methods and analysis used to validate the in-flight position and shape predictions for the reflectors based on photogrammetric metrology data taken under vacuum with the reflectors at -90 K. Contour maps showing reflector distortion were generated. The resulting reflector distortion data are shown to be crucial to the analytical assessment of the MAP instrument's microwave system in-flight performance.
Author
Anisotropy; Composite Structures; Microwave Probes; Photogrammetry; Reflectors; Distortion

20000034232 NASA Marshall Space Flight Center, Huntsville, AL USA
Quench Module Insert (QMI) and the Diffusion Module Insert (DMI) Furnace Development
Crouch, Myscha, NASA Marshall Space Flight Center, USA; Carswell, William, Alabama Univ., USA; Farmer, Jeff, NASA Marshall Space Flight Center, USA; Rose, Fred, Pace and Waite, Inc., USA; Tidwell, Paul, Micro Craft, Inc., USA; [2000]; 10p; In English; Space Technology and Application International Forum (STAIF-00), 30 Jan. - 3 Feb. 2000, Albuquerque, NM, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper presents, in viewgraph form, QMI (Quench Module Insert) and DMI (Diffusion Module Insert) furnace development. The topics include: 1) Furnace Module in Rack; 2) Quench Module Insert; 3) QMI in MSL Core; 4) Diffusion Module Insert; 5) QMI; and 6) QMI Development and Testing.
CASI
Diffusion; Furnaces; Modules; Inserts; High Temperature Tests

20000034907 NASA Marshall Space Flight Center, Huntsville, AL USA
SHIVA: Spaceflight Holography Investigation in a Virtual Apparatus
Trolinger, James D., MetroLaser, USA; Rangel, Roger, California Univ., USA; Coimbra, Carlos, Drexel Univ., USA; Lal, Ravindra B., Alabama A & M Univ., USA; Witherow, William, NASA Marshall Space Flight Center, USA; Rogers, Jan, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Aerospace Conference, 12 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-0699; No Copyright; Avail: Issuing Activity; Abstract Only

SHIVA, a NASA spaceflight program, will exploit a unique, holography-based, diagnostics tool to test and apply a new, more general analytical solution to a fundamental equation of motion. The equation describes particle dynamics in fluids in a microgravity environment, and our solution represents the first analytical solution of it. When gravity is removed the equation becomes much more complex and had been solved previously only by numerical means. After our analytical solution has been validated it will be used as a tool for making additional measurements of the gravity environment. Our experiment will be optimized for testing the model, measuring g, g-jitter, and other microgravity phenomena. We will also collect data for which no

current theory exists, This paper describes ground experiments and analysis that have been conducted by the investigator team to support the flight experiment.
Author
Holography; Microgravity; Equations of Motion; Gravimetry

20000036601 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
A Method for Systems Analysis and Specification with Performance, Cost and Reliability Requirements Applied to the Design of a Reaction Wheel ***Um Metodo de Analise e Especificacao de Sistemas Com Requisitos de Desempenho, Custo e Confiabilidade, Aplicado a Rodas de Reacao***
Amoroso, Anderson Levati, Instituto Nacional de Pesquisas Espacias, Brazil; 2000; 136p; In Portuguese
Report No.(s): INPE-7517-TDI/730; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

In the past, space design activities commonly emphasized mainly the system requirements. The available methods focused on functional aspects only. The cost was estimated at the end of the process. Recently, new design methodologies have been proposed. Among them, the design-to-cost (DTC) method was developed to include the cost as a parameter. In this work, we propose a DTC method for systems analysis and specification applied to the design of a reaction wheel. Its basic components are described. General information on system development is related. The object-oriented approach is used as a modeling tool. Performance indexes are defined. A set of algebraic equations describes the cost behavior as a function of system parameters. Reliability is evaluated secondary. The proposed model embodies many approaches to solve and/or optimize a problem with any level of complexity.
Author
Procedures; Systems Analysis; Specifications; Performance Prediction; Reliability; Reaction Wheels; Design to Cost

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LASERS AND MASERS

Includes parametric amplifiers. For related information see also 76 Solid-State Physics.

20000037814 Italian Air Force, Comando Lofistico, Rome, Italy
Laser Designation Pod on the Italian Air Force AM-X Aircraft: A Prototype Integration
Donzelli, Paolo, Italian Air Force, Italy; Marozza, Roberto, Italian Air Force, Italy; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A16-1 - A16-10; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

The paper describes the prototype integration, on the Italian Air Force AM-X aircraft, of the Thomson Convertible Laser Designation Pod. The integration was conducted within the Italian Air Force Official Test Centre, and the process adopted was devised to produce a quick, low-cost, and low-risk sub-system integration. Software had the greatest part in the project, and software-engineering methods have been used to support the effort. This integration is a good example of how a careful use of existing assets and experiences, together with the application of advanced software engineering techniques, can improve the effectiveness of an aircraft, keeping it up with the evolving needs. The integration is now being used as baseline by the aircraft manufacturer, thus reducing costs and times for the Italian Air Force.
Author
Software Engineering; Systems Integration; Pods (External Stores); Lasers

20000037952 Communications Research Lab., Tokyo, Japan
Miniature Nd: YVO4 Microchip Laser
Hyodo, Masaharu, Communications Research Lab., Japan; Kasai, Katsuyuki, Communications Research Lab., Japan; Zhou, Jun, Communications Research Lab., Japan; Ishizu, Mitsuo, Communications Research Lab., Japan; Carty, T., Communications Research Lab., Japan; Review of the Communications Research Laboratory; Sep. 1994; ISSN 0914-9279; Volume 40, No. 3, pp. 295-302; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Laser-diode-pumped microchip lasers have several advantages over traditional lasers, such as compactness and single-mode oscillation without additional cavity elements, but the size of the laser and pumping power range for single-mode operation are restricted by the pump-beam focusing optics. The output power and mode structure of the microchip laser depend strongly on the pump-beam spot size parameter Omega. We demonstrate a miniature Nd : YV04 microchip laser with simple pump-beam focusing optics and obtain small circular spot sizes by making changes in the position of the focusing lens. Using a pump-beam with an intensity radius Omega = 106 micron we obtain 314 mW of multi-longitudinal mode TEM(00) oscillation for 638 mW of absorbed

pump power, and by decreasing the pump power, obtain a maximum single-mode lambda = 1.064 micron output of 93 mW. We show that these results agree well with the simple end-pumped rate equation model.
Author
Semiconductor Lasers; Laser Pumping; Miniaturization; Lasers; Chips (Electronics); Neodymium Lasers; Yttrium Compounds; Vanadium Oxides

37
MECHANICAL ENGINEERING

Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

20000034236 GenCorp Aerojet, Azusa, CA USA
Integrated Advanced Microwave Sounding Unit-A (AMSU-A). Performance Verification Report: Antenna Drive Subsystem METSAT AMSU-A2 (PN:1331200-2, SN:108)
Haapala, C., GenCorp Aerojet, USA; Aug. 04, 1999; 114p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): AEROJET-11486; CDRL-208; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
This is the Performance Verification Report, Antenna Drive Subassembly, Antenna Drive Subsystem, METSAT AMSU-A2 (P/N 1331200-2, SN: 108), for the Integrated Advanced Microwave Sounding Unit-A (AMSU-A).
Author
Advanced Microwave Sounding Unit; Subassemblies; Performance Tests; Meteorological Satellites; Mechanical Drives; Earth Observing System (EOS)

20000034859 NASA Johnson Space Center, Houston, TX USA
STS-36: Hydrogen Turbo Pump Removal Preps
Feb. 02, 1990; In English; Videotape: 4 min. 50 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000043339; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS
Live footage shows workers preparing for the removal of the hydrogen pump turbo.
CASI
Hydrogen; Turbine Pumps; Fuel Pumps; Removal

20000036527 Department of the Navy, Washington, DC USA
Precision Hinge Mounting Stops
Nedderman, William H., Jr, Inventor; Jun. 14, 1999; 10p; In English
Patent Info.: Filed 14 Jun. 1999; US-Patent-Appl-SN-09,332,407
Report No.(s): AD-D019613; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche
The present invention relates to a precision hinge apparatus. To accurately and reproducibly set the angle of a hinge, especially a very small hinge, a precision hinge and angled mounting stops are provided. The device comprises a hinge joint having a fastener, such as a screw, connecting two bodies. A flat C-shaped mounting stop fits over the fastener and has two straight outer edges that contact each of the two bodies, respectively. The relative angle between the outer edges determines the set angle of the hinge.
DTIC
Hinges; Mounting

20000036534 SRS Technologies, Huntsville, AL USA
SSME Bearing and Seal Tester Data Compilation, Analysis, and Reporting; and Refinement of the Cryogenic Bearing Analysis Mathematical Model ***Final Report, Jan. 1992 - Jan. 2000***
Moore, James, SRS Technologies, USA; Marty, Dave, SRS Technologies, USA; Cody, Joe, SRS Technologies, USA; Jan. 31, 2000; 346p; In English
Contract(s)/Grant(s): NAS8-39379
Report No.(s): NASA/CR-2000-210139; NAS 1.26:210139; TR00-1017; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche
SRS and NASA/MSFC have developed software with unique capabilities to couple bearing kinematic modeling with high fidelity thermal modeling. The core thermomechanical modeling software was developed by SRS and others in the late 1980's and early 1990's under various different contractual efforts. SRS originally developed software that enabled SHABERTH (Shaft

Bearing Thermal Model) and SINDA (Systems Improved Numerical Differencing Analyzer) to exchange data and autonomously allowing bearing component temperature effects to propagate into the steady state bearing mechanical model. A separate contract was issued in 1990 to create a personal computer version of the software. At that time SRS performed major improvements to the code. Both SHABERTH and SINDA were independently ported to the PC and compiled. SRS them integrated the two programs into a single program that was named SINSHA. This was a major code improvement.
Author
Bearings; Turbine Pumps; Cryogenic Cooling; Cryogenics; Heat Transfer; Thermodynamics

38
QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

20000034125 Commissariat a l'Energie Atomique, Lab. d'Electronique de Technologie et d'Instrumentation, Grenoble, France
Non destructive testing of industrial pieces by radiography: quantitative characterization and 3D reconstruction by the way of a limited number of images
Retraint, F.; Dec. 31, 1998; 136p; In French; In English
Report No.(s): DE99-635205; No Copyright; Avail: Department of Energy Information Bridge

The non destructive testing of industrial pieces is evaluated on the basis of numerical radiographies.The context of the study is the online control of the fuel rods production. A direct model of a numerical radiography formation is proposed and detailed for an acquisition system consisting of a CCD video connected to a converter screen by an optical system. As this approach does not allow the determination of the measured matter thickness from the X-ray photograph, an approximate model based on realistic approximations of the industrial non destructive testing, has been developed. For the specific cases it is possible to inverse the model and to reach the quantitative information present in the x-ray photograph, in other words, the map of the X-rays measured matter thickness. It becomes then possible to access to the quantitative parameters of the possible defects present in the measured specimen, such as the surface and the bulk. to reach the 3D information on the defects a 3D reconstruction method, from 3 X-rays photographs, is proposed.The inverse problem is solved by the non convex energy minimization.
NTIS
Fuel Production; Radiography

20000034898 Northwestern Univ., Center for Quality Engineering and Failure Prevention, Evanston, IL USA
An Ultrasonic Technique to Determine the Residual Strength of Adhesive Bonds ***Final Report, 1 Mar. 1996 - 31 Aug. 1999***
Achenbach, J. D., Northwestern Univ., USA; Tang, Z., Northwestern Univ., USA; Aug. 04, 1999; 143p; In English
Contract(s)/Grant(s): NAG1-1813; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

In this work, ultrasonic techniques to nondestructively evaluate adhesive bond degradation have been studied. The key to the present approach is the introduction of an external factor which pulls the adhesive bond in the nonlinear range, simultaneously with the application of an ultrasonic technique. With the aid of an external static tensile loading, a superimposed longitudinal wave has.been used to obtain the slopes of the stress-strain curve of an adhesive bond at a series of load levels. The critical load, at which a reduction of the slope is detected by the superimposed longitudinal wave, is an indication of the onset of nonlinear behavior of the adhesive bond, and therefore of bond degradation. This approach has been applied to the detection of adhesive bond degradation induced by cyclic fatigue loading. Analogously to the longitudinal wave case, a superimposed shear wave has been used to obtain the effective shear modulus of adhesive layers at different shear load levels. The onset of the nonlinear behavior of an adhesive bond under shear loading has been detected by the use of a superimposed shear wave. Experiments show that a longitudinal wave can also detect the nonlinear behavior when an adhesive bond is subjected to shear loading. An optimal combination of ultrasonic testing and mechanical loading methods for the detection of degradation related nonlinear behavior of adhesive bonds has been discussed. For the purpose of a practical application, an ultrasonic technique that uses a temperature increase as an alternative to static loading has also been investigated. A general strain-temperature correspondence principle that relates a mechanical strain to a temperature has been presented. Explicit strain-temperature correspondence relations for both the tension and shear cases have been derived. An important parameter which quantifies the relation between the wave velocity and temperature has been defined. This parameter, which is indicative of adhesive bond nonlinearity and which can be conveniently obtained by an ultrasonic measurement, has been used as an indication of adhesive bond degradation. Experimental results have shown that the temperature increase method is a convenient and productive alternative to static loading. A technique which uses

the reflected waveform data to obtain the fundamental ultrasonic parameters (transit time, reflection coefficient and attenuation coefficient) of an adhesive bond has also been presented.
Author
Adhesive Bonding; Residual Strength; Ultrasonic Tests; Degradation; Cyclic Loads

20000036591 Alabama Univ., In-Line Process Control Lab., Huntsville, AL USA
Surface Characterization and Contamination ***Final Report***
Workman, Gary L., Alabama Univ., USA; Mar. 22, 1999; 12p; In English
Contract(s)/Grant(s): NAG8-1071; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Nondestructive characterization of surface contamination can play an extremely important role in improving quality in manufacturing processes. This area of interest led to the formation of a Surface Contamination Analysis Team (SCAT) at Marshall Space Flight Center, which is primarily concerned with critical bondlines and has provided the major focus for activities under this grant. In addition, determining minute levels of contamination on emerging aerospace systems fabricated from composites has also been an area of interest for which the methods being presented here can be used. Important considerations for the inspection methodologies are good sensitivity, large area coverage, robustness, portability and ease of use for normal production personnel. In parallel with the evaluation of detection methods, considerable effort has been made to developing good, uniform contamination films to use as calibration standards. This activity within itself has presented unique challenges. The development of NIR methods for detecting and identifying contaminants has been in progress for several years. Cooperative efforts between the University, NASA, and Thiokol Corporation has shown some useful results for implementation in both laboratory and on-line procedures.
Author
Nondestructive Tests; Contaminants; Surface Distortion; Detection; Fabrication; Identifying; Standards

39
STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress. For applications see 05 Aircraft Design, Testing and Performance and 18 Spacecraft Design, Testing and Performance.

20000034020 Virginia Univ., Dept. of Civil Engineering, Charlottesville, VA USA
Load Diffusion in Composite Structures ***Final Report, 25 Mar. 1998 - 24 Mar. 2000***
Horgan, Cornelius O., Virginia Univ., USA; Simmonds, J. G., Virginia Univ., USA; [2000]; 13p; In English
Contract(s)/Grant(s): NAG1-2031; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This research has been concerned with load diffusion in composite structures. Fundamental solid mechanics studies were carried out to provide a basis for assessing the complicated modeling necessary for large scale structures used by NASA. An understanding of the fundamental mechanisms of load diffusion in composite subcomponents is essential in developing primary composite structures. Analytical models of load diffusion behavior are extremely valuable in building an intuitive base for developing refined modeling strategies and assessing results from finite element analyses. The decay behavior of stresses and other field quantities provides a significant aid towards this process. The results are also amendable to parameter study with a large parameter space and should be useful in structural tailoring studies.
Derived from text
Composite Structures; Diffusion; Mathematical Models; Solid Mechanics; Loads (Forces)

20000034098 NASA Langley Research Center, Hampton, VA USA
Controlling Chaos Via Knowledge of Initial Condition for a Curved Structure
Maestrello, L., NASA Langley Research Center, USA; [2000]; 16p; In English; 6th; 6th Aeroacoustics Conference, 12-14 Jun. 2000, Lahaina, HI, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-2016; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Nonlinear response of a flexible curved panel exhibiting bifurcation to fully developed chaos is demonstrated along with the sensitivity to small perturbation from the initial conditions. The response is determined from the measured time series at two fixed points. The panel is forced by an external nonharmonic multifrequency and monofrequency sound field. Using a low power time-continuous feedback control, carefully tuned at each initial condition, produces large long-term effects on the dynamics toward taming chaos. Without the knowledge of the initial conditions, control may be achieved by destructive interference. In this

case, the control power is proportional to the loading power. Calculation of the correlation dimension and the estimation of positive Lyapunov exponents, in practice, are the proof of chaotic response.
Author
Chaos; Curved Panels; Nonlinearity; Control Systems Design

20000034887 International Centre for Theoretical Physics, Trieste, Italy
Elastic fracture in driven media
Lung Chiwei,; Wang Shenggang,; Long Qiyi,; Aug. 31, 1999; 9p; In English
Report No.(s): DE99-634318; IC-99/85; No Copyright; Avail: Department of Energy Information Bridge
Fracture as one of the mechanical properties of materials is structurally dependent. Defects, defect assemblies, grain boundaries and sub-boundaries materials, modify the local stress intensity factors intensively. Brittle fracture prefers to confine to the grain boundary where the specific surface energy is lower than that in the grain. Again, transgranular cracking may occur on the crystal cleavage plane or planes where the local toughness is lowered by dislocation interaction and motion. This paper shows the complexity of the fractal dimension or roughness index of fractured surfaces in materials with metallographic structures or in inhomogeneous media.
NTIS
Elastic Media; Fracturing

20000036606 Army Engineer District, Jacksonville, FL USA
Rivet Replacement Analysis *Final Report*
Reichle, Erich Edward; Dec. 1999; 92p; In English
Report No.(s): AD-A374408; WES-ITL-99-5; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy
Recently there has been much discussion concerning deterioration of the infrastructure in the USA. Associated with this concern is the decay of structures built with steel some 30 to 40 years ago. Examples are numerous and include bridges on our highways, school and office buildings, and hydraulic structures used in flood control and water supply, just to name a few. An integral part of each of these structures is their connections. Since riveted connections were widely used, there is particular interest in material loss due to corrosion in rivets and its effect on connection performance. Currently there is very limited information available to evaluate these effects and determine the structural integrity of the connection. This research is directed at developing criteria to determine when a corroded rivet should be replaced. This research develops numerical modeling to simulate the deterioration of a rivet. This model incorporates the stress that is developed from service loading. A two dimensional axisymmetric model is developed using a numerically integrated finite element analysis computer program. Service loads are applied to determine the state of stress within the rivet. Elements modeling the rivet head are then made inactive to stimulate the corrosion process. Additional analyses are performed incrementally reducing the number of elements modeling the rivet head to provide sufficient data to plot stress variations versus reduction of head area. This plot is used to identify a material loss threshold that may exist and its effect on rivet stability. in addition, it is proposed that this research be used to determine how much rivet head material can be lost before the rivet must be replaced.
DTIC
Rivets; Replacing; Deterioration

20000037693 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Scalability of the CTH Hydrodynamics Code on the Sun HPC 10000 Architecture *Final Report*
Schraml, Stephen J.; Kimsey, Kent D.; Feb. 2000; 27p; In English
Report No.(s): AD-A374979; ARL-TR-2173; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report presents an overview of an explicit message-passing paradigm for an Eulerian finite volume method for modeling solid dynamics problems involving shock wave propagation, multiple materials, and large deformations. Three-dimensional simulations of high velocity impact were conducted on the Sun HPC 10000 computer system. The scalability of the message-passing code on this symmetrical multiple processor architecture is presented and is compared to the ideal linear multiple processor performance. The computed results are also compared to experimental data for the purpose of validating the shock physics application on the Sun HPC 10000 system.
DTIC
Computerized Simulation; Hypervelocity Impact; Shock Waves; Penetration; Hydrodynamics

20000037695 Adtech Systems Research, Inc., Beavercreek, OH USA

Advanced Stochastic Techniques for Evaluating Reliability and Residual Strength of Damaged Structures ***Final Report, 17 May 1999 - 16 Feb. 2000***

Soni, Som R., Adtech Systems Research, Inc., USA; Xie, Ming, Adtech Systems Research, Inc., USA; Balan, Mohan, Adtech Systems Research, Inc., USA; Krajcinovic, Dusan, Arizona State Univ., USA; Feb. 2000; 75p; In English; Prepared in cooperation with Arizona State Univ., Mechanical and Aerospace Engineering, Tempe, AZ

Contract(s)/Grant(s): F33615-99-C-3605

Report No.(s): AD-A375021; AFRL-VA-WP-TR-2000; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

Report developed under SBIR contract for Topic AF99-278. A finite element based stochastic damage model has been developed in the present research program. The model has been shown to be very efficient in the stochastic modeling of damage and prediction of residual strength of materials and structures. In this report, the stochastic model is used to study the residual stiffness of a structure with a randomly distributed damage. The damage density threshold is predicted for the complete failure of a square plate. The model is also extended to study the random fiber distribution in a unidirectional composite material, and the corrosion damage of a plate. The present stochastic model can be used to study the vulnerability, fatigue and corrosion of air/space structures.

DTIC

Stochastic Processes; Damage Assessment; Reliability Analysis; Evaluation; Residual Strength; Damage; Spacecraft Structures; Finite Element Method

20000037735 Illinois Univ., Circle Dept. of Mechanical Engineering, Chicago, IL USA

An Isoparametric Three Dimensional Beam Element Using the Absolute Nodal Coordinate Formulation

Shabana, A. A., Illinois Univ., USA; Yakoub, R. Y., Illinois Univ., USA; Feb. 2000; 34p; In English

Contract(s)/Grant(s): DAAG55-97-1-0303

Report No.(s): AD-A374867; MBS00-1-UIC; ARO-35711.23-EG; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The description of a beam element by only the displacement of its center line leads to some difficulties in the representation of the torsion and shear effects. For instance such a representation does not capture the rotation of the beam as a rigid body about its own axis. This problem was circumvented in the literature by using a local coordinate system in the incremental finite element method or by using the multi body floating frame of reference formulation. The use of such a local element coordinate system leads to a highly nonlinear expression for the inertia forces as the result of the large element rotation. In this investigation, an absolute nodal coordinate formulation is presented for the large rotation and deformation analysis of three dimensional beam elements. This formulation leads to a constant mass matrix, and as a result, the vectors of the centrifugal and Coriolis forces are identically equal to zero. The formulation presented in this paper takes into account the effect of rotary inertia, torsion and shear effects, and ensures continuity of the slopes as well as the rotation of the beam cross section at the nodal points. Using the proposed formulation curved beams can be systematically modeled.

DTIC

Deformation; Finite Element Method; Beams (Radiation); Three Dimensional Models; Centrifugal Force; Displacement

20000037784 NASA Marshall Space Flight Center, Huntsville, AL USA

Effect of Crystal Orientation on Analysis of Single-Crystal, Nickel-Based Turbine Blade Superalloys

Swanson, G. R., NASA Marshall Space Flight Center, USA; Arakere, N. K., Florida Univ., USA; February 2000; 78p; In English

Report No.(s): NASA/TP-2000-210074; M-971; NAS 1.60:210074; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

High-cycle fatigue-induced failures in turbine and turbopump blades is a pervasive problem. Single-crystal nickel turbine blades are used because of their superior creep, stress rupture, melt resistance, and thermomechanical fatigue capabilities. Single-crystal materials have highly orthotropic properties making the position of the crystal lattice relative to the part geometry a significant and complicating factor. A fatigue failure criterion based on the maximum shear stress amplitude on the 24 octahedral and 6 cube slip systems is presented for single-crystal nickel superalloys (FCC crystal). This criterion greatly reduces the scatter in uniaxial fatigue data for PWA 1493 at 1,200 F in air. Additionally, single-crystal turbine blades used in the Space Shuttle main engine high pressure fuel turbopump/alternate turbopump are modeled using a three-dimensional finite element (FE) model. This model accounts for material orthotrophy and crystal orientation. Fatigue life of the blade tip is computed using FE stress results and the failure criterion that was developed. Stress analysis results in the blade attachment region are also presented. Results demonstrate that control of crystallographic orientation has the potential to significantly increase a component's resistance to fatigue crack growth without adding additional weight or cost.

Author

Single Crystals; Crystal Lattices; Crystals; Crystallography; Nickel Alloys; Heat Resistant Alloys; Turbine Blades; Blade Tips;

Turbine Pumps

20000038014 Boeing Defense and Space Group, Phantom Works, Seattle, WA USA
Grid Stiffened Structure Analysis Tool
Apr. 30, 1999; In English; CD-ROM contains the users documentation in a Word file plus the Grid 99 program in Excel spreadsheet
Contract(s)/Grant(s): NASA Order H-30249-D; No Copyright; Avail: CASI; C01, CD-ROM; A02, Diskette

The Grid Stiffened Analysis Tool contract is contract performed by Boeing under NASA purchase order H30249D. The contract calls for a ”best effort” study comprised of two tasks: (1) Create documentation for a composite grid-stiffened structure analysis tool, in the form of a Microsoft EXCEL spread sheet, that was developed by originally at Stanford University and later further developed by the Air Force, and (2) Write a program that functions as a NASTRAN pre-processor to generate an FEM code for grid-stiffened structure. In performing this contract, Task 1 was given higher priority because it enables NASA to make efficient use of a unique tool they already have; Task 2 was proposed by Boeing because it also would be beneficial to the analysis of composite grid-stiffened structures, specifically in generating models for preliminary design studies. The contract is now complete, this package includes copies of the user’s documentation for Task 1 and a CD ROM & diskette with an electronic copy of the user’s documentation and an updated version of the ”GRID 99” spreadsheet.
Derived from text
Applications Programs (Computers); Structural Analysis; Structured Grids (Mathematics); Structural Members; Stiffness; User Manuals (Computer Programs); Composite Structures

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GEOSCIENCES (GENERAL)

20000034083 Army Construction Engineering Research Lab., Champaign, IL USA
Stochastic Models of Plant Diversity: Application to White Sands Missile Range ***Final Report***
Cao, Xiangchi; Gertner, George Z.; MacAllister, Bruce A.; Anderson, Alan B.; Feb. 2000; 86p; In English
Report No.(s): AD-A374140; ERDC/CERL-TR-00-5; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Diversity is an average property of a community and is identified as the species variety and abundance. The study of biodiversity is important because it is one of the central themes in ecology; the diversity of a system is often seen as an indicator of the well-being of the system. In this study, we selected and defined theoretical statistical measures of plant diversity and developed theoretical dynamics models for plant communities. This project provides a new approach to measuring plant diversity through time. The stochastic dynamics modeled in this project contain two main components: deterministic processes and stochastic processes. Stochastic dynamics models make it possible to simulate plant diversity changes through time even without long-term observed data. Because both the time and space dimensions are included in these stochastic dynamics models, they have more extensive uses in assessing and monitoring plant communities. The potential applications of these models include (1) providing standard diversity measures, (2) monitoring the development of plant communities in terms of species diversity and structure diversity, (3) testing the significance of the influence of human activities on plant communities, and (4) estimating the rehabilitation time of a disturbed plant community.
DTIC
Mathematical Models; Stochastic Processes; Biological Diversity; Ecology

20000034171 Geological Survey, Water Resources Div., Indianapolis, IN USA
Water Resources Data for Indiana, Water Year 1999 ***Annual Report, 1 Oct. 1998 - 30 Sep. 1999***
Stewart, J. A.; Keeton, C. R.; Hammil, L. E.; Nguyen, H. T.; Majors, D. K.; Mar. 2000; 416p; In English
Report No.(s): PB2000-103432; USGS/WDR/IN-99/1; No Copyright; Avail: CASI; A18, Hardcopy; A04, Microfiche

Water resources data for the 1999 water year for Indiana consists of records of discharge, stage, and water quality of streams and wells; reservoir state and contents; and water levels in lakes and wells. This report contains records of discharge for 165 stream-gaging stations, stage for 7 stream stations, stage and contents for 1 reservoir, water quality for 4 streams, sediment analysis for 1 stream, water levels for 80 lakes and 94 observation wells. Also included are records of miscellaneous discharge measurements, not part of the systematic data-collection program.
NTIS
Water Resources; Surface Water; Ground Water; Hydrology

20000034260 Geological Survey, Water Resources Div., Altamonte Springs, FL USA

Water Resources Data for Florida, Water Year 1999, Volume 1B, Northeast Florida Ground Water ***Annual Report, 1 Oct. 1998 - 30 Sep. 1999***

Mar. 08, 2000; 352p; In English

Report No.(s): PB2000-103868; USGS/WDR/FL-99/Vol-1B; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche

The data for northeast Florida include continuous or daily discharge for 143 streams, periodic discharge for 3 streams, continuous or daily stage for 22 streams, periodic stage for 0 streams; peak stage and discharge for 1 stream; continuous or daily elevations for 134 lakes, periodic elevations for 16 lakes; continuous ground water levels for 60 wells, periodic ground-water levels for 940 wells; quality-of-water data for 29 surface-water sites and 60 wells.

NTIS

Water Resources; Hydrology; Ground Water; Surface Water; Water Quality; Water Sampling; Florida

20000036452 Lembaga Penerbangan dan Antariksa Nasional, Jakarta, Indonesia

Warta LAPAN, Volume 1

September 1999; ISSN 0126-9754; 48p; In Malay-Indonesian; See also 20000036453 through 20000036457; Copyright; Avail: Issuing Activity

+This paper presents Warta LAPAN (Indonesian National Institute of Aeronautics and Space). Volume 1. No. 3. The topics include: 1) An investigation of GCM (Global Circulation Model) CSIRO-9 (Commonwealth Scientific and Industrial Research Organization) External Divergency and Vorticity Profiles and Their Relationship to Rainfall; 2) A Date Time Series Autocorrelation Analysis of Annual Rainfall in Bandung 1952-1997; 3) Simulation of ENSO Phenomena Based on a Global Circulation Model; 4) An Analysis of Climate Change in Bandung Based on Rainfall Data; and 5) Management of Solid-State Rocket Motor Propulsion Static Testing Operations.

CASI

Indonesian Space Program; Atmospheric General Circulation Models; Aeronautics; Rain; Computerized Simulation

20000037754 Geological Survey, Water Resources Div., Columbus, OH USA

Use of Environmental Tracers to Evaluate Ground-Water Age and Water-Quality Trends in a Buried-Valley Aquifer, Dayton Area, Southwestern, Ohio

Rowe, G. L.; Shapiro, S. D.; Schlosser, P.; 1999; 94p; In English

Report No.(s): PB2000-103129; USGS/WRI-99-4113; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Chlorofluorocarbons (CFC method) and tritium and helium isotopes ((H-3 - He-3) method) were used as environmental tracers to estimate ground-water age in conjunction with efforts to develop a regional ground-water flow model of the buried-valley aquifer in the Dayton area, southwestern Ohio. This report describes results of CFC and water-quality sampling, summarizes relevant aspects of previously published work, and describes the use of (H-3 - He-3) ages to characterize temporal trends in ground-water quality of the buried-valley aquifer near Dayton, Ohio.

NTIS

Ground Water; Aquifers; Water Flow; Hydrology Models; Water Quality; Water Sampling; Trends

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EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography. For instrumentation see 35 Instrumentation and Photography.

20000033818 NASA Goddard Space Flight Center, Greenbelt, MD USA

Remote Sensing and the Kyoto Protocol: A Review of Available and Future Technology for Monitoring Treaty Compliance

Imhoff, Marc L., NASA Goddard Space Flight Center, USA; Rosenquist, A., NASA Goddard Space Flight Center, USA; Milne, A. K., NASA Goddard Space Flight Center, USA; Dobson, M. C., NASA Goddard Space Flight Center, USA; Qi, J., NASA Goddard Space Flight Center, USA; [2000]; 6p; In English; 28th; 28th International Symposium on Remote Sensing, 27-31 Mar. 2000, Cape Town, South Africa; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

An International workshop was held to address how remote sensing technology could be used to support the environmental monitoring requirements of the Kyoto Protocol. An overview of the issues addressed and the findings of the workshop are discussed.
Author
Remote Sensing; Microwave Sensors; Multispectral Radar; Imaging Techniques

20000033996 Alabama Univ., Center for Applied Optics, Huntsville, AL USA
Analysis of Lidar Remote Sensing Concepts ***Final Report, 10 Aug. 1997 - 10 Aug. 1998***
Spiers, Gray D., Alabama Univ., USA; [1998]; 186p; In English
Contract(s)/Grant(s): NAS8-97095; NASA Order H-28503-D
Report No.(s): NASA/CR-2000-210137; NAS 1.26:210137; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche
An orbiting coherent Doppler lidar for measuring winds is required to provide two basic pieces of data to the user community. The first is the line of sight wind velocity and the second is knowledge of the position at which the measurement was made. In order to obtain this data for targets of interest to the atmospheric community the instrument must also have a level of backscatter sensitivity sufficient to achieve the goal. Sensitivity analyses for the line of sight velocity and position requirements for two lidar instruments, one with a nadir angle of 30 deg. in a 300 km altitude, 58 deg. inclination orbit and the second for a 45 deg. nadir angle instrument in a 833 km altitude , 89 deg. inclination orbit are performed. The issues relating to the backscatter sensitivity of a coherent lidar have been well documented previously and are not discussed here other than to identify a space-specific issue that does not typically need to be considered for ground and aircraft based coherent lidars. Section 2 and appendices A1 and A2 document these sensitivity analyses. This contract was intended to develop requirements for a space shuttle (STS) based coherent lidar however, shortly after the award of this contract NASA MSFC won the SPARCLE program to put a coherent Doppler lidar on STS. Consequently much of the work conducted under this contract has been documented within the development of the SPARCLE project documentation. The relevant portions of the SPARCLE documentation are identified in section 3.0 and included in appendices A3 and A4. Section 4.0 briefly outlines miscellaneous other activities that occurred under this contract.
Author
Optical Radar; Remote Sensing; Data Processing; Doppler Radar; Backscattering

20000034000 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Melting Layer Model for Passive/Active Microwave Remote Sensing Applications, Part 2, Simulation of TRMM Observations
Olson, William S., Maryland Univ. Baltimore County, USA; Bauer, Peter, Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; Kummerow, Christian D., NASA Goddard Space Flight Center, USA; Tao, Wei-Kuo, Caelum Research Corp., USA; Jan. 04, 2000; 47p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The one-dimensional, steady-state melting layer model developed in Part I of this study is used to calculate both the microphysical and radiative properties of melting precipitation, based upon the computed concentrations of snow and graupel just above the freezing level at applicable horizontal gridpoints of 3-dimensional cloud resolving model simulations. The modified 3-dimensional distributions of precipitation properties serve as input to radiative transfer calculations of upwelling radiances and radar extinction/reflectivities at the TRMM Microwave Imager (TMI) and Precipitation Radar (PR) frequencies, respectively. At the resolution of the cloud resolving model grids (approx. 1 km), upwelling radiances generally increase if mixed-phase precipitation is included in the model atmosphere. The magnitude of the increase depends upon the optical thickness of the cloud and precipitation, as well as the scattering characteristics of ice-phase precipitation aloft. Over the set of cloud resolving model simulations utilized in this study, maximum radiance increases of 43, 28, 18, and 10 K are simulated at 10.65, 19.35 GHz, 37.0, and 85.5 GHz, respectively. The impact of melting on TMI-measured radiances is determined not only by the physics of the melting particles but also by the horizontal extent of the melting precipitation, since the lower-frequency channels have footprints that extend over 10''s of kilometers. At TMI resolution, the maximum radiance increases are 16, 15, 12, and 9 K at the same frequencies. Simulated PR extinction and reflectivities in the melting layer can increase dramatically if mixed-phase precipitation is included, a result consistent with previous studies. Maximum increases of 0.46 (-2 dB) in extinction optical depth and 5 dBZ in reflectivity are simulated based upon the set of cloud resolving model simulations.
Author
Melting; Microwave Imagery; Remote Sensing; Trmm Satellite; Atmospheric Models; Three Dimensional Models; Computerized Simulation

20000034092 NASA Goddard Space Flight Center, Greenbelt, MD USA

A Catchment-Based Approach to Modeling Land Surface Processes in a GCM, Part 2, Parameter Estimation and Model Demonstration

Ducharne, Agnes, Paris Univ., France; Koster, Randal D., NASA Goddard Space Flight Center, USA; Suarez, Max J., NASA Goddard Space Flight Center, USA; Stieglitz, Marc, Columbia Univ., USA; Kumar, Praveen, Illinois Univ., USA; Jan. 06, 2000; 50p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The viability of a new catchment-based land surface model (LSM) developed for use with general circulation models is demonstrated. First, simple empirical functions -- tractable enough for operational use in the LSM -- are established that faithfully capture the control of topography on the subgrid variability of soil moisture and the surface water budget, as predicted by theory. Next, the full LSM is evaluated offline. Using forcing and validation datasets developed for PILPS Phase 2c, the minimally calibrated model is shown to reproduce observed evaporation and runoff fluxes successfully in the Red-Arkansas River Basin. A complementary idealized study that employs the range of topographic variability seen over North America demonstrates that the simulated surface water budget does vary strongly with topography, which can, by itself, induce variations in annual evaporation as high as 20%.

Author

Earth Surface; Topography; Variability; Models; Surface Properties

20000034093 NASA Goddard Space Flight Center, Greenbelt, MD USA

A Catchment-Based Approach to Modeling Land Surface Processes in a GCM, Part 1, Model Structure

Koster, Randal D., NASA Goddard Space Flight Center, USA; Suarez, Max J., NASA Goddard Space Flight Center, USA; Ducharne, Agnes, UMR, France; Stieglitz, Marc, Columbia Univ., USA; Kumar, Praveen, Illinois Univ., USA; Jan. 06, 2000; 64p; In English; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A new strategy for modeling the land surface component of the climate system is described. The strategy is motivated by an arguable deficiency in most state-of-the-art land surface models (LSMs), namely the disproportionately higher emphasis given to the formulation of one-dimensional, vertical physics relative to the treatment of horizontal heterogeneity in surface properties -- particularly subgrid soil moisture variability and its effects on runoff generation. The new strategy calls for the partitioning of the continental surface into a mosaic of hydrologic catchments, delineated through analysis of high-resolution surface elevation data. The effective ”grid” used for the land surface is therefore not specified by the overlying atmospheric grid. Within each catchment, the variability of soil moisture is related to characteristics of the topography and to three bulk soil moisture variables through a well-established model of catchment processes. This modeled variability allows the partitioning of the catchment into several areas representing distinct hydrological regimes, wherein distinct (regime-specific) evaporation and runoff parameterizations are applied. Care is taken to ensure that the deficiencies of the catchment model in regions of little to moderate topography are minimized.

Author

Variability; Models; Earth Surface; Surface Properties; Topography

20000034095 NASA Goddard Space Flight Center, Greenbelt, MD USA

A Melting Layer Model for Passive/Active Microwave Remote Sensing Applications, Part 1, Model Formulation and Comparison with Observations

Olson, William S., Maryland Univ. Baltimore County, USA; Bauer, Peter, Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; Viltard, Nicolas F., Centre detudes des Environnements Terrestre et Planetaires, France; Johnson, Daniel E., Science Systems and Applications, Inc., USA; Tao, Wei-Kuo, NASA Goddard Space Flight Center, USA; Jan. 04, 2000; 75p; In English; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In this study, a 1-D steady-state microphysical model which describes the vertical distribution of melting precipitation particles is developed. The model is driven by the ice-phase precipitation distributions just above the freezing level at applicable gridpoints of ”parent” 3-D cloud-resolving model (CRM) simulations. It extends these simulations by providing the number density and meltwater fraction of each particle in finely separated size categories through the melting layer. The depth of the modeled melting layer is primarily determined by the initial material density of the ice-phase precipitation. The radiative properties of melting precipitation at microwave frequencies are calculated based upon different methods for describing the dielectric properties of mixed phase particles. Particle absorption and scattering efficiencies at the Tropical Rainfall Measuring Mission Microwave Imager frequencies (10.65 to 85.5 GHz) are enhanced greatly for relatively small (approx. 0.1) meltwater fractions. The relatively large number of partially-melted particles just below the freezing level in stratiform regions leads to significant microwave absorption, well-exceeding the absorption by rain at the base of the melting layer. Calculated precipitation backscatter efficiencies at the Precipitation Radar frequency (13.8 GHz) increase in proportion to the particle meltwater fraction,

leading to a ”bright-band” of enhanced radar reflectivities in agreement with previous studies. The radiative properties of the melting layer are determined by the choice of dielectric models and the initial water contents and material densities of the ”seeding” ice-phase precipitation particles. Simulated melting layer profiles based upon snow described by the Fabry-Szyrmer core-shell dielectric model and graupel described by the Maxwell-Garnett water matrix dielectric model lead to reasonable agreement with radar-derived melting layer optical depth distributions. Moreover, control profiles that do not contain mixed-phase precipitation particles yield optical depths that are systematically lower than those observed. Therefore, the use of the melting layer model to extend 3-D CRM simulations appears justified, at least until more realistic spectral methods for describing melting precipitation in high-resolution, 3-D CRM’s are implemented.
Author
Melting; Microwave Frequencies; Precipitation (Meteorology); Remote Sensing; Mathematical Models; Computerized Simulation

20000034244 Forest Service, Pacific Northwest Research Station, Portland, OR USA
Phytomass in Southwest Alaska ***Topical Report***
Mead, B. R.; Jan. 2000; 178p; In English
Report No.(s): PB2000-103857; FSRP-PNW-523; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche
Phytomass tables are presented for southwest Alaska. The methods used to estimate plant weight and occurrence in the river basin are described and discussed. Average weight for each sampled species of tree, shrub, grass, forb, lichen, and moss in 19 forest and 48 nonforest vegetation types is shown. Species frequency of occurrence and species constancy within the type are presented. Comparisons are made with the results of similar inventories of the Tanana River Basin and the southeast Alaska archipelago.
NTIS
Biomass; Forests; Grasses; Lichens; Vegetation

20000034254 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Project, Development and Evaluation of Pointwise Statistics and Contextual Classifiers for Polarimetric SAR Images
Projeto, Desenvolvimento e Avaliacao de Classificadores Estatisticos Pontuais e Contextuais Para Imagens sar Polarimetricas
Correia, Antonio Henrique, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 273p; In Portuguese; Original contains color illustrations
Report No.(s): INPE-7178-TDI/679; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche; C01, CD-ROM
The purposes of this study is to investigate, implement and test a Maximum Likelihood Classifier (MLC), associated to the Iterated Conditional Modes (ICM) contextual classifier, for eight neighborhood, developed by Vieira (1996), for multi-look Synthetic Aperture Radar (SAR) polarimetric data. The modeling of the data is made using the multiplicative model, where the speckle is modeled by Wishart multivariate complex distribution, while the backscatter is modeled by different distributions, depending on the degree of homogeneity of the imaged area. The distributions of the univariate (phase difference and intensity ratio) and bivariate (intensity pair and intensity-phase difference pair) multi-look polarimetric data are presented based on the assumption of the constant backscatter. Considering the modeling available for multi-look complex multivariate data (represented by the complex covariance matrix) at the moment a new distribution, denominated G(c)(sup 0) multivariate was developed in this study. This distribution models the data from areas considered extremely heterogeneous. Using statistical properties from polarimetric data it was implemented five classification routines, one for each kinds of univariate and bivariate polarimetric data and another which uses the multivariate distribution more appropriated for the complex multivariate data. This routines function using graphics interface and they are totally user-friendly. They were implemented inside the software ENVI 3.0, with the aim of using the several tools of this software in the processing and analysis of SAR images. to test the implemented routines it was used multi-look polarimetric images from SIR-C/X-SAR mission, in L and C bands, in attempt to discriminate nine classes of interest. With the finality of evaluate quantitatively the quality gain from classification obtained using polarimetric data under different statistical modeling, through the Kappa coefficient of agreement, different types of multi-look SAR data were used: univariate in amplitude (using the distribution most appropriate), univariate and bivariate polarimetric, multivariate in amplitude (using Normal multivariate distribution) and complex multivariate. The results show that the use of complex multivariate distribution produced a classification better than any other and it allowed the discrimination of the nine classes of interest, while the others ones with Normal multivariate distribution, univariate and bivariate polarimetric and the most appropriate univariate in amplitude only eight, six and four class, respectively, were discriminated in the same classification. Considering that the complex multivariate data are not always available, the results obtained from univariate and bivariate polarimetric data classification are also significant because it was possible to discriminate every class of interest in different classification. The use of the complex multivariate data allow, therefore, to obtain very good results in the discrimination of class such soybean (three)

and corn (two) cultivation periods, prepared soil, tillage, caatinga and river, as it is the case of the SIR-C/X-SAR image used in this study.
Author
Multivariate Statistical Analysis; Maximum Likelihood Estimates; Polarimetry; Radar Data; Data Processing; Image Classification; Radar Imagery; Synthetic Aperture Radar

20000034256 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Microwave Land Surface Emissivities Estimated from SSM/I Observations ***Estimativa de Emissividade da Superficie Continental a Partir de Dados de Satelite em Microondas***
deSouza, Rodrigo Augusto Ferreira, Instituto Nacional de Pesquisas Espacias, Brazil; 2000; 106p; In Portuguese; Original contains color illustrations
Report No.(s): INPE-7473-RSU/713; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Microwave emissivities of land surface were estimated from the Special Sensor Microwave/Imager (SSM/I) observations using the 19 and 85 GHz channels, and surface skin temperature data derived from the Tiros Operational Vertical Sounder (TOVS). The atmospheric contribution was calculated from simulations of the Atmospheric Transmission at Millimetric and sub-millimetric wavelengths (ATM) model. The microwave emissivities over Brazil were estimated for July and December, 1997, using the Radiative Transfer Equation (RTE). The emissivity polarization difference was performed to verify the land surface roughness patterns. The results show that the regional patterns and the vegetation seasonal changes retrieved from the land surface emissivities are compatible with the large scale topography and vegetation distributions. Thus, the estimation of the microwave emissivities of land surface may be used to retrieve some atmospheric parameters (clouds) and monitor the land surface (for instance, vegetation and floods).
Author
Microwave Emission; Radiative Transfer; Surface Temperature; Surface Roughness; Remote Sensing; Meteorological Parameters; Emissivity

20000036510 NASA Marshall Space Flight Center, Huntsville, AL USA
Applications of Fractal Analytical Techniques in the Estimation of Operational Scale
Emerson, Charles W., University of Western Michigan, USA; Quattrochi, Dale A., NASA Marshall Space Flight Center, USA; [2000]; 2p; In English, 16-23 Jul. 2000, Amsterdam, Netherlands; No Copyright; Avail: Issuing Activity; Abstract Only

The observational scale and the resolution of remotely sensed imagery are essential considerations in the interpretation process. Many atmospheric, hydrologic, and other natural and human-influenced spatial phenomena are inherently scale dependent and are governed by different physical processes at different spatial domains. This spatial and operational heterogeneity constrains the ability to compare interpretations of phenomena and processes observed in higher spatial resolution imagery to similar interpretations obtained from lower resolution imagery. This is a particularly acute problem, since longterm global change investigations will require high spatial resolution Earth Observing System (EOS), LANDSAT 7, or commercial satellite data to be combined with lower resolution imagery from older sensors such as LANDSAT TM and MSS. Fractal analysis is a useful technique for identifying the effects of scale changes on remotely sensed imagery. The fractal dimension of an image is a non-integer value between two and three which indicates the degree of complexity in the texture and shapes depicted in the image. A true fractal surface exhibits self-similarity, a property of curves or surfaces where each part is indistinguishable from the whole, or where the form of the curve or surface is invariant with respect to scale. Theoretically, if the digital numbers of a remotely sensed image resemble an ideal fractal surface, then due to the self-similarity property, the fractal dimension of the image will not vary with scale and resolution, and the slope of the fractal dimension-resolution relationship would be zero. Most geographical phenomena, however, are not self-similar at all scales, but they can be modeled by a stochastic fractal in which the scaling properties of the image exhibit patterns that can be described by statistics such as area-perimeter ratios and autocovariances. Stochastic fractal sets relax the self-similarity assumption and measure many scales and resolutions to represent the varying form of a phenomenon as the pixel size is increased in a convolution process. We have observed that for images of homogeneous land covers, the fractal dimension varies linearly with changes in resolution or pixel size over the range of past, current, and planned space-borne sensors. This relationship differs significantly in images of agricultural, urban, and forest land covers, with urban areas retaining the same level of complexity, forested areas growing smoother, and agricultural areas growing more complex as small pixels are aggregated into larger, mixed pixels. Images of scenes having a mixture of land covers have fractal dimensions that exhibit a non-linear, complex relationship to pixel size. Measuring the fractal dimension of a difference image derived from two images of the same area obtained on different dates showed that the fractal dimension increased steadily, then exhibited a sharp decrease at increasing levels of pixel aggregation. This breakpoint of the fractal dimension/resolution plot is related to the spatial domain or operational scale of the phenomenon exhibiting the predominant visible difference between the two images (in this case,

mountain snow cover). The degree to which an image departs from a theoretical ideal fractal surface provides clues as to how much information is altered or lost in the processes of rescaling and rectification. The measured fractal dimension of complex, composite land covers such as urban areas also provides a useful textural index that can assist image classification of complex scenes.
Author
Fractals; Stochastic Processes; Image Analysis; Imagery; Image Classification; Image Resolution

20000036602 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Land Use and Cover Multitemporal Mapping of SAO Sebastiao-SP Municipality Using Segmentation and Classification Techniques of TM-LANDSAT and HRV-Spot Images ***Mapeamento Multitemporal do Uso e Cobertura do Solo do Municipio de Sao Sebastiao: SP, Utilizano Tecnicas de Segmentacao e Classificacao de Imagens TM-Landstat e HRV-Spot***
Rodriguez, Ana Cristina Machado, Instituto Nacional de Pesquisas Espacias, Brazil; 2000; 98p; In Portuguese
Report No.(s): INPE-7510-PUD/39; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The permanent human influence on the environment has become an important problem for preservation and conservation of the natural resources. Therefore, the study of the changes along the time, has been of great importance for central and state governments alike. The objective of this research work is to show a multi-temporal mapping of land use and cover using TM and HRV images from LANDSAT 5 and Spot 3 satellites. The study area with an extension of 400,97 sq km corresponds to the municipality of Sao Sebastiao, that belongs to the administrative region of Sao Jose dos Campos. The choice of this city located at the north coast of Sao Paulo state, was based on its their land use diversity and urban growth rates, especially in the last years. TM-LANDSAT images (bands 3, 4 and 5) referring to 1988 and 1997 years and HRV-Spot (panchromatic- 1999) image were used in this study. From these images, land use and cover maps in 1:50.000 scale, were created using segmentation (growing regions) and supervised classification (Bhattacharrya distance) algorithms. The land use and cover dynamics were obtained through the crossing of thematic layers using the LEGAL language from the SPRING software. The high tendency of the urban growth in the municipality was confirmed by the results. This should trigger measures guided to diminish the degradation of the natural resources. The immediate enforcement of management plan based on the Ecological - Economic study of the municipality is highly recommended.
Author
Management Planning; Mapping; Segments; LANDSAT Satellites; Degradation; Conservation

20000036608 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Multispectral Image Segmentation Based on Hue Component of HSV Feature ***Segmentacao de Imagens Multiespectrais Baseada na Componente Matiz da Transformacao HSV***
daSilva, Davi Affonso, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 168p; In Portuguese; Original contains color illustrations
Report No.(s): INPE-7255-TDI/698; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Segmentation is a major step in remote sensing imagery analysis, being responsible for the images subdivision in its constitute parts. Segmentation methods traditionally applied for such data types are usually based on the analysis of digital pixel values thoughout several bands of a multispectral sensor. The analysis processes based on those methods may become rather expensive, in computational terms, specially considering the new trend of using hyperspectral sensors. Moreover, because most of these methods uses RGB color space, they usually conducts to segmentation mistakes due to illumination variation at the surface level. The HSV color space, which is derived from RGB color space, is a closer approach to the way that the human brain senses colors patterns. The HSV components features presents a better adequacy in addressing the problems above outlined for RGB processes. The aim of this work is to develop a multispectral image segmentation algorithm using hue component of the HSV features. Application results to several types of test images showed the feasibility and consistency of this method, particularly less sensitivity to illumination variation. However, more detailed assessment to several application fields is needed.
Author
Segments; Remote Sensing; Imaging Techniques; Sensory Perception

20000037945 NASA Goddard Space Flight Center, Greenbelt, MD USA
Passive Microwave Observation of Diurnal Surface Soil Moisture
Jackson, Thomas J., Agricultural Research Service, USA; ONeill, Peggy E., NASA Goddard Space Flight Center, USA; Swift, Calvin T., Massachusetts Univ., USA; Laboratory for Hydrospheric Processes Research Publications; 19970901; ISSN 0196-2892, pp. 11-12; Repr. from IEEE Transactions on Geoscience and Remote Sensing (IEEE), v. 35, no. 5, Sep. 1997; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Microwave radiometers operating at low frequencies are sensitive to surface soil moisture changes. Few studies have been conducted that have involved multifrequency observations at frequencies low enough to measure a significant soil depth and not be attenuated by the vegetation cover. Another unexplored aspect of microwave observations at low frequencies has been the impact of diurnal variations of the soil moisture and temperature on brightness temperature. In this investigation, observations were made using a dual frequency radiometer (1.4 and 2.65 GHz) over bare soil and corn for extended periods in 1994. Comparisons of emissivity and volumetric soil moisture at four depths for bare soils showed that there was a clear correspondence between the 1 cm soil moisture and the 2.65-GHz emissivity and between the 3-5 cm soil moisture and the 1.4-GHZ emissivity, which confirms previous studies. Observations during drying and rainfall demonstrate that new and unique information for hydrologic and energy balance studies can be extracted from these data.
Author
Soil Moisture; Brightness Temperature; Diurnal Variations; Microwave Imagery; Remote Sensing

20000037946 NASA Goddard Space Flight Center, Greenbelt, MD USA
Spatial Distribution and Pattern Persistence of Surface Soil Moisture and Temperature Over Prairie from Remote Sensing
Chen, Daoyi, Manchester Univ., UK; Engman, Edwin T., NASA Goddard Space Flight Center, USA; Brutsaert, Wilfried, Cornell Univ., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 7-8; Repr. from Remote Sensing of Environment (USA, Elsevier Science, Inc.), v. 61, 1997 p 347-360; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Images remotely sensed aboard aircraft during FIFE, namely, PBMR (microwave) soil moisture and NS001 thermal infrared surface temperature, were mapped on the same coordinate system covering the 20 km x 20 km experimental site. For both kinds of image data, the frequency distributions were close to symmetric, and the area average compared reasonably well with the ground based measurements. For any image on any given day, the correlation between the remotely sensed values and collocated ground based measurements over the area was usually high in the case of NS001 surface temperature but low in the case of PBMR soil moisture. On the other hand, at any given flux station the correlation between the PBMR and gravimetric soil moisture over all available days was usually high. The correlation pixel by pixel between images of PBMR on different days was generally high. The preservation of the spatial patterns of soil moisture was also evaluated by considering the correlation station by station between ground-based soil moisture measurements on different days; no persistence of spatial pattern was apparent during wet periods, but a definite pattern gradually established itself toward the end of each drying episode. The spatial patterns of surface temperature revealed by NS001 were not preserved even within a single day. The cross-correlations among the two kinds of images and the vegetation index NDVI were normally poor. This suggests that different processes of vegetation growth, and of the near-surface soil water and energy budgets.
Author
Spatial Distribution; Surface Temperature; Soil Moisture; Remote Sensing; Image Correlators

20000037963 Princeton Univ., Water Resources Program, NJ USA
Evaluation of Special Sensor Microwave/Imager Satellite Data for Regional Soil Moisture Estimation Over the Red River Basin
Lakshmi, Venkataraman, Princeton Univ., USA; Wood, Eric F., Princeton Univ., USA; Choudhury, Bhaskar J., Princeton Univ., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 53-54; Repr. from Journal of Applied Meteorology, v. 36, no. 10 p 1309-1328; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Regional-scale estimation of soil moisture using in situ field observations is not possible due to problems with the representativeness of the sampling and costs. Remotely sensed satellite data are helpful in this regard. Here, the simulations of 19- and 37-GHz vertical and horizontal polarization brightness temperatures and estimation of soil moistures using data from the Special Sensor Microwave/Imager (SSM/I) for 798 0.25 x 0.25 deg boxes in the southwestern plains region of the USA for the time period between 1 August 1987 and 31 July 1988 are presented. A coupled land-canopy-atmosphere model is used for simulating the brightness temperatures. The land-surface hydrology is modeled using a thin-layer hydrologic model. The canopy scattering is modeled using a radiative transfer model, and the atmospheric attenuation is characterized using an empirical model. The simulated brightness temperatures are compared with those observed by the SSM/I sensor aboard the Defense Meteoreological Satellite Program satellite. The observed brightness temperatures are used to derive the soil moistures using the canopy radiative transfer and atmospheric attenuation model. The discrepancies between the SSM/I-based estimates and the simulated soil moisture are discussed. The mean monthly soil moistures estimated using the 19-GHz SSM/I brightness temperature data are interpreted along with the mean monthly leaf area index and accumulated rainfall. The soil moistures estimated using the 19-GHz SSM/I data are used in conjunction with the hydrologic model to estimate cumulative monthly

evaporation. The results of the simulations hold promise for the utilization of microwave brightness temperatures in hydrologic modeling for soil moisture estimation.
Author
Microwave Imagery; Remote Sensing; Soil Moisture; Earth Surface; River Basins; Satellite Observation; Sampling

20000037964 Princeton Univ., Water Resources Program, NJ USA
Investigation of Effect of Heterogeneities in Vegetation and Rainfall on Simulated SSM/I Brightness Temperatures
Lakshmi, V., Princeton Univ., USA; Wood, E. F., Princeton Univ., USA; Choudhury, B. J., Princeton Univ., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 51-52; Repr. from International Journal of Remote Sensing, v. 18, no. 13, 1997 p 2763-2784; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Land surface characteristics: soil and vegetation, and rainfall inputs are distributed in nature. Representation of land surface characteristics and inputs in models is lumped at spatial scales corresponding to the grid size or observation density. Complete distributed representation of these characteristics or inputs is infeasible due to excessive computational costs or costs associated with maintaining dense observational networks. The measurements of microwave brightness temperatures by the SSM/I (Special Sensor Microwave Imager) are at resolutions of the order of 56 km x 56 km for 19 GHz and 33 km x 33 km for 37 GHz. At these resolutions, soil moisture and vegetation are not homogeneous over the measurement area. The experiments carried out in this study determine the effect of heterogeneities in vegetation (leaf area index) and input rainfall on simulated soil moisture and brightness temperatures and the inversion of brightness temperatures to obtain soil moisture estimates. This study would help us to understand the implications of using the SSM/I microwave brightness temperatures for soil moisture estimation. The consequences of treating rainfall inputs and vegetation over large land surface areas in a lumped fashion is examined. Simpler methods based on dividing the leaf area index or input rainfall into classes rather than explicit representation for representing heterogeneities in leaf area index and spatial distribution of rainfall is tested. It is seen that soil moisture is affected by the representation (lumped vs distributed) of rainfall and not leaf area index. The effect of spatially distributed soil moisture on the inversion of observed SSM/I brightness temperatures to obtain soil moisture estimates is investigated. The inversion process does not exhibit biases in the retrieval of soil moisture. The methodology presented in this paper can be used for any satellite sensor for purposes of analysis and evaluation.
Author
Microwave Imagery; Earth Surface; Brightness Temperature; Vegetation; Remote Sensing; Soil Moisture

20000037965 Princeton Univ., Water Resources Program, NJ USA
A Soil Canopy-Atmosphere Model for Use in Satellite Microwave Remote Sensing
Lakshmi, Venkataraman, Princeton Univ., USA; Wood, Eric F., Princeton Univ., USA; Choudhury, Bhaskar J., Princeton Univ., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 49-50; Repr. from Journal of Geophysical Research, v. 102, no. D6, 27 Mar. 1997 p 6911-6927; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Regional and global scale studies of land-surface-atmosphere interactions require the use of observations for calibration and validation. In situ field observations are not representative of the distributed nature of land surface characteristics, and large-scale field experiments are expensive undertakings. In light of these requirements and shortcomings, satellite observations serve our purposes adequately. The use of satellite data in land surface modeling requires developing a hydrological model with a thin upper layer to be compatible with the nature of the satellite observations and that would evaluate the soil moisture and soil temperature of a thin layer close to the surface. This paper outlines the formulation of a thin layer hydrological model for use in simulating the soil moistures and soil temperatures. This thin layer hydrological model is the first step in our attempt to use microwave brightness temperature data for regional soil moisture estimation. The hydrological model presented here has been calibrated using five years (1980-1984) of daily streamflow data for the Kings Creek catchment. The calibrated parameters are used to validate the daily streamflows for the next 5 year period (1985-1989). The comparison of surface soil moistures and surface temperatures for the period of the Intensive Field Campaigns (IFCS) during the First ISLSCP (International Satellite Land Surface Climatology Project) Field Experiment (FIFE) in 1987 is carried out and yields good results. The thin layer hydrological model is coupled with a canopy radiative transfer model and an atmospheric attenuation model to create a coupled soil-canopy-atmosphere model in order to study the effect of the vegetation and the soil characteristics on the Special Sensor Microwave Imager (SSM/I) brightness temperatures. The sensitivities of the brightness temperatures to the soil and vegetation

is examined in detail. The studies show that increasing leaf area index masks the polarization difference signal originating at the soil surface.
Author
Hydrology Models; Satellite Observation; Remote Sensing; Soil Moisture; Surface Temperature; Earth Surface; Microwave Imagery; Atmospheric Models; Canopies (Vegetation)

20000037969 NASA Goddard Space Flight Center, Greenbelt, MD USA
Remote Sensing of Dipole Rings
Hooker, Stanford B., NASA Goddard Space Flight Center, USA; Mied, Richard P., Naval Research Lab., USA; Brown, James W., Miami Univ., USA; Kirwan, A. D., Jr., Old Dominion Univ., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 37-38; Repr. from IEEE Transactions on Geoscience and Remote Sensing, v. 35, no. 6, Nov. 1997 p 1394-1399; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Historical satellite-derived sea surface temperature (SST) data are reanalyzed with a zebra color palette and a thermal separatrix method. The new results from this reanalysis are as follows: (a) Thirteen observational sequences of six rings from the Gulf Stream and the Brazil Current, which have historically been interpreted as solitary vortices or monopoles are shown to have a dipolar character; (b) some of these dipole rings have been observed in the open ocean, thereby eliminating the possibility that they are sustained by topographic interactions with the continental slope; (c) whether interacting with other features or evolving as isolated circulations, dipoles are seen to rotate within a relatively narrow range of approximately 4-8 deg/day (interacting) and 10-11 deg/day (isolated); and (d) feature tracking delineates energetic fluid in both vortices and eliminates the possibility of interpreting dipole rings as transient features produced by active monopoles and patches of entrained fluid.
Author
Satellite Observation; Sea Surface Temperature; Remote Sensing; Gulf Stream; Oceans

20000038011 NASA Goddard Space Flight Center, Greenbelt, MD USA
Soil Moisture: The Hydrologic Interface Between Surface and Ground Waters
Engman, Edwin T., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 9-10; Repr. from Rabat Symposium on Remote Sensing and Geographic Information Systems for Design and Operation of Water Resources Systems, p 129-140; In English; Remote Sensing and Geographic Information Systems for Design and Operation of Water Resources Systems, Apr. 1997, Rabat, Israel; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

A hypothesis is presented that many hydrologic processes display a unique signature that is detectable with microwave remote sensing. These signatures are in the form of the spatial and temporal distributions of surface soil moisture. The specific hydrologic processes that may be detected include groundwater recharge and discharge zones, storm runoff contributing areas, regions of potential and less than potential evapotranspiration (ET), and information about the hydrologic properties of soils. In basin and hillslope hydrology, soil moisture is the interface between surface and ground waters.
Author
Microwave Imagery; Remote Sensing; Soil Moisture; Ground Water; Hydrological Cycle; Earth Surface

20000038045 NASA Goddard Space Flight Center, Greenbelt, MD USA
Surface Energy Heat Fluxes Using Remotely Sensed Parameters
Toll, David L., NASA Goddard Space Flight Center, USA; Vukovich, Fred M., Science Systems and Applications, Inc., USA; Pontikes, Elizabeth G., Yale Univ., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 267-268; Repr. from Proceedings of the Third International Workshop on Applications of Remote Sensing in Hydrology p 337-344; In English; 3rd; Applications of Remote Sensing in Hydrology, 16-18 Oct. 1996, Greenbelt, MD, USA; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Realistic estimates of surface energy heat fluxes are needed for the study of water and energy interactions between the land and atmosphere. The primary objective of this work is to study the estimation of surface heat energy fluxes using remote sensing derived parameters under different spatial and temporal conditions. Surface energy fluxes and remote sensing derived data from two sources were analyzed. First, we used surface heat flux, remote sensing, and ancillary data from the International Satellite Land Surface Climatology Project (ISLSCP), mapped at a 1 deg. x 1 deg. grid. Second, we used NOAA AVHRR (1 km), weather station, and ancillary data to derive estimates of surface latent and sensible heat energy fluxes over a 100 sq kilometers area for three test sites: 1) First ISLSCP Field Experiment (FIFE) grassland site, Konza Prairie, Kansas; 2) Howland, Maine Forest Ecosystem Dynamics Site; and 3) Walnut Gulch, scrubland site, surrounding Tombstone, Arizona. Satellite derived estimates of

land surface temperature, surface albedo, and spectral vegetation index are used in selected models to provide estimates of surface heat fluxes. Analysis of results from the 1 deg. x 1 deg. grid for North America indicated there were similar, overall correlations between sensible and latent heat energy fluxes versus remotely sensed vegetation index and ground temperature during dry and wet year conditions. However, there were significant differences in correlations between years when stratified by land cover class. Analysis of 100 km x 100 km data (1 km resolution) indicated partitioning the areas in to primary versus secondary cover, with the secondary cover comprising less than 5% of the area, significantly improved surface heat energy flux estimates.
Author
Earth Surface; Surface Energy; Remote Sensing; Satellite Observation; Surface Temperature; Flux Quantization; Heat Flux

20000038046 NASA Goddard Space Flight Center, Greenbelt, MD USA
Simultaneous Measurements of Water Vapor Profiles From Airborne MIR and LASE
Wang, J. R., NASA Goddard Space Flight Center, USA; Racette, P., NASA Goddard Space Flight Center, USA; Triesky, M. E., NASA Goddard Space Flight Center, USA; Browell, E. V., NASA Langley Research Center, USA; Ismail, S., NASA Langley Research Center, USA; Chang, L. A., Futuretech Corp., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 271-272; Repr. from Proceedings of 1997 International Geoscience and Remote Sensing Symposium (IGARSS 1997), v. 4 p 1969-1971; In English; Geoscience and Remote Sensing, 3-8 Aug. 1997, Singapore, Singapore
Report No.(s): IEEE-97CH36042; LC-97-70575; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

A NASA ER-2 aircraft flight with both Millimeter-wave Imaging radiometer (MIR) and lidar Atmospheric Sensing Experiment (LASE) was made over ocean areas in the eastern USA on September 25, 1995. The water vapor profiles derived from both instruments under both clear and cloudy conditions are compared in this paper. It is shown that good agreement is found between the MIR-derived and the LASE-measured water vapor profiles over the areas of clear-sky condition. In the cloudy areas, the MIR-retrieved values at the altitudes of the cloud layers and below are generally higher than those measured by the LASE.
Author
Atmospheric Moisture; Radiometers; Atmospheric Sounding; Microwave Imagery; Optical Radar; Water Vapor

20000038047 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Effects of Laterite and Associated Terrain Components on PBMR Response in HAPEX-Sahel
Teng, William L., Hughes STX, Inc., USA; Choudhury, Bhaskar J., NASA Goddard Space Flight Center, USA; Wang, James R., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 67-68; Repr. from Journal of Hydrology, v. 188-189, 1997 p 310-329; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Terrain characteristics such as roughness and vegetation have been shown to significantly affect the interpretation of microwave brightness temperatures (T(B)s) for mapping soil moisture. This study, a part of the 1992 HAPEX-Sahel experiment (Hydrologic Atmospheric Pilot Experiment in the Sahel), aimed to determine the effects of laterite and associated terrain components (i.e. vegetation, soil, and exposed water bodies) on the T(B) response of the Pushbroom Microwave Radiometer (PBMR, L-band, 21 cm wavelength), using the NS001 Thematic Mapper Simulator data as a surrogate for ground data. Coincident PBMR and NS001 data acquired from the high altitude (about 1500 m) long transect flights were processed to obtain TBs and radiances, respectively. The transects covered a range of moisture conditions. For this preliminary evaluation, no atmospheric corrections were applied, and the data sets were aligned by matching the acquisition times of the data records. NS001 pixels (about 4 m) were averaged to approximate the resolution of the PBMR (about 450 m), before their flight line data were compared. The laterite plateaux were found to have a surprisingly strong effect on the PBMR T(B) response. T(B) variations along the flight line could largely be explained by a combination of density and dielectric properties of laterite. The effect of surface moisture was distinguishable from the laterite effect, with the distinction apparently related to the occurrence of ephemeral pools of water after rainfall. Model simulated T(B)s agreed reasonably well with the observed T(B)s.
Author
Laterites; Terrain; Brightness Temperature; Data Acquisition; Remote Sensors; Soil Moisture; Hydrology; Earth Surface

20000038048 NASA Goddard Space Flight Center, Greenbelt, MD USA
Multiangle Observations of Directional Reflectances of Snow Fields
Chang, A.T.C., NASA Goddard Space Flight Center, USA; Hall, D. K., NASA Goddard Space Flight Center, USA; Foster, J. L., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 87-88; Repr. from Journal of Remote Sensing, Supplement, v. 1, May 1997 p 11-17; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Accurate measurements of snow areas and surface albedo are crucial to advancing our understanding of the global climate system. This is because of the highly reflective nature of snow combined with its large surface coverage (snow can cover up to 40 % of the Earth's land surface during the Northern Hemisphere winter). The reflectance of snow varies with both solar incidence angle and the viewing angle. Visible sensors with different spatial resolutions have been used to infer the snow parameters. Currently, only nadir-viewing directional reflectance data are available from satellite observations. Observations at multiple angles are needed to infer the hemispheric reflectance albedo of snow fields. We propose to study the directional reflectance of snow fields using POLDER data, which contains information from different viewing angles and polarization. POLDER was successfully launched an the ADEOS-1 satellite in August, 1996, however, because POLDER data are not yet available, data from ASAS, a pointable, airborne spectroradiometer, were used in this study. Data collected over Glacier National Park of Montana show strong angular dependence. Preliminary results confirm the anisotropic nature of the snow reflectance. Knowledge of the bi-directional reflectance function(BDRF) of snow -covered surfaces is the key to developing a true albedo model in the future.
Author
Earth Albedo; Climatology; Bidirectional Reflectance; Snow; Climate Change; Radiance; Spectral Reflectance

20000038049 NASA Goddard Space Flight Center, Greenbelt, MD USA
Comparison of Satellite-Derived with Ground-Based Measurements of the Fluctuations of the Margins of Vatnajokull, Iceland 1973-1992
Williams, Richard S., Jr., Geological Survey, USA; Hall, Dorothy K., NASA Goddard Space Flight Center, USA; Sigurdsson, Oddur, National Energy Authority, Iceland; Chien, Janet Y. L., General Sciences Corp., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 101-102; Repr. from Ann. Glaciol., v. 24 p 72-80; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Vatnajokull, Iceland, is the Earth's most studied ice cap and represents a classical glaciological field site on the basis of S. Palsson's seminal glaciological field research in the late 18th century. Since the 19th century, Vatnajokull has been the focus of an array of glaciological studies by scientists from many nations, including many remote-sensing investigations since 1951. LANDSAT-derived positions of the termini of 11 outlet glaciers of Vatnajokull were compared with frontal positions of six of these 11 outlet glaciers determined by field observations during the period 1973-92. The largest changes during the 19 year period (1973-92) occurred in the large lobate, surge-type outlet glaciers along the southwestern, western, and northern margins of Vatnajokull, Tungnaarjokull receded - 1413 +/- 112 m (1380 +/- 1 m from ground observations), and Bruarjokull receded -1975 +/- 191 m (-2096 +/- 5 m from extrapolated ground observations) between 1973 and 1992. Satellite images can be used to delineate glacier margin changes on a time-lapse basis, if the glacier margin can be spectrally discriminated from terminal moraines and sandur deposits and if the advance/recession is larger than maximum image pixel size. "Local knowledge" of glaciers is critically important, however, in the accurate delineation of glacier margins on LANDSAT images.
Author
Satellite Imagery; Remote Sensing; Iceland; Glaciers; Delineation; Land Ice

20000038051 NASA Goddard Space Flight Center, Greenbelt, MD USA
Airborne Millimeter-Wave Radiometric Observations of Cirrus Clouds
Wang, J. R., NASA Goddard Space Flight Center, USA; Racette, P., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 269-270; Repr. from 1997 International Geoscience and Remote Sensing Symposium (IGARSS 1997), v. 4 p 1737-1739; In English; Geoscience and Remote Sensing, 3-8 Aug. 1997, Singapore, Singapore
Report No.(s): IEEE-97CH36042; LC-97-70575; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

This paper reports the first radiometric measurements of cirrus clouds in the frequency range of 89-325 GHz from a high-altitude aircraft flight. The measurements are conducted with a Millimeter-wave Imaging Radiometer (MIR) on board the NASA ER-2 aircraft over a region in northern Oklahoma. Aboard the same aircraft are a cloud lidar system and a multichannel radiometer operating at the visible and infrared wavelengths. The instrument ensemble is well suited for identifying cirrus clouds. It is shown that the depressions in brightness temperatures associated with a few intense cirrus clouds occur at all frequency channels of the MIR. Estimates of total ice water path of the cirrus clouds are derived from comparisons of radiative transfer calculations and observed brightness depressions.
Author
Cirrus Clouds; Millimeter Waves; Optical Radar; Radiometers; Remote Sensing; Microwaves; Atmospheric Sounding

20000038103 NASA Goddard Space Flight Center, Greenbelt, MD USA

Timescales of Land Surface Evapotranspiration Response

Scott, Russell, Agricultural Research Service, USA; Entekhabi, Dara, Massachusetts Inst. of Tech., USA; Koster, Randal, NASA Goddard Space Flight Center, USA; Suarez, Max, NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 65-66; Repr. from Journal of Climate, v. 10, no. 4, Apr. 1997 p 559-566; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Soil and vegetation exert strong control over the evapotranspiration rate, which couples the land surface water and energy balances. A method is presented to quantify the timescale of this surface control using daily general circulation model (GCM) simulation values of evapotranspiration and precipitation. by equating the time history of evaporation efficiency (ratio of actual to potential evapotranspiration) to the convolution of precipitation and a unit kernel (temporal weighting function), response functions are generated that can be used to characterize the timescales of evapotranspiration response for the land surface model (LSM) component of GCMS. The technique is applied to the output of two multiyear simulations of a GCM, one using a Surface-Vegetation-Atmosphere-Transfer (SVAT) scheme and the other a Bucket LSM. The derived response functions show that the Bucket LSM's response is significantly slower than that of the SVAT across the globe. The analysis also shows how the timescales of interception reservoir evaporation, bare soil evaporation, and vegetation transpiration differ within the SVAT LSM. Author

Atmospheric General Circulation Models; Earth Surface; Evapotranspiration; Vegetation; Soils

20000038105 NASA Goddard Space Flight Center, Greenbelt, MD USA

Improved Passive Microwave Algorithms for North America and Eurasia

Foster, James, NASA Goddard Space Flight Center, USA; Chang, Alfred, NASA Goddard Space Flight Center, USA; Hall, Dorothy, NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 203-204; Repr. from Proceedings of the Third International Workshop on the Applications of Remote Sensing in Hydrology p 63-70; In English; 3rd; Applications of Remote Sensing in Hydrology, 16-18 Oct. 1996, Greenbelt, MD, USA; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Microwave algorithms simplify complex physical processes in order to estimate geophysical parameters such as snow cover and snow depth. The microwave radiances received at the satellite sensor and expressed as brightness temperatures are a composite of contributions from the Earth's surface, the Earth's atmosphere and from space. Owing to the coarse resolution inherent to passive microwave sensors, each pixel value represents a mixture of contributions from different surface types including deep snow, shallow snow, forests and open areas. Algorithms are generated in order to resolve these mixtures. The accuracy of the retrieved information is affected by uncertainties in the assumptions used in the radiative transfer equation (Steffen et al., 1992). One such uncertainty in the Chang et al., (1987) snow algorithm is that the snow grain radius is 0.3 mm for all layers of the snowpack and for all physiographic regions. However, this is not usually the case. The influence of larger grain sizes appears to be of more importance for deeper snowpacks in the interior of Eurasia. Based on this consideration and the effects of forests, a revised SMMR snow algorithm produces more realistic snow mass values. The purpose of this study is to present results of the revised algorithm (referred to for the remainder of this paper as the GSFC 94 snow algorithm) which incorporates differences in both fractional forest cover and snow grain size. Results from the GSFC 94 algorithm will be compared to the original Chang et al. (1987) algorithm and to climatological snow depth data as well.

Author

Microwave Sensors; Snow Cover; Forests; Algorithms; Climatology; Grain Size; Remote Sensing

20000038106 NASA Goddard Space Flight Center, Greenbelt, MD USA

An Extended Kalman Filter to Assimilate Altimetric Data into a Non-Linear Model of the Tropical Pacific

Gourdeau, L., Office de la Recherche Scientifique et Technique Outre-Mer, New Caledonia; Verron, J., Centre National de la Recherche Scientifique, France; Murtugudde, R., NASA Goddard Space Flight Center, USA; Busalacchi, A. J., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 211-212; Repr. from Proceedings of the Internationational Symposium on Monitoring the Oceans in the 2000s: An Integrated Approach. Poster Session: Dynamic Oceanography; In English; Monitoring the Oceans in the 2000s: An Integrated Approach, 15-17 Oct. 1997, Biarritz, France

Report No.(s): Paper 4-34; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

A new implementation of the extended Kaman filter is developed for the purpose of assimilating altimetric observations into a primitive equation model of the tropical Pacific. Its specificity consists in defining the errors into a reduced basis that evolves in time with the model dynamic. Validation by twin experiments is conducted and the method is shown to be efficient in quasi real conditions. Data from the first 2 years of the TOPEX/Poseidon mission are assimilated into the Gent & Cane [1989] model. Assimilation results are evaluated against independent in situ data, namely TAO mooring observations.
Author
Satellite Altimetry; Kalman Filters; Mathematical Models; Pacific Ocean; Tropical Regions; Data Processing; Radar Data

20000038107 Mullard Space Science Lab., Dorking, UK
Derivation of Lake Areas and Elevations for the Mackenzie Basin Using Satellite Remote Sensing
Birkett, Charon, Mullard Space Science Lab., UK; Kite, Geoff, National Hydrology Research Inst., Canada; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 187-188; Repr. from Proceedings of the Third International Workshop, no. 17, Oct. 1996 p 19-32; In English; 3rd; Applications of Remote Sensing in Hydrology, 16-18 Oct. 1996, Greenbelt, MD, USA; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Modelling hydrological processes in large watersheds flowing to the Arctic ocean is one step towards larger-scale modelling of the global water and energy cycles. Models of the Mackenzie River Basin (Northern Canada) are currently available but omit explicit routing of river flows through the three main lakes - Athabasca, Great Slave Lake and Great Bear Lake (Kite et al, 1994). These lakes occupy an area of 65,000 sq km but little gauge information is available. The levels of the lakes are only measured at a few points on the circumferences and river flows are only measured downstream. The hydraulic relationships between level/discharge and level/area/volume are uncertain. It has been previously shown that satellite remote sensing can be utilised in providing measurements of both lake surface area using imaging techniques and lake level using radar altimetry (Birkett, 1994). Here, we explore the application of these techniques to derive the lake levels and areas for the Mackenzie Basin lakes.
Author
Satellite Observation; Remote Sensing; Radio Altimeters; River Basins; Lakes; Elevation

20000038108 NASA Goddard Space Flight Center, Greenbelt, MD USA
Snow Parameters Derived from Microwave Measurements During the BOREAS Winter Field Campaign
Chang, A. T. C., NASA Goddard Space Flight Center, USA; Foster, J. L., NASA Goddard Space Flight Center, USA; Hall, D. K., NASA Goddard Space Flight Center, USA; Goodison, B. E., Atmospheric Environment Service, Canada; Walker, A. E., Atmospheric Environment Service, Canada; Metcalfe, J. R., Atmospheric Environment Service, Canada; Harby, A., Norwegian Hydrotechnical Lab., Norway; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 125-126; Repr. from Journal of Geophysical Research, v. 102, no. D24, 26 Dec. 1997 p 29,663-29,671; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Passive microwave data have been used to infer the snow-covered area and snow water equivalent (SWE) over forested areas, but the accuracy of these retrieved snow parameters cannot be easily validated for heterogeneous vegetated regions. The Boreal Ecosystem-Atmosphere Study Winter Field Campaign provided the opportunity to study the effect of boreal forests on snow parameter retrieval in detail. Microwave radiometers (18, 37, and 92 GHz) were flown on board the Canadian National Aeronautical Establishment's Twin Otter. Flight lines covered both the southern study area near Prince Albert and the northern study area near Thompson, Canada. During the 1994 winter campaign, extensive ground-based snow cover information, including depth, density, and grain size, was collected along most of the flight lines, jointly by U.S. and Canadian investigators. Satellite data collected by the special sensor microwave imager are also used for comparison. Preliminary results reconfirmed the relationship between microwave brightness temperature and SWE. However, the effect of forest cover observed by the aircraft sensors is different from that of the satellite observations. This is probably due to the difference in footprint averaging. There were also several flight lines flown over Candle Lake and Waskesiu Lake to assess lake ice signatures. Preliminary results show the thickness of the lake ice may be inferred from the airborne microwave observations. The microwave signature relationship between lake ice and snow matches the results from radiative transfer calculations.
Author
Snow; Microwave Imagery; Brightness Temperature; Forests; Lake Ice; Satellite Observation; Remote Sensing

20000038112 NASA Goddard Space Flight Center, Greenbelt, MD USA
Improved IRI Predictions for the GEOSAT Time Period
Bilitza, D., Hughes STX, Inc., USA; Bhardwaj, S., Hughes STX, Inc., USA; Koblinsky, C., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 115-116; Repr. from Advances in Space Research

(Pergamon), v. 20, no. 9 p 1755-1760; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Single-frequency altimeter measurements require an estimate of the signal retardation effect in the ionosphere. Ionospheric models like the International Reference Ionosphere (IRI) are being used to obtain these correction factors. Incorporation of worldwide ionosonde measurements is discussed as a way towards more accurate predictions. Using measurements of the F peak critical frequency (foF2) from more than 70 ionosondes AC have derived (hour and month dependent) regional and global ionospheric-effective solar indices. Replacing the solar index in IRI with these new indices we could improve the IRI estimates for the GEOSAT time period (1986-1989) by a few percent.

Author

Earth Ionosphere; Ionosondes; Atmospheric Models; Frequencies; Altimetry; Satellite Observation

20000038118 NASA Goddard Space Flight Center, Greenbelt, MD USA

Estimation of Soil Moisture for Vegetated Surfaces Using Multi-Temporal L-Band SAR Measurements

Shi, Jian-Cheng, California Univ., USA; Sun, G., NASA Goddard Space Flight Center, USA; Hsu, A., NASA Goddard Space Flight Center, USA; Wang, J., NASA Goddard Space Flight Center, USA; ONeill, P., NASA Goddard Space Flight Center, USA; Ranson, J., NASA Goddard Space Flight Center, USA; Engman, E. T., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 261-261; Repr. from Proceedings of the 1997 International Geoscience and Remote Sensing Symposium (IGARSS 1997) v. 3 p 1269-1271; In English; Geoscience and Remote Sensing, 3-8 Aug. 1997, Singapore, Singapore

Report No.(s): IEEE-97CH36042; LC-97-70575; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

This paper demonstrates the technique to estimate ground surface and vegetation scattering components, based on the backscattering model and the radar decomposition theory, under configuration of multi-temporal L-band polarimetric SAR measurement. This technique can be used to estimate soil moisture of vegetated surface.

Author

Synthetic Aperture Radar; Soil Moisture; Vegetation; Radar Measurement; Remote Sensing

20000038120 NASA Goddard Space Flight Center, Greenbelt, MD USA

Estimation of Bare Surface Soil Moisture and Surface Roughness Parameter Using L-Band SAR Image Data

Shi, Jian-Cheng, California Univ., USA; Wang, James, NASA Goddard Space Flight Center, USA; Hsu, Ann, NASA Goddard Space Flight Center, USA; ONeill, Peggy, NASA Goddard Space Flight Center, USA; Engman, Edwin T., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 259-260; Repr. from Proceedings of the Third International Workshop on Applications of Remote Sensing in Hydrology p 323-335; In English; 3rd; Applications of Remote Sensing in Hydrology, 16-18 Oct. 1996, Greenbelt, MD, USA; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

An algorithm based on a fit of the single-scattering Integral Equation Method (IEM) was developed to provide estimation of soil moisture and surface roughness parameter (a combination of rms roughness height and surface power spectrum) from quasi-polarized synthetic aperture radar (SAR) measurements. This algorithm was applied to a series of measurements acquired at L-band (1.25 GHz) from both AIRSAR (Airborne Synthetic Aperture Radar operated by Jet Propulsion Laboratory) and SIR-C (Spaceborne Imaging Radar-C) over a well-managed watershed in southwest Oklahoma. It was found that the two co-polarized backscattering coefficients and their combinations would provide the best input to the algorithm for estimation of soil moisture and roughness parameter. Application of the inversion algorithm to the co-polarized measurements of both AIRSAR and SIR-C resulted in estimated values of soil moisture and roughness parameter for bare and short-vegetated fields that compared favorably with those sampled on the ground. The root-mean-square (rms) errors of the comparison were found to be 3.4% and 1.9 dB for soil moisture and surface roughness parameter, respectively.

Author

Algorithms; Synthetic Aperture Radar; Radar Data; Radar Measurement; Data Processing; Soil Moisture; Surface Roughness

20000038121 NASA Wallops Flight Center, Wallops Island, VA USA

Vertical Ozone Profile Comparisons Between Ozonesondes and Remote Instrumentation

Schmidlin, F. J., NASA Wallops Flight Center, USA; McCarthy, S., Computer Sciences Corp., USA; Michel, W., Science and Engineering Services, Inc., USA; Ross, E. David, ManTech Environmental Technology, Inc., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 255-256; Repr. from Proceedings of the 13th ESA Symposium on European Rocket and Balloon Programmes and Related Research p 169-173; In English; 13th; European Rocket and Balloon Programmes and

Related Research, 26-29 May 1997, Oeland, Sweden; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Ozonesonde measurement quality is a critical factor for insuring measurement accuracy and is fundamentally indispensable for validating remotely measured ozone. Reasonable results from such ozone profile comparisons are best obtained by maintaining the smallest possible spatial and time differences between ozonesonde and remote measurement observations. Ozone profiles measured with the Halogen Occultation Experiment (HALOE) instrument and the Microwave Limb Sounder (MLS) instrument on NASA's Upper Atmosphere Research Satellite (UARS) are compared with ECC profiles. Comparisons with the GSFC ozone lidar also demonstrate good agreement. In this paper we show: (1) the process used by NASA to secure quality ozonesonde measurements, (2) comparisons of ozonesondes with various remote sensing instruments and, (3) the reliability obtained when both measurement types are obtained close in time and, when possible, in space.

Author

Microwave Sounding; Remote Sensing; Optical Radar; Ozonometry; Radar Measurement

20000038122 NASA Goddard Space Flight Center, Greenbelt, MD USA

MODIS Snow and Ice Products from the NSIDC DAAC

Scharfen, Greg R., Colorado Univ., USA; Hall, Dorothy K., NASA Goddard Space Flight Center, USA; Riggs, George A., Research and Data Systems, Inc., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 253-254; Repr. from Proceedings of Earth Observing Systems 2, v. 3117 p 143-147; In English; 2nd; Earth Observing Systems, 28-29 Jul. 1997, San Diego, CA, USA; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

The National Snow and Ice Data Center (NSIDC) Distributed Active Archive Center (DAAC) provides data and information on snow and ice processes, especially pertaining to interactions among snow, ice, atmosphere and ocean, in support of research on global change detection and model validation, and provides general data and information services to cryospheric and polar processes research community. The NSIDC DAAC is an integral part of the multi-agency-funded support for snow and ice data management services at NSIDC. The Moderate Resolution Imaging Spectroradiometer (MODIS) will be flown on the first Earth Observation System (EOS) platform (AM-1) in 1998. The MODIS Instrument Science Team is developing geophysical products from data collected by the MODIS instrument, including snow and ice products which will be archived and distributed by NSIDC DAAC. The MODIS snow and ice mapping algorithms will generate global snow, lake ice, and sea ice cover products on a daily basis. These products will augment the existing record of satellite-derived snow cover and sea ice products that began about 30 years ago. The characteristics of these products, their utility, and comparisons to other data set are discussed. Current developments and issues are summarized.

Author

Remote Sensing; Satellite Observation; Snow Cover; Sea Ice; Spectroradiometers; Imaging Spectrometers

20000038125 NASA Goddard Space Flight Center, Greenbelt, MD USA

Ground-Based Microwave Radiometer Measurements over Various Surface Covers

Owe, Manfred, NASA Goddard Space Flight Center, USA; deRuiter, Jan, Vrije Univ., Netherlands; Gouweleeuw, Ben, Vrije Univ., Netherlands; vandeGriend, Adriaan, Vrije Univ., Netherlands; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 247-248; Repr. from Proceedings of the Third International Workshop on Applications of Remote Sensing in Hydrology p 227-236; In English; 3rd; Applications of Remote Sensing in Hydrology, 16-18 Oct. 1996, Greenbelt, MD, USA; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Microwave brightness temperatures were measured over a young wheat crop of varying canopy density during the First NOPEX Concentrated Field Effort near Uppsala, Sweden. Measurements were made with a portable ground-based microwave radiometer system at a frequency of 1.4 GHz. The brightness temperature at each wavelength was measured at horizontal and vertical polarization, and at incidence angles ranging from nadir to 60 degrees. Three measuring sequences were made; at full canopy, after the partial harvest, and of the bare soil. Supporting data such as soil and canopy temperature, soil moisture, other soil physical properties, and canopy biomass were also collected. Preliminary results of some of the field measurements and comparisons with theoretical calculations are presented.

Author

Brightness Temperature; Canopies (Vegetation); Wheat; Microwave Radiometers; Ultrahigh Frequencies; Remote Sensing

20000038126 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Impact of Microwave-Derived Surface Soil Moisture on Watershed Hydrological Modeling

ONeill, P. E., NASA Goddard Space Flight Center, USA; Hsu, A. Y., Science Systems and Applications, Inc., USA; Jackson, T. J., Agricultural Research Service, USA; Wood, E. F., Princeton Univ., USA; Zion, M., Princeton Univ., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 245-246; Repr. from Proceedings of the Third International Workshop on Applications of Remote Sensing p 211-226; In English; 3rd; Applications of Remote Sensing in Hydrology, 16-18 Oct. 1996, Greenbelt, MD, USA; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

The usefulness of incorporating microwave-derived soil moisture information in a semi-distributed hydrological model was demonstrated for the Washita '92 experiment in the Little Washita River watershed in Oklahoma. Initializing the hydrological model with surface soil moisture fields from the ESTAR airborne L-band microwave radiometer on a single wet day at the start of the study period produced more accurate model predictions of soil moisture than a standard hydrological initialization with streamflow data over an eight-day soil moisture drydown.

Author

Hydrology Models; Soil Moisture; Watersheds; Rivers

20000038130 NASA Goddard Space Flight Center, Greenbelt, MD USA

Application of Multitemporal Remotely Sensed Soil Moisture for the Estimation of Soil Physical Properties

Mattikalli, N. M., NASA Goddard Space Flight Center, USA; Engman, E. T., NASA Goddard Space Flight Center, USA; Jackson, T. J., Agricultural Research Service, USA; Ahuja, L. R., Agricultural Research Service, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 237-238; Repr. from Proceeding of the 3rd International Workshop on Applications of Remote Sensing in Hydrology, Oct. 1996 p 183-197; In English; 3rd; Applications of Remote Sensing in Hydrology, 16-18 Oct. 1996, Greenbelt, MD, USA; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

This paper demonstrates the use of multitemporal soil moisture derived from microwave remote sensing to estimate soil physical properties. The passive microwave ESTAR instrument was employed during June 10-18, 1992, to obtain brightness temperature (TB) and surface soil moisture data in the Little Washita watershed, Oklahoma. Analyses of spatial and temporal variations of TB and soil moisture during the dry-down period revealed a direct relationship between changes in T and soil moisture and soil physical (viz. texture) and hydraulic (viz. saturated hydraulic conductivity, K(sat)) properties. Statistically significant regression relationships were developed for the ratio of percent sand to percent clay (RSC) and K(sat), in terms of change components of TB and surface soil moisture. Validation of results using field measured values and soil texture map indicated that both RSC and K(sat) can be estimated with reasonable accuracy. These findings have potential applications of microwave remote sensing to obtain quick estimates of the spatial distributions of K(sat), over large areas for input parameterization of hydrologic models.

Author

Brightness Temperature; Soil Moisture; Remote Sensing; Microwave Imagery; Watersheds; Soil Mapping; Soil Science

20000038131 NASA Goddard Space Flight Center, Greenbelt, MD USA

Microwave Remote Sensing of Soil Moisture for Estimation of Soil Properties

Mattikalli, Nandish M., Hughes STX, Inc., USA; Engman, Edwin T., NASA Goddard Space Flight Center, USA; Jackson, Thomas J., Agricultural Research Service, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 235-236; Repr. from 1997 International Geoscience and Remote Sensing Symposium (IGARSS 1997), v. 3 p 1093-1095; In English; Geoscience and Remote Sensing, 3-8 Aug. 1997, Singapore, Singapore

Report No.(s): IEEE-97CH36042; LC-97-70575; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Surface soil moisture dynamics was derived using microwave remote sensing, and employed to estimate soil physical and hydraulic properties. The L-band ESTAR radiometer was employed in an airborne campaign over the Little Washita watershed, Oklahoma during June 10-18, 1992. Brightness temperature (TB) data were employed in a soil moisture inversion algorithm which corrected for vegetation and soil effects. Analyses of spatial TB and soil moisture dynamics during the dry-down period revealed a direct relationship between changes in TB, soil moisture and soil texture. Extensive regression analyses were carried out which yielded statistically significant quantitative relationships between ratio of percent sand to percent clay (RSC, a term derived to quantify soil texture) and saturated hydraulic conductivity (Ksat) in terms of change components of TB and surface

soil moisture. Validation of results indicated that both RSC and Ksat can be estimated with reasonable accuracy. These findings have potential applications for deriving spatial distributions of RSC and Ksat over large areas.
Author
Brightness Temperature; Soil Moisture; Regression Analysis; Remote Sensing; Microwave Imagery

20000038132 NASA Goddard Space Flight Center, Greenbelt, MD USA
Estimation of Snow Parameters from Dual-Wavelength Airborne Radar
Liao, Liang, Caelum Research Corp., USA; Meneghini, Robert, NASA Goddard Space Flight Center, USA; Iguchi, Toshio, Communications Research Lab., Japan; Detwiler, Andrew, South Dakota School of Mines and Technology, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 231-232; Repr. from 28th Conference on Radar Meteorology (American Meteorological Society) p 510-511; In English; 28th; Radar Meteorology, 7-12 Sep. 1997, Austin, TX, USA; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Estimation of snow characteristics from airborne radar measurements would complement In-situ measurements. While In-situ data provide more detailed information than radar, they are limited in their space-time sampling. In the absence of significant cloud water contents, dual-wavelength radar data can be used to estimate 2 parameters of a drop size distribution if the snow density is assumed. to estimate, rather than assume, a snow density is difficult, however, and represents a major limitation in the radar retrieval. There are a number of ways that this problem can be investigated: direct comparisons with in-situ measurements, examination of the large scale characteristics of the retrievals and their comparison to cloud model outputs, use of LDR measurements, and comparisons to the theoretical results of Passarelli(1978) and others. In this paper we address the first approach and, in part, the second.
Author
Airborne Radar; Atmospheric Models; Radar Data; Snow; Remote Sensing

20000038133 NASA Goddard Space Flight Center, Greenbelt, MD USA
Effects of Faraday Rotation on Microwave Remote Sensing From Space at L-Band
LeVine, D. M., NASA Goddard Space Flight Center, USA; Kao, M., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 229-230; Repr. from 1997 International Geoscience and Remote Sensing Symposium (IGARSS 1997), v. 1 p 377-379; In English; Geoscience and Remote Sensing, 3-8 Aug. 1997, Singapore, Singapore
Report No.(s): IEEE-97CH36042; LC-97-70575; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

The effect of Faraday rotation on the remote sensing of soil moisture from space is investigated using the International Reference Ionosphere (IRI) to obtain electron density profiles and the International Geomagnetic Reference Field (IGRF) to model the magnetic field. With a judicious choice of satellite orbit (6 am, sunsynchronous) the errors caused by ignoring Faraday rotation are less than 1 K at incidence angles less than 40 degrees.
Author
Faraday Effect; Microwave Imagery; Ultrahigh Frequencies; Soil Moisture; Remote Sensing; Radiometers; Geomagnetism

20000038136 NASA Goddard Space Flight Center, Greenbelt, MD USA
Passive Microwave Observation of Soil Water Infiltration
Jackson, Thomas J., Department of Agriculture, USA; Schmugge, Thomas J., Department of Agriculture, USA; Rawls, Walter J., Department of Agriculture, USA; ONeill, Peggy E., NASA Goddard Space Flight Center, USA; Parlange, Marc B., Johns Hopkins Univ., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 223-224; Repr. from 1997 International Geoscience and Remote Sensing Symposium (IGARSS 1997), v. 3 p 1099-1101; In English; Geoscience and Remote Sensing, 3-8 Aug. 1997, Singapore, Singapore
Report No.(s): IEEE-97CH36042; LC-97-70575; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Infiltration is a time varying process of water entry into soil. Experiments were conducted here using truck based microwave radiometers to observe small plots during and following sprinkler irrigation. Experiments were conducted on a sandy loam soil in 1994 and a silt loam in 1995. Sandy loam soils typically have higher infiltration capabilities than clays. For the sandy loam the observed brightness temperature (TB) quickly reached a nominally constant value during irrigation. When the irrigation was stopped the TB began to increase as drainage took place. The irrigation rates in 1995 with the silt loam soil exceeded the saturated conductivity of the soil. During irrigation the TB values exhibited a pattern that suggests the occurrence of coherent reflection,

a rarely observed phenomena under natural conditions. These results suggested the existence of a sharp dielectric boundary (wet over dry soil) that was increasing in depth with time.
Author
Remote Sensing; Infiltration; Soils; Satellite Observation; Microwave Imagery; Microwave Radiometers

20000038138 NASA Goddard Space Flight Center, Greenbelt, MD USA
Examination of Soil Moisture Retrieval Using SIR-C Radar Data and a Distributed Hydrological Model
Hsu, A. Y., NASA Goddard Space Flight Center, USA; ONeill, P. E., NASA Goddard Space Flight Center, USA; Wood, E. F., Princeton Univ., USA; Zion, M., Princeton Univ., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 219-220; Repr. from 1997 International Geoscience and Remote Sensing Symposium (IGARSS 1997), v. 3 p 1266-1268; In English; Geoscience and Remote Sensing, 3-8 Aug. 1997, Singapore, Singapore
Report No.(s): IEEE-97CH36042; LC-97-70575; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

A major objective of soil moisture-related hydrological-research during NASA's SIR-C/X-SAR mission was to determine and compare soil moisture patterns within humid watersheds using SAR data, ground-based measurements, and hydrologic modeling. Currently available soil moisture-inversion methods using active microwave data are only accurate when applied to bare and slightly vegetated surfaces. Moreover, as the surface dries down, the number of pixels that can provide estimated soil moisture by these radar inversion methods decreases, leading to less accuracy and, confidence in the retrieved soil moisture fields at the watershed scale. The impact of these errors in microwave- derived soil moisture on hydrological modeling of vegetated watersheds has yet to be addressed. In this study a coupled water and energy balance model operating within a topographic framework is used to predict surface soil moisture for both bare and vegetated areas. In the first model run, the hydrological model is initialized using a standard baseflow approach, while in the second model run, soil moisture values derived from SIR-C radar data are used for initialization. The results, which compare favorably with ground measurements, demonstrate the utility of combining radar-derived surface soil moisture information with basin-scale hydrological modeling.
Author
Soil Moisture; Remote Sensing; Radar Data; Synthetic Aperture Radar; Watersheds; Hydrology Models; Microwave Imagery

20000038144 NASA Goddard Space Flight Center, Greenbelt, MD USA
Snow Crystal Shape and Microwave Scattering
Foster, J. L., NASA Goddard Space Flight Center, USA; Hall, D. K., NASA Goddard Space Flight Center, USA; Chang, A. T. C., NASA Goddard Space Flight Center, USA; Rango, A., Department of Agriculture, USA; Wergin, W., Department of Agriculture, USA; Erbe, E., Department of Agriculture, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 205-206; Repr. from Proceedings of the1997 International Geoscience and Remote Sensing Symposium (IGARSS 1997), v. 2 p 625-627; In English; Geoscience and Remote Sensing, 3-8 Aug. 1997, Singapore, Singapore
Report No.(s): IEEE-97CH36042; LC-97-70575; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771); Abstract Only, Hardcopy, Microfiche

The radiometric calibration of SeaWiFS data includes a correction for the temperature dependence of the individual detector sensitivities. The detector temperature are measured by temperature sensors mounted on instrument focal planes. Processing of the temperature sensor output by an onboard instrument computer introduces a nonlinear response into the temperature data. This paper describes the calibration of the temperature sensor output and the computation of the temperature corrections for the radiometric calibration of the instrument.
Author
Sea Surface Temperature; Temperature Sensors; Calibrating; Remote Sensing; Radiometers; Sea-Viewing Wide Field-Of-View Sensor; Temperature Dependence

20000038145 NASA Goddard Space Flight Center, Greenbelt, MD USA
Potential for Remotely Sensed Soil Moisture Data in Hydrologic Modeling
Engman, Edwin T., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 199-200; Repr. from Earth Surface Remote Sensing, v. 3222 p 161-170; In English; Earth Surface Remote Sensing, 22-25 Sep. 1997, London, UK; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Many hydrologic processes display a unique signature that is detectable with microwave remote sensing. These signatures are in the form of the spatial and temporal distributions of surface soil moisture and portray the spatial heterogeneity of hydrologic processes and properties that one encounters in drainage basins. The hydrologic processes that may be detected include ground

water recharge and discharge zones, storm runoff contributing areas, regions of potential and less than potential ET, and information about the hydrologic properties of soils and heterogeneity of hydrologic parameters. Microwave remote sensing has the potential to detect these signatures within a basin in the form of volumetric soil moisture measurements in the top few cm. These signatures should provide information on how and where to apply soil physical parameters in distributed and lumped parameter models and how to subdivide drainage basins into hydrologically similar sub-basins.
Author
Microwave Imagery; Hydrology Models; Soil Moisture; Remote Sensing; Ground Water; Earth Surface

20000038148 NASA Goddard Space Flight Center, Greenbelt, MD USA
Antarctic Surface Temperatures Using Satellite Infrared Data from 1979 Through 1995
Comiso, Josefino C., NASA Goddard Space Flight Center, USA; Stock, Larry, NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 193-194; Repr. from 1997 International Geoscience and Remote Sensing Symposium, v. 3 p 1300-1304; In English; Geoscience and Remote Sensing, 3-8 Aug. 1997, Singapore, Singapore; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

The large scale spatial and temporal variations of surface ice temperature over the Antarctic region are studied using infrared data derived from the Nimbus-7 Temperature Humidity Infrared Radiometer (THIR) from 1979 through 1985 and from the NOAA Advanced Very High Resolution Radiometer (AVHRR) from 1984 through 1995. Enhanced techniques suitable for the polar regions for cloud masking and atmospheric correction were used before converting radiances to surface temperatures. The observed spatial distribution of surface temperature is highly correlated with surface ice sheet topography and agrees well with ice station temperatures with 2K to 4K standard deviations. The average surface ice temperature over the entire continent fluctuates by about 30K from summer to winter while that over the Antarctic Plateau varies by about 45K. Interannual fluctuations of the coldest interannual variations in surface temperature are highest at the Antarctic Plateau and the ice shelves (e.g., Ross and Ronne) with a periodic cycle of about 5 years and standard deviations of about 11K and 9K, respectively. Despite large temporal variability, however, especially in some regions, a regression analysis that includes removal of the seasonal cycle shows no apparent trend in temperature during the period 1979 through 1995.
Author
Advanced Very High Resolution Radiometer; Ice; Surface Temperature

20000038149 NASA Goddard Space Flight Center, Greenbelt, MD USA
Temperature Corrected Bootstrap Algorithm
Comiso, Joey C., NASA Goddard Space Flight Center, USA; Zwally, H. Jay, NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 191-192; Repr. from Proceedings of 1997 International Geoscience and Remote Sensing Symposium, v. 2, p 857-861; In English; Geoscience and Remote Sensing, 3-8 Aug. 1997, Singapore, Singapore
Report No.(s): IEEE-97CH36042; LC-97-70575; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

A temperature corrected Bootstrap Algorithm has been developed using Nimbus-7 Scanning Multichannel Microwave Radiometer data in preparation to the upcoming AMSR instrument aboard ADEOS and EOS-PM. The procedure first calculates the effective surface emissivity using emissivities of ice and water at 6 GHz and a mixing formulation that utilizes ice concentrations derived using the current Bootstrap algorithm but using brightness temperatures from 6 GHz and 37 GHz channels. These effective emissivities are then used to calculate surface ice which in turn are used to convert the 18 GHz and 37 GHz brightness temperatures to emissivities. Ice concentrations are then derived using the same technique as with the Bootstrap algorithm but using emissivities instead of brightness temperatures. The results show significant improvement in the area where ice temperature is expected to vary considerably such as near the continental areas in the Antarctic, where the ice temperature is colder than average, and in marginal ice zones.
Author
Algorithms; Emissivity; Brightness Temperature; Microwave Radiometers; Satellite Observation; Sea Ice

20000038153 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Comparison of Soil Moisture Retrieval Models Using SIR-C Measurements over the Little Washita River Watershed
Wang, J. R., NASA Goddard Space Flight Center, USA; Hsu, A., Scientific Systems and Applications, Inc., USA; Shi, J. C., California Univ., USA; ONeill, P. E., NASA Goddard Space Flight Center, USA; Engman, E. T., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 161-162; Repr. from Remote Sensing of

Environment (Elsevier), v. 59 p 308-320; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Six SIR-C L-band measurements over the Little Washita River watershed in Chickasha, Oklahoma during 11-17 April 1994 have been analyzed for studying the change of soil moisture in the region. Two algorithms developed recently for estimation of moisture content in bare soil were applied to these measurements and the results were compared with those sampled on the ground. There is a good agreement between the values of soil moisture estimated by either one of the algorithms and those measured from ground sampling for bare or sparsely vegetated fields. The standard error from this comparison is on the order of 0.05-0.06 cu cm/cu cm, which is comparable to that expected from a regression between backscattering coefficients and measured soil moisture. Both algorithms provide a poor estimation of soil moisture or fail to give solutions to areas covered with moderate or dense vegetation. Even for bare soils the number of pixels that bear no numerical solution from the application of either one of the two algorithms to the data is not negligible. Results from using one of these algorithms indicate that the fraction of these pixels becomes larger as the bare soils become drier. The other algorithm generally gives a larger fraction of these pixels when the fields are vegetation-covered. The implication and impact of these features are discussed in this article.

Author

Soil Moisture; Algorithms; Moisture Content; Remote Sensing; Earth Observations (From Space); Shuttle Imaging Radar; Radar Imagery

20000038155 NASA Goddard Space Flight Center, Greenbelt, MD USA

NOAA AVHRR Land Surface Albedo Algorithm Development

Toll, D. L., NASA Goddard Space Flight Center, USA; Shirey, D., Maryland Univ., USA; Kimes, D. S., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 157-158; Repr. from International Journal of Remote Sensing, v. 18, no. 18, 1997 p 3761-3796; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

The primary objective of this research is to develop a surface albedo model for the National Oceanic and Atmospheric Administration (NOAA) Advanced Very High Resolution Radiometer (AVHRR). The primary test site is the Konza prairie, Kansas (U.S.A.), used by the International Satellite Land Surface Climatology Project (ISLSCP) in the First ISLSCP Field Experiment (FIFE). In this research, high spectral resolution field spectrometer data was analyzed to simulate AVHRR wavebands and to derive surface albedos. Development of a surface albedo algorithm was completed by analysing a combination of satellite, field spectrometer, and ancillary data. Estimated albedos from the field spectrometer data were compared to reference albedos derived using pyranometer data. Variations from surface anisotropy of reflected solar radiation were found to be the most significant albedo-related error. Additional error or sensitivity came from estimation of a shortwave mid-IR reflectance (1.3-4.0 micro-m) using the AVHRR red and near-IR bands. Errors caused by the use of AVHRR spectral reflectance to estimate both a total visible (0.4-0.7 micro-m) and near-IR (0.7-1.3 micro-m) reflectance were small. The solar spectral integration, using the derived ultraviolet, visible, near-IR and SW mid-IR reflectivities, was not sensitive to many clear-sky changes in atmospheric properties and illumination conditions.

Author

Advanced Very High Resolution Radiometer; Algorithms; Earth Albedo; Meteorological Parameters; Remote Sensing; Spectral Reflectance; Earth Surface; Surface Properties

20000038163 NASA Goddard Space Flight Center, Greenbelt, MD USA

Comparison of Snow Mass Estimates from a Prototype Passive Microwave Snow Algorithm, a Revised Algorithm and a Snow Depth Climatology

Foster, J. L., NASA Goddard Space Flight Center, USA; Chang, A. T. C., NASA Goddard Space Flight Center, USA; Hall, D. K., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 135-136; Repr. from Remote Sensing of Environment (Elsevier), v. 62 p 132-142; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

While it is recognized that no single snow algorithm is capable of producing accurate global estimates of snow depth, for research purposes it is useful to test an algorithm's performance in different climatic areas in order to see how it responds to a variety of snow conditions. This study is one of the first to develop separate passive microwave snow algorithms for North America and Eurasia by including parameters that consider the effects of variations in forest cover and crystal size on microwave brightness temperature. A new algorithm (GSFC 1996) is compared to a prototype algorithm (Chang et al., 1987) and to a snow depth climatology (SDC), which for this study is considered to be a standard reference or baseline. It is shown that the GSFC 1996 algorithm compares much more favorably to the SDC than does the Chang et al. (1987) algorithm. For example, in North America in February there is a 15% difference between the GSFC 198-96 Algorithm and the SDC, but with the Chang et al. (1987) algorithm

the difference is greater than 50%. In Eurasia, also in February, there is only a 1.3% difference between the GSFC 1996 algorithm and the SDC, whereas with the Chang et al. (1987) algorithm the difference is about 20%. As expected, differences tend to be less when the snow cover extent is greater, particularly for Eurasia. The GSFC 1996 algorithm performs better in North America in each month than dose the Chang et al. (1987) algorithm. This is also the case in Eurasia, except in April and May when the Chang et al.(1987) algorithms is in closer accord to the SDC than is GSFC 1996 algorithm.
Author
Snow Cover; Algorithms; Microwave Radiometers; Microwave Imagery; Estimates; Depth; Climatology

20000038166 NASA Goddard Space Flight Center, Greenbelt, MD USA
Passive Microwave Algorithms for Sea Ice Concentration: A Comparison of Two Techniques
Comiso, Josefino C., NASA Goddard Space Flight Center, USA; Cavalieri, Donald J., NASA Goddard Space Flight Center, USA; Parkinson, Claire L., NASA Goddard Space Flight Center, USA; Gloersen, Per, NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997; ISSN 0034-4257, pp. 129-130; Repr. from Remote Sensing Environment (Elsevier Science, Inc., New York, NY), v. 60, 1997 p 357-384; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

The most comprehensive large-scale characterization of the global sea ice cover so far has been provided by satellite passive microwave data. Accurate retrieval of ice concentrations from these data is important because of the sensitivity of surface flux(e.g. heat, salt, and water) calculations to small change in the amount of open water (leads and polynyas) within the polar ice packs. Two algorithms that have been used for deriving ice concentrations from multichannel data are compared. One is the NASA Team algorithm and the other is the Bootstrap algorithm, both of which were developed at NASA's Goddard Space Flight Center. The two algorithms use different channel combinations, reference brightness temperatures, weather filters, and techniques. Analyses are made to evaluate the sensitivity of algorithm results to variations of emissivity and temperature with space and time. to assess the difference in the performance of the two algorithms, analyses were performed with data from both hemispheres and for all seasons. The results show only small differences in the central Arctic in but larger disagreements in the seasonal regions and in summer. In some ares in the Antarctic, the Bootstrap technique show ice concentrations higher than those of the Team algorithm by as much as 25%; whereas, in other areas, it shows ice concentrations lower by as much as 30%. The The differences in the results are caused by temperature effects, emissivity effects, and tie point differences. The Team and the Bootstrap results were compared with available LANDSAT, advanced very high resolution radiometer (AVHRR) and synthetic aperture radar (SAR) data. AVHRR, LANDSAT, and SAR data sets all yield higher concentrations than the passive microwave algorithms. Inconsistencies among results suggest the need for further validation studies.
Author
Sea Ice; Microwave Imagery; Algorithms; Radar Data; Satellite Observation; Oceanography; Microwave Radiometers; Temperature Effects

20000038167 NASA Goddard Space Flight Center, Greenbelt, MD USA
Airborne Microwave Radiometry on a Semi-Arid Area During HAPEX-Sahel
Chanzy, A, Institut National de la Recherche Agronomique, France; Schmugge, T. J., Department of Agriculture, USA; Calvet, J.-C., Centre National de la Recherche Scientifique, France; Kerr, Y., Office National d'Etudes et de Recherches Aerospatiales, France; vanOevelen, P., Wageningen Agricultural Univ., Netherlands; Grosjean, O., Centre National d'Etudes Spatiales, France; Wang, J. R., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 127-128; Repr. from Journal of Hydrology (Elsevier), v. 188-189, 1997 p 285-309; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Airborne microwave radiometric measurements in the framework of the HAPEX-Sahel Experiment were performed by the Push Broom Microwave Radiometer (PBMR) and the PORTOS radiometer. The flights of both radiometers produced an original set of data covering the 1.4-90 GHz range of frequency. The East and West Central Super Sites were the areas most intensively observed by the microwave radiometers. Over those sites, several brightness temperature (TB) maps are available at seven dates distributed over a 1 month period in the middle of the rainy season. A comparison of the two radiometers demonstrates their radiometric quality and the precision of the localization of the microwave observations. At 1.4 GHz, the vegetation had very little effect on the soil microwave emission. Maps of soil moisture were developed using a single linear relationship between TB and the surface soil moisture. There is an important spatial heterogeneity in the soil moisture distribution, which is explained by both the soil moisture hydrodynamic properties and the localization of the precipitation fields. At 5.05 GHz, the vegetation must be

accounted for to infer soil moisture from the microwave observations. A method based on a simple radiative transfer model and on microwave data has shown encouraging results.
Author
Microwave Radiometers; Arid Lands; Brightness Temperature; Soil Moisture; Remote Sensing; Satellite Observation

20000038169 NASA Goddard Space Flight Center, Greenbelt, MD USA
Detection and Monitoring of Stratigraphic Markers and Temperature Trends at the Greenland Ice Sheet Project 2 Using Passive-Microwave Remote-Sensing Data
Shuman, C. A., NASA Goddard Space Flight Center, USA; Alley, R. B., Pennsylvania State Univ., USA; Fahnestock, M. A., Maryland Univ., USA; Fawcett, P. J., Pennsylvania State Univ., USA; Bondschadler, R. A., NASA Goddard Space Flight Center, USA; White, J. W. C., Colorado Univ., USA; Grootes, P. M., Kiel Univ., Germany; Anandakrishnan, S., Pennsylvania State Univ., USA; Stearns, C. R., Wisconsin Univ., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 99-100; Repr. from Journal of Geophysical Research, v. 102, no. C12, 30 Nov. 1997 p 26,877-26,886; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Satellite passive-microwave sensors provide a sensitive means of studying ice-sheet surface processes that assists ice-core interpretation and can extend local observations across regional scales. Analysis of special sensor microwave/imager (SSM/I) brightness temperature (TB) data supports ice-core research in two specific ways. First, the summer hoar complex layers used to date the Holocene portion of the Greenland Ice Sheet Project 2 ice core can be defined temporally and spatially by SSM/I 37-GHz vertically (V) and horizontally (H) polarized B ratio (V/H) trends. Second, comparison of automatic weather station temperatures to SSM/I 37-GHz V TB data shows that they are an effective proxy temperature record in this region. Also, the TB data can be correlated with proxy temperature trends from stable-isotope-ratio (delta O-18 and delta-D) profiles from snow pits and this allows the assignment of dates to specific snow depths.
Author
Satellite Observation; Remote Sensing; Stratigraphy; Greenland; Ice Mapping; Brightness Temperature; Microwave Sensors

20000038171 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
North and Northeast Greenland Ice Discharge from Satellite Radar Interferometry
Rignot, E. J., Jet Propulsion Lab., California Inst. of Tech., USA; Gogineni, S. P., Kansas Univ., USA; Krabill, W. B., NASA Wallops Flight Facility, USA; Ekholm, S., National Survey of Denmark, Denmark; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 93-94; Repr. from Science, v. 276, 9 May 1997 p 934-937; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Ice discharge from north and northeast Greenland calculated from satellite radar interferometry data of 14 outlet glaciers is 3.5 times that estimated from iceberg production. The satellite estimates, obtained at the grounding line of the outlet glaciers, differ from those obtained at the glacier front, because basal melting is extensive at the underside of the floating glacier sections. The results suggest that the north and northeast parts of the Greenland ice sheet may be thinning and contributing positively to sea-level rise.
Author
Interferometry; Radar Data; Satellite Observation; Remote Sensing; Greenland; Glaciers; Estimating

20000038172 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Balance Velocities of the Greenland Ice Sheet
Joughin, Ian, Jet Propulsion Lab., California Inst. of Tech., USA; Fahnestock, Mark, Maryland Univ., USA; Ekholm, Simon, National Survey of Denmark, Denmark; Kwok, Ron, Jet Propulsion Lab., California Inst. of Tech., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 89-90; Repr. from Geophysical Research Letters, v. 24, no. 23, 1 Dec. 1997 p 3045-3048; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

We present a map of balance velocities for the Greenland ice sheet. The resolution of the underlying DEM, which was derived primarily from radar altimetry data, yields far greater detail than earlier balance velocity estimates for Greenland. The velocity contours reveal in striking detail the location of an ice stream in northeastern Greenland, which was only recently discovered using satellite imagery. Enhanced flow associated with all of the major outlets is clearly visible, although small errors in the source data result in less accurate estimates of the absolute flow speeds. Nevertheless, the balance map is useful for ice-sheet modelling, mass balance studies, and field planning.
Author
Greenland; Ice; Remote Sensing; Satellite Imagery; Velocity Distribution; Satellite Altimetry

20000038175 Colorado Univ., Center for the Study of Earth From Space, Boulder, CO USA

Snowmelt on the Greenland Ice Sheet as Derived From Passive Microwave Satellite Data

Abdalati, Waleed, Universities Space Research Association, USA; Steffen, Konrad, Colorado Univ., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 81-82; Repr. from Journal of Climate, v. 10, no. 2, Feb. 1997 p 165-175; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

The melt extent of the snow on the Greenland ice sheet is of considerable importance to the ice sheet's mass and energy balance, as well as Arctic and global climates. by comparing passive microwave satellite data to field observations, variations in melt extent have been detected by establishing melt thresholds in the cross-polarized gradient ratio (XPGR). The XPGR, defined as the normalized difference between the 19-GHz horizontal channel and the 37-GHz vertical channel of the Special Sensor Microwave/Imager (SSM/I), exploits the different effects of snow wetness on different frequencies and polarizations and establishes a distinct melt signal. Using this XPGR melt signal, seasonal and interannual variations in snowmelt extent of the ice sheet are studied. The melt is found to be most extensive on the western side of the ice sheet and peaks in late July. Moreover, there is a notable increasing trend in melt area between the years 1979 and 1991 of 4.4% per year, which came to an abrupt halt in 1992 after the eruption of Mt. Pinatubo. A similar trend is observed in the temperatures at six coastal stations. The relationship between the warming trend and increasing melt trend between 1979 and 1991 suggests that a 1 C temperature rise corresponds to an increase in melt area of 73000 sq km, which in general exceeds one standard deviation of the natural melt area variability. Author

Snow Cover; Greenland; Microwave Imagery; Remote Sensing; Melting; Environment Effects; Volcanoes; Satellite Observation; Climate Change; Ice Environments

20000038177 NASA Goddard Space Flight Center, Greenbelt, MD USA

A Microwave Technique for Mapping Ice Temperature in the Arctic Seasonal Sea Ice Zone

St.Germain, Karen M., Naval Research Lab., USA; Cavalieri, Donald J., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997; ISSN 0196-2892, pp. 155-156; Repr. from IEEE Transactions on Geoscience and Remote Sensing, v. 35, no. 4, Jul. 1997 p 946-953; In English

Contract(s)/Grant(s): RTOP 622-82-13; RTOP 229-04-15; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

A technique for deriving ice temperature in the Arctic seasonal sea ice zone from passive microwave radiances has been developed. The algorithm operates on brightness temperatures derived from the Special Sensor Microwave/Imager (SSM/I) and uses ice concentration and type from a previously developed thin ice algorithm to estimate the surface emissivity. Comparisons of the microwave derived temperatures with estimates derived from infrared imagery of the Bering Strait yield a correlation coefficient of 0.93 and an RMS difference of 2.1 K when coastal and cloud contaminated pixels are removed. SSM/I temperatures were also compared with a time series of air temperature observations from Gambell on St. Lawrence Island and from Point Barrow, AK weather stations. These comparisons indicate that the relationship between the air temperature and the ice temperature depends on ice type.

Author

Microwave Imagery; Arctic Ocean; Remote Sensing; Sea Ice; Temperature Measurement; Algorithms

20000038178 NASA Goddard Space Flight Center, Greenbelt, MD USA

Estimation of Bare Surface Soil Moisture and Surface Roughness Parameter Using L-Band SAR Image Data

Shi, Jian-Cheng, California Univ., USA; Wang, James, NASA Goddard Space Flight Center, USA; Hsu, Ann Y., NASA Goddard Space Flight Center, USA; ONeill, Peggy E., NASA Goddard Space Flight Center, USA; Engman, Edwin T., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997; ISSN 0196-2892, pp. 153-154; Repr. from IEEE Transactions on Geosciences and Remote Sensing, v. 35, no. 5, Sep. 1997 p 1254-1266; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

An algorithm based on a fit of the single-scattering Integral Equation Method (IEM) was developed to provide estimation of soil moisture and surface roughness parameter (a combination of rms roughness height and surface power spectrum) from quad-polarized synthetic aperture radar (SAR) measurements. This algorithm was applied to a series of measurements acquired at L-band (1.25 GHz) from both AIRSAR (Airborne Synthetic Aperture Radar operated by the Jet Propulsion Laboratory) and SIR-C (Spaceborne Imaging Radar-C) over a well- managed watershed in southwest Oklahoma. Prior to its application for soil moisture inversion, a good agreement was found between the single-scattering IEM simulations and the L band measurements of SIR-C and AIRSAR over a wide range of soil moisture and surface roughness conditions. The sensitivity of soil moisture

variation to the co-polarized signals were then examined under the consideration of the calibration accuracy of various components of SAR measurements. It was found that the two co-polarized backscattering coefficients and their combinations would provide the best input to the algorithm for estimation of soil moisture and roughness parameter. Application of the inversion algorithm to the co-polarized measurements of both AIRSAR and SIR-C resulted in estimated values of soil moisture and roughness parameter for bare and short-vegetated fields that compared favorably with those sampled on the ground. The root-mean-square (rms) errors of the comparison were found to be 3.4% and 1.9 dB for soil moisture and surface roughness parameter, respectively.
Author
Synthetic Aperture Radar; Surface Roughness; Soil Moisture; Radar Imagery; Algorithms; Estimating; Integral Equations

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ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower. For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, and 28 Propellants and Fuels.

20000033705 Naval Research Lab., Washington, DC USA
Naval Research Laboratory's Programs in Advanced Indium Phosphide Solar Cell Development
Summers, Geoffrey P., Naval Research Lab., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 21-23; In English; See also 20000033702; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

The Naval Research Laboratory (NRL) has been involved in the development of solar cells for space applications since the 1960s. It quickly became apparent in this work that radiation damage caused to solar cells by electrons and protons trapped by the earth's magnetic field would seriously degrade the power output of photovoltaic arrays in extended missions. Techniques were therefore developed to harden the cells by shielding them with coverglass, etc. Ultimately, however, there is a limit to such approaches, which is determined by the radiation response of the semiconductor material employed. A desire for high efficiency and radiation resistance led to the development of alternative cell technologies such as GaAs, which has since become the technology of choice for many applications. InP cells are currently the most radiation resistant, high efficiency, planar cells known. NRL first sponsored InP solar cell technology in 1986, when Arizona State University was contracted to grow p/n cells by liquid phase epitaxy. NRL's interest in InP cells was generated by the results presented by Yamaguchi and his co-workers in the early 1980s on the remarkable radiation resistance of cells grown by diffusion of S into Zn doped p-type InP substrates. These cells also had beginning of life (BOL) efficiencies approx. 16%(AM0). Related to the radiation resistance of the cells was the fact that radiation-induced damage could be optically annealed by sunlight. Relatively large quantities of l x 2 sq cm diffused junction cells were made and were used on the MUSES-A and the EXOS-D satellites. These cells were also available in the U.S. through NIMCO, and were studied at NRL and elsewhere. Workers at NASA Lewis became involved in research in InP cells about the same time as NRL.
Author
Indium Phosphides; Solar Cells; Fabrication; Annealing; Doped Crystals; Gallium Arsenides; Photovoltaic Cells; Radiation Damage; Technology Utilization

20000033706 Defence Research Agency, Space Dept., Farnborough, UK
The Defence Research Agency Photovoltaic Programme
Goodbody, C., Defence Research Agency, UK; Kimber, R., Defence Research Agency, UK; Space Photovoltaic Research and Technology 1995; October 1995, pp. 24-30; In English; See also 20000033702; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The current DRA photovoltaic programme is funded mainly by the UK Ministry of Defence. The programme is aimed at research and development into the performance of new solar cells and array concepts. The core of the programme consists of studies to determine the potential benefits and disadvantages of using the different solar cell/array combinations on future MoD spacecraft. The main areas of interest are cost, mass, volume, lifetime, radiation hardness, area, reliability and when the relevant technologies are likely to reach maturity. The programme addresses two timeframes, 5-10 years and 10-15 years. This is backed up by an extensive programme of cell characterisation and environmental testing to provide data for the studies. When the opportunity arises flight experiments are conducted to verify the results from the ground testing and to demonstrate the performance in the real environment with all its synergistic effects.
Author
Defense Program; Photovoltaic Conversion; Reliability; Solar Cells

20000033708 NASA Goddard Space Flight Center, Greenbelt, MD USA

Cost Trade Between Multi-Junction, Gallium Arsenide, and Silicon Solar Cells

Gaddy, Edward M., NASA Goddard Space Flight Center, USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 40-46; In English; See also 20000033702; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Multi-junction (MJ), gallium arsenide (GaAs), and silicon (Si) solar cells have respective test efficiencies of approximately 24%, 18.5% and 14.8%. Multi-junction and gallium arsenide solar cells weigh more than silicon solar 2 cells and cost approximately five times as much per unit power at the cell level. A trade is performed for the TRMM spacecraft to determine which of these cell types would have offered an overall performance and price advantage to the spacecraft. A trade is also performed for the multi-junction cells under the assumption that they will cost over ten times that of silicon cells at the cell level. The trade shows that the TRMM project, less the cost of the instrument, ground systems and mission operations, would spend approximately $552,000 dollars per kilogram to launch and suppon3science in the case of the spacecraft equipped with silicon solar cells. If these cells are changed out for gallium arsenide solar cells, an additional 31 kilograms of science can be launched and serviced at a price of approximately $90 thousand per kilogram. The weight reduction is shown to derive from the smaller area of the array and hence reductions in the weight of the array substrate and supporting structure. ff the silicon solar cells are changed out for multi-junction solar cells, an additional 45 kilograms of science above the silicon base line can be launched and supported at a price of approximately $58,000 per kilogram. The trade shows that even if the multi-junction cells are priced over ten times that of silicon cells, a price that is much higher than projected, that the additional 45 kilograms of science are launched and serviced at $180,000 per kilogram. This is still much less than the original $552,000 per kilogram to launch and service the science. Data and qualitative factors are presented to show that these figures are subject to a great deal of uncertainty. Nonetheless, the benefit of the higher efficiency solar cells for TRMM is far greater than the uncertainties in the analysis.
Author

Gallium Arsenides; Junctions; Silicon; Solar Cells; Performance Tests; Costs

20000033709 Spectrolab, Inc., Sylmar, CA USA

The Progress of Large Area GainP2/GaAs/Ge Triple-Junction Cell Development at Spectrolab

Chiang, P. K., Spectrolab, Inc., USA; Krut, D. D., Spectrolab, Inc., USA; Cavicchi, B. T., Spectrolab, Inc., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 47-56; In English; See also 20000033702
Contract(s)/Grant(s): F33615-91-2146; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper describes the successful demonstration of high efficiency, large area monolithic triple-junction, n on p, GaInP2/GaAs/Ge cells. The highest open circuit voltage and cell efficiency (cell size: 2 cm x 2 cm) measured to date are 2.573 V and 23.3%, respectively, under 1 sun, AM0 illumination. A very uniform distribution of cell efficiency across a 3 in. diameter wafer is also achieved. The temperature coefficient and 1 MeV electron irradiation results are obtained. We have incorporated a triple-junction cell in the 1995 JPL balloon flight. The I-V result obtained from the balloon flight and the solar simulators are compared. Finally, we have fabricated more than 50,2 cm x 2 cm triple-junction cell-interconnect-cover (CIC) assemblies. The highest CIC efficiency is 23.2%. No degradation in CIC performance after 100, -120 C to +140 C thermal cycles was observed.
Author

Solar Cells; Fabrication; Gallium Phosphides; Indium Phosphides; Gallium Arsenides; Germanium; Efficiency; Semiconductor Junctions

20000033710 Applied Solar Energy Corp., City of Industry, CA USA

Status of Multijunction Solar Cells

Yeh, Y. C. M., Applied Solar Energy Corp., USA; Chu, C. L., Applied Solar Energy Corp., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 57-64; In English; See also 20000033702; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper describes Applied Solars present activity on Multijunction space cells. We have worked on a variety of MJ cells, both monolithic and mechanically stacked. In recent years, most effort has been directed to GaInP2/GaAs monolithic cells, grown on Ge substrates, and the status of this cell design will be reviewed here.
Author

Solar Cells; Junction Transistors; Feasibility Analysis

20000033711 Houston Univ., Space Vacuum Epitaxy Center, TX USA

InP Tunnel Junctions for InP/InGaAs Tandem Solar Cells

Vilela, M. F., Houston Univ., USA; Medelci, N., International Stellar Technology, Inc., USA; Bensaoula, A., International Stellar Technology, Inc., USA; Freundlich, A., Houston Univ., USA; Renaud, P., Houston Univ., USA; Space Photovoltaic Research and

Technology 1995; October 1995, pp. 65-70; In English; See also 20000033702
Contract(s)/Grant(s): NASW-4093; 93-03652-224; 93-03652-236; 93-03652-243; 93-03652-260; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

We report, for the first time, an epitaxially grown InP p(+)/n(++) tunnel junction. A diode with peak current densities up to 1600 Al/sq cm and maximum specific resistivities (Vp/lp - peak voltage to peak current ratio) in the range of 10(exp -4)Om sq cm is obtained. This peak current density is comparable to the highest results previously reported for lattice matched In(0.53)Ga(0.47)As tunnel junctions. Both results were obtained using chemical beam epitaxy (CBE). In this paper we discuss the electrical characteristics of these tunnel diodes and how the growth conditions influence them.
Author
Epitaxy; Crystal Growth; Indium Gallium Arsenides; Indium Phosphides; Semiconductor Junctions; Electrical Properties

20000033712 Naval Research Lab., Washington, DC USA
The Role of Radiation Hard Solar Cells in Minimizing the Costs of Global Satellite Communication Systems
Summers, Geoffrey P., Naval Research Lab., USA; Walters, Robert J., Naval Research Lab., USA; Messenger, Scott R., Sachs/Freeman Associates, Inc., USA; Burke, Edward A., Sachs/Freeman Associates, Inc., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 71-79; In English; See also 20000033702; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

An analysis embodied in a PC computer program is presented, which quantitatively demonstrates how the availability of radiation hard solar cells can help minimize the cost of a global satellite communications system. An important distinction between the currently proposed systems, such as Iridium, Odyssey and Ellipsat, is the number of satellites employed and their operating altitudes. Analysis of the major costs associated with implementing these systems shows that operation at orbital altitudes within the earth's radiation belts (10(exp 3) to 10(exp 4) km) can reduce the total cost of a system by several hundred percent, so long as radiation hard components including solar cells can be used. A detailed evaluation of the predicted performance of photovoltaic arrays using several different planar solar cell technologies is given, including commercially available Si and GaAs/Ge, and InP/Si which is currently under development. Several examples of applying the program are given, which show that the end of life (EOL) power density of different technologies can vary by a factor of ten for certain missions. Therefore, although a relatively radiation-soft technology can usually provide the required EOL power by simply increasing the size of the array, the impact upon the total system budget could be unacceptable, due to increased launch and hardware costs. In aggregate, these factors can account for more than a 10% increase in the total system cost. Since the estimated total costs of proposed global-coverage systems range from $lB to $9B, the availability of radiation-hard solar cells could make a decisive difference in the selection of a particular constellation architecture.
Author
Cost Reduction; Gallium Arsenides; Computer Programs; Launch Costs; Radiation Effects; Solar Cells; Terrestrial Radiation

20000033713 NASA Lewis Research Center, Cleveland, OH USA
High and Low Energy Proton Radiation Damage in p/n InP MOCVD Solar Cells
Rybicki, George, NASA Lewis Research Center, USA; Weinberg, Irv, NASA Lewis Research Center, USA; Scheiman, Dave, NYMA, Inc., USA; Vargas-Aburto, Carlos, Kent State Univ., USA; Uribe, Roberto, Kent State Univ., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 80-88; In English; See also 20000033702
Contract(s)/Grant(s): NCC3-281; NAG3-946; NAG3-1726; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

InP p(+)/n/n(+) solar cells, fabricated by metal organic chemical vapor deposition, (MOCVD) were irradiated with 0.2 MeV and 10 MeV protons to a fluence of 10(exp 13)/sq cm. The power output degradation, IV behavior, carrier concentration and defect concentration were observed at intermediate points throughout the irradiations. The 0.2 MeV proton-irradiated solar cells suffered much greater and more rapid degradation in power output than those irradiated with 10 MeV protons. The efficiency losses were accompanied by larger increases in the recombination currents in the 0.2 MeV proton-irradiated solar cells. The low energy proton irradiations also had a larger impact on the series resistance of the solar cells. Despite the radiation induced damage, the carrier concentration in the base of the solar cells showed no reduction after 10 MeV or 0.2 MeV proton irradiations and even increased during irradiation with 0.2 MeV protons. In a deep level transient spectroscopy (DLTS) study of the irradiated samples, the minority carrier defects H4 and H5 at E(sub v) + 0.33 and E(sub v) + 0.52 eV and the majority carrier defects E7 and El0 at E(sub c) - 0.39 and E(sub c) - 0.74 eV, were observed. The defect introduction rates for the 0.2 MeV proton irradiations were about 20 times higher than for the 10 MeV proton irradiations. The defect El0, observed here after irradiation, has been shown to act as a donor in irradiated n-type InP and may be responsible for obscuring carrier removal. The results of this study are consistent with

the much greater damage produced by low energy protons whose limited range causes them to stop in the active region of the solar cell.
Author
Solar Cells; Indium Phosphides; Carrier Density (Solid State); Degradation; Majority Carriers; Metalorganic Chemical Vapor Deposition; Proton Irradiation; Radiation Damage

20000033714 Naval Research Lab., Washington, DC USA
Correlation of Electron and Proton Irradiation-Induced Damage in InP Solar Cells
Walters, Robert J., Naval Research Lab., USA; Summers, Geoffrey P., Naval Research Lab., USA; Messenger, Scott R., Sachs/Freeman Associates, Inc., USA; Burke, Edward A., Sachs/Freeman Associates, Inc., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 89-94; In English; See also 20000033702; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The measured degradation of epitaxial shallow homojunction n(+)p InP solar cells under 1 MeV electron irradiation is correlated with that measured under 3 MeV proton irradiation based on ”displacement damage dose”. The measured data is analyzed as a function of displacement damage dose from which an electron to proton dose equivalency ratio is determined which enables the electron and proton degradation data to be described by a single degradation curve. It is discussed how this single curve can be used to predict the cell degradation under irradiation by any particle energy. The degradation curve is used to compare the radiation response of InP and GaAs/Ge cells on an absolute damage energy scale. The comparison shows InP to be inherently more resistant to displacement damage deposition than the GaAs/Ge.
Author
Proton Irradiation; Degradation; Semiconductor Junctions; Solar Cells; Radiation Effects; Data Processing; Homojunctions; Indium Phosphides

20000033715 Spire Corp., Bedford, MA USA
Diffusion Lengths in Irradiated N/P InP-on-Si Solar Cells
Wojtczuk, Steven, Spire Corp., USA; Colerico, Claudia, Spire Corp., USA; Summers, Geoffrey P., Naval Research Lab., USA; Walters, Robert J., Naval Research Lab., USA; Burke, Edward A., Burke (Edward A.), USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 95-99; In English; See also 20000033702; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

Indium phosphide (InP) solar cells were made on silicon (Si) wafers (InP/Si) by to take advantage of both the radiation-hardness properties of the InP solar cell and the light weight and low cost of Si wafers. The InP/Si cell application is for long duration and/or high radiation orbit space missions. Spire has made N/P InP/Si cells of sizes up to 2 cm by 4 cm with beginning-of-life (BOL) AM0 efficiencies over 13% (one- sun, 28 C). These InP/Si cells have higher absolute efficiency and power density after a high radiation dose than gallium arsenide (GaAs) or silicon (Si) solar cells after a fluence of about 2el5 I MeV electrons/sq cm. In this work, we investigate the minority carrier (electron) base diffusion lengths in the N/P InP/Si cells. A quantum efficiency model was constructed for a 12% BOL AM0 N/P InP/Si cell which agreed well with the absolutely measured quantum efficiency and the sun-simulator measured AM0 photocurrent (30.1 mA/sq cm). This model was then used to generate a table of AM0 photocurrents for a range of base diffusion lengths. AM0 photocurrents were then measured for irradiations up to 7.7el6 1 MeV electrons/sq cm (the 12% BOL cell was 8% after the final irradiation). By comparing the measured photocurrents with the predicted photocurrents, base diffusion lengths were assigned at each fluence level. A damage coefficient K of 4e-8 and a starting (unirradiated) base electron diffusion length of 0.8 microns fits the data well. The quantum efficiency was measured again at the end of the experiment to verify that the photocurrent predicted by the model (25.5 mA/sq cm) agreed with the simulator-measured photocurrent after irradiation (25.7 mA/sq cm).
Author
Indium Phosphides; Diffusion Length; Solar Cells; Silicon; Wafers; Radiation Hardening; Electron Diffusion; Gallium Arsenides; P-N Junctions

20000033716 Sachs/Freeman Associates, Inc., Landover, MD USA
Electron and Proton Damage in In(0.53)Ga(0.47)As Solar Cells Having an InP Window Layer
Messenger, Scott R., Sachs/Freeman Associates, Inc., USA; Cotal, Hector L., Naval Research Lab., USA; Walters, Robert J., Naval Research Lab., USA; Summers, Geoffrey P., Naval Research Lab., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 100-105; In English; See also 20000033702; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

As part of a continuing NRL program to optimize the space radiation resistance of InP/In(0.53)Ga(0.57)As tandem solar cells, In(0.53)Ga(0.47)As (referred to as InGaAs below) solar cells were irradiated with 1 MeV electrons and with 3 MeV protons. The cells were grown with a 3 microns n-InP window layer to mimic the top cell in the tandem cell configuration for both AM0 solar absorption and radiation effects. The results have been plotted against 'displacement damage dose' which is the product of the nonionizing energy loss (NIEL) and the particle fluence. A characteristic radiation damage curve is then obtained for predicting the effect of all particles and energies. Air mass zero (AM0), one sun solar illumination IV measurements were performed on the irradiated InGaAs solar cells and a characteristic radiation degradation curve was obtained using the solar cell conversion efficiency as the model parameter. Also presented are data comparing the radiation response of both n/p and p/n InGaAs solar cells. For the solar cell efficiency, the radiation degradation was found to be independent of the sample polarity.
Author
Proton Damage; Electrons; Indium Gallium Arsenides; Solar Cells; Indium Phosphides; Extraterrestrial Radiation; Radiation Damage

20000033717 Meulenberg (Andrew), Gaithersburg, MD USA
Photo-Recovery of Electron-Irradiated GaAs Solar Cells
Meulenberg, Andrew, Meulenberg (Andrew), USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 106-113; In English; See also 20000033702; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The first long-term (3000 hours) UV testing of unirradiated and 1 MeV electron4rradiated GaAs/Ge solar cells, with multilayer-coated coverslides to reduce operating temperature, has produced some unexpected results. The cells used for this series of tests displayed a much higher radiation degradation than that predicted based on JPL Solar Cell Radiation Handbook data. Covered cells degraded more than did bare cells and use of multilayer-coated coverslides further increased the radiation degradation in short-circuit current (I(sub sc)). Electron radiation damage to these GaAs solar cells anneals at 40 C when exposed to approx. 1 sun AM0 UV light sources. The effect appears to be linear with time (approx. 1% of I(sub sc) per 1000 UVSH), has not yet saturated (at 3000 hours), and may not saturate until recovery of electron damage is complete. If electron, and perhaps proton damage, to GaAs solar cells recovers totally with extended exposure to sunlight, the financial implications to the satellite community are immense. This effect must be confirmed by further laboratory and flight data.
Author
Solar Cells; Gallium Arsenides; Annealing; Coatings; Electron Radiation; Radiation Damage

20000033718 AstroPower, Inc., Newark, DE USA
Initial Results for the Silicon Monolithically Interconnected Solar Cell Product
DiNetta, L. C., AstroPower, Inc., USA; Shreve, K. P., AstroPower, Inc., USA; Cotter, J. E., AstroPower, Inc., USA; Sun, S., AstroPower, Inc., USA; Barnett, A. M., AstroPower, Inc., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 114-121; In English; See also 20000033702
Contract(s)/Grant(s): DASG60-95-C-0007; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

This proprietary technology is based on AstroPowers electrostatic bonding and innovative silicon solar cell processing techniques. Electrostatic bonding allows silicon wafers to be permanently attached to a thermally matched glass superstrate and then thinned to final thicknesses less than 25 microns. These devices are based on the features of a thin, light-trapping silicon solar cell: high voltage, high current, light weight (high specific power) and high radiation resistance. Monolithic interconnection allows the fabrication costs on a per Watt basis to be roughly independent of the array size, power or voltage, therefore, the cost effectiveness to manufacture solar cell arrays with output powers ranging from milliwatts up to four watts and output voltages ranging from 5 to 500 volts will be similar. This compares favorably to conventionally manufactured, commercial solar cell arrays, where handling of small parts is very labor intensive and costly. In this way, a wide variety of product specifications can be met using the same fabrication techniques. Prototype solar cells have demonstrated efficiencies greater than 11%. An open-circuit voltage of 5.4 volts, fill factor of 65%, and short-circuit current density of 28mA/sq cm at AM 1.5 illumination are typical. Future efforts are being directed to optimization of the solar cell operating characteristics as well as production processing. The monolithic approach has a number of inherent advantages, including reduced cost per interconnect and increased reliability of array connections. These features make this proprietary technology an excellent candidate for a large number of consumer products.
Author
Solar Cells; Technology Assessment; Electrostatic Bonding; Fabrication; Cost Effectiveness

20000033719 Ohio State Univ., Dept. of Electrical Engineering, Columbus, OH USA

Hydrogen Passivation of N(+)P and P(+)N Heteroepitaxial InP Solar Cell Structures

Chatterjee, B., Ohio State Univ., USA; Davis, W. C., Ohio State Univ., USA; Ringel, S. A., Ohio State Univ., USA; Hoffman, R., Jr., Essential Research, Inc., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 127-136; In English; See also 20000033702

Contract(s)/Grant(s): NAG3-1416; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Dislocations and related point defect complexes caused by lattice mismatch currently limit the performance of heteroepitaxial InP cells by introducing shunting paths across the active junction and by the formation of deep traps within the base region. We have previously demonstrated that plasma hydrogenation is an effective and stable means to passivate the electrical activity of such defects in specially designed heteroepitaxial InP test structures to probe hydrogen passivation at typical base depths within a cell structure. In this work, we present our results on the hydrogen passivation of actual heteroepitaxial n(+)p and p(+)n InP cell structures grown on GaAs substrates by metalorganic chemical vapor deposition (MOCVD). We have found that a 2 hour exposure to a 13.56 MHz hydrogen plasma at 275 C reduces the deep level concentration in the base regions of both n(+)p and p(+)n heteroepitaxial InP cell structures from as-grown values of 5 - 7 x 10(exp 14)/cc, down to 3 - 5 x 10(exp 12)/cc. All dopants were successfully reactivated by a 400 C, 5 minute anneal With no detectable activation of deep levels. I-V analysis indicated a subsequent approx. 100 fold decrease In reverse leakage current at -1 volt reverse bias, and an improved built in voltage for the p(+)n structures. ln addition to being passivated,dislocations are also shown to participate in secondary interactions during hydrogenation. We find that the presence of dislocations enhances hydrogen diffusion into the cell structure, and lowers the apparent dissociation energy of Zn-H complexes from 1.19 eV for homoepitaxial Zn-doped InP to 1.12 eV for heteroepitaxial Zn-doped InP. This is explained by additional hydrogen trapping at dislocations subsequent to the reactivation of Zn dopants after hydrogenation.

Author

Passivity; P-N Junctions; Epitaxy; Indium Phosphides; Solar Cells; Hydrogen Plasma; Hydrogenation

20000033724 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Solar Cell Angle of Incidence Corrections

Burger, Dale R., Jet Propulsion Lab., California Inst. of Tech., USA; Mueller, Robert L., Jet Propulsion Lab., California Inst. of Tech., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 168-177; In English; See also 20000033702; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The Mars Pathfinder mission has three different solar arrays each of which sees changes in incidence angle during normal operation. When solar array angle of incidence effects was researched little published data was found. The small amount of-published data created a need to obtain and evaluate such data. The donation of the needed data, which was taken in the fall of 1994, was a major factor in the preparation of this paper.

Author

Solar Cells; Solar Arrays; Data Acquisition

20000033725 NASA Lewis Research Center, Cleveland, OH USA

Low Intensity Low Temperature (LILT) Measurements and Coefficients on New Photovoltaic Structures

Scheiman, David A., NYMA, Inc., USA; Jenkins, Phillip P., NYMA, Inc., USA; Brinker, David J., NASA Lewis Research Center, USA; Appelbaum, Joseph, Tel-Aviv Univ., Ramat-Aviv, Israel; Space Photovoltaic Research and Technology 1995; October 1995, pp. 178-185; In English; See also 20000033702; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Past NASA missions to Mars, Jupiter and the outer planets were powered by radioisotope thermal generators (RTGs). Although these devices proved to be reliable, their high cost and highly toxic radioactive heat source has made them far less desirable for future planetary missions. This has resulted in a renewed search for alternate energy sources, some of them being photovoltaics (PV) and thermophotovoltaics (TPV). Both of these alternate energy sources convert light/thermal energy directly into electricity. In order to create a viable PV data base for planetary mission planners and cell designers, we have compiled low intensity low temperature (LILT) I-V data on single junction and multi-junction high efficiency solar cells. The cells tested here represent the latest photovoltaic technology. Using this LILT data to calculate Short Circuit Current (I(sub sc)), Open Circuit Voltage (V(sub os)), and Fill Factor (FF) as a function of temperature and intensity, an accurate prediction of cell performance under the AM0 spectrum can be determined. When combined with QUantum efficiency at Low Temperature (QULT) data, one can further enhance the data by adding spectral variations to the measurements. This paper presents an overview of LILT measurements and is only intended to be used as a guideline for material selection and performance predictions. As single junction and multi-junction cell technologies emerge, new test data must be collected. Cell materials included are Si, GaAs/Ge, GaInP/GaAs/GaAs, InP, InGaAs/InP, InP/InGaAs/InP, and GaInP. Temperatures range down to as low as -180 C and intensities

range from 1 sun down to 0.02 suns. The coefficients presented in this paper represent experimental results and are intended to provide the user with approximate numbers.
Author
Low Temperature; Temperature Measurement; Photovoltaic Conversion; Performance Prediction; Alternatives; Gallium Phosphides; Indium Gallium Arsenides; Indium Phosphides; Thermal Energy; Radiance

20000033726 NASA Lewis Research Center, Cleveland, OH USA
A Summary of the International Workshops on Space Solar Cell Calibration and Measurement Techniques
Brinker, D. J., NASA Lewis Research Center, USA; Curtis, H. B., NASA Lewis Research Center, USA; Flood, D. J., NASA Lewis Research Center, USA; Jenkins, P., NYMA, Inc., USA; Scheiman, D. A., NYMA, Inc., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 186-190; In English; See also 20000033702; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

The first two of a planned series of international workshops concerning space solar cell calibration and measurement techniques have been held within the past year. The need for these workshops arose from the increasing complexity of space solar cells coupled with the growing international nature of the market for space cells and arrays. The workshops, jointly sponsored by NASDA, ESA and NASA, have the objective of obtaining international agreement on standardized values for the AM0 spectrum and constant, recommendations for laboratory measurement practices and the establishment of a set of protocols for making interlaboratory comparison measurements. The results of the first two workshops, held in Waikiki, Hawaii, USA in 1994 and Madrid, Spain in 1995, are presented.
Author
Conferences; Solar Cells; Calibrating; Measuring Instruments; Standardization

20000033727 NASA Lewis Research Center, Cleveland, OH USA
Review of Recent Thermophotovoltaic (TPV) Research at Lewis Research Center
Chubb, Donald L., NASA Lewis Research Center, USA; Good, Brian S., NASA Lewis Research Center, USA; Wilt, David M., NASA Lewis Research Center, USA; Lowe, Roland A., Essential Research, Inc., USA; Fatemi, Navid S., Essential Research, Inc., USA; Hoffman, Richard H., Essential Research, Inc., USA; Scheiman, David, NYMA, Inc., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 191-207; In English; See also 20000033702; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Thermophotovoltaic (TPV) research at NASA Lewis Research Center that began in the late 1980's is reviewed. This work has been concentrated on low bandgap indium gallium arsenide (InGaAs) PV calls and rare earth - yttrium aluminum garnet (YAG) thin film selective emitters, as well as, TPV system studies. An emittance theory has been developed for the thin film emitters. Experimental spectral emittance results for erbium Er-YAG and holmium Ho-YAG show excellent emittance (greater than or equal to 0.7) within the emission bands. The 0.75 eV InGaAs PV cells fabricated at Lewis have excellent quantum efficiency. An efficiency of 130% has been measured for this cell coupled to an Er-YAG selective emitter and a short pass IR filter.
Author
Thermophotovoltaic Conversion; Research; Indium Gallium Arsenides; Yttrium-Aluminum Garnet; Thin Films; Emittance

20000033728 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Thermophotovoltaic Generators Using Selective Metallic Emitters
Fraas, Lewis M., JX Crystals, Inc., USA; Samaras, John E., JX Crystals, Inc., USA; Avery, James E., JX Crystals, Inc., USA; Ewell, Richard, Jet Propulsion Lab., California Inst. of Tech., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 208-214; In English; See also 20000033702; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

In the literature to date on thermophotovoltaic (TPV) generators, two types of infrared emitter's have been emphasized : gray body emitters and rare earth oxide selective emitters. The gray body emitter is defined as an emitter with a spectral emissivity independent of wavelength whereas the rare earth oxide selective emitter is idealized as a delta function emitter with a high emissivity at a select wavelength and a near zero emissivity at all other wavelengths. Silicon carbide is an example of a gray body emitter and ER-YAG is an example of a selective emitter. The Welsbach mantle in a common lantern is another example of an oxide selective emitter. Herein, we describe an alternative type of selective emitter, a selective metallic emitter. These metallic emitters are characterized by a spectral emissivity curve wherein the emissivity monotonically increases with shorter infrared wavelengths as is shown. The metal of curve "A", tungsten, typifies this class of selective metallic emitter's. In a thermophotovoltaic generator, a photovoltaic cell typically converts infrared radiation to electricity out to some cut-off wavelength. For example, Gallium Antimonide (GaSb) TPV cells respond out to 1.7 microns. The problem with gray body emitters is that they emit at all wavelengths. Therefore, a large fraction of the energy emitted will be outside of the response band

of the TPV cell. The argument for the selective emitter is that, ideally, all the emitted energy can be in the cells response band. Unfortunately, rare earth oxide emitters are not ideal. In order to suppress the emissivity toward zero away from the select wavelength, the use of thin fiber's is necessary. This leads to a fragile emitter typical of a lantern mantle. Even given a thin ER-YAG emitter, the measured emissivity at the select wavelength of 1.5 microns has been reported to be 0.6 while the off wavelength background emissivity falls to only 0.2 at 5 microns. This gives a selectivity ratio of only 3. Another problem with a delta function selective emitter is its low power density at practical temperatures because of its narrow emission bandwidth. The concept of selectivity can be generalized by noting that we simply wish to maximize the ratio of in-cell-band power to out-of-cell-band power. Using this generalized selectivity concept and assuming a GaSb cell covered by a simple dielectric filter, we note that the emissivity selectivity ratio for tungsten is 0.3 (at 1.5 microns) / 0.07 (at 5 microns) = 4.3. In the folloy4ng sections, we note that the selective metallic emitters can be valuable in both radioisotope TPV generators in space and in hydrocarbon fired TPV generators here on earth.
Author
Photovoltaic Cells; Emitters; Infrared Spectra; Hydrocarbons; Gallium Antimonides

20000033729 AstroPower, Inc., Newark, DE USA
InGaAsSb/GaSb Thermophotovoltaic Cells
Shellenbarger, Z. A., AstroPower, Inc., USA; Mauk, M. G., AstroPower, Inc., USA; DiNetta, L. C., AstroPower, Inc., USA; Charache, G. W., Lockheed Martin Corp., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 215-222; In English; See also 20000033702; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

AstroPower is developing InGaAsSb thermophotovoltaic (TPV) devices. This photovoltaic cell is a two-layer epitaxial InGaAsSb structure formed by liquid-phase epitaxy on a GaSb substrate. The (direct) bandgap of the In(1-x)Ga(x)As(1-y)Sb(y) alloy is 0.50 to 0.55 eV, depending on its exact alloy composition (x.y); and is closely lattice-matched to the GaSb substrate. The use of the quaternary alloy, as opposed to a ternary alloy - such as, for example, InGaAs/InP - permits low bandgap devices optimized for 1000 to 1500 C thermal sources with, at the same time, near-exact lattice matching to the GaSb substrate. Lattice-matching is important since even a small degree of lattice mismatch degrades device performance and reliability and increases processing complexity. Internal quantum efficiencies as high as 95% have been measured at a wavelength of 2 microns. At 1 micron wavelengths, internal quantum efficiencies of 55% have been observed. The open-circuit voltage at currents of 0.3 Al/sq cm is 0.220 volts and 0.260 V for current densities of 2 A/sq cm. Fill factors of 56% have been M2 measured at 60 mA/sq cm. However, as current density increases there is some decrease in fill factor. Our results to date show that the GaSb-based quaternary compounds provide a viable and high performance energy conversion solution for thermophotovoltaic systems operating with 1000 to 1500 C source temperatures.
Author
Indium Gallium Arsenides; Photovoltaic Cells; Fabrication; Gallium Antimonides; Energy Conversion

20000033730 Spire Corp., Bedford, MA USA
Multijunction InGaAs Thermophotovoltaic Power Converter
Wojtczuk, Steven, Spire Corp., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 223-230; In English; See also 20000033702; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The experimental performance of a multijunction monolithic lattice-matched 0.74 eV InGaAs thermophotovoltaic (TPV) power converter under 980 C blackbody irradiation is reported. Eight InGaAs PN junctions grown epitaxially on a semi-insulating wafer were monolithically integrated in series to boost the approx. 0.4 V photovoltage per typical InGaAs junction to over 3 volts for the 1 sq cm chip. This chip was originally designed and characterized for free-space 1.3 microns laser power beaming. The power efficiency of this TPV device is 16% for that part of the blackbody spectrum above the material bandgap. The device is shown to deliver about 1 watt of output power when driven with enough light. This is the first report of such a multijunction TPV device. This is not a traditional tandem cell in which the junctions are stacked vertically. Eight 1 mm long by 1 cm wide junctions are laterally connected across the device area. This multijunction design has the potential for lower I(exp 2)R power loss since the smaller PN junction area limits the current to one-eighth that of the equivalent surface area. In essence, the current is traded for voltage to avoid the I(exp 2)R loss, analogous to the way power utilities avoid 12R loss in high-tension power lines, by transforming the high current, low voltage generated at a power plant into a high voltage at a low current before transmitting the power over great distances. The present multijunction TPV does not yet work at the 100 W/sq cm level. the concept.
Author
Semiconductor Junctions; Indium Gallium Arsenides; P-N Junctions; Thermophotovoltaic Conversion; Epitaxy; Insulation; Solar Cells

20000033731 AstroPower, Inc., Newark, DE USA

Gallium Phosphide Energy Converters

Sims, P. E., AstroPower, Inc., USA; DiNetta, L. C., AstroPower, Inc., USA; Cavanagh, K. Dugan, AstroPower, Inc., USA; Goetz, M. A., AstroPower, Inc., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 231-236; In English; See also 20000033702; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Betavoltaic power supplies based on gallium phosphide can supply long term low-level power with high reliability. Results are presented for GaP devices powered by Ni-63 and tritiarated phosphors. Leakage currents as low as 1.2 x 10(exp -17) A/sq cm have been measured and the temperature dependence of the reverse saturation current is found to have ideal behavior. A small demonstration system has been assembled that generates and stores enough electricity to light up an LED.

Author

Gallium Phosphides; Radioisotope Batteries; Temperature Dependence; Direct Power Generators

20000033732 Hughes Space and Communications Co., Spacecraft Integrations and Structures Business Unit, El Segundo, CA USA

Characteristics Testing of MEASAT GaAs/Ge Solar Cell Assemblies

Brown, Mike R., Hughes Space and Communications Co., USA; Garcia, Curtis A., Hughes Space and Communications Co., USA; Goodelle, George S., Hughes Space and Communications Co., USA; Powe, Joseph S., Hughes Space and Communications Co., USA; Schwartz, Joel A., Hughes Space and Communications Co., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 237-246; In English; See also 20000033702; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The first commercial communications satellite with gallium-arsenide on germanium (GaAs/Ge) solar arrays is scheduled for launch in December 1995. The spacecraft, named MEASAT, was built by Hughes Space and Communications Company. The solar cell assemblies consisted of large area GaAs/Ge cells supplied by Spectrolab Inc. with infrared reflecting (IRR) coverglass supplied by Pilkington Space Technology. A comprehensive characterization program was performed on the GaAs/Ge solar cell assemblies used on the MEASAT array. This program served two functions; first to establish the database needed to accurately predict on-orbit performance under a variety of conditions; and second, to demonstrate the ability of the solar cell assemblies to withstand all mission environments while still providing the required power at end-of-life. Characterization testing included measurement of electrical performance parameters as a function of radiation exposure, temperature, and angle of incident light; reverse bias stability; optical and thermal properties; mechanical strength tests, panel fabrication, humidity and thermal cycling environmental tests. The results provided a complete database enabling the design of the MEASAT solar array, and demonstrated that the GaAs/Ge cells meet the spacecraft requirements at end-of-life.

Author

Performance Tests; Solar Arrays; Gallium Arsenides; Germanium; Data Bases; Electrical Measurement; Fabrication; Stability

20000033733 Applied Solar Energy Corp., City of Industry, CA USA

Advanced Solar Panel Designs

Ralph, E. L., Applied Solar Energy Corp., USA; Linder, E. B., Applied Solar Energy Corp., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 247-256; In English; See also 20000033702

Contract(s)/Grant(s): NAS8-4057; NAS8-4056; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Solar panel designs that utilize new high-efficiency solar cells and lightweight rigid panel technologies are described. The resulting designs increase the specific power (W/kg) achievable in the near-term and are well suited to meet the demands of higher performance small satellites (smallsats). Advanced solar panel designs have been developed and demonstrated on two NASA SBIR contracts at Applied Solar. The first used 19% efficient, large area (5.5 cm x 6.5 cm) GaAs/Ge solar cells with a lightweight rigid graphite epoxy isogrid substrate configuration. A 1,445 sq cm coupon was fabricated and tested to demonstrate 60 W/kg with a high potential of achieving 80 W/kg. The second panel design used new 22% efficiency, dual-junction GaInP2/GaAs/Ge solar cells combined with a lightweight aluminum core/graphite fiber mesh facesheet substrate. A 1,445 sq cm coupon was fabricated and tested to demonstrate 105 W/kg with the potential of achieving 115 W/kg.

Author

Structural Design; Panels; Solar Cells; Technology Assessment; Fabrication; Gallium Arsenides

20000033734 Meulenberg (Andrew), Gaithersburg, MD USA

Space Qualification of UV and IR Reflecting Coverslides for GaAs Solar Cells

Meulenberg, Andrew, Meulenberg (Andrew), USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 257-267; In English; See also 20000033702; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

As part of the space qualification effort for blue-red reflecting coverslides designed for use with GaAs solar cells, the first long-term (3000 hours) UV testing of unirradiated and 1 MeV electron4rradiated GaAs solar cells, with 4 types of multilayer-coated coverslides to reduce operating temperature. has produced some unexpected results. Important conclusions from this study, which includes two parallel tests, are: (1) All of the GaAs solar cells with multilayer-coated coverslides display UV degradation. The laboratory data, extrapolated to 10 years in orbit, point to a significant loss mechanism from a combination of absorption and a reduction in optical match in such coatings from this portion of the space environment. (2) The effects of contamination in a vacuum system, on the measured degradation in solar-cell short-circuit current during a UV test, depend upon the type of coverslide coatings present on the cover'slide surfaces. This has implications for both coated coverslides and optical solar reflectors (OSRs) in space. and (3) Because of the observed trends in this test and uncertainties in the extrapolation of data for multilayer-coated coverslides, the use of any multilayer-coated coverslides for extended missions (less than 1 year) cannot be recommended Without prior flight testing.
Author
Ultraviolet Filters; Infrared Filters; Gallium Arsenides; Solar Cells; Design Analysis; Fabrication; Solar Reflectors

20000033741 AstroPower, Inc., Newark, DE USA
Monolithically Interconnected GaAs Solar Cells: A New Interconnection Technology for High Voltage Solar Cell Output
DiNetta, L. C., AstroPower, Inc., USA; Hannon, M. H., AstroPower, Inc., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 122-126; In English; See also 20000033702; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

Photovoltaic linear concentrator arrays can benefit from high performance solar cell technologies being developed at AstroPower. Specifically, these are the integration of thin.GaAs solar cell and epitaxial lateral overgrowth technologies with the application of monolithically interconnected solar cell (MISC) techniques. This MISC array has several advantages which make it ideal for space concentrator systems. These are high system voltage, reliable low cost monolithically formed interconnections, design flexibility, costs that are independent of array voltage, and low power loss from shorts, opens, and impact damage. This concentrator solar cell will incorporate the benefits of light trapping by growing the device active layers over a low-cost, simple, PECVD deposited silicon/silicon dioxide Bragg reflector. The high voltage-low current output results in minimal I(exp 2)R losses, while properly designing the device allows for minimal shading and resistance losses. It is possible to obtain open circuit voltages as high as 67 volts/cm of solar cell length with existing technology. The projected power density for the high performance device is 5 kW/sq M for an AM0 efficiency of 26% at 15X. Concentrator solar cell arrays are necessary to meet the power requirements of specific mission platforms and can supply high voltage power for electric propulsion systems. It is anticipated that the high efficiency, GaAs monolithically interconnected linear concentrator solar cell array will enjoy widespread application for space based sol'ar power needs. Additional applications include remote man-portable or ultra-light unmanned air vehicle (UAV) power supplies where high power per area, high radiation hardness and a high bus voltage or low bus current are important. The monolithic approach has a number of inherent advantages, including reduced cost per interconnect and increased reliability of array connections. There is also a high potential for a large number of consumer products. Dual-use applications can include battery chargers and remote power supplies for consumer electronics products such as portable telephones/beepers, portable radios, CD players, dashboard radar detectors, remote walkway lighting, etc.
Author
Gallium Arsenides; Solar Cells; Photovoltaic Conversion; Epitaxy; Linear Arrays; Photovoltaic Cells; Reliability

20000034038 NASA Glenn Research Center, Cleveland, OH USA
Technology Development for a Stirling Radioisotope Power System
Thieme, Lanny G., NASA Glenn Research Center, USA; Qiu, Songgang, Stirling Technology Co., USA; White, Maurice A., Stirling Technology Co., USA; March 2000; 12p; In English; Space Technology and Applications International Forum, 30 Jan. - 3 Feb. 2000, Albuquerque, NM, USA; Sponsored by American Inst. of Physics, USA
Contract(s)/Grant(s): NAS3-98016; NAS3-27817; RTOP 632-6A-1K
Report No.(s): NASA/TM-2000-209791; E-12080; NAS 1.15:209791; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA Glenn Research Center and the Department of Energy are developing a Stirling convertor for an advanced radioisotope power system to provide spacecraft on-board electric power for NASA deep space missions. NASA Glenn is addressing key technology issues through the use of two NASA Phase II SBIRs with Stirling Technology Company (STC) of Kennewick, WA. Under the first SBIR, STC demonstrated a synchronous connection of two thermodynamically independent free-piston Stirling convertors and a 40 to 50 fold reduction in vibrations compared to an unbalanced convertor. The second SBIR is for the development of an Adaptive Vibration Reduction System (AVRS) that will essentially eliminate vibrations over the mission

lifetime, even in the unlikely event of a failed convertor. This paper presents the status and results for these two SBIR projects and also discusses a new NASA Glenn in-house project to provide supporting technology for the overall Stirling radioisotope power system development. Tasks for this new effort include convertor performance verification, controls development, heater head structural life assessment, magnet characterization and thermal aging tests, FEA analysis for a lightweight alternator concept, and demonstration of convertor operation under launch and orbit transfer load conditions.
Author
Stirling Engines; Nuclear Electric Power Generation; Technology Utilization; Radioisotope Batteries

20000034243 ARCADIS Geraghty and Miller, Inc., Mountain View, CA USA
Evaluation of Fuel Cell Reformer Emissions, Appendix A, Partial Oxidation Fuel Processor Gas Composition and Emission Test Data Report ***Final Report***
Unnasch, S.; Drunert, V.; Sep. 1999; 86p; In English
Contract(s)/Grant(s): CARB-95-313
Report No.(s): PB2000-103866; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
This Appendix contains the result of the testing of the Underoxidized Burner (UOB) developed by Hydrogen Burner Technology (HBT) (Long Beach, California) to produce hydrogen from ethane, water and air making use of the partial oxidation (POX) process. Vehicles powered with proton exchange membrane fuel cells (PEMFC) and POX fuel processors are a leading candidate for passenger cars. A POX system can operate on a variety of fuels, which would make fuel cell powered vehicles feasible throughout a greater geographic area and not as dependent on fuel infrastructure. The primary focus of the fuel cell program for passengers cars at the USA Department of Energy is PEMFCs with multi-fuel fuel processors such as a POX system. The HBT system was tested at various loads, start up, and transient operation. The data was evaluated and incorporated into a vehicle simulation model to determine g/mi emissions.
NTIS
Fuel Cells; Membranes; Emission; Air Pollution; Pollution Monitoring; Hydrogen Production

20000034856 Boeing Co., Rocketdyne, Canoga Park, CA USA
Space Solar Power Management and Distribution (PMAD)
Lynch, Thomas H., Boeing Co., USA; [2000]; 18p; In English; Space Power Workshop, 10 Apr. 2000, Long Beach, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This paper presents, in viewgraph form, SSP PMAD (Space Solar Power Management and Distribution). The topics include: 1) Architecture; 2) Backside Thermal View; 3) Solar Array Interface; 4) Transformer design and risks; 5) Twelve phase rectifier; 6) Antenna (80V) Converters; 7) Distribution Cables; 8) Weight Analysis; and 9) PMAD Summary.
CASI
Design Analysis; Solar Generators; Solar Arrays; Aerospace Environments

20000036517 Institute of Electrical and Electronics Engineers, Piscataway, NJ USA
12TH International Pulsed Power Conference ***Final Report, 1 May-30 Nov 1999***
Stallings, Charles; Kirbie, Hugh; Feb. 25, 2000; 22p; In English
Contract(s)/Grant(s): F49620-99-1-0233; AF Proj. 2301
Report No.(s): AD-A374797; AFRL-SR-BL-TR-00-0050; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The 12th IEEE International Pulsed Power Conference was held June 27-30, 1999 at the Double Tree Hotel in Monterey, California. ”Advancing Pulsed Power Into the 21st Century” was the theme of this final Pulsed Power Conference of the millennium. It was the largest and most diverse conference in the 23-year history of the Pulsed Power Conference with 623 attendees from 23 countries. Two-thirds of the attendees were from the USA.
DTIC
Millimeter Waves; Energy Storage; Magnetohydrodynamics

20000037742 Army Research Lab., Sensors Directorate, Adelphi, MD USA
Performance and Evaluation of Bipolar Fuel Cell Stacks ***Progress Report, Oct. 1998-Sep. 1999***
Chu, Deryn; Jiang, Rongzhong; Walker, Charles; Jacobs, Richard; Gardner, Krist; Feb. 2000; 24p; In English
Report No.(s): AD-A374909; ARL-TR-2064; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Under a joint technology planning annex (TPA) agreement, fuel cell groups at the U.S. Army Research Laboratory (ARL) and the U.S. Army Communications-Electronics Command (CECOM) worked together to develop Army power sources for soldier applications. Two 50-W bipolar fuel cell stacks designed by CECOM were extensively evaluated. The performance of the stacks depended significantly

on the environmental temperature. Decreasing environmental temperature granted better heat dissipation in the stacks, resulting in improved stack performance. Long-term performance of 62 W was obtained at low temperature (-5 deg C). Higher environmental temperatures caused an increase in stack surface temperature. When the stack surface temperature reached 43 deg C, the stack voltage dropped to zero within a short time. The maximum power density for long-term operation was 97.3 W/kg, or 167 W/L. The average hydrogen utilization efficiency was 95 percent. The water production efficiency was dependent on the discharge currents, varying from 40 percent (at 1.0 A) to 90 percent (at 2.5 A).
DTIC
Fuel Cells; Bipolarity; Electric Potential

45
ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

20000033772 Army Construction Engineering Research Lab., Champaign, IL USA
Enhanced Operations and Maintenance of Pollution Control Equipment ***Final Report***
Northrup, Jearldine I., Army Construction Engineering Research Lab., USA; Ginsberg, Mark D., Army Construction Engineering Research Lab., USA; Baird, Joyce C., Army Construction Engineering Research Lab., USA; Nov. 1999; 58p; In English
Report No.(s): AD-A372744; CERL-TR-99/88; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

Laws and regulations mandate that Army installations monitor emissions from industrial processes, and maintain their processes within emissions standards. Army installations commonly use pollution control equipment (PCE) to monitor emissions, and to stay within regulatory and legal limits. Alternatives to use of PCE include using advanced technologies to detect problem conditions, collecting data to predict and determine the cause of failures, using dynamic modeling techniques to model the system or components that have a higher than expected frequency of failure, and verifying the efficacy of the model with data collected from test runs. This study summarized recent attempts to model large systems by using a model based on queuing theory. by studying the methods being used now for reliability centered maintenance (RCM) and the military's predilection to run-to-failure maintenance, this research has produced a linear program from the queuing model that can help reduce equipment downtime. These recent methods may allow U.S. Army installations to optimize maintenance policy for minimal ecological impact.
DTIC
Air Pollution; Pollution Control; Control Equipment; Queueing Theory

20000034010 NASA Glenn Research Center, Cleveland, OH USA
Comparison of Adsorbed Mercury Screening Method With Cold-Vapor Atomic Absorption Spectrophotometry for Determination of Mercury in Soil
Easterling, Donald F., Science Applications International Corp., USA; Hovanitz, Edward S., Science Applications International Corp., USA; Street, Kenneth W., NASA Glenn Research Center, USA; March 2000; 18p; In English
Contract(s)/Grant(s): RTOP 910-30-11
Report No.(s): NASA/TM-2000-209642; NAS 1.15:209642; E-11973; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A field screening method for the determination of elemental mercury in environmental soil samples involves the thermal desorption of the mercury from the sample onto gold and then the thermal desorption from the gold to a gold-film mercury vapor analyzer. This field screening method contains a large number of conditions that could be optimized for the various types of soils encountered. In this study, the conditions were optimized for the determination of mercury in silty clay materials, and the results were comparable to the cold-vapor atomic absorption spectrophotometric method of determination. This paper discusses the benefits and disadvantages of employing the field screening method and provides the sequence of conditions that must be optimized to employ this method of determination on other soil types.
Author
Absorption Spectroscopy; Spectrophotometry; Spectroscopic Analysis; Adsorption; Atomic Spectra

20000034076 General Accounting Office, Resources, Community and Economic Development Div., Washington, DC USA

Aviation and the Environment: Aviation's Effects on the Global Atmosphere Are Potentially Significant and Expected to Grow

Feb. 2000; 51p; In English; Report to the Honorable James L. Oberstar, Ranking Democratic Members, Committee on Transportation and Infrastructure, House of Representatives.

Report No.(s): AD-A373835; GAO/RCED-00-57; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Concerns about global warming are focusing increasingly on the contribution of human activities, including aviation. Jet aircraft are among many sources of greenhouse gases-gases that can trap heat, potentially increasing the temperature of the earth's surface and leading to changes in climate." According to a recent report by the National Research Council, the average global temperature at the earth's surface has risen 0.7 to 1.4 degrees Fahrenheit over the last century. Many experts agree that, in total, greenhouse gases are warming the earth and that this warming could have harmful effects on the environment and human health. For example, some scientists are concerned that with global warming, glaciers and ice sheets could melt, leading to a rise in sea levels and subsequent coastal flooding. In addition, they expressed concern that the incidence of malaria and other tropical infectious diseases could increase in moderate climates.

DTIC

Environment Effects; Climate Change; Global Warming; Greenhouse Effect; Jet Aircraft; Emission

20000034225 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Principal Components Analysis (PCA) in Characterization of the Dynamic of the Land Use in Semi-arid Brazilian Area: Quixaba - PE ***Analise por Componentes Principais (ACP) na Caracterizacao da Dinamica do Uso da Terra em Area do Semi-Arido Brasileiro: Quixaba-PE***

Maldonado, Francisco Dario, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 2p; In Portuguese; Original contains color illustrations

Report No.(s): INPE-7180-TDI/680; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; C01, CD-ROM

The Brazilian semi-arid region has demonstrated the pressure of human occupation changes, which are developed in non-sustainable forms. The analysis of the multi-temporal effects changes for the "Caatinga" land cover, may provide sufficient information about dynamics for the typical exploitation of "Caatinga" semi-arid areas. Considering these objectives, the Principal Component Analysis (PCA), combining with the field survey data, was applied, which permitted the estimation of the point sample state in terms of re-occupation / degradation. The selected area for this study is situated in the Central-Southern Semi-Arid part of the "Pernambuco" State of Northern Brazil. It covers about 190 sq km and lies between 8 deg. 00 min. and 8 deg. 07 min. S latitude; 39 deg. 45 min. and 39 deg. 53 min. W longitude respectively. There were only five changed and unchanged classes of multi-temporal effects, with the combined use of the Geographical Information System (GIS) and appropriated field survey, the results of this study were evaluated. This study was less time consuming and economically significant for the period of 83-96. Also, the influence of irregular rain effects was observed with the use of LANDSAT TM; which was resulted in the generalized alteration for the PCA changes detection. Because of an affected part of the image the total detection was suffered. Based on the analysis of the results and the errors in Confusion Matrix, an alternative method of PCA was suggested. This method is based on the rotative analogy of the PCA transformation, where a smaller angle of rotation was applied.

Author

Remote Sensing; Arid Lands; Land Use; Principal Components Analysis; Image Processing

20000034262 Bay Area Environmental Research Inst., San Francisco, CA USA

An Improved Radiative Transfer Model for Climate Calculations

Bergstrom, Robert W., Bay Area Environmental Research Inst., USA; Mlawer, Eli J., Atmospheric and Environmental Research, Inc., USA; Sokolik, Irina N., Colorado Univ., USA; Clough, Shepard A., Atmospheric and Environmental Research, Inc., USA; Toon, Owen B., Colorado Univ., USA; May 1998; 23p; In English

Contract(s)/Grant(s): NCC2-858; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents a radiative transfer model that has been developed to accurately predict the atmospheric radiant flux in both the infrared and the solar spectrum with a minimum of computational effort. The model is designed to be included in numerical climate models to assess the accuracy of the model, the results are compared to other more detailed models for several standard cases in the solar and thermal spectrum. As the thermal spectrum has been treated in other publications, we focus here on the solar part of the spectrum. We perform several example calculations focussing on the question of absorption of solar radiation by gases and aerosols.

Author

Mathematical Models; Radiative Transfer; Climate Models; Solar Radiation; Solar Spectra; Infrared Spectra

20000034263 NASA Goddard Space Flight Center, Greenbelt, MD USA

NASA/GSFC Research Activities for the Global Ocean Carbon Cycle: A Prospectus for the 21st Century

Gregg, W. W., NASA Goddard Space Flight Center, USA; Behrenfield, M. J., NASA Goddard Space Flight Center, USA; Hoge, F. E., NASA Goddard Space Flight Center, USA; Esaias, W. E., NASA Goddard Space Flight Center, USA; Huang, N. E., NASA Goddard Space Flight Center, USA; Long, S. R., NASA Goddard Space Flight Center, USA; McClain, C. R., NASA Goddard Space Flight Center, USA; February 2000; 38p; In English; Original contains color illustrations

Report No.(s): NASA/TM-2000-209882; Rept-2000-01025-0; NAS 1.15:209882; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

There are increasing concerns that anthropogenic inputs of carbon dioxide into the Earth system have the potential for climate change. In response to these concerns, the GSFC Laboratory for Hydrospheric Processes has formed the Ocean Carbon Science Team (OCST) to contribute to greater understanding of the global ocean carbon cycle. The overall goals of the OCST are to: 1) detect changes in biological components of the ocean carbon cycle through remote sensing of biooptical properties, 2) refine understanding of ocean carbon uptake and sequestration through application of basic research results, new satellite algorithms, and improved model parameterizations, 3) develop and implement new sensors providing critical missing environmental information related to the oceanic carbon cycle and the flux of CO2 across the air-sea interface. The specific objectives of the OCST are to: 1) establish a 20-year time series of ocean color, 2) develop new remote sensing technologies, 3) validate ocean remote sensing observations, 4) conduct ocean carbon cycle scientific investigations directly related to remote sensing data, emphasizing physiological, empirical and coupled physical/biological models, satellite algorithm development and improvement, and analysis of satellite data sets. These research and mission objectives are intended to improve our understanding of global ocean carbon cycling and contribute to national goals by maximizing the use of remote sensing data.

Author

Carbon Cycle; Oceans; Remote Sensing; NASA Programs; Air Water Interactions; Research and Development

20000034895 NASA Marshall Space Flight Center, Huntsville, AL USA

EPA/NASA/USAF Depainting Effort Concludes

Finckenor, Miria M., NASA Marshall Space Flight Center, USA; Clark-Ingram, Marceia, NASA Marshall Space Flight Center, USA; [2000]; 3p; In English

Contract(s)/Grant(s): RTOP 036-00; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The final report contains strip rate data from all of the methods, lessons learned during processing, metallurgical evaluations of the panels, and summaries of corrosion and hydrogen embrittlement studies. Any changes in surface roughness, fatigue and tensile properties, and crack detectability are noted in the report. No process was singled out above the others, as companies should consider equipment and operational costs when complying with the Aerospace NESHAP (National Emission Standards for Hazardous Air Pollutants) and new OSHA (Occupational Safety and Health Administration) regulations.

Derived from text

Paint Removal; Civil Aviation; Environment Pollution; Pollution Control

20000034919 Occupational Safety and Health Administration, Industrial Hygiene Chemistry Div., Salt Lake City, UT USA

Evaluation Guidelines for Air Sampling Methods Utilizing Chromatographic Analysis

2000; 54p; In English

Report No.(s): PB2000-103358; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The evaluation guidelines were developed to provide chemists of the Methods Development Team with a uniform and practical means for evaluating sampling and analytical methods that utilize chromatographic techniques. The guidelines define sampling and analytical parameters, specify required laboratory tests, statistical calculations, and criteria for acceptance, and provide a detailed outline for the written reports. The overall goal of these guidelines is to provide OSHA with sampling and analytical methods that can be clearly defended with evaluation data.

NTIS

Air Sampling; Gas Chromatography

20000036605 Alabama Univ., Research Inst., Huntsville, AL USA

Environmental Technology Team (ETT) Information System ***Final Report, 18 Sep. 1998 - 30 Sep. 1999***

Maddux, Gary A.; Oct. 1999; 6p; In English

Contract(s)/Grant(s): DAAH01-98-D-R001

Report No.(s): AD-A374411; 5-20331; 5-20332; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

The Directorate of Environmental Management and Planning (DEMP), Redstone Arsenal Support Activity (RASA) is responsible for the development and management of command activities required to comply with environmental protection laws and requirements. The Environmental Technology Team (ETT) of the DEMP has the mission of managing and providing support for pollution prevention and ozone depleting chemical (ODC) elimination requirements associated with command activities and weapon system management. The objective of this task was to design and develop an information system necessary to provide the infrastructure for the storage, retrieval, and use of technical information required to support the above mission. Specific requirements of this task included integration of hardware/software platforms, data transfer requirements, communication protocols to internal and external sources, and development of user interface procedures.
DTIC
Information Systems; Environment Management; Environment Protection; Ozone Depletion; Pollution Control; Management Planning; Systems Management

20000037677 Institute for Environmental Safety and Occupational Risk Analysis, Risk Analysis Directorate, Brooks AFB, TX USA
Air Emissions Pollution Prevention Special Report ***Final Report, Dec. 1997 - Dec. 1999***
Lanoue, James; OBrien, Robert J.; Eninger, Robert M.; Johnson, Grant; Dec. 1999; 81p; In English; Prepared in collaboration with Karta Technologies, Inc., San Antonio, TX.
Report No.(s): AD-A374327; IERA-RS-BR-SR-1999-0002; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
This report serves as a guidance document for the reduction of stationary source air emissions and minimization of regulatory burden associated with the Clean Air Act Ammendments of 1990 at U.S. Air Force Installations. The report provides recommended methodologies for reducing both actual and potential emissions and identifies common emission calculation errors that may increase the degree to which an installation is regulated. The report summarizes major air-based pollution prevention opportunities identified during two years of site support visits covering 1998 and 1999. The report contains recommendations for six specific source categories associated with Air Force operations. The six categories include aerospace ground support equipment, boilers, emergency generators, fuel storage/dispensing operations, solvents, and surface coating operations. Also, budgeting (A-lO6) inputs associated with air emission recommendations are included.
DTIC
Air Pollution; Air Quality; Pollution Control

20000037752 Midwest Research Inst., Kansas City, MO USA
FTIR Emissions Test at an Iron Foundry; Waupaca Foundry, Inc. Plant No. 5, Tel City, Indiana ***Final Report***
Sep. 1999; 336p; In English; Portions of this document are not fully legible
Report No.(s): PB2000-103282; No Copyright; Avail: National Technical Information Service (NTIS)
The purpose of this testing program was to obtain emission data by using FTIR sampling at iron foundries, specifically on cupola emission control devices as well as pouring, cooling, and shake-out operations to support a national emission standard for hazardous air pollutants (NESHAP).
NTIS
Air Pollution; Control Equipment; Iron; Steels; Foundries; Infrared Spectra; Infrared Spectroscopy

20000038019 NASA Ames Research Center, Moffett Field, CA USA
3ARM: A Fast, Accurate Radiative Transfer Model For Use in Climate Models
Bergstrom, R. W., Bay Area Environmental Research Inst., USA; Kinne, S., Bay Area Environmental Research Inst., USA; Sokolik, I. N., Bay Area Environmental Research Inst., USA; Toon, O. B., NASA Ames Research Center, USA; Mlawer, E. J., Atmospheric and Environmental Research, Inc., USA; Clough, S. A., Atmospheric and Environmental Research, Inc., USA; Ackerman, T. P., Pennsylvania State Univ., USA; Mather, J., Pennsylvania State Univ., USA; [1996]; 4p; In English; International Radiation Symposium, 1996, Fairbanks, AL, USA
Contract(s)/Grant(s): NCC2-817; NCC2-940; Copyright; Avail: Issuing Activity
A new radiative transfer model combining the efforts of three groups of researchers is discussed. The model accurately computes radiative transfer in a inhomogeneous absorbing, scattering and emitting atmospheres. As an illustration of the model, results are shown for the effects of dust on the thermal radiation.
Author
Climate Models; Radiative Transfer; Emittance; Earth Atmosphere

20000038101 Universities Space Research Association, Seabrook, MD USA

The Apparent Effects of the Mt. Pinatubo Eruption on the Greenland Ice Sheet Melt Extent

Abdalati, Waleed, Universities Space Research Association, USA; Steffen, Konrad, Colorado Univ., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 75-76; Repr. from Geophysical Research Letters, v. 24, no. 14, 15 Jul. 1997 p 1795-1797; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

The indirect climatological effects of major volcanic eruptions can be of great importance because of the complex feedbacks that exist in the global climate system. One such effect is the melt area reduction on the Greenland ice sheet. Using passive microwave satellite data for the period 1979-1995, the melt conditions of the ice sheet before and after the 1991 Mt. Pinatubo eruptions are examined. Statistical tests indicate that an observed drop following the eruptions has a 97% to 99% probability of being outside the limits of undisturbed variability. Furthermore, this anomaly diminishes as the time from the eruption increases. These characteristics, in conjunction with an observed increasing melt trend prior to the eruptions indicate that Mt. Pinatubo has had a significant effect on the melt conditions, and consequently the energy balance characteristics of the Greenland ice sheet.
Author

Greenland; Ice; Melting; Volcanoes; Satellite Observation; Climate Change; Statistical Analysis; Environment Effects

20000038114 NASA Wallops Flight Facility, Wallops Island, VA USA

Crista Ozone Measurements/Validation

Bittner, M., Wuppertal Univ., Germany; Offermann, D., Wuppertal Univ., Germany; Preusse, P., Wuppertal Univ., Germany; Riese, M., Wuppertal Univ., Germany; Claude, H., Deutscher Wetterdienst, Germany; Schmidlin, F. J., NASA Wallops Flight Facility, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 109-110; Repr. from Advances in Space Research, v. 19 p 109-110; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Seven days of global high resolution middle atmosphere ozone profiles have been measured by the CRyogenic Infrared Spectrometers and Telescopes for the Atmosphere (CRISTA) in November 1994. Measurements cover the altitude range from 10 to 80 km and latitudes from 59 deg S to 64 deg N. An example of a global ozone map is presented and demonstrates the ability of the instrument to detect medium and even small scale structures. Comparisons with ECC- and Brewer Mast balloon-sonde underflights are discussed. Reasonable agreement between CRISTA and balloon-sondes is found especially in the altitude interval between about 19 km and 27 km.
Author

Ozone; Ozonometry; Atmospheric Sounding; Infrared Spectrometers; Cryogenics; Remote Sensing

20000038139 NASA Goddard Space Flight Center, Greenbelt, MD USA

Geosynchronous Technology Infusion Studies

Hilliard, L., NASA Goddard Space Flight Center, USA; Jenstrom, D., NASA Goddard Space Flight Center, USA; Chesters, D., NASA Goddard Space Flight Center, USA; Racette, P., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 217-218; Repr. from 1997 International Geoscience and Remote Sensing Symposium (IGARSS 1997), v. 2 p 984-987; In English; Geoscience and Remote Sensing, 3-8 Aug. 1997, Singapore, Singapore
Report No.(s): IEEE-97CH36042; LC-97-70575; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

NASA and NOAA are now sponsoring Advanced Geosynchronous Studies (AGeoS), technology work that will lead to the next generation of space sensors located in geosynchronous orbit. This report briefly describes the initial steps being taken to investigate the high priority geosynchronous measurement needs identified so far.
Author

Remote Sensors; Earth Orbital Environments; Research and Development; Earth Observations (From Space)

20000038142 NASA Goddard Space Flight Center, Greenbelt, MD USA

Importance of Sea Ice for Validating Global Climate Models

Geiger, Cathleen A., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 209-210; Repr. from Workshop on Polar Processes in Global Climate, (American Meteorological Society, Boston, MA) p 122-125; In English; Polar Processes in Global Climate, 13-15 Nov. 1996, Cancun, Mexico; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771); Abstract Only, Hardcopy, Microfiche

Reproduction of current day large-scale physical features and processes is a critical test of global climate model performance. Without this benchmark, prognoses of future climate conditions are at best speculation. A fundamental question relevant to this issue is, which processes and observations are both robust and sensitive enough to be used for model validation and furthermore are they also indicators of the problem at hand? In the case of global climate, one of the problems at hand is to distinguish between anthropogenic and naturally occuring climate responses. The polar regions provide an excellent testing ground to examine this problem because few humans make their livelihood there, such that anthropogenic influences in the polar regions usually spawn from global redistribution of a source originating elsewhere. Concomitantly, polar regions are one of the few places where responses to climate are non-anthropogenic. Thus, if an anthropogenic effect has reached the polar regions (e.g. the case of upper atmospheric ozone sensitivity to CFCs), it has most likely had an impact globally but is more difficult to sort out from local effects in areas where anthropogenic activity is high. Within this context, sea ice has served as both a monitoring platform and sensitivity parameter of polar climate response since the time of Fridtjof Nansen. Sea ice resides in the polar regions at the air-sea interface such that changes in either the global atmospheric or oceanic circulation set up complex non-linear responses in sea ice which are uniquely determined. Sea ice currently covers a maximum of about 7% of the earth's surface but was completely absent during the Jurassic Period and far more extensive during the various ice ages. It is also geophysically very thin (typically is less than 10 m in Arctic, is less than 3 m in Antarctic) compared to the troposphere (roughly 10 km) and deep ocean (roughly 3 to 4 km). Because of these unique conditions, polar researchers regard sea ice as one of the more important features to monitor in terms of heat, mass, and momentum transfer between the air and sea and furthermore, the impact of such responses to global climate.
Derived from text

Climate Models; Climatology; Environment Effects; Sea Ice; Ocean Surface; Antarctic Regions; Arctic Regions; Climate Change; Environment Models

20000038180 NASA Goddard Inst. for Space Studies, New York, NY USA

The Role of Sea Ice in 2 x CO2 Climate Model Sensitivity, Part 2, Hemispheric Dependencies

Rind, D., NASA Goddard Inst. for Space Studies, USA; Healy, R., Columbia Univ., USA; Parkinson, C., NASA Goddard Space Flight Center, USA; Martinson, D., Lamont-Doherty Geological Observatory, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 95-96; Repr. from Geophysical Research Letters, v. 24, no. 12, 15 Jun. 1997 p 1491-1494; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

How sensitive are doubled CO2 simulations to GCM control-run sea ice thickness and extent? This issue is examined in a series of 10 control-run simulations with different sea ice and corresponding doubled CO2 simulations. Results show that with increased control-run sea ice coverage in the Southern Hemisphere, temperature sensitivity with climate change is enhanced, while there is little effect on temperature sensitivity of (reasonable) variations in control-run sea ice thickness. In the Northern Hemisphere the situation is reversed: sea ice thickness is the key parameter, while (reasonable) variations in control-run sea ice coverage are of less importance. In both cases, the quantity of sea ice that can be removed in the warmer climate is the determining factor. Overall, the Southern Hemisphere sea ice coverage change had a larger impact on global temperature, because Northern Hemisphere sea ice was sufficiently thick to limit its response to doubled CO2, and sea ice changes generally occurred at higher latitudes, reducing the sea ice-albedo feedback. In both these experiments and earlier ones in which sea ice was not allowed to change, the model displayed a sensitivity of -0.02 C global warming per percent change in Southern Hemisphere sea ice coverage.
Author

Carbon Dioxide; Climate Models; Climate Change; Sea Ice; Atmospheric Temperature; Simulation

20000038182 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Surface Heat Flux as a Function of Ground Cover for Climate Models

Vukovich, Fred M., Science Applications International Corp., USA; Wayland, Robert, Science Applications International Corp., USA; Toll, David, NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 69-70; Repr. from Monthly Weather Review, v. 125, no. 4, Apr. 1997 p 572-586; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Surface heat fluxes were examined as a function of surface properties and meteorological conditions in a 100 km x 100 km grid square at 1-km spatial resolution centered at the location of the First ISLSCP (International Satellite Land Surface Climatology Project) Field Experiment (FIFE), the Forest Ecosystem Dynamics site in central Maine, and a semiarid rangeland site around Walnut Gulch, Arizona. This investigation treats the surface heat flux variability within a GCM grid box to provide insight into methods for treating that variability in climate models. The heat fluxes were calculated using NOAA AVHRR and available meteorological data. The average heat fluxes that were estimated using the various area ground-cover representations were compared with the ensemble average heat fluxes for the entire area, which were assumed to be the best representation of

the heat fluxes for the areas. Average beat fluxes were estimated for the entire 100 km x 100 km area based on a single ground-cover representation, and the mean error for the area sensible heat flux was about 10% and for the area latent heat flux, 21%. The estimation error was reduced, and in some cases significantly reduced, when the area heat fluxes were estimated by partitioning the area according to significant ground cover. The most significant effect of the partitioning was on the latent heat flux estimates. Author

Climate Models; Heat Flux; Earth Surface; Meteorological Parameters; Remote Sensing; Surface Properties; Climatology; Atmospheric Models; Atmospheric Boundary Layer

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GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For space radiation see 93 Space Radiation.

20000033843 Search for Extraterrestrial Intelligence Inst., Mountain View, CA USA

Physical and Chemical Study of Minerals and Rocks Containing Low-Z Compounds of Interest to Astrobiology and Origin of Life ***Final Report, 1 Feb. 1997 - 30 Apr. 1999***

[1999]; 14p; In English

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

Understanding the origins of Life requires a good understanding of the physics and chemistry of biogenic low-z elements H, C, N, O, P, S in terrestrial environments, on Mars, on extraterrestrial bodies such as meteorite parent bodies and comets, and in interstellar space. In this Proposal five Tasks form a coherent program aimed at elucidating various aspects of low-z element geo- and cosmochemistry with special reference to the origin of Life on Earth and to the search for life on Mars, extant or extinct. (i) Formation of organic molecules, in particular oxygenated H-C-0 molecules or precursors thereof of the composition H(x)C(y)O(z)(n-), inside the hard matrix of structurally dense magmatic minerals; (ii) Formation of organic molecules inside the soft matrix of amorphous and crystalline water ice; (iii) Preservation of organic molecules in cherts and other siliceous rocks formed in hot spring or submarine hydrothermal vent environments; (iv) The nature of the elusive Martian soil oxidant; and (v) Prototype development of an XRD instrument, using a new patented XRD camera concept that utilizes a Charge Coupled Device (CCD) as a camera and as a energy-dispersive analyzer.

Author

Biological Evolution; Life Sciences; Exobiology; Extraterrestrial Life

20000033990 NASA Marshall Space Flight Center, Huntsville, AL USA

Anomalous Flows at Dayside High-Latitude Magnetopause as Observed by Interball Tail Probe

Vaisberg, O. L., NASA Marshall Space Flight Center, USA; Avanov, L. A., Space Research Inst., Russia; Smirnov, V. N., Space Research Inst., Russia; [2000]; 1p; In English, 30 May - 3 Jun. 2000, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We analyze magnetopause crossings at high latitudes dayside magnetopause as observed by Interball Tail probe. High time resolution plasma data show strong short-time flows near magnetopause that strongly deviate from surrounding magnetosheath flow. Several quasi- periodic velocity variations are observed at times. Plasma parameters, such as number density, temperature and bulk velocity-of these flows are close to magnetosheath values. These anomalous flows are observed almost at every magnetopause crossing in this region. The ion velocity distributions in these regions indicate the presence of open field lines. Observed properties of these flows suggest their association with reconnection at high latitudes.

Author

Magnetopause; Anomalies; Polar Regions; Flow Velocity; Daytime

20000034024 NASA Goddard Space Flight Center, Greenbelt, MD USA

A Comprehensive Model of the Near-Earth Magnetic Field, Phase 3

Sabaka, Terence J., Raytheon STX Corp., USA; Olsen, Nils, Danish Space Research Inst., Denmark; Langel, Robert A., NASA Goddard Space Flight Center, USA; April 2000; 100p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS5-31760

Report No.(s): NASA/TM-2000-209894/PHASE3; Rept-2000-02234-0/PHASE3; NAS 1.15:209894/PHASE3; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The near-Earth magnetic field is due to sources in Earth's core, ionosphere, magnetosphere, lithosphere, and from coupling currents between ionosphere and magnetosphere and between hemispheres. Traditionally, the main field (low degree internal field) and magnetospheric field have been modeled simultaneously, and fields from other sources modeled separately. Such a scheme, however, can introduce spurious features. A new model, designated CMP3 (Comprehensive Model: Phase 3), has been derived from quiet-time Magsat and POGO satellite measurements and observatory hourly and annual means measurements as part of an effort to coestimate fields from all of these sources. This model represents a significant advancement in the treatment of the aforementioned field sources over previous attempts, and includes an accounting for main field influences on the magnetosphere, main field and solar activity influences on the ionosphere, seasonal influences on the coupling currents, a priori characterization of ionospheric and magnetospheric influence on Earth-induced fields, and an explicit parameterization and estimation of the lithospheric field. The result of this effort is a model whose fits to the data are generally superior to previous models and whose parameter states for the various constituent sources are very reasonable.
Author
Earth Ionosphere; Magnetic Fields; Mathematical Models; Earth Surface; Earth Magnetosphere

20000034223 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Magnetotelluric Soundings Across the Taubate Basin ***Sondagens Magnetoteluricas Transversais a Bacia de Taubate***
deBrito, Paula Marcia Aranha, Instituto Nacional de Pesquisas Espacias, Brazil; 1998; In Portuguese; Original contains color illustrations
Report No.(s): INPE-7235-TDI/688; No Copyright; Avail: CASI; C01, CD-ROM

Thirteen magnetotelluric soundings were carried out in the Taubate basin region. They were positioned along a profile cutting across the thickest part of the basin, named Tremembe sub-basin, and extending over the Serra do Mar and Serra da Mantiqueira, respectively to the southeast and northwest. The data were interpreted through a 2-D inversion scheme and the results were tested through a forward modelling. A 10 km deep conductive layer was observed quite clearly under the crystalline regions but was undetected under the sedimentary rocks. The latter can be probably associated with screening effects due to the high conductance of the surficial sediments. Studies at different tectonic regions in the world have reported the same conductive layer at around the same depth but in the present study the layer has an anomalously low conductance considering that it is a region which was reworked during the Neo-Proterozoic. These findings are strong constraints to any tectonic model suggested to explain regional features.
Author
Magnetic Surveys; Structural Basins; Sedimentary Rocks; Tectonics; Remote Sensing

20000034226 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Pc3-5 Study of Geomagnetic Micropulsations at Very Low Latitude, in Brazil ***Estudo de Micropulsacoes Geomagneticas Pc3-5 em Latitudes Muito Baixas no Brasil***
Zanandrea, Ademilson, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 164p; In Portuguese; Original contains color illustrations
Report No.(s): INPE-7233-TDI/687; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche; C01, CD-ROM

This study is aimed at the understanding of source mechanisms and propagation modes of Pc3-5 micropulsations at very low and equatorial latitudes. It used simultaneous data measured with a chain of 10 geomagnetic stations in Brazil using high sensitive fluxgate magnetometers. Multiple tapered spectral estimation method based on Fast Fourier Transforms (FFT) was used to obtain micropulsation power spectra, polarization parameters and phases. It was observed an increase on the occurrence of highly polarized Pc3-5 pulsations, reaching maxima close to local noon (14:00 and 15:00 UT) in the stations nearest to the magnetic equator. The dynamic spectra showed the occurrence of 81 simultaneous events of Pc3-4 pulsations with high degree of polarization, mainly during daytime. The diurnal events showed increases in the polarized power density of 3,2 times for pulsations observed at stations close to the magnetic equator in comparison to the more distant ones. The phase of the pulsations observed at station close of the magnetic equator showed a delay of 48 deg. and 62 deg. in relation to the most distant one. This effects is clearly related to the increase of ionospheric conductivity and equatorial electrojet intensity. The polarized power density curves for all the 10 stations showed a similar behaviour, the maximum peaks occurring at same frequency. This may indicate a possible link to the plasmaspheric cavity global oscillation mode. The ellipticity was quase-linear, with the larger axis in the north-south direction, due to the fact that the poloidal mode is almost uncoupled from the oscillation of magnetic field lines. The amplitude of north-south component is much larger than the west-east one. These results could be an evidence that field line resonance mechanism does not explain Pc3-5 micropulsations observed at very low and equatorial latitudes. The increase in the occurrence of Pc3-4 diurnal events is probably associated with incoming compressional waves resulted from bow shock ion cyclotron instabilities that propagate in the magnetosphere at low latitudes. The propagation of the compressional waves may

excite the trapped compressional mode or the compressional global mode. The resulting phenomenon, field lines forced oscillations in the plasmasphere, may be a possible source mechanism for Pc3-4 pulsations at very low latitudes.
Author
Geomagnetic Micropulsations; Propagation Modes; Magnetic Measurement; Power Spectra; Atmospheric Sounding; Bow Waves; Wave Propagation; Magnetometers

20000034249 NASA Marshall Space Flight Center, Huntsville, AL USA
Evidence for an Early High-Energy Afterglow Observed with BATSE from GRB 980923
Giblin, T. W., Alabama Univ., USA; vanParadijs, J., Alabama Univ., USA; Kouveliotou, C., NASA Marshall Space Flight Center, USA; Connaughton, V., National Academy of Sciences - National Research Council, USA; Wijers, R. A. M. J., State Univ. of New York, USA; Briggs, M. S., Alabama Univ., USA; Preece, R. D., Alabama Univ., USA; Fishman, G. J., NASA Marshall Space Flight Center, USA; Astrophysical Journal; Oct. 10, 1999; Volume 524, pp. L47-L50; In English
Contract(s)/Grant(s): NAG5-3247; Copyright; Avail: Issuing Activity

In this Letter, we present the first evidence in the BATSE data for a prompt high-energy (25-300 keV) afterglow component from a gamma-ray burst, GRB 980923. The event consists of rapid variability lasting approximately 40 s followed by a smooth power-law emission tail lasting approximately 400 s. An abrupt change in spectral shape is found when the tail becomes noticeable. Our analysis reveals that the spectral evolution in the tail of the burst mimics that of a cooling synchrotron spectrum, similar to the spectral evolution of the low-energy afterglows for gamma-ray bursts. This evidence for a separate emission component is consistent with the internal-external shock scenario in the relativistic fireball picture. In particular, it illustrates that the external shocks can be generated during the gamma-ray emission phase, as in the case of GRB 990123.
Author
Gamma Ray Bursts; Afterglows; Light Curve; Stellar Radiation; Light (Visible Radiation)

20000034918 State Univ. of New York, Multidisciplinary Center for Earthquake Engineering Research, Buffalo, NY USA
Proceedings of the MCEER Workshop on Ground Motion Methodologies for the Eastern USA
Abrahamson, N.; Becker, A.; Aug. 11, 1999; 120p; In English; Ground Motion Methodologies for the Eastern USA, 16-17 Oct. 1997, Memphis, TN, USA; Sponsored by Federal Highway Administration, USA
Report No.(s): PB2000-103385; MCEER-99-0016; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This workshop was help to evaluate the current methods for developing rock time histories for engineering applications in the Eastern USA. The participants focused on: (1) the amplitude of the ground motion (for example, response spectra); and (2) the character of the time history. The state-of-the-art for strong ground motion prediction in the region is evaluated and the variability of time histories from different modeling methods. The methods evaluated are: (1) Composite Fractal Source Method; (2) Stochastic Model with Empirical Source Spectrum; (3) Hybrid Kinematic Source Model; (4) Empirical and Analytical Greens Function Method; (5) Isochron Method; (6) Specific Barrier Method; (7) Stochastic Method with (omega squared) sub-events; and (7) Broadband Green's Function Method. Recommendations are provided about the seismological community's ability to predict absolute levels of expected shaking and the ability to judge whether synthetic motions require subsequent modification. The appendices contain information about the workshop, validation exercise results, and modeling results for each method that was evaluated.
NTIS
Seismology; USA; Mathematical Models; Earthquakes; Earth Movements

20000037759 South Dakota School of Mines and Technology, Rapid City, SD USA
Atmospheric Flux Computations in Complex Terrain
Smith, Paul L., South Dakota School of Mines and Technology, USA; Kopp, Fred J., South Dakota School of Mines and Technology, USA; Orville, Harold D., South Dakota School of Mines and Technology, USA; 15th Conference on Hydrology; [2000], pp. 69-72; In English; 15th; Hydrology, 9-14 Jan. 2000, Long Beach, CA, USA; Sponsored by American Meteorological Society, USA
Contract(s)/Grant(s): NAG8-1447; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The greatest challenges in applying atmospheric water budget expressions are in determining the divergence and evapotranspiration terms. The evapotranspiration problem is ubiquitous, and critical issues of spatial and temporal resolution commonly arise in establishing the divergence term. In complex terrain, further difficulties crop up in using typical data on

atmospheric profiles of water vapor and wind to estimate the divergence term. Those difficulties are the subject of this paper; considerations related to topographic variations both along and normal to the flow direction are treated.
Derived from text
Terrain; Wind Profiles; Hydrology; Computation; Atmospheric Moisture; Flux Density

20000037780 Massachusetts Inst. of Tech., Cambridge, MA USA
Flow Tube Studies of Gas Phase Chemical Processes of Atmospheric Importance *Final Report*
Molina, Mario J., Massachusetts Inst. of Tech., USA; [1999]; 19p; In English
Contract(s)/Grant(s): NAG5-3947; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
In this report we summarize the results of the work carried out in our laboratory under the project ”Flow Tube Studies of Gas Phase Chemical Processes of Atmospheric Importance.”
Author
Chemical Reactions; Vapor Phases; Mathematical Models; Earth Atmosphere; Flow Measurement

20000037948 Communications Research Lab., Tokyo, Japan
Crustal Deformation Observation by Space Techniques: Toward the Earthquake Prediction in the Tokyo Metropolitan Area
Heki, Kosuke, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Sep. 1994; ISSN 0914-9279; Volume 40, No. 3, pp. 333-339; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
Seismic activity in the Tokyo metropolitan area has been unusually quiet since the great Kanto earthquake in 1923. It is, however, expected to get more active in the coming several tens of years from geophysical and historical viewpoints. Both the population and the political/economical activities in Japan heavily concentrate there and future earthquake damages in this region will obviously influence the whole country. Earthquake prediction is not only the subject of public demand but also one of the ultimate goals of geophysics. however, there is not even an agreement among geophysicists whether earthquakes are predictable in principle or not. This is coming from the shortness of the observing history of earthquake precursors and thereby the incompleteness of the theory describing how earthquakes start. It would therefore be essentially important to densify and improve the observing networks currently deployed in Japan to accelerate the progress of the earthquake prediction studies. Crustal deformation is one of the most fundamental items to be observed for both long- and short-term earthquake predictions. Space techniques, such as Global Positioning System (GPS), Satellite Laser Ranging (SLR) and Very Long Baseline Interferometry (VLBI), are now widely used in crustal deformation studies. In this article I review what kind of new roles they are expected to play in the future earthquake prediction program in this country.
Author
Crustal Fractures; Earthquakes; Satellite Instruments; Satellite Observation; Geodesy; Prediction Analysis Techniques

20000038161 NASA Goddard Space Flight Center, Greenbelt, MD USA
Equatorial Dynamics Observed by Rocket, Radar, and Satellite During the CADRE/MALTED Campaign, 1, Programmatics and small-scale fluctuations
Goldberg, Richard A., NASA Goddard Space Flight Center, USA; Lehmacher, Gerald A., NASA Goddard Space Flight Center, USA; Schmidlin, Frank J., NASA Wallops Flight Facility, USA; Fritts, David C., Colorado Univ., USA; Mitchell, J. D., Pennsylvania State Univ., USA; Croskey, C. L., Pennsylvania State Univ., USA; Friedrich, M., Technische Hochschule, Austria; Swartz, W. E., Cornell Univ., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 139-140; Repr. from Journal of Geophysical Research, v. 102, no. D22, 27 Nov. 1997 p 26,179-26,190; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche
In August 1994, the Mesospheric and Lower Thermospheric Equatorial Dynamics (MALTED) Program was conducted from the Alcantara rocket site in northeastern Brazil as part of the International Guard Rocket Campaign to study equatorial dynamics, irregularities, and instabilities in the ionosphere. This site was selected because of its proximity to the geographic (2.3 deg S) and magnetic (approx. 0.5 deg S) equators. MALTED was concerned with planetary wave modulation of the diurnal tidal amplitude, which exhibits considerable amplitude variability at equatorial and subtropical latitudes. Our goals were to study this global modulation of the tidal motions where tidal influences on the thermal structure are maximum, to study the interaction of these tidal structures with gravity waves and turbulence at mesopause altitudes, and to gain a better understanding of dynamic influences and variability on the equatorial middle atmosphere. Four (two daytime and two nighttime) identical Nike-Orion payloads designed to investigate small-scale turbulence and irregularities were coordinated with 20 meteorological falling-sphere rockets designed to measure temperature and wind fields during a 10-day period. These in situ measurements were coordinated with observations of global-scale mesospheric motions that were provided by various ground based radars and the Upper Atmosphere

Research Satellite (UARS) through the Coupling and Dynamics of Regions Equatorial (CADRE) campaign. The ground-based observatories included the Jicamarca radar observatory near Lima, Peru, and medium frequency (MF) radars in Hawaii, Christmas Island, and Adelaide. Since all four Nike-Orion flights penetrated and overflew the electrojet with apogees near 125 km, these flights provided additional information about the electrodynamics and irregularities in the equatorial ionospheric E region and may provide information on wave coupling between the mesosphere and the electrojet. Simultaneous with these flights, the CUPRI 50-MHz radar (Cornell University) provided local sounding of the electrojet region. A description of the campaign logistics and the measurements performed with the Nike-Orion instrumentation and their implications for turbulence due to gravity waves and tidal instability in the mesosphere and lower thermosphere (MLT) are presented here. From a study of electron density fluctuations measured by rocket probes, we have found evidence for equatorial mesospheric neutral-atmospheric turbulence between 85 and 90 km. Furthermore, falling-sphere data imply that gravity wave breaking was a source for this turbulence. Mean motions and the various planetary, tidal, and gravity wave structures and their coherence and variability are the subjects of a companion paper.
Author
Equatorial Atmosphere; Atmospheric Turbulence; Equatorial Regions; Middle Atmosphere; Sounding Rockets; Earth Ionosphere; Satellite Observation; Radar Tracking; Electrodynamics; Atmospheric Temperature

20000038179 NASA, Washington, DC USA
A Comparison of Geoid Undulations for West Central Greenland
Roman, Daniel R., Ohio State Univ., USA; Csatho, Beata, Ohio State Univ., USA; Jezek, Kenneth C., Ohio State Univ., USA; Thomas, Robert H., NASA, USA; Krabill, William B., NASA Wallops Flight Facility, USA; vonFrese, Ralph R. B., Ohio State Univ., USA; Forsberg, Rene, National Survey of Denmark, Denmark; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 151-152; Repr. from Journal of Geophysical Research, v. 102, no. B2, 10 Feb. 1997 p 2807-2814; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

The accuracy of a new local gravity field model, GEOID94A, is examined at a site on the western Greenland ice sheet. The model, developed by the Danish National Survey and Cadastre, incorporates several new gravity data sets including an extensive amount of airborne gravity data. Model-derived geoid undulations were compared to independently determined undulations found by differencing the elevations from Global Positioning System controlled airborne laser altimetry and optical leveling surveys. Differences between the two sets of undulations were less than +/- 6 cm RMS. The comparison improved (+/- 5 cm RMS) when GEOID94A undulations were adjusted by local gravity observations also acquired at the site. Our comparisons demonstrate that GEOID94A adequately models the long to intermediate wavelengths of the gravity field. We conclude that GEOID94A constitutes a reliable reference model for studies of Greenland's gravity field.
Author
Greenland; Ice; Gravitational Fields; Cadastral Mapping; Geoids; Gravimetry; Satellite Altimetry; Oceanography

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METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

20000033817 NASA Langley Research Center, Hampton, VA USA
Sensitivity of Cirrus Bidirectional Reflectance at MODIS Bands to Vertical Inhomogeneity of Ice Crystal Habits and Size Distribution
Yang, P., Scientific Systems and Applications, Inc., USA; Gao, B.-C., Naval Research Lab., USA; Baum, B. A., NASA Langley Research Center, USA; Wiscombe, W., NASA Goddard Space Flight Center, USA; Hu, Y., NASA Langley Research Center, USA; Nasiri, S. L., Wisconsin Univ., USA; Soulen, P. F., Maryland Univ. Baltimore County, USA; Heymsfield, A. J., National Center for Atmospheric Research, USA; McFarquhar, G. M., National Center for Atmospheric Research, USA; Miloshevich, L. M., National Center for Atmospheric Research, USA; [2000]; 55p; In English; Original contains color illustrations
Contract(s)/Grant(s): NASA Order S-97894-F; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A common assumption in satellite imager-based cirrus retrieval algorithms is that the radiative properties of a cirrus cloud may be represented by those associated with a specific ice crystal shape (or habit) and a single particle size distribution. However, observations of cirrus clouds have shown that the shapes and sizes of ice crystals may vary substantially with height within the clouds. In this study we investigate the sensitivity of the top-of-atmosphere bidirectional reflectances at two MODIS bands centered at 0.65 micron and 2.11 micron to the cirrus models assumed to be either a single homogeneous layer or three distinct

but contiguous, layers. First, we define the single- and three-layer cirrus cloud models with respect to ice crystal habit and size distribution on the basis of in situ replicator data acquired during the First ISCCP Regional Experiment (FIRE-II), held in Kansas during the fall of 1991. Subsequently, fundamental light scattering and radiative transfer theory is employed to determine the single scattering and the bulk radiative properties of the cirrus cloud. Regarding the radiative transfer computations, we present a discrete form of the adding/doubling principle by introducing a direct transmission function, which is computationally straightforward and efficient an improvement over previous methods. For the 0.65 micron band, at which absorption by ice is negligible, there is little difference between the bidirectional reflectances calculated for the one- and three-layer cirrus models, suggesting that the vertical inhomogeneity effect is relatively unimportant. At the 2.11 micron band, the bidirectional reflectances computed for both optically thin (tau = 1) and thick (tau = 10) cirrus clouds show significant differences between the results for the one- and three-layer models. The reflectances computed for the three-layer cirrus model are substantially larger than those computed for the single-layer cirrus. Finally, we find that cloud reflectance is very sensitive to the optical properties of the small crystals that predominate in the top layer of the three-layer cirrus model. It is critical to define the most realistic geometric shape for the small ”quasi-spherical” ice crystals in the top layer for obtaining reliable single-scattering parameters and bulk radiative properties of cirrus.
Author
Cirrus Clouds; Sensitivity; Bidirectional Reflectance; Light Scattering; Spectral Reflectance

20000034198 NASA Goddard Space Flight Center, Greenbelt, MD USA
Intrinsic Coupled Ocean-Atmosphere Modes of the Asian Summer Monsoon: A Re-assessment of Monsoon-ENSO Relationships
Lau, K.-M., NASA Goddard Space Flight Center, USA; Wu, H. T., SM and A Corp., USA; [2000]; 49p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Using global rainfall and sea surface temperature (SST) data for the past two decades (1979-1998), we have investigated the intrinsic modes of Asian summer monsoon (ASM) and ENSO co-variability. Three recurring ASM rainfall-SST coupled modes were identified. The first is a basin scale mode that features SST and rainfall variability over the entire tropics (including the ASM region), identifiable with those occurring during El Nino or La Nina. This mode is further characterized by a pronounced biennial variation in ASM rainfall and SST associated with fluctuations of the anomalous Walker circulation that occur during El Nino/La Nina transitions. The second mode comprises mixed regional and basin-scale rainfall and SST signals, with pronounced intraseasonal and interannual variabilities. This mode features a SST pattern associated with a developing La Nina, with a pronounced low level anticyclone in the subtropics of the western Pacific off the coast of East Asia. The third mode depicts an east-west rainfall and SST dipole across the southern equatorial Indian Ocean, most likely stemming from coupled ocean-atmosphere processes within the ASM region. This mode also possesses a decadal time scale and a linear trend, which are not associated with El Nino/La Nina variability. Possible causes of year-to-year rainfall variability over the ASM and sub-regions have been evaluated from a reconstruction of the observed rainfall from singular eigenvectors of the coupled modes. It is found that while basin-scale SST can account for portions of ASM rainfall variability during ENSO events (up to 60% in 1998), regional processes can accounts up to 20-25% of the rainfall variability in typical non-ENSO years. Stronger monsoon-ENSO relationship tends to occur in the boreal summer immediately preceding a pronounced La Nina, i.e., 1998, 1988 and 1983. Based on these results, we discuss the possible impacts of the ASM on ENSO variability via the west Pacific anticyclone and articulate a hypothesis that anomalous wind forcings derived from the anticyclone may be instrumental in inducing a strong biennial modulation to natural ENSO cycles.
Author
Coupled Modes; Air Water Interactions; Sea Surface Temperature; Rain; El Nino; Southern Oscillation

20000034222 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Analysis and Modelling of Negative Downward Lightning Current Curves Between 1985 and 1994 at Morro do Cachimbo Research Station (MG) ***Analise e Modelagem de Curvas de Corrente de Relampagos Descendentes Entre 1985 e 1994, na Estacao de Pesquisa do Morro do Cachimbo-MG***
Lacerda, Moacir, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 29p; In Portuguese; Original contains color illustrations Report No.(s): INPE-7238-TDI/691; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; C01, CD-ROM

In this thesis is presented an analysis of 22 negative descendent lightning collected in Brazil from 1985 to 1994 in the ”Morro do Cachimbo” research station (43 deg 58 min 26 sec W, 20 deg 00 min 39 sec S) of the Companhia Energetica de Minas Gerais (CEMIG). The historic evolution of direct discharge measurements and the thecniques involved are summarized. From the comparision of first return strokes with those of another station in Switzerland, it was noted that electric current wave forms are similar in both countries, although the mean peak current in Brazil (40kA) is greater than that in Switzerland (30 kA) and the

average instant in which the peak occurs is greater in Brazil (22 microns) than in Switzerland (13 microns). Differences in subsequent strokes were observed too. to explain such differences it has developed an extension of the Borovski model, from which the conductivity of channel-tower-atmosphere-ground system was calculated straightly from mean current curves. The values obtained were 1.21 x 10(exp -6)/ (Ohm m) (Brazil) and 2.74 x 10(exp -6)/ (Ohm m) (Switzerland). The differences in the peak current and conductivity values were explained based on Ohm's Law. It was found that the time to peak current is correlated to the time to peak of derivative current with a linear correlation coefficient of about 94%.The mean third return stroke current was found to be stronger than the second and an explanation for that was suggested. M-components recorded at about 200 microns (peak current values approx. 2kA) had time to peak lower than those obtained after 1 ms in other research stations.
Author
Correlation Coefficients; Electric Current; Lightning; Electrical Measurement

20000034224 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Utilization of an Atmospheric Correction Method for the Processing of Hyperspectral AVIRIS Data in Tropical Region ***Utilizacao de um Metodo de Correcao Atmosferica Para o Processamento de Dados Hiperespectrais do Sensor Aviris em Regioes Tropicais***
Latorre, Marcelo Lopes, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 125p; In Portuguese; Original contains color illustrations
Report No.(s): INPE-7295-TDI/710; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche; C01, CD-ROM

The main purpose of this work is to apply an atmospheric correction method to the hyperspectral data processing, emphasising the need of atmospheric correction to proceed the analysis of this kind of data. As a reference for this discussion targets of green vegetation (riparian forest), bare soil and water surfaces were used. The atmospheric correction method used in this work was developed by Green et al. (1993) for hyperspectral data processing which was applied to images from the sensor AVIRIS. The selected images were obtained from the region of Cuiaba, Brazil, during the experiment SCAR-B, from August to September, 1995. Comparison has been performed, for the same scene, between the corrected spectra of the aforesaid targets (obtained with the mentioned atmospheric correction method) and the non-corrected spectra (obtained with an algorithm constructed for this purpose). Besides such spectral analysis between the target samples, relative comparison was made based on the estimate of NDVI calculation for vegetation (for both situations), as well as the ratio between the blue and green bands (450micro-m / 520micro-m) for water surface. Illumination geometry effects was verified to the three different situations (different date and schedule), over comparative analysis between the spectra of the corrected samples related to the selected targets. Finally, a sensitivity analysis of the above-mentioned method was made according to the variation of parameters used during its processing, like visibility and spectral shift. The results obtained from the differences between the spectra (with and without atmospheric correction) and respective calculations were much satisfactory, confirming the need of atmospheric effects mitigation when analysing hyperspectral data, as well as the possible negative consequences when using images without atmospheric correction. Regarding the results related to the comparative analysis between corrected samples, they indicated that the correction performed for the same target, although in different dates and atmospheric conditions, presented variations. The method also presented sensibility to the variation of the considered parameters. Concerning to tropical climate (environment generally with high humidity and saturated with aerosols, factors that are highly variable in time and space), despite of the problems verified during the execution of this work, the atmospheric correction method developed by Green et al. (1993), in a general way, provided good results in the application to the selected images.
Author
Atmospheric Correction; Data Processing; Images; Tropical Regions; Atmospheric Effects; Vegetation; Spectrum Analysis; Remote Sensing; Airborne Equipment; Infrared Spectrometers

20000034247 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Tropical Rainfall Measuring Mission (TRMM) Progress Report ***Progress Report***
Simpson, Joanne, NASA Goddard Space Flight Center, USA; Meneghini, Robert, NASA Goddard Space Flight Center, USA; Kummerow, Christian D., NASA Goddard Space Flight Center, USA; Meneghini, Robert, NASA Goddard Space Flight Center, USA; Hou, Arthur, NASA Goddard Space Flight Center, USA; Adler, Robert F., NASA Goddard Space Flight Center, USA; Huffman, George, NASA Goddard Space Flight Center, USA; Barkstrom, Bruce, NASA Langley Research Center, USA; Wielicki, Bruce, NASA Langley Research Center, USA; Goodman, Steve, NASA Marshall Space Flight Center, USA; [1999]; 52p; In English; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Recognizing the importance of rain in the tropics and the accompanying latent heat release, NASA for the U.S. and NASDA for Japan have partnered in the design, construction and flight of an Earth Probe satellite to measure tropical rainfall and calculate the associated heating. Primary mission goals are 1) the understanding of crucial links in climate variability by the hydrological

cycle, 2) improvement in the large-scale models of weather and climate 3) Improvement in understanding cloud ensembles and their impacts on larger scale circulations. The linkage with the tropical oceans and landmasses are also emphasized. The Tropical Rainfall Measuring Mission (TRMM) satellite was launched in November 1997 with fuel enough to obtain a four to five year data set of rainfall over the global tropics from 37'N to 37'S. This paper reports progress from launch date through the spring of 1999. The data system and its products and their access is described, as are the algorithms used to obtain the data. Some exciting early results from TRMM are described. Some important algorithm improvements are shown. These will be used in the first total data reprocessing, scheduled to be complete in early 2000. The reader is given information on how to access and use the data.
Author
Trmm Satellite; Rain; Atmospheric Circulation; Tropical Meteorology; Earth Radiation Budget; Earth Radiation Budget Experiment

20000034853 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
The Impact of Convection Parameterization on Oceanic Cyclogenesis ***Impacto de Parametrizacoes de Conveccao em Ciclogenese Sobre o Oceano***
daRocha, Rosmeri Porfirio, Instituto Nacional de Pesquisas Espacias, Brazil; 2000; 206p; In Portuguese
Report No.(s): INPE-7505-TDI/720; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Numerical simulations of a South Atlantic cyclogenese event were performed in order to examine the role of three cumulus parameterizations (Kuo; Kain and Fritsch; Fritsch and Chappell). The atmospheric model employed is the Japan Meteorological Agency limited area model, adapted to the South America region. The effect of the cumulus parameterization depending on the horizontal resolution was examined by running the model with grid length of 75 km and 25 km. In a 72 h run with the 75 km grid-length two distinct phases were identified. The first phase, from 0 to 36 h, showed similar features for the three schemes. In the second phase, from 36 h onward, the Kuo parameterization yielded a more deeper cyclone. The similarities in the first phase were attributed to a wet and conditional unstable atmosphere surrounding the cyclone. Under these conditions, the total diabatic heating was very similar with the three schemes, although they presented different partitions between grid-scale and convective heating. In the second phase, the conditional instability arose on the north flank of the cyclone, where the Kain and Fritsch and Fritsch and Chappell schemes showed a larger areal convective activity than the Kuo. However, in the southern region of the cyclone the atmosphere became stable, and the grid-scale scheme was dominant in the three schemes. Nevertheless, the total diabatic heating was larger with the Kuo parameterization, which explains the more intense cyclone. The increase of the horizontal resolution enhanced the mesoscale structure associated with the cyclone. However no significant modifications on the two phases were observed. An additional experiment evidenced that the release latent heat played a crucial role on the development and displacement of the cyclone in both spatial resolutions.
Author
Cyclogenesis; Parameterization; Convective Heat Transfer; Numerical Analysis; Computational Grids; Simulation

20000034866 Naval Postgraduate School, Monterey, CA USA
Convective Activities Within the Stratocumulus-Topped Boundary Layer
Whisenhant, Michelle K.; Dec. 1999; 96p; In English
Report No.(s): AD-A374281; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This study utilizes aircraft measurements obtained off the California coast to analyze the geometric, thermodynamic, and micro physical characteristics of convective updrafts and down drafts in the stratocumulus-topped boundary layer (BL). The vertical structure of thermodynamic and micro physical properties is consistent. The difference in peak droplet concentration between updrafts, down drafts, and the defined environment increases near the cloud top. We observe larger mean droplet diameters in down drafts near the cloud top, as the number of small droplets in cloud top down drafts appears to decrease. The horizontal variability seen in the cloud droplet spectra and micro physics properties is likely due to aerosol activation and growth in updrafts, cloud top entrainment, and penetrating cumulus. We compute the mass flux, using a mass flux parameterization. Several measured variables produce consistent results and agree with mass flux calculations from other stratocumulus datasets.
DTIC
Atmospheric Sounding; Stratocumulus Clouds; Physical Properties; Thermodynamic Properties; Boundary Layers

20000034867 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Validation of Level 2 TRMM Rain Profile Algorithms by Intercomparison and Hypothesis Testing
Hollis, Throy D.; Feb. 17, 2000; 75p; In English
Contract(s)/Grant(s): NAG5-4752
Report No.(s): AD-A374284; AFIT-FY00-74; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Satellite algorithms are currently the methodology showing most promise for obtaining more accurate global precipitation estimates. However, a general problem with satellite methods is that they do not measure precipitation directly, but through inversion of radiation-rain relationships. Because of this, procedures are needed to verify algorithm-generated results. The most common method of verifying satellite rain estimates is by comparison with ground truth' derived from measurements obtained by raingage networks, ground weather radar, or a combination of the two. However, these types of measurements often have uncertainty magnitudes on the order or greater than the satellite algorithms, motivating the search for alternate approaches. The purpose of this research is to explore a new type of approach for validating the level 2 TRMM facility rain profile algorithms. This is done by an algorithm-to-algorithm intercomparison analysis in the context of physical hypothesis testing. Beginning with the four algorithms' strengths and weaknesses garnered from the physics used to develop the algorithms, seven hypotheses were formed detailing expected performance characteristics of the algorithms. Procedures were developed to test these hypotheses and applied to 48 storms from all ocean basins within the tropical and subtropical zones over which TRMM coverage is available (approx. 35N - 35S). The testing resulted in five hypotheses verified, one partially verified, and one inconclusive. These findings suggest that the four level 2 TRMM facility profile algorithms are performing in a manner consistent with the underlying physical limitations in the measurements (or, alternatively, the strengths of the physical assumptions), providing an independent measure of the level 2 algorithms' validity.
DTIC
Rain; Meteorological Radar; Trmm Satellite; Precipitation (Meteorology); Algorithms; Rain Gages

20000036453 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Dinami8ka Atmosfer, Jakarta, Indonesia
An Investigation of GCM CSIRO-9 External Divergency and Vorticity Profiles and Their Relationship to Rainfall ***Telaah Profil Divergensi Dan Vortisitas Luaran GCM CSIRO-9 Serta Hubungannya Dengan Curah Hujan***
Hariadi, T. E., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; September 1999; Volume 1, No. 3, pp. 1-9; In Malay-Indonesian; See also 20000036452; Copyright; Avail: Issuing Activity

It is very important to understand the interaction between precipitation process and the atmospheric global circulation. Generally, in the interaction between precipitation process and atmospheric global circulation there are heat and water substance transferred. This process drive atmospheric global circulation, and formed cumulus cloud in the other hand. The characteristic of divergence and vorticity parameter as the out put of GCM CSIRO-9, which are the atmospheric dynamic parameter would be discussed. The positive and negative values of these parameter are to identify the meteorology condition over the grid, and the interaction with the global atmospheric circulation. The out put of GCM CSIRO-9, which represent the wind field, over the grid for 9 level be the input to calculate the Divergence and Vorticity value. In the discussion, the grid area used are the grid I (7,96 deg.S, 106,875 deg.E) and the grid II (4,778 deg.S, 123,75 deg.T). In general, we find that over grid I the atmosphere is not stable for the whole year. The upward current of the air is shown by negative value of vorticity. Meanwhile, over grid II, the unstable air are only in May and June. Supported by the value of Divergence, it is fit in with the characteristic of rainfall for both observed area.
Author
Divergence; Meteorology; Rain; Vorticity; Atmospheric General Circulation Models

20000036454 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Dinamika Atmosfer, Jakarta, Indonesia
A Date Time Series Autocorrelation Analysis of Annual Rainfall in Bandung 1952-1997 ***Analisis Autokorelasi Data Time Series Curah Hujan Tahunan Bandung 1952-1997***
Suharnis, Syamsuar, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; September 1999; Volume 1, No. 3, pp. 10-15; In Malay-Indonesian; See also 20000036452; Copyright; Avail: Issuing Activity

The autocorrelation analysis and the partial autocorrelation analysis using yearly rainfall data Bandung 1952 - 1997 have been done. The result of this analysis was the ARMA(l,l) model as an initial model to forecasting model, and is given by regression equation : z (sub t) = 2122,08 -0,789 z (sub t-1) + 0,915 a (sub t-1) + a (sub t)
Author
Autocorrelation; Rain; Time Series Analysis; Mathematical Models

20000036456 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Dinamika Atmofer, Jakarta, Indonesia
An Analysis of Climatic Change in Bandung Based on Rainfall Data ***Analisis Perubahan Iklim Bandung Berdasarkan Data Curah-Hujan***
Hariadi, Tatang Endi, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; September 1999; Volume 1, No. 3, pp. 25-32; In Malay-Indonesian; See also 20000036452; Copyright; Avail: Issuing Activity

Research about climate change in Bandung has been done using rainfall data for the periods of 1900-1930 and 1960-1990, with the assumption that the two periods to represent the clear and the polluted periode. The result show that the value of total annual rainfall, wet season, dry season and transition show that there are increasing rainfall. But from Hypotesys for mean value and variance of total annual, dry season; June-July-August (JJA), wet season; December-January-February (DJF) and transition; March-April-May and September-October-November (MAM and SON), the changes are under tolerance.
Author
Climate Change; Rain; Indonesia; Annual Variations; Data Acquisition

20000037680 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
The Effects of Turbulence on the Growth of Droplets by Condensation of Water Vapor in Clouds ***Efeitos da Turbulencia no Crescimento de Goticulas por Condensacao de Vapor d'Agua em Nuvens***
Martins, Jorge Alberto, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 134p; In Portuguese; Original contains color illustrations
Report No.(s): INPE-7258-TDI/701; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
The processes involved in the initial stages of cloud formation are of fundamental importance for the development of precipitation. This work studies the processes involved when cloud droplets are growing by condensation. According to Howell's theory, the condensational growth neglects the effects of turbulence and consequently does not represent the probabilistic features involved in the process of cloud droplets growth. In this study, the effects of a turbulent environment on the development of the droplet spectra growing by condensation in a warm cloud are investigated. Such effects are analysed using a conceptual model, in which the supersaturation field around the droplets is floating with time and the curvature and solute terms are not neglected in the growth equation. A simple model of turbulence was used to simulate supersaturation fields and showed that turbulent motions lead to changes in the spectra shape. The results show that turbulence could cause some broadening in the cloud droplet distribution. This broadening is largest in the region of smallest droplets.
Author
Turbulence Effects; Drops (Liquids); Condensation; Water Vapor; Clouds (Meteorology)

20000037788 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Synoptic-Dynamic Study of Cyclogenesis Using Potential Vorticity ***Estudo Sinotico-Dinamico de Ciclogenese Usando Vorticidade Potencial***
Funatsu, Beatriz Miky, Instituto Nacional de Pesquisas Espacias, Brazil; 2000; 152p; In Portuguese; Original contains color illustrations
Report No.(s): INPE-7264-TDI/706; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
A case study of cyclogenesis that occurred on 9-10 of July, 1996 over Uruguay was performed. The data utilized consists on the daily temperature, geopotential, pressure at mean sea level, vertical velocity and wind fields, at 17 isobaric levels, from the National Centers for Environmental Prediction (NCEP). The study was based on isobaric and isentropic analysis of those meteorological parameters, and also on potential vorticity perspective. The extratropical cyclone formed from the propagation of a pre-existent cut-off low in the Pacific Ocean, which reached the surface, and crossed the Andes Cordillera. The synoptic analysis of this case revealed that this event can be "classified" as a lee cyclogenesis, since the existence of the mountain barrier was Fundamental for the intensification of the surface baroclinicity, which, in turn, brought to the formation of the extratropical cyclone. Also, the Andes Cordillera defined the vertical tilt of the system to the east, favoring the cyclonic vorticity advection at higher levels, above the warm thermal advection at low levels, and it defined the final baroclinic configuration that fed the system in its greater development stage. The numerical inversion of total and perturbation potential vorticity was also undertaken. The results revealed that the evolution of the system can be recovered by the dynamically balanced part of the flow. It was also accessed the relative contributions of three distinct anomalies to this cyclogenesis event: lower boundary temperature perturbation and high and low-levels potential vorticity perturbations. It was found that at low levels, the most significant contribution (concerning intensity) to surface cyclogenesis was related to the low-level potential vorticity perturbation. But the position of the system was defined by the jointed contribution of low-level potential vorticity and lower boundary temperature anomalies. At upper levels, the ciclonic circulation was mostly due to the upper-level potential vorticity perturbation.
Author
Cyclogenesis; Cyclones; Atmospheric Circulation; Vorticity; Synoptic Meteorology; Baroclinic Waves; Baroclinity

20000037796 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

A Study of the Influence of the Coherent Structures and of the Roughness in the Estimate of Turbulent Fluxes on the Pantanal ***Estudo da Influencia das Estruturas Coerentes e da Rugosidade na Estimativa de Fluxos Turbulentos Sobre o Pantanal***

Bolzan, Mauricio Jose Alves, Instituto Nacional de Pesquisas Espacias, Brazil; 2000; 142p; In Portuguese; Original contains color illustrations

Report No.(s): INPE-7500-TDI/715; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The fast response turbulent data consisting of the wind velocity and the temperature, measured simultaneously at two different heights on a micrometerological tower installed in the Reserve Passo do Lontra, (19 deg 34.3' S; 57 deg 1.3' O) covered district of Miranda, MS, is analyzed. The data used is for the period September to October 1996, which corresponds to the dry season in the Pantanal Matogrossense. The experimental site region is flat plane, but with quite complex surface condition. The surface of the site is covered by grasses with height of 2 m and composed of the vegetation typical of the region, along with sparsely spaced trees which grow to about 8 m. The momentum and sensible heat fluxes are estimated using the method of covariance. The Wavelet Transform is applied to separate the turbulent fluctuations, and to separate and visualize the coherent structures, in the wind and temperature fields. The biorthogonal wavelet is used for the detection of the coherent structures and the continuous wavelet (Mexican hat) is used to examine the turbulent fluctuations in time scale. New criteria for the classification of the stability conditions of the atmosphere are used to group the data, and to study the fraction of turbulent flux associated with the coherent structures as a function of the height and stability conditions. Techniques for the separation into quadrants of the turbulent fluctuations are used to better understand the physical processes involved in the intrusion and ejection. Statistical tests are used to verify if the turbulent fluxes are constant with height. The study used various frequency bands that contribute to the turbulent cospectrum. Results show that there is marked difference in the behavior of the thermal and momentum coherent structures, except in conditions of near neutral stability. In these cases, the predominant patterns of fluctuations on scales of about 100 s appear to be related to the roll type structures. Under moderately unstable conditions and in free convection, the patterns of the coherent structures are not well localized in scale, and appear to belong to a mixed regime, varying from temporal scales of 50 s (typical of "smooth" surfaces) to scales of the order of 100 s (typical of very rough surfaces), and are probably associated with the so called "point of instability". Under certain conditions of atmospheric stability, the fluxes measured at the two different heights (5 m separation) are statistically different.

Author

Turbulence; Turbulent Flow; Roughness; Wavelet Analysis

20000037959 NASA Goddard Space Flight Center, Greenbelt, MD USA

Data Assimilation in the Ocean and in the Atmosphere: What Should be Next?

Kalnay, Eugenia, National Centers for Environmental Prediction, USA; Anderson, David L. T., Oxford Univ., UK; Bennett, Andrew F., Oregon State Univ., USA; Busalacchi, Antonio J., NASA Goddard Space Flight Center, USA; Cohn, Stephen E., NASA Goddard Space Flight Center, USA; Courtier, Philippe, European Centre for Medium-Range Weather Forecasts, UK; Derber, John, National Centers for Environmental Prediction, USA; Lorenc, Andrew C., Meteorological Office, UK; Parrish, David, National Centers for Environmental Prediction, USA; Schlatter, Thomas, National Oceanic and Atmospheric Administration, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 43-44; Repr. from Journal of the Meteorological Society of Japan, v. 75, no. 1B, 1997 p 489-496; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

As part of the International Symposium on Assimilation of Observation in Meteorology and Oceanography, a panel discussion was held on the evening of 15 March 1995. The purpose of this panel discussion was focus on what the next major areas of research in data assimilation should be. The panelists had five minutes each for short presentations (Kalman filters, representers, etc.) and this was followed by an open discussion. This preprocessing will require a good understanding of the fine-scale phenomena. Least square methods such as Kalman filters and variational schemes are inefficient estimators of non-Gaussian field such as chemical traces. Regardless of the modeling technique employed (Lagrangian methods seem best), a least squares assimilation scheme will smear fine structure. The estimator of maximum likelihood must be sought, by examination of tracer probability distributions.

Derived from text

Data Processing; Data Reduction; Meteorology; Oceanography; Statistical Analysis; Conferences

20000037966 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Interplay Between Transpiration and Runoff Formulations in Land Surface Schemes Used with Atmospheric Models

Koster, Rindal D., NASA Goddard Space Flight Center, USA; Milly, P. C. D., National Oceanic and Atmospheric Administration, USA; Laboratory of Hydrospheric Processes Research Publications; 1997, pp. 45-46; Repr. from Journal of Climate, v. 10 p 1578-1591; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

The Project for Intercomparison of Land-surface Parameterization Schemes (PILPS) has shown that different land surface models (LSMS) driven by the same meteorological forcing can produce markedly different surface energy and water budgets, even when certain critical aspects of the LSMs (vegetation cover, albedo, turbulent drag coefficient, and snow cover) are carefully controlled. To help explain these differences, the authors devised a monthly water balance model that successfully reproduces the annual and seasonal water balances of the different PILPS schemes. Analysis of this model leads to the identification of two quantities that characterize an LSM's formulation of soil water balance dynamics: (1) the efficiency of the soil's evaporation sink integrated over the active soil moisture range, and (2) the fraction of this range over which runoff is generated. Regardless of the LSM's complexity, the combination of these two derived parameters with rates of interception loss, potential evaporation, and precipitation provides a reasonable estimate for the LSM's simulated annual water balance. The two derived parameters shed light on how evaporation and runoff formulations interact in an LSM, and the analysis as a whole underscores the need for compatibility in these formulations.

Author

Atmospheric Models; Water; Earth Surface; Energy Budgets; Transpiration; Soil Moisture; Surface Energy

20000037970 NASA Wallops Flight Center, Wallops Island, VA USA

The Effect of Rain on Air-Water Gas Exchange

Ho, David T., Lamont-Doherty Geological Observatory, USA; Bliven, Larry F., NASA Wallops Flight Center, USA; Wanninkhof, Rik, National Oceanic and Atmospheric Administration, USA; Schlosser, Peter, Lamont-Doherty Geological Observatory, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 35-36; Repr. from Tellus, v. 49B, 1997 p 149-158; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

The relationship between gas transfer velocity and rain rate was investigated at NASA's Rain-Sea Interaction Facility (RSIF) using several SF, evasion experiments. During each experiment, a water tank below the rain simulator was supersaturated with SF6, a synthetic gas, and the gas transfer velocities were calculated from the measured decrease in SF6 concentration with time. The results from experiments with IS different rain rates (7 to 10 mm/h) and 1 of 2 drop sizes (2.8 or 4.2 mm diameter) confirm a significant and systematic enhancement of air-water gas exchange by rainfall. The gas transfer velocities derived from our experiment were related to the kinetic energy flux calculated from the rain rate and drop size. The relationship obtained for mono-dropsize rain at the RSIF was extrapolated to natural rain using the kinetic energy flux of natural rain calculated from the Marshall-Palmer raindrop size distribution. Results of laboratory experiments at RSIF were compared to field observations made during a tropical rainstorm in Miami, Florida and show good agreement between laboratory and field data.

Author

Gas Exchange; Rain; Sulfur Hexafluoride; Simulators; Raindrops; Air Water Interactions

20000037972 NASA Goddard Space Flight Center, Greenbelt, MD USA

Global Pattern of Potential Evaporation Calculated from the Penman-Monteith Equation Using Satellite and Assimilated Data

Choudhury, Bhaskar J., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 29-30; Repr. from Remote Sensing Environment (Elsevier), v. 61, 1997 p 64-81; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Potential evaporation (E(0)) has been found to be useful in many practical applications and in research for setting a reference level for actual evaporation. All previous estimates of regional or global E(0) are based upon empirical formulae using climatologic meteorologic measurements at isolated stations (i.e., point data). However, the Penman-Monteith equation provides a physically based approach for computing E(0), and by comparing 20 different methods of estimating E(0), Jensen et al. (1990) showed that the Penman-Monteith equation provides the most accurate estimate of monthly E(0) from well-watered grass or alfalfa. In the present study, monthly total E(0) for 24 months (January 1987 to December 1988) was calculated from the Penman-Monteith equation, with prescribed albedo of 0.23 and surface resistance of 70 s/m, which are considered to be representative of actively growing well-watered grass covering the ground. These calculations have been done using spatially

representative data derived from satellite observations and data assimilation results. Satellite observations were used to obtain solar radiation, fractional cloud cover, air temperature, and vapor pressure, while four-dimensional data assimilation results were used to calculate the aerodynamic resistance. Meteorologic data derived from satellite observations were compared with the surface measurements to provide a measure of accuracy. The accuracy of the calculated E(0) values was assessed by comparing with lysimeter observations for evaporation from well-watered grass at 35 widely distributed locations, while recognizing that the period of present calculations was not concurrent with the lysimeter measurements and the spatial scales of these measurements and calculations are vastly different. These comparisons suggest that the error in the calculated E(0) values may not be exceeded, on average, 20% for any month or location, but are more likely to be about 15%. These uncertainties are difficult to quantify for mountainous areas or locations close to extensive water bodies. The difference between the calculated and observed E(0) is about 5% when all month and locations were considered. Errors are expected to be less than 15% for averages of E(0) over large areas or several months. Further comparisons with lysimeter observations could provide a better appraisal of the calculated values. Global pattern of E(0) was presented, together with zonal average values.
Author
Evaporation; Climatology; Grasses; Alfalfa; Estimating; Earth Surface

20000037973 NASA Goddard Space Flight Center, Greenbelt, MD USA
Cabauw Experimental Results from the Project for Intercomparison of Land-Surface Parameterization Schemes
Chen, Tian Hong, MacQuarie Univ., Australia; Henderson-Sellers, A., MacQuarie Univ., Australia; Milly, P. C. D., National Oceanic and Atmospheric Administration, USA; Pitman, A. J., MacQuarie Univ., Australia; Beljaars, A. C. M., Royal Netherlands Meteorological Inst., Netherlands; Polcher, J., Laboratoire de Meteorologie Dynamique, France; Abramopoulos, F., Science Systems and Applications, Inc., USA; Boone, A., NASA Goddard Space Flight Center, USA; Chang, S., Phillips Lab., USA; Chen, F., National Centers for Environmental Prediction, USA; Dai, Y., Academia Sinica, China; Desborough, C. E., MacQuarie Univ., Australia; Dickinson, R. E., Arizona Univ., USA; Duemenil, L., Max-Planck-Inst. fuer Meteorologie, Germany; Ek, M., Royal Netherlands Meteorological Inst., Netherlands; Garratt, J. R., Commonwealth Scientific and Industrial Research Organization, Australia; Gedney, N., Reading Univ., UK; Gusev, Y. M., Academy of Sciences (USSR), USSR; Kim, J., Lawrence Livermore National Lab., USA; Koster, R., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 27-28; Repr. from Journal of Climate, v. 10, no. 7 p 1194-1215; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

In the Project for Intercomparison of Land-Surface Parameterization Schemes phase 2a experiment, meteorological data for the year 1987 from Cabauw, the Netherlands, were used as inputs to 23 land-surface flux schemes designed for use in climate and weather models. Schemes were evaluated by comparing their outputs with long-term measurements of surface sensible heat fluxes into the atmosphere and the ground, and of upward longwave radiation and total net radiative fluxes, and also comparing them with latent heat fluxes derived from a surface energy balance. Tuning of schemes by use of the observed flux data was not permitted. On an annual basis, the predicted surface radiative temperature exhibits a range of 2 K across schemes, consistent with the range of about 10 W/m in predicted surface net radiation. Most modeled values of monthly net radiation differ from the observations by less than the estimated maximum monthly observational error (+/- 10 W/sq m). However, modeled radiative surface temperature appears to have a systematic positive bias in most schemes; this might be explained by an error in assumed emissivity and by models' neglect of canopy thermal heterogeneity. Annual means of sensible and latent heat fluxes, into which net radiation is partitioned, have ranges across schemes of 30 W/sq m and 25 W/sq m, respectively. Annual totals of evapotranspiration and runoff, into which the precipitation is partitioned, both have ranges of 315 mm. These ranges in annual heat and water fluxes were approximately halved upon exclusion of the three schemes that have no stomatal resistance under non-water-stressed conditions. Many schemes tend to underestimate latent heat flux and overestimate sensible heat flux in summer, with a reverse tendency in winter. For six schemes, root-mean-square deviations of predictions from monthly observations are less than the estimated upper bounds on observation errors (5 W/m for sensible beat flux and 10 W/m for latent heat flux). Actual runoff at the site is believed to be dominated by vertical drainage to ground water, but several schemes produced significant amounts of runoff as overland flow or interflow. There is a range across schemes of 184 mm (40% of total pore volume) in the simulated annual mean root-zone soil moisture. Unfortunately, no measurements of soil moisture were available for model evaluation. A theoretical analysis suggested that differences in boundary conditions used in various schemes are not sufficient to explain the large variance in soil moisture. However, many of the extreme values of soil moisture could be explained in terms of the particulars of experimental setup or excessive evapotranspiration.
Author
Earth Surface; Meteorological Parameters; Heat Flux; Long Wave Radiation; Latent Heat; Weather

20000037974 NASA Wallops Flight Facility, Wallops Island, VA USA

Global Oceanic Precipitation: A Joint View by TOPEX and the TOPEX Microwave Radiometer

Chen, Ge, Qingdao Inst. of Oceanology, China; Chapron, Bertrand, Institut Francais de Recherche pour l'Exploitation de la Mer, France; Tournadre, Jean, Institut Francais de Recherche pour l'Exploitation de la Mer, France; Katsaros, Kristina, Institut Francais de Recherche pour l'Exploitation de la Mer, France; Vandemark, Douglas, NASA Wallops Flight Facility, USA; Laboratory for Hydrospheric Processes Research Processes; 1997, pp. 25-26; Repr. from Journal of Geophysical Research, v. 102, no. C5, 15 May 1997 p 10,457-10,471; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

The TOPEX/POSEIDON mission offers the first opportunity to observe rain cells over the ocean by a dual-frequency radar altimeter (TOPEX) and simultaneously observe their natural radiative properties by a three-frequency radiometer (TOPEX microwave radiometer (TMR)). This work is a feasibility study aimed at understanding the capability and potential of the active/passive TOPEX/TMR system for oceanic rainfall detection. On the basis of past experiences in rain flagging, a joint TOPEX/TMR rain probability index is proposed. This index integrates several advantages of the two sensors and provides a more reliable rain estimate than the radiometer alone. One year's TOPEX/TMR data are used to test the performance of the index. The resulting rain frequency statistics show quantitative agreement with those obtained from the Comprehensive Ocean-Atmosphere Data Set (COADS) in the Intertropical Convergence Zone (ITCZ), while qualitative agreement is found for other regions of the world ocean. A recent finding that the latitudinal frequency of precipitation over the Southern Ocean increases steadily toward the Antarctic continent is confirmed by our result. Annual and seasonal precipitation maps are derived from the index. Notable features revealed include an overall similarity in rainfall pattern from the Pacific, the Atlantic, and the Indian Oceans and a general phase reversal between the two hemispheres, as well as a number of regional anomalies in terms of rain intensity. Comparisons with simultaneous Global Precipitation Climatology Project (GPCP) multisatellite precipitation rate and COADS rain climatology suggest that systematic differences also exist. One example is that the maximum rainfall in the ITCZ of the Indian Ocean appears to be more intensive and concentrated in our result compared to that of the GPCP. Another example is that the annual precipitation produced by TOPEX/TMR is constantly higher than those from GPCP and COADS in the extratropical regions of the northern hemisphere, especially in the northwest Pacific Ocean. Analyses of the seasonal variations of prominent rainy and dry zones in the tropics and subtropics show various behaviors such as systematic migration, expansion and contraction, merging and breakup, and pure intensity variations. The seasonality of regional features is largely influenced by local atmospheric events such as monsoon, storm, or snow activities. The results of this study suggest that TOPEX and its follow-on may serve as a complementary sensor to the special sensor microwave/imager in observing global oceanic precipitation.

Author

Precipitation (Meteorology); Oceans; TOPEX; Microwave Radiometers; Oceanography; Marine Meteorology; Climatology; Microwave Imagery; Rain

20000037979 NASA Goddard Space Flight Center, Greenbelt, MD USA

Initialization and Predictability of a Coupled ENSO Forecast Model

Chen, Dake, Lamont-Doherty Geological Observatory, USA; Zebiak, Stephen E., Lamont-Doherty Geological Observatory, USA; Cane, Mark A., Lamont-Doherty Geological Observatory, USA; Busalacchi, Antonio J., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 23-24; Repr. from Monthly Weather Review, v. 125, no. 5, May 1997 p 773-788; In English

Report No.(s): LDGO-Contrib--5592; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

The skill of a coupled ocean-atmosphere model in predicting ENSO has recently been improved using a new initialization procedure in which initial conditions are obtained from the coupled model, nudged toward observations of wind stress. The previous procedure involved direct insertion of wind stress observations, ignoring model feedback from ocean to atmosphere. The success of the new scheme is attributed to its explicit consideration of ocean-atmosphere coupling and the associated reduction of "initialization shock" and random noise. The so-called spring predictability barrier is eliminated, suggesting that such a barrier is not intrinsic to the real climate system. Initial attempts to generalize the nudging procedure to include SST were not successful; possible explanations are offered. In all experiments forecast skill is found to be much higher for the 1980s than for the 1970s and 1990s, suggesting decadal variations in predictability.

Author

Air Water Interactions; El Nino; Atmospheric Models; Climate; Ocean Models; Wind Shear; Weather Forecasting

20000038050 NASA Goddard Space Flight Center, Greenbelt, MD USA

Uncertainty in Satellite Rainfall Estimates: Time Series Comparison

Chang, Alfred T. C., NASA Goddard Space Flight Center, USA; Chiu, Long S., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 123-124; Repr. from Advances in Space Research, v. 19, no. 3, 1997 p 469-472; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

We examined nine satellite rainfall algorithms and compared the rain fields produced from these algorithms for the period of August 1987 to December 1988. Preliminary results show algorithms which use the same satellite sensor data tend to be similar, suggesting the importance of sampling. Oceanic global mean rainfall ranges from 2.7 to 3.6 mm/d. The variability in zonal mean rain rate is about 1.5-2 mm/d for these algorithms.

Author

Algorithms; Marine Meteorology; Sampling; Rain; Remote Sensing; Oceans; Satellite Observation

20000038100 NASA Goddard Space Flight Center, Greenbelt, MD USA

Analyses of 1994 Typhoons in the Taiwan Region Using Satellite Data

Chang, A. T. C., NASA Goddard Space Flight Center, USA; Chiu, L. S., General Sciences Corp., USA; Liu, G. R., National Central Univ., Taiwan, Province of China; Wang, K. H., National Central Univ., Taiwan, Province of China; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 77-78; Repr. from Space Remote Sensing of Subtropical Oceans (SRSSO) (Elsevier Science, New York, NY) p 89-96; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Taiwan is situated in the prevalent typhoon track in the northwestern Pacific. On average, about one third of the island total annual precipitation is due to typhoons, with the other two third being contributed by the summer monsoon, or Meiyu, and wintertime large scale frontal rainfall. While the typhoons bring the needed moisture for agricultural consumption and industrial utilization, heavy rainfall associated with typhoons often result in large scale flooding and land slide. The prediction of the typhoon track and its severity is therefore a high priority topic both for operation and research. The severity of a typhoon can be defined in terms of the wind strength and the moisture content. The Special Sensor Microwave/Imager (SSM/I) on board of the Defense Meteorological Satellite Program (DMSP) satellites measures microwave radiation in 19.4, 22.2, 37, and 85.5 GHz. These measurements provide an opportunity to estimate parameters such as surface wind speed, water vapor and cloud water contents, and rainfall rate over oceans. In 1994, Taiwan experienced an above normal frequency of typhoon hits, five typhoons hit the island in two months. In this report, estimates of the moisture content of these typhoons are made based on the SSM/I measurements. An assessment of the relative strength of the typhoons are made with analyzed data.

Author

Microwave Imagery; Typhoons; Remote Sensing; Satellite Observation; Meteorology

20000038102 NASA Goddard Space Flight Center, Greenbelt, MD USA

Can the TOPEX/Poseidon Altimetry Data be Used to Estimate Air Sea Heat Flux in the North Atlantic?

Wang, Liping, Maryland Univ., USA; Koblinsky, Chester, NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 71-72; Repr. from Geophysical Research Letters, v. 24, no. 2, 15 Jan. 1997 p 139-142; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

We propose a novel approach to directly invert large-scale anomalous annual net air-sea heat flux from the TOPEX/Poseidon altimetry data in the North Atlantic. The major advantage of this new approach over the conventional bulk formula approach is that it does not need those climate parameters used in the conventional bulk formula calculation in estimating the large-scale anomalous annual net air-sea heat flux. Comparison with expendable bathythermograph data demonstrates that it is a feasible approach.

Author

Air Water Interactions; Data Processing; Atlantic Ocean; Heat Flux; Altimetry; Ocean Currents

20000038109 NASA Goddard Space Flight Center, Greenbelt, MD USA

Correction of Sampling Errors in Ocean Surface Cross-Sectional Estimates from Nadir-Looking Weather Radar

Caylor, I. Jeff, NASA Goddard Space Flight Center, USA; Meneghini, R., NASA Goddard Space Flight Center, USA; Miller, L. S., Clemson Univ., USA; Heymsfield, G. M., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 121-122; Repr. from Journal of Atmospheric and Oceanic Technology, v. 14, no. 1, Feb. 1997 p 203-210; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

The return from the ocean surface has a number of uses for airborne meteorological radar. The normalized surface cross section has been used for radar system calibration, estimation of surface winds, and in algorithms for estimating the path-integrated attenuation in rain. However, meteorological radars are normally optimized for observation of distributed targets that fill the resolution volume, and so a point target such as the surface can be poorly sampled, particularly at near-nadir look angles. Sampling the nadir surface return at an insufficient rate results in a negative bias of the estimated cross section. This error is found to be as large as 4 dB using observations from a high-altitude airborne radar. An algorithm for mitigating the error is developed that is based upon the shape of the surface echo and uses the returned signal at the three range gates nearest the peak surface echo.

Author

Meteorological Radar; Error Analysis; Ocean Surface; Airborne Radar; Remote Sensing

20000038110 NASA Wallops Flight Center, Wallops Island, VA USA

A Summary of Scatterometer Returns from Water Surfaces Agitated by Rain

Bliven, Larry F., NASA Wallops Flight Center, USA; Giovanangeli, Jean-Paul, Aix-Marseille Univ., France; Branger, Hubert, Aix-Marseille Univ., France; Sobieski, Piotr W., Universite Catholique de Louvain, Belgium; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 119-120; Repr. from The Air-Sea Interface, Radio and Acoustic Sensing (RSMAS Miami Univ., Miami, FL) p 761-766; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

In this paper, we summarize our initial findings from K(a)- and K(u)-band scatterometers which include: a scaling law for backscattered power as a function of rain rate; a linear superposition model for light rains and low wind speeds; evidence of the importance of scattering from rain-generated ring-waves; and progress towards development of a scattering model for computing normalized radar cross sections from wind and rain roughened water surfaces.

Author

Ocean Surface; Scatterometers; Rain; Scattering; Wind Velocity; Ocean Models

20000038111 NASA Wallops Flight Facility, Wallops Island, VA USA

Friction Velocity Estimation Using Dual-Frequency Altimeter Data

Bliven, Larry F., NASA Wallops Flight Facility, USA; Sobieski, Piotr, Universite Catholique de Louvain, Belgium; Guissard, Albert, Universite Catholique de Louvain, Belgium; Branger, Hubert, Aix-Marseille Univ., France; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 117-118; Repr. from The Air-Sea Interface, Radio and Acoustic Sensing RSMAS Miami Univ., Miami, FL) p 755-760; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Global estimation of wind speeds near the sea-surface can be obtained using normalized radar cross sections sigma(o) from satellite-borne single-frequency altimeters. Indeed recent validation studies of Geosat altimeter-derived wind speeds show that several often cited semiempirical algorithms yield linear trends between wind-speeds from altimeter data and wind speeds from (a) ships of opportunity (Etcheto 1992), (b) buoys (Carter 1992), and (c) atmospheric models (Guillaume 1992). Although the linear trends are striking, there is considerable scatter since the range of standard deviations is from 1.5 to 3 m/s. In fact, the scatter of some particular measurements about the regressions is striking because they depart from the 'standard' by as much as +/- 5 m/s, which is large - even for full gale winds of 20 m/s. These anomalies can cause serious problems for gas exchange, heat, and aerosol estimates. They can also induce considerable errors in wind-driven oceanic circulation models and sea-surface wave models. This paper explores the possibility of improving the accuracy of wind speed estimation using dual-frequency altimeters.

Author

Wind Velocity; Radar Cross Sections; Satellite Altimetry; Ocean Surface; Satellite Observation; Estimating

20000038116 NASA Goddard Space Flight Center, Greenbelt, MD USA

Rainfall Measurement with a Ground Based Dual Frequency Radar

Takahashi, Nobuhiro, Universities Space Research Association, USA; Horie, Hiroaki, Communications Research Lab., Japan; Meneghini, Robert, NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 265-266; Repr. from 28th Conference on Radar Meteorology (American Meteorological Society) p 206-207; In English; 28th; Radar Meteorology, 7-12 Sep. 1997, Austin, TX, USA

Report No.(s): P2.32; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Dual frequency methods are one of the most useful ways to estimate precise rainfall rates. However, there are some difficulties in applying this method to ground based radars because of the existence of a blind zone and possible error in the radar calibration. Because of these problems, supplemental observations such as rain gauges or satellite link estimates of path integrated attenuation (PIA) are needed. This study shows how to estimate rainfall rate with a ground based dual frequency radar with rain gauge and satellite link data. Applications of this method to stratiform rainfall is also shown. This method is compared with single wavelength method. Data were obtained from a dual frequency (10 GHz and 35 GHz) multiparameter radar radiometer built by the Communications Research Laboratory (CRL), Japan, and located at NASA/GSFC during the spring of 1997. Optical rain gauge (ORG) data and broadcasting satellite signal data near the radar t location were also utilized for the calculation.

Author

Rain; Radar Measurement; Rain Gages; Ground Stations; Errors; Multispectral Radar

20000038128 NASA Goddard Space Flight Center, Greenbelt, MD USA

Application of a Threshold Method to the TRMM Radar for the Estimation of Space-Time Rain Rate Statistics

Meneghini, Robert, NASA Goddard Space Flight Center, USA; Jones, Jeffrey A., Hughes STX, Inc., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 241-242; Repr. from 28th Conference on Radar Meteorology (American Meteorology Society) p 280-281; In English; 28th; Radar Meteorology, 7-12 Sep. 1997, Austin, TX, USA

Report No.(s): Paper 7A.7; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

One of the TRMM radar products of interest is the monthly-averaged rain rates over 5 x 5 degree cells. Clearly, the most directly way of calculating these and similar statistics is to compute them from the individual estimates made over the instantaneous field of view of the Instrument (4.3 km horizontal resolution). An alternative approach is the use of a threshold method. It has been established that over sufficiently large regions the fractional area above a rain rate threshold and the area-average rain rate are well correlated for particular choices of the threshold [e.g., Kedem et al., 19901]. A straightforward application of this method to the TRMM data would consist of the conversion of the individual reflectivity factors to rain rates followed by a calculation of the fraction of these that exceed a particular threshold. Previous results indicate that for thresholds near or at 5 mm/h, the correlation between this fractional area and the area-average rain rate is high. There are several drawbacks to this approach, however. At the TRMM radar frequency of 13.8 GHz the signal suffers attenuation so that the negative bias of the high resolution rain rate estimates will increase as the path attenuation increases. To establish a quantitative relationship between fractional area and area-average rain rate, an independent means of calculating the area-average rain rate is needed such as an array of rain gauges. This type of calibration procedure, however, is difficult for a spaceborne radar such as TRMM. To estimate a statistic other than the mean of the distribution requires, in general, a different choice of threshold and a different set of tuning parameters.

Author

Trmm Satellite; Satellite Observation; Radar Data; Rain; Remote Sensing; Rain Gages; Statistical Analysis

20000038137 NASA Goddard Space Flight Center, Greenbelt, MD USA

Rain Profiling Algorithm for the TRMM Precipitation Radar

Iguchi, Toshio, Communications Research Lab., Japan; Kozu, Toshiaki, Communications Research Lab., Japan; Meneghini, Robert, NASA Goddard Space Flight Center, USA; Okamoto, Kenichi, Communications Research Lab., Japan; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 221-222; Repr. from 1997 International Geoscience and Remote Sensing Symposium, v. 4 p 1636-1638; In English; Geoscience and Remote Sensing, 3-8 Aug. 1997, Singapore, Singapore

Report No.(s): IEEE-97CH36042; LC-97-70575; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

This paper describes an outline of the algorithm that estimates the instantaneous profiles of the true radar reflectivity factor and rainfall rate from the radar reflectivity profiles observed by the Precipitation Radar (PR) onboard the TRMM satellite. The

major challenge of the algorithm lies in the correction of rain attenuation with the non-uniform beam filling effect. The algorithm was tested with synthetic data and the result is shown.
Author
Algorithms; Rain; Meteorological Radar; Remote Sensing; Radar Imagery; Radar Data

20000038143 NASA Wallops Flight Center, Wallops Island, VA USA
Combined High-Resolution Active and Passive Imaging of Ocean Surface Winds from Aircraft
Gasiewski, A. J., Georgia Inst. of Tech., USA; Piepmeier, J. R., Georgia Inst. of Tech., USA; McIntosh, R. E., Massachusetts Univ., USA; Swift, C. T., Massachusetts Univ., USA; Carswell, J. R., Massachusetts Univ., USA; Donnelly, W. J., Massachusetts Univ., USA; Knapp, E., Massachusetts Univ., USA; Westwater, E. R., National Oceanic and Atmospheric Administration, USA; Irisov, V. I., National Oceanic and Atmospheric Administration, USA; Fedor, L. S., National Oceanic and Atmospheric Administration, USA; Vandemark, D. C., NASA Wallops Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 207-208; Repr. from Proceeding of the 1997 International Geoscience and Remote Sensing Symposium, v. 2 p 1001-1005; In English; Geoscience and Remote Sensing, 3-8 Aug. 1997, Singapore, Singapore
Report No.(s): IEEE-97CH36042; LC-97-70575; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

A unique complement of passive and active microwave imaging and sensing instruments for observing ocean surface emission and scattering signatures were integrated onto the NASA Wallops Flight Facility's Orion P-3B aircraft (N426NA) for the purpose of studying the signature of ocean surface winds. The complement included: (1) a, four-band (X, K, Ka, and W) tri-polarimetric scanning radiometer (PSR), (2) a C-band ocean surface scatterometer (CSCAT), (3) a Ka-band conical-scanning polarimetric radiometer (KASPR), (4) a nadir-viewing Ka-band polarimetric radiometer, (KAPOL), (5) a 21- and 31-GHz zenith-viewing cloud and water vapor radiometer (CWVR), and (6) a radar ocean wave spectrometer (ROWS). The above Ocean Winds Imaging (OWI) complement was flown during January-March, 1997 over the Labrador Sea. Conically-scanned brightness temperature and backscatter imagery were observed over open ocean for a variety of wind speeds and cloud conditions. Presented herein are the results of a preliminary intercomparison of data from several of the OWI instruments.
Author
Ocean Surface; Wind Velocity; Microwave Imagery; Backscattering; Wind Direction; Oceans; Remote Sensing

20000038147 NASA Goddard Space Flight Center, Greenbelt, MD USA
Rainfall Estimation Over Tropical Oceans, 1, Area Average Rain Rate
Cuddapah, Prabhakara, NASA Goddard Space Flight Center, USA; Cadeddu, Maria, NASA Goddard Space Flight Center, USA; Meneghini, R., NASA Goddard Space Flight Center, USA; Short, David A., NASA Goddard Space Flight Center, USA; Yoo, Jung-Moon, NASA Goddard Space Flight Center, USA; Dalu, G., NASA Goddard Space Flight Center, USA; Schols, J. L., NASA Goddard Space Flight Center, USA; Weinman, J. A., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 195-196; Repr. from WMO Workshop on Measurements of Cloud Properties for Forecasts of Weather and Climate p 286-291; In English; Measurements of Cloud Properties for Forecasts of Weather and Climate, 23-27 Jun. 1997, Mexico City, Mexico; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771); Abstract Only, Hardcopy, Microfiche

Multichannel dual polarization microwave radiometer SSM/I observations over oceans do not contain sufficient information to differentiate quantitatively the rain from other hydrometeors on a scale comparable to the radiometer field of view (approx. 30 km). For this reason we have developed a method to retrieve average rain rate over a mesoscale grid box of approx. 300 x 300 sq km area over the TOGA COARE region where simultaneous radiometer and radar observations are available for four months (Nov. 92 to Feb. 93). The rain area in the grid box, inferred from the scattering depression due to hydrometeors in the 85 Ghz brightness temperature, constitutes a key parameter in this method. Then the spectral and polarization information contained in all the channels of the SSM/I is utilized to deduce a second parameter. This is the ratio S/E of scattering index S, and emission index E calculated from the SSM/I data. The rain rate retrieved from this method over the mesoscale area can reproduce the radar observed rain rate with a correlation coefficient of about 0.85. Furthermore monthly total rainfall estimated from this method over that area has an average error of about 15%.
Author
Rain; Radar Tracking; Estimating; Oceans; Tropical Regions; Remote Sensing

20000038150 NASA Goddard Space Flight Center, Greenbelt, MD USA

Correction of Rayleigh Scattering Effects in Cloud Optical Thickness Retrievals

Wang, Meng-Hua, Maryland Univ., USA; King, Michael D., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 169-170; Repr. from Journal of Geophysical Research, v. 102, no. D22, 27 Nov. 1997 p 25,915-25,926; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

We present results that demonstrate the effects of Rayleigh scattering on the 9 retrieval of cloud optical thickness at a visible wavelength (0.66 Am). The sensor-measured radiance at a visible wavelength (0.66 Am) is usually used to infer remotely the cloud optical thickness from aircraft or satellite instruments. For example, we find that without removing Rayleigh scattering effects, errors in the retrieved cloud optical thickness for a thin water cloud layer (T = 2.0) range from 15 to 60%, depending on solar zenith angle and viewing geometry. For an optically thick cloud (T = 10), on the other hand, errors can range from 10 to 60% for large solar zenith angles (0-60 deg) because of enhanced Rayleigh scattering. It is therefore particularly important to correct for Rayleigh scattering contributions to the reflected signal from a cloud layer both (1) for the case of thin clouds and (2) for large solar zenith angles and all clouds. On the basis of the single scattering approximation, we propose an iterative method for effectively removing Rayleigh scattering contributions from the measured radiance signal in cloud optical thickness retrievals. The proposed correction algorithm works very well and can easily be incorporated into any cloud retrieval algorithm. The Rayleigh correction method is applicable to cloud at any pressure, providing that the cloud top pressure is known to within +/- 100 bPa. With the Rayleigh correction the errors in retrieved cloud optical thickness are usually reduced to within 3%. In cases of both thin cloud layers and thick ,clouds with large solar zenith angles, the errors are usually reduced by a factor of about 2 to over 10. The Rayleigh correction algorithm has been tested with simulations for realistic cloud optical and microphysical properties with different solar and viewing geometries. We apply the Rayleigh correction algorithm to the cloud optical thickness retrievals from experimental data obtained during the Atlantic Stratocumulus Transition Experiment (ASTEX) conducted near the Azores in June 1992 and compare these results to corresponding retrievals obtained using 0.88 Am. These results provide an example of the Rayleigh scattering effects on thin clouds and further test the Rayleigh correction scheme. Using a nonabsorbing near-infrared wavelength lambda (0.88 Am) in retrieving cloud optical thickness is only applicable over oceans, however, since most land surfaces are highly reflective at 0.88 Am. Hence successful global retrievals of cloud optical thickness should remove Rayleigh scattering effects when using reflectance measurements at 0.66 Am.

Author

Cloud Cover; Rayleigh Scattering; Stratocumulus Clouds; Optical Thickness; Cloud Physics; Remote Sensing

20000038151 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Effect of Clouds on Water Vapor Profiling from the Millimeter-Wave Radiometric Measurements

Wang, J. R., NASA Goddard Space Flight Center, USA; Spinhirne, J. D., NASA Goddard Space Flight Center, USA; Racette, P., NASA Goddard Space Flight Center, USA; Chang, L. A., Futuretech Corp., USA; Hart, W., Science Systems and Applications, Inc., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 165-166; Repr. from Journal of Applied Meteorology, v. 36, no. 9 p 1232-1244; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Simultaneous measurements with the millimeter-wave imaging radiometer (MIR), cloud lidar system (CLS), and the MODIS airborne simulator (MAS) were made aboard the NASA ER-2 aircraft over the western Pacific Ocean on 17-18 January 1993. These measurements were used to study the effects of clouds on water vapor profile retrievals based on millimeter-wave radiometer measurements. The CLS backscatter measurements (at 0.532 and 1.064 am) provided information on the heights and a detailed structure of cloud layers; the types of clouds could be positively identified. All 12 MAS channels (0.6-13 Am) essentially respond to all types of clouds, while the six MIR channels (89-220 GHz) show little sensitivity to cirrus clouds. The radiances from the 12-/Am and 0.875-gm channels of the MAS and the 89-GHz channel of the MIR were used to gauge the performance of the retrieval of water vapor profiles from the MIR observations under cloudy conditions. It was found that, for cirrus and absorptive (liquid) clouds, better than 80% of the retrieval was convergent when one of the three criteria was satisfied; that is, the radiance at 0.875 Am is less than 100 W/cm.sr, or the brightness at 12 Am is greater than 260 K, or brightness at 89 GHz is less than 270 K (equivalent to cloud liquid water of less than 0.04 g/cm). The range of these radiances for convergent retrieval increases markedly when the condition for convergent retrieval was somewhat relaxed. The algorithm of water vapor profiling from the MIR measurements could not perform adequately over the areas of storm-related clouds that scatter radiation at millimeter wavelengths.

Author

Cirrus Clouds; Water Vapor; Microwave Radiometers; Microwave Imagery; Ocean Surface; Pacific Ocean; Radiance; Atmospheric Sounding; Remote Sensing; Rainstorms

20000038152 NASA Goddard Space Flight Center, Greenbelt, MD USA

MIR Measurements of Atmospheric Water Vapor Profiles

Wang, J. R., NASA Goddard Space Flight Center, USA; Racette, P., NASA Goddard Space Flight Center, USA; Chang, L. A., Futuretech Corp., USA; Laboratory for Hydrospheric Processes Research Publications; 1997; ISSN 0196-2892, pp. 163-164; Repr. from IEEE Transactions on Geoscience and Remote Sensing, v. 35, no. 2, Mar. 1997 p 212-223; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Three subjects related to atmospheric water vapor profiling using the 183.3 GHz absorption line are discussed in this paper. First, data acquired by an airborne millimeter-wave imaging radiometer (MIR) over ocean surface in the western Pacific are used to estimate three-dimensional (3-D) distribution of atmospheric water vapor. The instrument's radiometric measurements with mixed vertical and horizontal polarizations require modifications to the retrieval algorithm used in the past. It is demonstrated that, after the modifications, the new algorithm can provide adequate retrieval of water vapor profiles, even though the measured data are of mixed polarizations. Next, the retrieved profiles, in terms of water vapor mixing ratio rho (g/kg), are compared with those measured in near concurrence by dropsondes from a research aircraft in the western Pacific and by a ground-based Raman lidar at Wallops Island, Virginia. The ratio of the standard deviation to the mean rho is found to be 0.12 at 0.25 km altitude and gradually degraded to 0.67 at the highest altitude of the retrieval of 10.25 km. Finally, the effect of the "initial guess" relative humidity profile on the final retrieved product is analyzed with respect to the condition for the convergent retrieval. It is found that the effect is minimal if the initial profile is not unrealistically different from the true one. If the initial profile is very different from the true one, the final retrieved product could be subject to a substantial error. Tightening of the convergent condition in the retrieval helped reduce magnitude of the error, but not remove it totally. It is concluded that an initial profile based on climatology is likely to provide most reliable retrieval results.

Author

Millimeter Waves; Microwave Imagery; Ocean Surface; Water Vapor; Radiometers; Algorithms; Optical Radar

20000038154 NASA Wallops Flight Center, Wallops Island, VA USA

Altimeter Estimation of Sea Surface Wind Stress for Light to Moderate Winds

Vandemark, Douglas, NASA Wallops Flight Center, USA; Edson, James B., Woods Hole Oceanographic Inst., USA; Chapron, Bertrand, Institut Francais de Recherche pour l'Exploitation de la Mer, France; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 159-160; Repr. from Journal of Atmospheric and Oceanic Technology, v. 14, no. 3, Pt. 2, Jun. 1997 p 716-722; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Aircraft altimeter and in situ measurements are used to examine relationships between altimeter backscatter and the magnitude of near-surface wind and friction velocities. Comparison of altimeter radar cross section with wind speed is made through the modified Chelton-Wentz algorithm. Improved agreement is found after correcting 10-m winds for both surface current and atmospheric stability. An altimeter friction velocity algorithm is derived based on the wind speed model and an open-ocean drag coefficient. Close agreement between altimeter- and in situ-derived friction velocities is found. For this dataset, quality of the altimeter inversion to surface friction velocity is comparable to that for adjusted winds and clearly better than the inversion to true 10-m wind speed.

Author

Ocean Surface; Altimeters; Wind Shear; Wind Velocity; Remote Sensing

20000038156 NASA Goddard Space Flight Center, Greenbelt, MD USA

Stratiform and Convective Rain Discrimination from Microwave Radiometer Observations

Prabhakara, C., NASA Goddard Space Flight Center, USA; Cadeddu, M., Universities Space Research Association, USA; Short, D. A., NASA Goddard Space Flight Center, USA; Weinman, J. A., NASA Goddard Space Flight Center, USA; Schols, J. L., General Sciences Corp., USA; Haferman, J., Universities Space Research Association, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 149-150; Repr. from Proceedings of the International Radiation Symposium p 498-501; In English; Radiation, 19-24 Aug. 1996, Fairbanks, AK, USA; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

A criterion based on the SSM/I observations is developed to discriminate rain into convective and stratiform types. This criterion depends on the microwave polarization properties of the flat melting snow particles that fall slowly in the stratiform

clouds. Utilizing this criterion and some spatial and temporal characteristics of hydrometeors in TOGA-COARE area revealed by ship borne radars, we have developed an algorithm to retrieve convective and stratiform rain rate from SSM/I data.
Author
Microwave Imagery; Remote Sensing; Rain; Meteorological Radar; Microwave Radiometers; Radar Measurement

20000038158 NASA Goddard Space Flight Center, Greenbelt, MD USA
Microphysical Retrievals Over Stratiform Rain Using Measurements from an Airborne Dual-Wavelength Radar-Radiometer
Meneghini, Robert, NASA Goddard Space Flight Center, USA; Kumagai, Hiroshi, Communications Research Lab., Japan; Wang, James R., NASA Goddard Space Flight Center, USA; Iguchi, Toshio, Communications Research Lab., Japan; Kozu, Toshiaki, Communications Research Lab., Japan; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 145-146; Repr. from IEEE Transactions on Geoscience and Remote Sensing, v. 35, no. 3, May 1997 p 487-506; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

The need to understand the complementarity of the radar and radiometer is important not only to the Tropical Rain Measuring Mission (TRMM) program but to a growing number of multi-instrumented airborne experiment that combine single or dual-frequency radars with multichannel radiometers. The method of analysis used in this study begins with the derivation of dual-wavelength radar equations for the estimation of a two-parameter drop size distribution (DSD). Defining a ”storm model” as the set of parameters that characterize snow density, cloud water, water vapor, and features of the melting layer, then to each storm model there will usually correspond a set of range-profiled drop size distributions that are approximate solutions of the radar equations. to test these solutions, a radiative transfer model is used to compute the brightness temperatures for the radiometric frequencies of interest. A storm model or class of storm models is considered optimum if it provides the best reproduction of the radar and radiometer measurements. Tests of the method are made for stratiform rain using simulated storm models as well as measured airborne data. Preliminary results show that the best correspondence between the measured and estimated radar profiles usually can be obtained by using a moderate snow density (0.1-0.2 g/cu cm), the Maxwell-Garnett mixing formula for partially melted hydrometeors (water matrix with snow inclusions), and low to moderate values of the integrated cloud liquid water (less than 1 kg/sq m). The storm-model parameters that yield the best reproductions of the measured radar reflectivity factors also provide brightness temperatures at 10 GHz that agree well with the measurements. On the other hand, the correspondence between the measured and modeled values usually worsens in going to the higher frequency channels at 19 and 34 GHz. In searching for possible reasons for the discrepancies, It is found that changes in the DSD parameter Mu, the radar constants, or the path-integrated attenuation can affect the high frequency channels significantly. In particular, parameters that cause only modest increases in the median mass diameter of the snow, and which have a minor effect on the radar returns or the low frequency brightness temperature, can produce a strong cooling of the 34 GHz brightness temperature.
Author
Airborne Radar; Trmm Satellite; Rain; Snow; Radiometers; Data Processing; Radar Data

20000038165 NASA Wallops Flight Facility, Wallops Island, VA USA
Scattering by Artificial Wind and Rain Roughened Water Surfaces at Oblique Incidences
Craeye, C., Universite Catholique de Louvain, Belgium; Sobieski, P. W., Universite Catholique de Louvain, Belgium; Bliven, L. F., NASA Wallops Flight Facility, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 131-132; Repr. from International Journal of Remote Sensing, v. 18, no. 10 p 2241-2246; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Rain affects wind retrievals from scatterometric measurements of the sea surface. to depict the additional roughness caused by rain on a wind driven surface, we use a ring-wave spectral model. This enables us to analyse the rain effect on K(u) band scatterometric observations from two laboratory experiments. Calculations based on the small perturbation method provide good simulation of scattering measurements for the rain-only case, whereas for combined wind and rain cases, the boundary perturbation method is appropriate.
Author
Satellite-Borne Radar; Rain; Scattering; Ocean Surface; Remote Sensing; Ocean Models; Wind (Meteorology); Oceanography; Wind Measurement

20000038176 NASA Goddard Space Flight Center, Greenbelt, MD USA

Storm-Associated Microwave Radiometric Signatures in the Frequency Range of 90-220 GHz

Wang, James R., NASA Goddard Space Flight Center, USA; Zhan, J., Caelum Research Corp., USA; Racette, P., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 167-168; Repr. from Journal of Atmospheric and Oceanic Technology, v. 14, no. 1 p 13-31; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Radiometric measurements were made by a millimeter-wave imaging radiometer (MIR) at the frequencies of 89, 150, 183.3 +/- 1, 183.3 +/- 3, 183.3 +/- 7, and 220 GHz aboard the NASA ER-2 aircraft at an altitude of about 20 km over two rainstorms: one in the western Pacific Ocean on 19 January 1993 and another in southern Florida on 5 October 1993. These measurements were complemented by nearly simultaneous observations by other sensors aboard the same aircraft and another aircraft flying along the same path. Analysis of data from these measurements, aided by radiative transfer and radar reflectivity calculations of hydrometeor profiles, which arc generated by a general cloud ensemble model, demonstrates the utility of these frequencies for studying the structure of frozen hydrometeors associated with storms. Particular emphasis is placed on the three water vapor channels near 183.3 GHz. Results show that the radiometric signatures measured by these channels over the storm-associated scattering media bear a certain resemblance to those previously observed over a clear and fairly dry atmosphere with a cold ocean background. Both of these atmospheric conditions are characterized by a small amount of water vapor above a cold background. Radiative transfer calculations were made at these water vapor channels for a number of relative humidity profiles characterizing dry atmospheres over an ocean surface. The results are compared with the measurements to infer some characteristics of the environment near the scattering media. Furthermore, radiometric signatures from these channels display unique features for towering deep convective cells that could be used to identify the presence of such cells in storms.

Author

Microwave Radiometers; Microwave Imagery; Atmospheric Sounding; Pacific Ocean; Ocean Surface; Meteorology; Millimeter Waves; Radiative Transfer; Rainstorms; Remote Sensing

20000038204 Lamont-Doherty Geological Observatory, Palisades, NY USA

Modeling Studies of the Effects of Tropical Rainfall on Ocean-Atmosphere Interactions and Oceanic Hydrological Cycle ***Final Report, 15 Apr. 1997 - 14 Aug. 1999***

Chen, Dake, Lamont-Doherty Geological Observatory, USA; [2000]; 2p; In English

Contract(s)/Grant(s): NCC5-225; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This research project is a joint effort of UMD/JCESS, NASA/GSFC, NOAA/PMEL and LDEO, with UMD/JCESS being the leader and LDEO being responsible for coupled modeling. Although the project as a whole is for three years, the LDEO part was terminated at the end of the second year because of a shift of focus. The detailed description of the whole project and the effort made at LDEO have been given in the two joint annual reports and the two annual reports from LDEO. Here we only provide a brief summary of what we have done here at LDEO and a list of publications that resulted partly from this project.

Derived from text

Air Water Interactions; Hydrological Cycle; Rain; Climate Models

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OCEANOGRAPHY

Includes biological, dynamic, and physical oceanography; and marine resources. For related information see also 43 Earth Resources and Remote Sensing.

20000036455 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Dinamika Atmosfer, Jakarta, Indonesia

Simulation of ENSO Phenomena Based on a Global Circulation Model ***Simulasi Fenomena ENSO Berbasis Model Sirkulasi Global***

Bambang, Siswanto, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; September 1999; Volume 1, No. 3, pp. 16-24; In Malay-Indonesian; See also 20000036452; Copyright; Avail: Issuing Activity

In this study, the CSIR09 general circulation model (GCM) has been used to simulate a Mean Sea Level Pressure (MSLP) for the period of January 1949 to December 1997. The atmospheric parameters, CO2 dan CO3 (30 years averaged), the ”Q flux correction technique” as a driver for ocean-atmospheric interaction and also monthly sea surface temperature, have been used to run the GCM. ARIMA model also used for analyzing pressure data observed at Darwin and Tahiti, and the Southern Oscillation

Index is calculated using standardization method. The Southern Oscillation Index (SOI) calculated from GCM output and ARIMA are agree with observation result, but the SOI amplitude from model show smaller.
Author
Atmospheric General Circulation Models; El Nino; Southern Oscillation; Computerized Simulation; Sea Level

20000037723 Colorado Univ., National Snow and Ice Data Center, Boulder, CO USA
Variable Ice-Sheet Discharge and Coastal Change in West Antarctica ***Final Report***
Scambos, Ted A., Colorado Univ., USA; [2000]; 9p; In English
Contract(s)/Grant(s): NAG5-4179; UC-153-2439; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
This paper presents a final report on Variable Ice-Sheet Discharge and Coastal Change in West Antarctica. Results are given for Ice Shelf Patrol and Outlet glacier velocity mapping.
CASI
Antarctic Regions; Coasts; Land Ice; Change Detection

20000037947 NASA Goddard Space Flight Center, Greenbelt, MD USA
Primary Production in Antarctic Sea Ice
Arrigo, Kevin R., NASA Goddard Space Flight Center, USA; Worthen, Denise L., Science Systems and Applications, Inc., USA; Lizotte, Michael P., Wisconsin Univ., USA; Dixon, Paul, Scripps Institution of Oceanography, USA; Dieckmann, Gerhard, Alfred-Wegener-Inst. for Polar Research, Germany; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 5-6; Repr. from Science, v. 276 p 394-397; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche
A numerical model shows that in Antarctic sea ice, increased flooding in regions with thick snow cover enhances primary production in the infiltration (surface) layer. Productivity in the freeboard (sea level) layer is also determined by sea ice porosity, which varies with temperature. Spatial and temporal variation in snow thickness and the proportion of first-year ice thus determine regional differences in sea ice primary production. Model results show that of the 40 tera-grams of carbon produced annually in the Antarctic ice pack, 75 percent was associated with first-year ice and nearly 50 percent was produced in the Weddell Sea.
Author
Antarctic Regions; Sea Ice; Mathematical Models; Snow Cover; Infiltration; Remote Sensing; Marine Biology

20000037960 Institut Francais de Recherche Scientifique pour le Developpement en Cooperation, Groupe SURTROPAC, Noumea, New Caledonia
An Advective-Reflective Conceptual Model for the Oscillatory Nature of the ENSO
Picaut, J., Institut Francais de Recherche Scientifique pour le Developpement en Cooperation, New Caledonia; Masia, F., Institut Francais de Recherche Scientifique pour le Developpement en Cooperation, New Caledonia; duPenhoat, Y., Institut Francais de Recherche Scientifique pour le Developpement en Cooperation, New Caledonia; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 61-62; Repr. from Science, v. 277, 1 Aug. 1997 p 663-666; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche
Recent findings about zonal displacements of the Pacific warm pool required a notable modification of the delayed action oscillator theory, the current leading theory for the El Nino-Southern Oscillation (ENSO). Simulations with a linearized coupled ocean-atmosphere model resulted in 3- to 6-year ENSO-like oscillations, with many of the variable model parameters found to be very close to their observed values. This simple model suggests that ocean processes that are ignored or underestimated in the delayed action oscillator theory, such as zonal current convergence, zonal advection of sea surface temperature, and equatorial wave reflection from the eastern ocean boundary, are fundamental to the development of the ENSO, in particular to its manifestations in the central equatorial Pacific.
Author
El Nino; Southern Oscillation; Air Water Interactions; Sea Surface Temperature; Wave Reflection; Atmospheric Models; Ocean Models; Climate

20000037961 NASA Goddard Space Flight Center, Greenbelt, MD USA
Applications of Data Assimilation to Analysis of the Ocean on Large Scales
Miller, Robert N., Oregon State Univ., USA; Busalacchi, Antonio J., NASA Goddard Space Flight Center, USA; Hackert, Eric C., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 57-58; Repr. from Journal of the Meteorological Society of Japan, v. 75, no. 1B, 1997 p 445-462; In English; 2nd; Assimilation of Observations in Meteorology and Oceanography, 13-17 Mar. 1995, Tokyo, Japan

Contract(s)/Grant(s): N00014-92-J-1595; NOAA-NA-36GP0123-01; RTOP 578-21-03; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

It is commonplace to begin talks on this topic by noting that oceanographic data are too scarce and sparse to provide complete initial and boundary conditions for large-scale ocean models. Even considering the availability of remotely-sensed data such as radar altimetry from the TOPEX and ERS-1 satellites, a glance at a map of available subsurface data should convince most observers that this is still the case. Data are still too sparse for comprehensive treatment of interannual to interdecadal climate change through the use of models, since the new data sets have not been around for very long. In view of the dearth of data, we must note that the overall picture is changing rapidly. Recently, there have been a number of large scale ocean analysis and prediction efforts, some of which now run on an operational or at least quasi-operational basis, most notably the model based analyses of the tropical oceans. These programs are modeled on numerical weather prediction. Aside from the success of the global tide models, assimilation of data in the tropics, in support of prediction and analysis of seasonal to interannual climate change, is probably the area of large scale ocean modeling and data assimilation in which the most progress has been made. Climate change is a problem which is particularly suited to advanced data assimilation methods. Linear models are useful, and the linear theory can be exploited. For the most part, the data are sufficiently sparse that implementation of advanced methods is worthwhile. As an example of a large scale data assimilation experiment with a recent extensive data set, we present results of a tropical ocean experiment in which the Kalman filter was used to assimilate three years of altimetric data from Geosat into a coarsely resolved linearized long wave shallow water model. Since nonlinear processes dominate the local dynamic signal outside the tropics, subsurface dynamical quantities cannot be reliably inferred from surface height anomalies. Because of its potential for large scale synoptic coverage of the deep ocean, acoustic travel time data should be a natural complement to satellite altimetry. Satellite data give us vertical integrals associated with thermodynamic and dynamic processes.
Author

Ocean Models; Oceanographic Parameters; Remote Sensing; Data Acquisition; Oceanography; Kalman Filters; Satellite Observation

20000037962 NASA Goddard Space Flight Center, Greenbelt, MD USA

Tracking of Ice Edges and Ice Floes by Wavelet Analysis of SAR Images

Liu, Antony K., NASA Goddard Space Flight Center, USA; Martin, Seelye, Washington Univ., USA; Kwok, Ronald, Jet Propulsion Lab., California Inst. of Tech., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 55-56; Repr. from Journal of Atmospheric and Oceanic Technology, v. 14 p 1187-1198; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

This paper demonstrates the use of wavelet transforms in the tracking of sequential ice features in the ERS-1 synthetic aperture radar (SAR) imagery, especially in situations where feature correlation techniques fail to yield reasonable results. Examples include the evolution of the St. Lawrence polynya and summer sea ice change in the Beaufort Sea. For the polynya, the evolution of the region of young ice growth surrounding a polynya can be easily tracked by wavelet analysis due to the large backscatter difference between the young and old ice. Also within the polynya, a 2D fast Fourier transform (FFT) is used to identify the extent of the Langmuir circulation region, which is coincident with the wave-agitated frazil ice growth region, where the sea ice experiences its fastest growth. Therefore, the combination of wavelet and FFT analysis of SAR images provides for the large-scale monitoring of different polynya features. For summer ice, previous work shows that this is the most difficult period for ice trackers due to the lack of features on the sea ice cover. The multiscale wavelet analysis shows that this method delineates the detailed floe shapes during this period, so that between consecutive images, the floe translation and rotation can be estimated.
Author

Synthetic Aperture Radar; Radar Imagery; Ice Floes; Wavelet Analysis; Remote Sensing; Fast Fourier Transformations

20000037967 NASA Goddard Space Flight Center, Greenbelt, MD USA

Validity of the Temperature Reconstruction from Water Isotopes in Ice Cores

Jouzel, J., Centre National de la Recherche Scientifique, France; Alley, R. B., Pennsylvania State Univ., USA; Cuffey, K. M., Washington Univ., USA; Dansgaard, W., Copenhagen Univ., Denmark; Grootes, P., Washington Univ., USA; Hoffmann, G., Max-Planck-Inst. fuer Meteorologie, Germany; Johnsen, S. J., Copenhagen Univ., Denmark; Koster, R. D., NASA Goddard Space Flight Center, USA; Peel, D., British Antarctic Survey, UK; Shuman, C. A., NASA Goddard Space Flight Center, USA; Stievenard, M., Centre National de la Recherche Scientifique, France; Stuiver, M., Washington Univ., USA; White, J., Colorado Univ., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 41-42; Repr. from Journal of Geophysical Research, v. 102, no. C12, 30 Nov. 1997 p 26,471-26,487; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Well-documented present-day distributions of stable water isotopes (HDO and others) show the existence, in middle and high latitudes, of a linear relationship between the mean annual isotope content of precipitation (SD and 51”0) and the mean annual temperature at the precipitation site. Paleoclimatologists have used this relationship, which is particularly well obeyed over Greenland and Antarctica, to infer paleotemperatures from ice core data. There is, however, growing evidence that spatial and temporal isotope/ surface temperature slopes differ, thus complicating the use of stable water isotopes as paleothermometers. In this paper we review empirical estimates of temporal slopes in polar regions and relevant information that can be inferred from isotope models: simple, Rayleigh-type distillation models and (particularly over Greenland) general circulation models (GCMS) fitted with isotope tracer diagnostics. Empirical estimates of temporal slopes appear consistently lower than present-day spatial slopes and are dependent on the timescale considered. This difference is most probably due to changes in the evaporative origins of moisture, changes in the seasonality of the precipitation, changes in the strength of the inversion layer, or some combination of these changes. Isotope models have not yet been used to evaluate the relative influences of these different factors. The apparent disagreement in the temporal and spatial slopes clearly makes calibrating the isotope paleothermometer difficult. Nevertheless, the use of a (calibrated) isotope paleothermometer appears justified; empirical estimates and most (though not all) GCM results support the practice of interpreting ice core isotope records in terms of local temperature changes.
Author
Atmospheric General Circulation Models; Surface Temperature; Water; Isotopes; Polar Regions

20000037968 NASA Goddard Space Flight Center, Greenbelt, MD USA
Climate Variability in the Amundsen and Bellingshausen Seas
Jacobs, Stanley S., Lamont-Doherty Geological Observatory, USA; Comiso, Josefino C., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 39-40; Repr. from Journal of Climate (American Meteorological Society), v. 10, no. 4, Apr. 1997 p 697-709; In English
Report No.(s): LDGO-Contrib-5597; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Satellite data reveal a 20% decline in sea ice extent in the Amundsen and Bellingshausen Seas in the two decades following 1973. This change is negatively correlated with surface air temperatures on the west side of the Antarctic Peninsula, which have increased -0.5 C / decade- since the mid-1940s, The recession was strongest during summer, when monthly average minima in 1991-92 removed much of the incipient multiyear ice over the continental shelf. This would have lowered the regional-mean ice thickness, impacting snow ice formation, brine production, and vertical heat flux. The northern ice edge contracted by 1 deg of latitude in all seasons from 1973-79 to 1987-93, returning toward mean conditions in 1993-95. The decline included multiyear cycles of several years in length, superimposed on high interannual variability. A review of atmospheric forcing shows winds consistent with mean and extreme ice extents, and suggests links to larger-scale circulation changes in the South Pacific. Historical ocean measurements are sparse in this sector, but mixed-layer depths and upper pycnoclines beneath the sea ice resemble those in the Weddell Sea. Weaker surface currents or changes in the upwelling of Circumpolar Deep Water on the continental shelf could have contributed to the anomaly persistence.
Author
Sea Ice; Atmospheric Temperature; Climate Change; Remote Sensing; Satellite Observation; Antarctic Regions; Ice Formation

20000037971 Dartmouth Coll., Thayer School of Engineering, Hanover, NH USA
Year-Round Pack Ice in the Weddell Sea, Antarctica: Response and Sensitivity to Atmospheric and Oceanic Forcing
Geiger, Cathleen A., Dartmouth Coll., USA; Ackley, Stephen F., Army Cold Regions Research and Engineering Lab., USA; Hibler, William D., III, Dartmouth Coll., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 31-32; Repr. from Ann. Glaciol., v. 25 p 269-275; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Using a dynamic-thermodynamic numerical sea-ice model, external oceanic and atmospheric forcings on sea ice in the Weddell Sea are examined to identify physical processes associated with the seasonal cycle of pack ice, and to identify further the parameters that coupled models need to consider in predicting the response of the pack ice to climate and ocean-circulation changes. In agreement with earlier studies, the primary influence on the winter ice-edge maximum extent is air temperature. Ocean heat flux has more impact on the minimum-ice-edge extent and in reducing pack-ice thickness, especially in the eastern-Weddell Sea. Low relative humidity enhances ice growth in thin ice and open-water regions, producing a more realistic ice edge along the coastal areas of the western-Weddell Sea where dry continental air has an impact. The modeled extent of the Weddell summer pack is equally sensitive to ocean heat flux and atmospheric relative humidity variations with the more dynamic responses being from the atmosphere. Since the atmospheric regime in the eastern Weddell is dominated by marine intrusions from lower latitudes, with high humidity already, it is unlikely that either the moisture trans- port could be further raised or that it could be significantly

lowered because of its distance from the continent (the lower humidity source). Ocean heat-transport variability is shown to lead to overall ice thinning in the model response and is a known feature of the actual system, as evidenced by the occurrence of the Weddell Polynya in the mid 1970s.
Author
Antarctic Regions; Climate Change; Thermodynamics; Heat Transfer; Sea Ice; Oceanography

20000037975 NASA Goddard Space Flight Center, Greenbelt, MD USA
Seasonal Phytoplankton Dynamics in the Eastern Tropical Atlantic
Monger, Bruce, Universities Space Research Association, USA; McClain, Charles, NASA Goddard Space Flight Center, USA; Murtugudde, Ragu, Maryland Univ., USA; Laboratory for Hydrospheric Processes Research Publications; Jun. 15, 1997, pp. 15-16; Repr. from Journal of Geophysical Research, v. 102, no. C6, 15 Jun. 1997 p 12,389-12,411; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

The coastal zone color scanner (CZCS) that operated aboard the Nimbus 7 satellite provided extensive coverage of phytoplankton pigment concentrations in the surface waters of the eastern tropical Atlantic (ETA) from March 1979 to February 1980 and coincided with four major research cruises to this region. Total primary production within the ETA (5 deg N-10 deg S, 25 deg W-10 deg E) was determined from CZCS pigment estimates and an empirical algorithm derived from concurrent in situ data taken along 4 deg W that relates near-surface chlorophyll concentration and integrated primary production. We estimated an average annual production for the ETA of 2.3 Gt C/yr with an associated 3.5-fold seasonal variation in the magnitude of this production. We describe the principal physical mechanisms controlling seasonal phytoplankton dynamics within the ETA and propose that in addition to seasonal change in the thermocline depth, one must also consider changes in the depth of the equatorial under current. An extensive validation effort indicates that the standard CZCS global products are a conservative estimate of pigment concentrations in ETA surface waters. Significant underestimates by the CZCS global products were observed in June and July which we attributed, in part, to aerosol correction errors and, more importantly, to errors caused by a significant reduction in the concentration of near-surface dissolved organic matter that resulted from strong equatorial upwelling.
Author
Coastal Zone Color Scanner; Annual Variations; Phytoplankton; Pigments; Surface Water; Atlantic Ocean; Ocean Data Acquisitions Systems; Oceanography

20000037976 South Pacific Commission, Oceanic Fisheries Programme, Noumea, New Caledonia
El Nino Southern Oscillation and Tuna in the Western Pacific
Lehodey, P., South Pacific Commission, New Caledonia; Bertignac, M., South Pacific Commission, New Caledonia; Hampton, J., South Pacific Commission, New Caledonia; Lewis, A., South Pacific Commission, New Caledonia; Picaut, J., Office de la Recherche Scientifique et Technique Outre-Mer, New Caledonia; Laboratory for Hydrospheric Processes Research Publications; 19970814, pp. 13-14; Repr. from Nature, v. 389, 16 Oct. 1997 p 715-718; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Nearly 70% of the world's annual tuna harvest, currently 3.2 million tonnes, comes from the Pacific Ocean. Skipjack tuna (Katsuwonus pelamis) dominate the catch. Although skipjack are distributed in the surface mixed layer throughout the equatorial and subtropical Pacific, catches are highest in the western equatorial Pacific warm pool, a region characterized by low primary productivity rates that has the warmest surface waters of the world's oceans. Assessments of tuna stocks indicate that recent western Pacific skipjack catches approaching one million tonnes annually are sustainable. The warm pool, which is fundamental to the El Nino Southern Oscillation (ENSO) and the Earth's climate in general, must therefore also provide a habitat capable of supporting this highly productive tuna population. Here we show that apparent spatial shifts in the skipjack population are linked to large zonal displacements of the warm pool that occur during ENSO events. This relationship can be used to predict (several months in advance) the region of highest skipjack abundance, within a fishing ground extending over 6,000 km along the Equator.
Author
El Nino; Fishes; Southern Oscillation; Fisheries; Fishing; Surface Water

20000037977 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The Perennial Ice Cover of the Beaufort Sea from Active- and Passive-Microwave Observations
Kwok, R., Jet Propulsion Lab., California Inst. of Tech., USA; Comiso, J. C., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 47-48; Repr. from Ann. Glaciol., v. 25 p 376-381; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

The perennial ice concentration in the Beaufort Sea was examined using active- and passive-microwave observations. We compared the ice type and concentration estimates from SSM/I and ERS-1 SAR data over a seasonal cycle from January 1992 to January 1993. It was found the multi-year (MY) ice-concentration estimates from the SAR data were very stable and were nearly equivalent to the ice concentration estimated at the end of the previous summer. We contrast this with the variability of the MY ice-concentration and ice-fraction estimates obtained using the NASA Team algorithm. The passive- and active-microwave algorithms provide total ice concentrations that are comparable during the winter, but the passive estimates are significantly lower during the summer. Passive-microwave estimates of multi-year-ice concentrations are consistently lower (up to 30%) than those from the SAR data. We discuss reasons for these discrepancies and the possible biases introduced by the active and passive algorithms.
Author
Microwave Imagery; Remote Sensing; Beaufort Sea (North America); Sea Ice

20000037978 NASA Goddard Space Flight Center, Greenbelt, MD USA
An Assessment of the Regional Distribution of the Oxygen-Isotope Ratio in Northeastern Canada
Giovinetto, Mario B., Calgary Univ., Canada; Holdsworth, Gerald, Arctic Inst. of North America, Canada; Fisher, David A., Geological Survey of Canada, Canada; Waters, Nigel M., Calgary Univ., Canada; Zwally, H. Jay, NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 33-34; Repr. from Ann. Glaciol., v. 25 p 214-219; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

A compilation of mean values of the oxygen-isotope ratio relative to standard mean ocean Water for 22 sites representative of conditions in north-eastern Canada is complemented with data on mean annual surface temperature, latitude, surface elevation, and mean annual shortest distance to open ocean denoted by the 10% sea-ice concentration boundary. Stepwise regression analysis is used to develop a multivariate model suitable to infer the distribution of 6 1”0 in an area of complex topography and possibly mixed source of advected water vapor. The best model is produced by a run in the backward mode at the 95% confidence level in which only temperature, latitude and distance to the open ocean remain in the model (the correlation coefficient is 0.915, the adjusted coefficient of determination is 0.809, the root mean square residual is 1.62). This model is similar to the best 6180 predictive model derived elsewhere for Greenland, suggesting a common principal source of advected moisture.
Author
Oxygen Isotopes; Canada; Oceans; Regression Analysis; Sea Ice; Topography

20000037980 NASA Goddard Space Flight Center, Greenbelt, MD USA
Observed Hemispheric Asymmetry in Global Sea Ice Changes
Cavalieri, D. J., NASA Goddard Space Flight Center, USA; Gloersen, P., NASA Goddard Space Flight Center, USA; Parkinson, C. L., NASA Goddard Space Flight Center, USA; Comiso, J. C., NASA Goddard Space Flight Center, USA; Zwally, H. J., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; Nov. 01, 1997, pp. 21-22; Repr. from Science, v. 278, 7 Nov. 1997 p 1104-1106; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

From November 1978 through December 1996, the areal extent of sea ice decreased by 2.9 +/- 0.4 percent per decade in the Arctic and increased by 1.3 +/- 0.2 percent per decade in the Antarctic. The observed hemispheric asymmetry in these trends is consistent with a modeled response to a carbon dioxide-induced climate warming. The interannual variations, which are 2.3 percent of the annual mean in the Arctic, with a predominant period of about 5 years, and 3.4 percent of the annual mean in the Antarctic, with a predominant period of about 3 years, are uncorrelated.
Author
Antarctic Regions; Sea Ice; Climate Change; Arctic Regions; Global Warming; Earth Atmosphere

20000037981 NASA Goddard Space Flight Center, Greenbelt, MD USA
Oceanic Observations
Busalacchi, Antonio J., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 19-20; Repr. from Journal of the Meteorological Society of Japan, v. 75, no. 1B, 1997 p 131-154; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

For many years, merchant ships and the naval fleets of various countries have been the major source of data over and in the open ocean. Oceanographic research experiments and process studies in the field have also contributed to the climatological data bases for the global ocean, but, for the most part, these have been limited in duration and extent. However, over the last 10 years

under the auspices of the World Climate Research Program and the International Geosphere Biosphere Program the role of the oceans in global and climate change has taken on increased significance. This has created a need for a considerably improved understanding of the seasonal, interannual, decadal and longer time-scale variability of the physical and biogeochemical attributes of the global ocean. As a result, over the past 10 years several major international field programs have been implemented and have had a tremendous impact on the number of in situ observations obtained for the global ocean. The Tropical Ocean Global Atmosphere (TOGA) program, the World Ocean Circulation Experiment (WOCE), and the Joint Global Ocean Flux Study (JGOFS) were designed with observational, modelling, and process study components aimed at analyzing different aspects of the ocean's role in the coupled climate system. In parallel with the field programs, continuous space-based observations of sea surface temperature, sea surface topography, and sea surface winds spanning nearly a decade or longer have become a reality. During this same time period, numerical ocean models and computational power have advanced to the point where the oceanographic observations, both in situ and remotely sensed, can be assimilated into numerical ocean models in order to provide a four-dimensional (x-y-z-t) depiction of the evolving state of the global ocean.
Author
Oceanography; Oceanographic Parameters; Oceans; Periodic Variations; Remote Sensing; Topography; Air Water Interactions; Climate Change

20000038104 Scripps Institution of Oceanography, La Jolla, CA USA
Solitary Waves in the Western Equatorial Pacific Ocean
Pinkel, R., Scripps Institution of Oceanography, USA; Merrifield, M., Hawaii Univ., USA; McPhaden, M., National Oceanic and Atmospheric Administration, USA; Picaut, J., Institut Francais de Recherche Scientifique pour le Developpement en Cooperation, New Caledonia; Rutledge, S., Colorado State Univ., USA; Siegel, D., California Univ., USA; Washburn, L., California Univ., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 63-64; Repr. from Geophysical Research Letters, v. 24, no. 13, 1 Jul. 1997 p 1603-1606; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

During the spring tides of early January and February 1993, groups of solitary internal waves were observed propagating through the Intensive Flux Array of the TOGA COARE experiment. The waves appear to originate near the islands of Nugarba (3 deg S 30 deg S - 154 deg 30'E). They travel north-eastward at 2.5-3 m/s, closely coupled with the semi-diurnal baroclinic tide. Peak amplitudes exceed 60 m. Velocities are in excess of .8 m/s. Sea-surface vertical displacements of order.3 m can be inferred directly from the lateral acceleration of surface waters. The Equatorial Undercurrent is displaced by soliton passage but apparently is unaffected otherwise. The intrinsic shear of the solitary crests is small compared to ambient equatorial shears. The crests, while not themselves unstable, are effective at triggering instabilities on the background flow. The motions potentially contribute 10-15 Watts/sq m to the flux of heat into the mixed layer.
Author
Solitary Waves; Pacific Ocean; Ocean Surface; Tides; Internal Waves; Oceanography; Air Water Interactions

20000038113 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Atlantic Meridional Transect: Spatially Extensive Calibration and Validation of Optical Properties and Remotely Sensed Measurements of Ocean Colour
Aiken, James, Plymouth Marine Lab., UK; Hooker, Stanford, NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 113-114; Repr. from Backscatter, v. 8, no. 3 p 8-11; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Twice a year, the Royal Research Ship (RRS) James Clark Ross (JCR) steams a meridional transect of the atlantic Ocean between Grimsly (UK) and Stanley (Falkland Islands) with a port call in Montevideo (Uruguay), as part of the annual research activities of the British Antarctic Survey (BAS). In September, the JCR sails from the UK, and the following April it makes the return trip. The ship is operated by the BAS for the Natural Environment Research Council (NERC). The Atlantic Meridional Transect (AMT) Program exploits the passage of the JCR from approximately 50 deg. N to 50 deg. S with a primary objective to investigate physical and biological processes, as well as to measure the mesi-to-basin-scale bio-optical properties of the atlantic Ocean. The calibration and validation of remotely sensed observations of ocean colour is an inherent objective of these studies: first, by relating in situ measurements of water leaving radiance to satellite measurement, and second, by measuring the bio-optically active constituents of the water.
Derived from text
Water Color; Remote Sensing; Satellite Observation; Atlantic Ocean; Calibrating; Optical Properties

20000038115 NASA Goddard Space Flight Center, Greenbelt, MD USA

Areal Distribution of the Oxygen-Isotope Ratio in Greenland

Zwally, H. Jay, NASA Goddard Space Flight Center, USA; Giovinetto, Mario B., Calgary Univ., Canada; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 105-106; Repr. from Annales Geophysicae, v. 25, p 208-213; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Mean values of the oxygen-isotope ratio relative to standard mean ocean water reported for 46 sites on the Greenland ice sheet are compiled together with data on mean annual surface temperature, latitude, 6180 elevation, and mean annual shortest distance to the open ocean denoted by the 10% sea-ice concentration boundary. Stepwise regression analyses, with 6180 as the dependent variable, define two robust models. In the forward mode at the 99.9% confidence level, only temperature enters the model. In the backward mode at the 95% confidence level, only temperature, latitude, and distance to the open ocean remain in the model. Inversions of the models on the basis of 160 gridpoint locations 100 km apart in the area delimited by the surface equilibrium line produce four contoured distributions of 6”0. Two distributions are based on the bivariate model and two on the multivariate model. The second distribution for each model is obtained substituting mean annual surface-temperature values obtained from the Nimbus-7 Temperature Humidity Infrared Radiometer (THIR) database. All four distributions are considered valid, and differences between them are evaluated using contoured anomaly maps. It is suggested that the inversion of the multivariate model using THIR data provides the more reliable pattern for studies of atmospheric advection or for the derivation of ice-flow adjustments for 6180 series obtained from deep-core or ablation-zone sites.

Author

Oxygen Isotopes; Ocean Models; Regression Analysis; Isotope Ratios; Greenland; Sea Ice

20000038117 NASA Goddard Space Flight Center, Greenbelt, MD USA

A Comparison of Sea Ice Type, Sea Ice Temperature, and Snow Thickness Distributions in the Arctic Seasonal Ice Zones with the DMSP SSM/I

St.Germain, Karen, Naval Research Lab., USA; Cavalieri, Donald J., NASA Goddard Space Flight Center, USA; Markus, Thorsten, NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 263-264; Repr. from Proceedings of 1997 International Geoscience and Remote Sensing Symposium (IGARSS 1997), v. 3 p 1291-1293; In English; Geoscience and Remote Sensing, 3-8 Aug. 1997, Singapore, Singapore

Report No.(s): IEEE-97CH36042; LC-97-70575; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Global climate studies have shown that sea ice is a critical component in the global climate system through its effect on the ocean and atmosphere, and on the earth’s radiation balance. Polar energy studies have further shown that the distribution of thin ice and open water largely controls the distribution of surface heat exchange between the ocean and atmosphere within the winter Arctic ice pack. The thickness of the ice, the depth of snow on the ice, and the temperature profile of the snow/ice composite are all important parameters in calculating surface heat fluxes. In recent years, researchers have used various combinations of DMSP SSMI channels to independently estimate the thin ice type (which is related to ice thickness), the thin ice temperature, and the depth of snow on the ice. In each case validation efforts provided encouraging results, but taken individually each algorithm gives only one piece of the information necessary to compute the energy fluxes through the ice and snow. In this paper we present a comparison of the results from each of these algorithms to provide a more comprehensive picture of the seasonal ice zone using passive microwave observations.

Author

DMSP Satellites; Satellite Observation; Algorithms; Brightness Temperature; Climatology; Energy Budgets; Heat Flux; Sea Ice; Remote Sensing

20000038119 NASA Goddard Space Flight Center, Greenbelt, MD USA

The SeaWiFS Quality Monitor: A Portable Field Calibration Light Source

Shaw, Ping-Shine, National Inst. of Standards and Technology, USA; Johnson, B. Carol, National Inst. of Standards and Technology, USA; Hooker, Stanford B., NASA Goddard Space Flight Center, USA; Lynch, Don, Reyer Corp., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 257-258; Repr. from Proceedings of Ocean Optics 13, v. 2963 p 772-776; In English; 13th; Ocean Optics, 22-25 Oct. 1996, Halifax, Nova Scotia, Canada; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

ABSTRACT A portable and stable source, the Sea-viewing Wide Field-of-view Sensor (SeaWiFS) Quality Monitor, has been developed for use as a field instrument. The source can be used with either radiance- or irradiance-measuring sensors to transfer the laboratory calibration to the field so that the stability of the sensors can be monitored during the experiment.

Temperature-controlled silicon photodiodes with colored glass filters are used to monitor the stability of the SeaWiFS Quality Monitor.
Author
Sea-Viewing Wide Field-Of-View Sensor; Calibrating; Light Sources; Ocean Data Acquisitions Systems; Remote Sensing

20000038123 Office de la Recherche Scientifique et Technique Outre-Mer, Groupe SURTROPAC, Noumea, New Caledonia
ENSO Mechanisms
Picaut, Joeel, Office de la Recherche Scientifique et Technique Outre-Mer, New Caledonia; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 251-252; Repr. from the Proceedings of the International Symposium on Monitoring the Oceans in the 2000s: An Integrated Approach. Plenary Session 1: Oceanography and Climate; In English; Monitoring the Oceans in the 2000s: An Integrated Approach, 15-17 Oct. 1997, Biarritz, France
Report No.(s): Paper 1; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

This current leading theory of the El Nino-Southern Oscillation (ENSO) phenomenon involves reflection of equatorial waves on the western ocean boundary to shift the ENSO phase from El Nino to La Nina and vice versa. However, recent satellite altimetry and In situ observations indicate that this theory has several flaws. These include imperfect equatorial wave reflection on the western ocean boundary, a maxima of the simulated coupled wind-sea surface temperature (SST) interaction located too far into the eastern equatorial Pacific, and an excessive role of thermocline displacement on SST in this region. We show that the central equatorial Pacific SST is fundamental in driving the EIVSO ocean-atmosphere coupled system, through the east-west displacement of the eastern edge of the warm pool, perfectly related with ENSO. Within the equatorial wave-guide, the dominance of surface zonal advection in these displacements is demonstrated with four different satellite and in situ data sets and three ocean models. This demonstration is supported by the evidence of a convergence of water masses into the eastern edge of the warm pool, resulting in a well-defined salinity front. All these results lead us to propose a notable modification of the leading delayed-action oscillator theory for the oscillatory nature of ENSO. Simulations with a linearized coupled ocean-atmosphere model result in 3-6 year ENSO-like oscillations, with many of the variable model parameters found very close to their observed values. This simple model suggests that ocean processes ignored or underestimated in the delayed action oscillator theory, such as zonal current convergence, zonal advection of sea surface temperature and equatorial wave reflection from the eastern-ocean boundary, are fundamental to the development of ENSO, in particular to its manifestations in the central equatorial Pacific.
Author
Air Water Interactions; Satellite Altimetry; Southern Oscillation; El Nino; Climate; Wave Reflection

20000038127 NASA Goddard Space Flight Center, Greenbelt, MD USA
Can TOPEX/Poseidon Data be Used for Monitoring the Indonesian Throughflow?
Murtugudde, Ragu, Maryland Univ., USA; Busalacchi, Antonio J., NASA Goddard Space Flight Center, USA; Beauchamp, James, NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 243-244; Repr. from Proceedings of the International Symposium on Moniitoring the Oceans in the 2000s: An Integrated Approach. Poster Session 1: Oceanography and Climate; In English; Monitoring the Oceans in the 2000s: An Integrated Approach, 15-17 Oct. 1997, Biarritz, France
Report No.(s): Paper 1-12; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

The effects of the Indonesian throughflow(ITF) are studied in a reduced gravity, primitive equation, sigma coordinate model. The surface heat fluxes are provided by coupling the ocean GCAF to an advective atmospheric mixed layer model. There is an ENSO related signal in the ITF but the correlation with the Southern Oscillation Index (SOI) is only -0.31. When the winds over the Indian Ocean are held to climatology, this correlation jumps to -0.65 indicating that the non-EASO signal in the ITF is caused by the downstream winds. On interannual time-scales the ITF can be explained in terms of sea level differences between the western Pacific and eastern Indian Oceans when appropriate representative locations are chosen as demonstrated in both model and TOPEX data. It is shown that the main climatological effect of the ITF is to warm the Indian Ocean and cool the Pacific. Mile the main ENSO indices, NIN03 and NIN04, are almost identical with and without the ITF, the total SSTs show significant ENSO dependence.
Author
Climatology; Indonesia; Mathematical Models; Ocean Surface; TOPEX; Satellite Observation; Remote Sensing; Oceanography; Indian Ocean; Primitive Equations

20000038141 NASA Goddard Space Flight Center, Greenbelt, MD USA

Comparison of TOPEX/Poseidon Sea Level and Linear Model Results forced by Various Wind Products for the Tropical Pacific

Hackert, Eric C., NASA Goddard Space Flight Center, USA; Busalacchi, Antonio J., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 213-214; Repr. from International Symposium on Monitoring the Oceans in the 2000s: An Integrated Approach, Poster Session 4: Dynamic Oceanography; In English; Monitoring the Oceans in the 2000s: An Integrated Approach, 15-17 Oct. 1997, Biarritz, France

Report No.(s): Paper 1-11; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

The goal of this paper is to compare TOPEX/Posaidon (T/P) sea level with sea level results from linear ocean model experiments forced by several different wind products for the tropical Pacific. During the period of this study (October 1992 - October 1995), available wind products include satellite winds from the ERS-1 scatterometer product of [HALP 97] and the passive microwave analysis of SSMI winds produced using the variational analysis method (VAM) of [ATLA 91]. In addition, atmospheric GCM winds from the NCEP reanalysis [KALN 96], ECMWF analysis [ECMW94], and the Goddard EOS-1 (GEOS-1) reanalysis experiment [SCHU 93] are available for comparison. The observed ship wind analysis of FSU [STRI 92] is also included in this study. The linear model of [CANE 84] is used as a transfer function to test the quality of each of these wind products for the tropical Pacific. The various wind products are judged by comparing the wind-forced model sea level results against the T/P sea level anomalies. Correlation and RMS difference maps show how well each wind product does in reproducing the T/P sea level signal. These results are summarized in a table showing area average correlations and RMS differences. The large-scale low-frequency temporal signal is reproduced by all of the wind products, However, significant differences exist in both amplitude and phase on regional scales. In general, the model results forced by satellite winds do a better job reproducing the T/P signal (i.e. have a higher average correlation and lower RMS difference) than the results forced by atmospheric model winds. Author

TOPEX; Poseidon Satellite; Tropical Regions; Wind (Meteorology); Atmospheric Models; Sea Level; Ocean Surface; Satellite Observation; Pacific Ocean

20000038146 NASA Goddard Space Flight Center, Greenbelt, MD USA

Zonal and Meridional Mass Redistribution in the Tropical Pacific During El Nino Southern Oscillation Events

Delcroix, Thierry, Office de la Recherche Scientifique et Technique Outre-Mer, New Caledonia; Gourdeau, Lionel, Office de la Recherche Scientifique et Technique Outre-Mer, New Caledonia; Rual, Pierre, Office de la Recherche Scientifique et Technique Outre-Mer, New Caledonia; Murtugudde, Raghuram, NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 197-198; Repr. from International Symposium on Monitoring the Oceans in the 2000s: An Integrated Approach. Poster Session 1: Oceanography and Climate; In English; Monitoring the Oceans in the 2000s: An Integrated Approach, 13-14 Oct. 1997, Biarritz, France

Report No.(s): Paper 1-5; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

This note aims at documenting the ENSO-related sea level changes for the whole tropical Pacific, and for the 1979-1996 period which covers numerous El Nino and La Nina events. For this purpose, we rely on (a) 0/450 dbar surface dynamic height anomaly (an alias for sea level) derived from XBT and TOGA-TAO measurements during 1979-1996, (b) TOPEX/Poseidon derived sea level anomaly during 1993-1996, and (c) Murtugudde et al. [1996] model sea level output during 1979-1995. Derived from text

El Nino; Southern Oscillation; Tropical Meteorology; Air Water Interactions; Sea Level; Pacific Ocean

20000038159 NASA Goddard Space Flight Center, Greenbelt, MD USA

Wavelet Analysis of Satellite Images for Coastal Watch

Liu, Antony K., NASA Goddard Space Flight Center, USA; Peng, Chich Y., NASA Goddard Space Flight Center, USA; Chang, Steve Y.-S., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997; ISSN 0364-9059, pp. 143-144; Repr. from IEEE Journal of Oceanic Engineering, v. 22, no. 1, Jan. 1997 p 9-17; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

The two-dimensional wavelet transform is a very efficient bandpass filter, which can be used to separate various scales of processes and show their relative phase/location. In this paper, algorithms and techniques for automated detection and tracking of mesoscale features from satellite imagery employing wavelet analysis are developed. The wavelet transform has been applied to satellite images, such as those from synthetic aperture radar (SAR), advanced very-high-resolution radiometer (AVHRR), and

coastal zone color scanner (CZCS) for feature extraction. The evolution of mesoscale features such as oil slicks, fronts, eddies, and ship wakes can be tracked by the wavelet analysis using satellite data from repeating paths. Several examples of the wavelet analysis applied to various satellite Images demonstrate the feasibility of this technique for coastal monitoring.
Author
Wavelet Analysis; Satellite Imagery; Coasts; Marine Technology; Pattern Recognition; Bandpass Filters; Detection; Mesoscale Phenomena

20000038160 NASA Goddard Space Flight Center, Greenbelt, MD USA
Development of a Simulated Data Set for the SeaWiFS Mission
Gregg, Watson W., NASA Goddard Space Flight Center, USA; Patt, Frederick S., NASA Goddard Space Flight Center, USA; Woodward, Robert H., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997; ISSN 0196-2892, pp. 141-142; Repr. from IEEE Transactions on Geoscience and Remote Sensing, v. 35, no. 2, Mar. 1997 p 421-435; In English
Contract(s)/Grant(s): WWG-902-579-11-04; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

A realistic simulated data set is essential for mission readiness preparations and can potentially assist in all phases of ground support for a future mission. Such a data set was created for the Sea-viewing Wide Field-of-view Sensor (SeaWiFS), a global ocean color mission due for launch in 1997. This data set incorporates a representation of virtually every known aspect of the flight mission. Thus, it provides a high fidelity data set for testing most phases of the ground system, Including data processing, data transfers, calibration and validation, quality control, and mission operations. The data set is constructed for a seven-day period, March 25-31, 1994. Specific features of the data set: it includes Global Area Coverage (GAC), recorded Local Area Coverage (LAC), and real-time High Resolution Picture Transmission (HRFIT) data for the seven-day period; it includes a realistic orbit which is propagated using a Brouwer-Lyddane model with drag; the data correspond to a command schedule based on the orbit for this seven-day period; it includes total (at-satellite) radiances for ocean, land, clouds, and ice; it utilizes a high-resolution land/sea mask; it includes actual SeaWiFS spectral responses; it includes the actual sensor saturation responses; it is formatted according to current onboard data structures; and it includes corresponding telemetry (instrument and spacecraft) data. The methods are described and some examples of the output are given.
Author
Sea-Viewing Wide Field-Of-View Sensor; Data Processing; Ocean Data Acquisitions Systems; Real Time Operation; Remote Sensing; Water Color; Simulation

20000038162 NASA Goddard Space Flight Center, Greenbelt, MD USA
Algorithm for Atmospheric and Glint Corrections of Satellite Measurements of Ocean Pigment
Fraser, Robert S., NASA Goddard Space Flight Center, USA; Mattoo, Shana, Applied Research Corp., USA; Yeh, Eueng-Nan, General Sciences Corp., USA; McClain, C. R., NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 137-138; Repr. from Journal of Geophysical Research, v. 102, no. D14, 17 Jul. 1997 p 17,107-17,118; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

An algorithm is developed to correct satellite measurements of ocean color for atmospheric and surface reflection effects. The algorithm depends on taking the difference between measured and tabulated radiances for deriving water-leaving radiances. ’ne tabulated radiances are related to the measured radiance where the water-leaving radiance is negligible (670 nm). The tabulated radiances are calculated for rough surface reflection, polarization of the scattered light, and multiple scattering. The accuracy of the tables is discussed. The method is validated by simulating the effect of different wind speeds than that for which the lookup table is calculated, and aerosol models different from the maritime model for which the table is computed. The derived water-leaving radiances are accurate enough to compute the pigment concentration with an error of less than q 15% for wind speeds of 6 and 10 m/s and an urban atmosphere with aerosol optical thickness of 0.20 at lambda 443 nm and decreasing to 0.10 at lambda 670 nm. The pigment accuracy is less for wind speeds less than 6 m/s and is about 30% for a model with aeolian dust. On the other hand, in a preliminary comparison with coastal zone color scanner (CZCS) measurements this algorithm and the CZCS operational algorithm produced values of pigment concentration in one image that agreed closely.
Author
Satellite Observation; Oceans; Water Color; Pigments; Algorithms; Glint; Radiance

20000038164 NASA Wallops Flight Center, Wallops Island, VA USA

A Unified Directional Spectrum for Long and Short Wind-Driven Waves

Elfouhaily, T., Institut Francais de Recherche pour l'Exploitation de la Mer, France; Chapron, B., Institut Francais de Recherche pour l'Exploitation de la Mer, France; Katsaros, K., Institut Francais de Recherche pour l'Exploitation de la Mer, France; Vandemark, D., NASA Wallops Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 133-134; Repr. from Journal of Geophysical Research, v. 102, no. C7, 15 Jul. 1997 p 15,781-15,796; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Review of several recent ocean surface wave models finds that while comprehensive in many regards, these spectral models do not satisfy certain additional, but fundamental, criteria. We propose that these criteria include the ability to properly describe diverse fetch conditions and to provide agreement with in situ observations of Cox and Munk [1954] and Jiihne and Riemer [1990] and Hara et al. [1994] data in the high-wavenumber regime. Moreover, we find numerous analytically undesirable aspects such as discontinuities across wavenumber limits, nonphysical tuning or adjustment parameters, and noncentrosymmetric directional spreading functions. This paper describes a two-dimensional wavenumber spectrum valid over all wavenumbers and analytically amenable to usage in electromagnetic models. The two regime model is formulated based on the Joint North Sea Wave Project (JONSWAP) in the long-wave regime and on the work of Phillips [1985] and Kitaigorodskii [1973] at the high wavenumbers. The omnidirectional and wind-dependent spectrum is constructed to agree with past and recent observations including the criteria mentioned above. The key feature of this model is the similarity of description for the high- and low-wavenumber regimes; both forms are posed to stress that the air-sea interaction process of friction between wind and waves (i.e., generalized wave age, u/c) is occurring at all wavelengths simultaneously. This wave age parameterization is the unifying feature of the spectrum. The spectrum's directional spreading function is symmetric about the wind direction and has both wavenumber and wind speed dependence. A ratio method is described that enables comparison of this spreading function with previous noncentrosymmetric forms. Radar data are purposefully excluded from this spectral development. Finally, a test of the spectrum is made by deriving roughness length using the boundary layer model of Kitaigorodskii. Our inference of drag coefficient versus wind speed and wave age shows encouraging agreement with Humidity Exchange Over the Sea (HEXOS) campaign results.
Author

Air Water Interactions; Ocean Surface; Surface Roughness; Radar Data; Water Waves; Surface Waves; Mathematical Models

20000038168 NASA Goddard Space Flight Center, Greenbelt, MD USA

Annual Sea Level Variability Induced by Changes in Sea Ice Extent and Accumulation on Ice Sheets: An Assessment Based on Remotely Sensed Data

Zwally, H. J., NASA Goddard Space Flight Center, USA; Giovinetto, M. B., Calgary Univ., Canada; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 103-104; Repr. from Surveys in Geophysics, v. 18, 1997 p 327-340; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Changes of mean annual net accumulation at the surface on the grounded ice sheets of East Antarctica, West Antarctica, and Greenland in response to variations in sea ice extent are estimated using grid-point values 100 km apart. The data bases are assembled principally by bilinear interpolation of remotely sensed brightness temperature (Nimbus-5 ESMR, Nimbus-7 SMMR), surface temperature (Nimbus-7 THIR), and surface elevation (ERS-1 radar altimeter). These data, complemented by field data where remotely sensed data are not available, are used in multivariate analyses in which mean annual accumulation (derived from firn emissivity) is the dependent variable; the independent variables are latitude, surface elevation, mean annual surface temperature, and mean annual distance to open ocean (as a source of energy and moisture). The last is the shortest distance measured between a grid point and the mean annual position of the 10% sea ice concentration boundary, and is used as an index of changes in sea ice extent as well as of mean concentration. Stepwise correlation analyses indicate that variations in sea ice extent of +/-50 km would lead to changes in accumulation inversely of +/-4% on East Antarctica, +/- 10% on West Antarctica, and +4% on Greenland. These results are compared with those obtained in a previous study using visually interpolated values from contoured compilations of field data; they substantiate the findings for the Antarctic ice sheets (+/-4% on East Antarctica, +/-9% in West Antarctica), and suggest a reduction by one half of the probable change of accumulation on Greenland (from +/-8%). The results also suggest a reduction of the combined contribution to sea level variability to +/- 0.19 mm/a (from +/- 0.22 mm/a).
Author

Sea Ice; Antarctic Regions; Sea Level; Remote Sensing; Surface Temperature; Brightness Temperature; Climate Change; Snow Cover; Satellite Observation

20000038170 Lamont-Doherty Geological Observatory, Palisades, NY USA

Ocean Dynamics, Thermocline Adjustment, and Regulation of Tropical SST

Seager, Richard, Lamont-Doherty Geological Observatory, USA; Murtugudde, Ragu, Universities Space Research Association, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 97-98; Repr. from Journal of Climate, v. 10, no. 3, Mar. 1997 p 521-534; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

The role of tropical Pacific ocean dynamics in regulating the ocean response to thermodynamic forcing is investigated using an ocean general circulation model (GCM) coupled to a model of the atmospheric mixed layer. It is found that the basin mean sea surface temperature (SST) change is less in the presence of varying ocean heat transport than would be the case if the forcing was everywhere balanced by an equivalent change in the surface heat flux. This occurs because the thermal forcing in the eastern equatorial Pacific is partially compensated by an increase in heat flux divergence associated with the equatorial upwelling. This constitutes a validation of a previously identified ”ocean dynamical thermostat.” A simple two-box model of subtropical-equatorial interaction shows that the SST regulation mechanism crucially depends on spatial variation in the sensitivity of the surface fluxes to SST perturbations. In the GCM, this sensitivity increases with latitude, largely a result of the wind speed dependence of the latent heat flux, so that a uniform forcing can be balanced by a smaller SST change in the subtropics than in equatorial latitudes. The tropical ocean circulation moves heat to where the ocean more readily loses it to the atmosphere. Water that subducts in subtropical latitudes and returns to the equatorial thermocline therefore has a smaller temperature perturbation than the surface equatorial waters. The thermocline temperature adjusts on timescales of decades to the imposed forcing, but the adjustment is insufficient to cancel the thermostat mechanism. The results imply that an increase in the downward heat flux at the ocean surface, as happens with increasing concentrations of greenhouse gases, should be accompanied by a stronger equatorial SST gradient. This contradicts the results of coupled atmosphere-ocean GCMs. Various explanations are offered. None are conclusive, but the possibility that the discrepancy lies in the low resolution of the ocean GCMs typically used in the study of climate change is discussed.
Author

Ocean Dynamics; Ocean Models; Air Water Interactions; Atmospheric General Circulation Models; Ocean Surface; Thermoclines; Thermodynamics; Pacific Ocean; Sea Surface Temperature

20000038173 Lamont-Doherty Geological Observatory, Palisades, NY USA

Twentieth-Century Sea Surface Temperature Trends

Cane, Mark A., Lamont-Doherty Geological Observatory, USA; Clement, Amy C., Lamont-Doherty Geological Observatory, USA; Kaplan, Alexey, Lamont-Doherty Geological Observatory, USA; Kushnir, Yochanan, Lamont-Doherty Geological Observatory, USA; Pozdnyakov, Dmitri, Lamont-Doherty Geological Observatory, USA; Seager, Richard, Lamont-Doherty Geological Observatory, USA; Zebiak, Stephen E., Lamont-Doherty Geological Observatory, USA; Murtugudde, Ragu, Universities Space Research Association, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 85-86; Repr. from Science, v. 275, 14 Feb. 1997 p 957-960; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

An analysis of historical sea surface temperatures provides evidence for global warming since 1900, in line with land-based analyses of global temperature trends, and also shows that over the same period, the eastern equatorial Pacific cooled and the zonal sea surface temperature gradient strengthened. Recent theoretical studies have predicted such a pattern as a response of the coupled ocean-atmosphere system to an exogenous heating of the tropical atmosphere. This pattern, however, is not reproduced by the complex ocean-atmosphere circulation models currently used to simulate the climatic response to increased greenhouse gases. Its presence is likely to lessen the mean 20th-century global temperature change in model simulations.
Author

Sea Surface Temperature; Air Water Interactions; Global Warming; Climatology; Heating; Ocean Models

20000038174 NASA Goddard Space Flight Center, Greenbelt, MD USA

Visual-Stratigraphic Dating of the GISP2 Ice Core: Basis, Reproducibility, and Application

Alley, R. B., Pennsylvania State Univ., USA; Shuman, C. A., NASA Goddard Space Flight Center, USA; Meese, D. A., Army Cold Regions Research and Engineering Lab., USA; Gow, A. J., Army Cold Regions Research and Engineering Lab., USA; Taylor, K. C., Desert Research Inst., USA; Cuffey, K. M., Washington Univ., USA; Fitzpatrick, J. J., Geological Survey, USA; Grootes, P. M., Kiel Univ., Germany; Zielinski, G. A., New Hampshire Univ., USA; Ram, M., State Univ. of New York, USA; Spinelli, G., Pennsylvania State Univ., USA; Elder, B., Army Cold Regions Research and Engineering Lab., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 83-84; Repr. from Journal of Geophysical Research, v. 102, no. C12 p 26,367-26,381; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Annual layers are visible in the Greenland Ice Sheet Project 2 ice core from central Greenland, allowing rapid dating of the core. Changes in bubble and grain structure caused by near-surface, primarily summertime formation of hoar complexes provide the main visible annual marker in the Holocene, and changes in ”cloudiness” of the ice correlated with dustiness mark Wisconsinan annual cycles; both markers are evident and have been intercalibrated in early Holocene ice. Layer counts are reproducible between different workers and for one worker at different times, with 1% error over century-length times in the Holocene. Reproducibility is typically 5% in Wisconsinan ice-age ice and decreases with increasing age and depth. Cumulative ages from visible stratigraphy are not significantly different from independent ages of prominent events for ice older than the historical record and younger than approximately 50,000 years. Visible observations are not greatly degraded by ”brittle ice” or many other core-quality problems, allowing construction of long, consistently sampled time series. High accuracy requires careful study of the core by dedicated observers.

Author

Greenland; Ice; Stratigraphy; Chronology; Depth

20000038181 NASA Goddard Space Flight Center, Greenbelt, MD USA

Influence of Sea Ice on the Thermohaline Circulation in the Arctic-North Atlantic Ocean

Mauritzen, Cecilie, National Academy of Sciences - National Research Council, USA; Haekkinen, Sirpa, NASA Goddard Space Flight Center, USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 91-92; Repr. from Geophysical Research Letters, v. 243, no. 24, 15 Dec. 1997 p 3257-3260; In English; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

A fully prognostic coupled ocean-ice model is used to study the sensitivity of the overturning cell of the Arctic-North-Atlantic system to sea ice forcing. The strength of the thermohaline cell will be shown to depend on the amount of sea ice transported from the Arctic to the Greenland Sea and further to the subpolar gyre. The model produces a 2-3 Sv increase of the meridional circulation cell at 25N (at the simulation year 15) corresponding to a decrease of 800 cu km in the sea ice export from the Arctic. Previous modeling studies suggest that interannual and decadal variability in sea ice export of this magnitude is realistic, implying that sea ice induced variability in the overturning cell can reach 5-6 Sv from peak to peak.

Author

Sea Ice; Greenland; Atlantic Ocean; Oceanography; Gyres

51
LIFE SCIENCES (GENERAL)

20000033840 Columbia Univ., New York, NY USA

Effects of Space Flight-Associated Stimuli on Development of Murine and Medaka Sensory-Motor Systems ***Final Report, 1 Jan. 1998 - 30 Jun. 1999***

Wolgemuth, Debra J., Columbia Univ., USA; [1999]; 5p; In English

Contract(s)/Grant(s): NAG2-1185; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The major goal of these studies was to continue investigations into the influence of altered gravitational fields on the development and function of the vertebrate brain and nervous system. of major focus during the 18-month finding period of this award was the maintenance of the animals used in the experimental mouse and medaka model paradigms. The experiments focused on characterization of stress-sensitive periods in neural development and immediate or delayed effects on gene expression, physiology and behavior. The hypothesis under investigation was that the environment of space will have biologically significant effects on the development and function of the vertebrate nervous system. We have postulated that these effects will be more significant on certain neural compartments, such as the vestibular-motor system, and that these effects will have greater

impact at particular stages of embryonic and post-natal development of the animal. Development of the central nervous system is well known for its vulnerability and sensitivity to environmental stimuli, although the effects of gravitational influences are poorly understood. The long-term goals of this research effort, initiated previously and continued in limited capacity during this interim period, were to provide important new information on the effects of altered environments during these critical periods. Derived from text

Space Flight; Central Nervous System; Vertebrates; Brain; Gravitational Fields; Aerospace Medicine

20000034129 NASA Ames Research Center, Moffett Field, CA USA

Membrane-Based Functions in the Origin of Cellular Life ***Final Report, 1 Oct. 1995 - 31 Mar. 1999***

Chipot, Christophe, Nancy Univ., France; New, Michael H., California Univ., USA; Schweighofer, Karl, NASA Ames Research Center, USA; Pohorille, Andrew, NASA Ames Research Center, USA; Wilson, Michael A., NASA Ames Research Center, USA; [1999]; 27p; In English

Contract(s)/Grant(s): NCC2-772; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Our objective is to help explain how the earliest ancestors of contemporary cells (protocells) performed their essential functions employing only the molecules available in the protobiological milieu. Our hypothesis is that vesicles, built of amphiphilic, membrane-forming materials, emerged early in protobiological evolution and served as precursors to protocells. We further assume that the cellular functions associated with contemporary membranes, such as capturing and, transducing of energy, signaling, or sequestering organic molecules and ions, evolved in these membrane environments. An alternative hypothesis is that these functions evolved in different environments and were incorporated into membrane-bound structures at some later stage of evolution. We focus on the application of the fundamental principles of physics and chemistry to determine how they apply to the formation of a primitive, functional cell. Rather than attempting to develop specific models for cellular functions and to identify the origin of the molecules which perform these functions, our goal is to define the structural and energetic conditions that any successful model must fulfill, therefore providing physico-chemical boundaries for these models. We do this by carrying out large-scale, molecular level computer simulations on systems of interest.

Derived from text

Biological Evolution; Membrane Structures; Protobiology; Computerized Simulation; Cytology

20000034235 San Jose State Univ., Dept. of Biological Sciences, CA USA

NASA Animal Enclosure Module Mouse Odor Containment Study for STS-107 September 15, 1999;SJSU Odor Panel Data ***Final Report***

Holley, Daniel C., San Jose State Univ., USA; Mele, Gary D., San Jose State Univ., USA; Poffenroth, Mary, San Jose State Univ., USA; Young, Cliff, San Jose State Univ., USA; Feb. 29, 2000; 30p; In English

Contract(s)/Grant(s): NCC2-1136; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Experiment #153 by Scott Brady is manifested for shuttle flight STS-107. This evaluation of space flight induced stress and its effects on neuronal plasticity will use 18 six month old C57Bl/6 male mice. A 21 day evaluation study was proposed to determine the length of time groups of 6, 9, or 12 mice could be housed in the Animal Enclosure Module (AEM) without odor breakthrough. This study was performed at NASA-Ames Research Center beginning on September 15, 1999. NASA personnel, were responsible for animal care, maintenance, facilities, hardware, etc. San Jose State personnel performed the odor panel evaluations and data reduction. We used similar procedures and methods for earlier tests evaluating female mice.

Author

Neurophysiology; Odors; Aerospace Medicine; Containment; Space Transportation System Flights; Mice; NASA Programs

20000036512 NASA Marshall Space Flight Center, Huntsville, AL USA

NASA Sponsored Research Involving Crystallization of Biological Materials

Downey, James Patton, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 8th; Crystallization of Biological Macromolecules, 14-19 May 2000, Sandestin, FL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

An overview of NASA's plans for the performing experiments involving the crystallization of biological materials on the International Space Station (ISS) is presented. In addition, a brief overview of past work is provided as background. Descriptions of flight hardware currently available for use on the ISS are given and projections of future developments are discussed. In addition, experiment selection and funding is described. As of the flight of STS-95, these crystallization projects have proven to be some of the most successful in the history of microgravity research. The NASA Microgravity Research Division alone has flown 185 different proteins, nucleic acids, viruses, and complexes on 43 different missions. 37 of the 185 have resulted, in, diffraction patterns with higher resolution than was obtained in all previous ground based experiments. This occurred despite the fact that an average of only 41 samples per protein were flown. A number of other samples have shown improved signal to noise

characteristics, i.e. relative Wilson plots, when compared to the best ground experiments. In addition, a number of experiments investigating the effects of microgravity conditions on the crystallization of biological material have been conducted.
Author
Crystallization; Research and Development; Microgravity; International Space Station

20000037721 NASA Kennedy Space Center, Cocoa Beach, FL USA
Starch Metabolism in Space-Grown Soybean Seedlings ***Final Report, 1994-1999***
Guikema, James A., Kansas State Univ., USA; Leach, Jan E., Kansas State Univ., USA; Brown, Christopher, NASA Kennedy Space Center, USA; [1999]; 3p; In English
Contract(s)/Grant(s): NAG10-142; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The focus of this research was the study of sugar metabolism in soybean plants that had been in a clinorotation condition. The scope of activities was broadened greatly after the onset of the award. This broadening added two major research foci: 1) B-PAC: Photosynthetic activity of Brassica rapa; and 2) SOYPAT: The effects of microgravity on the interaction of a fungal root pathogen with soybean. Substantial investment and activity was also focused on the training of the astronaut team to conduct these experiments during orbital spaceflight.
Derived from text
Metabolism; Soybeans; Starches; Sugars; Spaceborne Experiments

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AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

20000034097 NASA Langley Research Center, Hampton, VA USA
Cosmic Ray Hits in the Central Nervous System at Solar Maximum
Curtis, S. B., Hutchinson (Fred) Cancer Research Center, USA; Vazquez, M. E., Brookhaven National Lab., USA; Wilson, J. W., NASA Langley Research Center, USA; Atwell, W., Boeing North American, Inc., USA; Kin, M.-H. Y., NASA Langley Research Center, USA; Advances in Space Research; 2000; ISSN 0273-1177; Volume 25, No. 10, pp. 2035-2040; In English; Copyright; Avail: Issuing Activity

It has been suggested that a manned mission to Mars be launched at solar maximum rather than at solar minimum to minimize the radiation exposure to galactic cosmic rays. It is true that the number of hits from highly ionizing particles to critical regions in the brain will be less at solar maximum, and it is of interest to estimate how much less. We present here calculations for several sites within the brain from iron ions (z = 26) and from particles with charge, z, greater than or equal to 15. The same shielding configurations and sites in the brain used in an earlier paper for solar minimum are employed so that direct comparison of results between the two solar activity conditions can be made. A simple pressure-vessel wall and an equipment room onboard a spacecraft are chosen as shielding examples. In the equipment room, typical results for the thalamus are that the probability of any particles with z greater than or equal to 15 and from 2.3 percent to 1.3 percent for iron ions. The extra shielding provided in the equipment room makes little difference in these numbers. We conclude that this decrease in hit frequency (less than a factor of two) does not provide a compelling reason to avoid solar minimum for a manned mission to Mars. This conclusion could be revised, however, if a very small number of hits is found to cause critical malfunction within the brain.
Author
Galactic Cosmic Rays; Solar Activity Effects; Radiation Dosage; Biological Effects; Radiation Effects; Brain

20000034151 Duke Univ., Durham, NC USA
GWI-98 Relationships of Stress Exposures to Health in Gulf War Veterans ***Annual Report, 1 Oct. 1998 - 30 Sep. 1999***
Fairbank, John A.; Oct. 1999; 54p; In English
Contract(s)/Grant(s): DAMD17-98-1-8662
Report No.(s): AD-A374108; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The Relationships of Stress Exposures to Health in Gulf War Veterans study of 10,000 Operation Desert Shield/Storm (ODS/S) veterans (including 5,000 females) uses a national probability-based clustered design in which the mail survey units are a proportional-to-size probability sample of metropolitan areas and county groups from the mailing addresses of veterans who were deployed to the Persian Gulf during ODS/S. The mail survey will provide information on physical health outcomes, exposure to traumatic stressors, psychological functioning, and some basic socioeconomic characteristics. A second systematic sample of over 2,000 male and female veterans will be selected in equal proportions from two groups (Gulf War veterans who reported

symptoms of Gulf War Illness and those who did not). This sample will be administered a computer-assisted telephone interview (CATI) that focuses on collecting more in-depth information on premilitary trauma exposure; military-Gulf War trauma and other stress exposures; psychiatric symptoms and disorder, including posttraumatic stress disorder (PTSD), major depression, dysthymia, and substance dependence; social support during the Gulf War and upon homecoming; and socioeconomic outcomes, including labor market functioning and health care service utilization. The mail survey questionnaire has been compiled and formatted for pilot testing and the Desert Shield/Storm (DS/S) and the Comprehensive Clinical Evaluation Program (CCEP) databases are being prepared for selecting the study sample.
DTIC
Health; Stress (Physiology); Stress (Psychology)

20000036548 Weizmann Inst. of Science, Rehovot Israel
Treatment of Retinal Injuries by Low-Energy Laser ***Final Report, 25 Mar. 1996-24 Mar. 1999***
Schwartz, Michal; Apr. 1999; 101p; In English
Contract(s)/Grant(s): DAMD17-96-1-6004
Report No.(s): AD-A374768; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Background and Purpose: Injury to the central nervous system (CNS) in general, and to the visual system (retina or optic nerve) in particular, has a final outcome which is far more severe than the initial damage. If neighboring neurons that escaped the initial insult are to be rescued from eventual degeneration, ways must be found protect them. Adequate neuroprotection presupposes a basic understanding of the way in which the damage spreads, the nature of the mediators of toxicity, the most efficient means of neutralizing these harmful agents or their effects, and ways of making the neural tissue more resistant to the toxicity mediators. Methods: Our choice of model for studying mediators of toxicity and methods of neuroprotection is a partial crush injury of the rat optic nerve. Results: Partial injury of the rat optic nerve leads to a gradual spread of damage from the injured neurons, commencing in either the axons or the cell bodies of adjacent neurons that escaped initial injury. The continuing degeneration is associated with an increase in extracellular glutamate and nitric oxide, and possibly also an increased susceptibility of the spared neurons to the toxicity. We have provided evidence that the immune response, in the form of autoimmune T cells directed against the CNS self antigen myelin basic protein, if suitably boosted, is beneficial in reducing the spread of damage. Conclusion: Partial lesion of the optic nerve results in a self perpetuating and self limiting spread of neuronal damage, which is mediated in part by a toxic increase in physiological compounds, in combination with an increased susceptibility of the affected neurons. Autoimmunity, if suitably controlled, may-be a benign response adapted for the protection and maintenance of the damaged tissue.
DTIC
Retina; Laser Damage; Neurophysiology; Injuries; Nerves

20000036595 NASA Johnson Space Center, Houston, TX USA
Core Temperature Measurement During Submaximal Exercise: Esophageal, Rectal, and Intestinal Temperatures
Lee, Stuart M. C., Wyle Labs., Inc., USA; Williams, W. Jon, Wyle Labs., Inc., USA; Schneider, Suzanne M., NASA Johnson Space Center, USA; April 2000; 56p; In English
Contract(s)/Grant(s): NAS9-18492
Report No.(s): NASA/TP-2000-210133; S-859; NAS 1.60:210133; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The purpose of this study was to determine if intestinal temperature (Tin) might be in acceptable alternative to esophageal (Tes) and rectal temperature (Trec) to assess thermoregulation during supine exercise. We hypothesized that Tin would have values similar to Tes and a response time similar to Trec, but the rate of temperature change across time would not be different between measurement sites. Seven subjects completed a continuous supine protocol of 20 min of rest, 20 min of cycle exercise at 40% peak oxygen consumption (VO2pk), 20 min of cycle exercise at 65% V02pk, and 20 min of recovery. Tes, Trec, and Tin were recorded each min throughout the test. Temperatures were not different after 20 min of rest, but Trec was less than the Tes and Tin at the end of the 40% and 65% VO2pk stages. After 20 min of recovery, Tes was less than either Trec or Tin, which were not different from each other. Time to threshold for increased temperature from rest was greater for Trec than Tes but not different from Tin. Time to reach peak temperature was greater for Tin and Trec than Tes. Similarly, time to a decrease in temperature after exercise was greater for Trec than Tes, but not different from Tin. The rate of temperature change from threshold to the end of the 40% VO2pk stage was not different between measurement sites. However, the rate of change during recovery was more

negative for Tes than Tin and Trec, which were different from each other. Measurement of Tin may he an acceptable alternative to Tes and Trec with an understanding of its limitations.
Author
Temperature Measurement; Body Temperature; Physical Exercise

20000037774 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne Australia
Physiological Performance of Soldiers Conducting Long Range Surveillance and Reconnaissance in Hot, Dry Environments
Lau, Wai-Man, Defence Science and Technology Organisation, Australia; Roberts, Warren, Defence Science and Technology Organisation, Australia; Forbes-Ewan, Chris, Defence Science and Technology Organisation, Australia; Nov. 1999; 40p; In English
Report No.(s): AD-A372886; DSTO-TR-0894; DODA-AR-011-127; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

A study was conducted to investigate the physiological performance of soldiers undertaking long range reconnaissance and surveillance activities in the Pilbara region, WA. The results indicated that soldiers experienced very low levels of heat strain during the transport and the setting up of the observation post phases. The heat strain increased to moderate levels while the subjects were conducting a route march in the afternoon. None of the thermal strain indicators (mean core temperature, average heart rate and average area weighted mean skin temperature) exceeded the level considered to indicate moderate heat strain by most civilian OH&S practitioners. The work load on the route march was approximately 50% of the peak metabolic rate, suggesting that this activity was sustainable provided that the environmental heat stress remained moderate. The sweating rate of the soldiers was generally low, with over 90% of the fluid loss attributable to evaporative cooling. There was also evidence that some soldiers experienced hypohydration while one subject appeared hyperhydrated. Based on the outcomes of the Soldier Combat Systems Enhancement Studies and the guidance from DOHSMAN, it is recommended that soldiers undertaking arduous activities should have a minimum fluid intake of 1.5 L.h-1 and that an hourly cycle of 30 min work/30 min rest should be introduced if the Wet Bulb Globe Temperature (WBGT) reaches or exceeds 280C. Caution must be exercised in interpreting the results as the weather conditions at the time of the study were influenced by a low pressure system. Consequently, the study was carried out under conditions far less stressful than normally experienced in this region. It is recommended that a repeat of the study is necessary to ascertain the true levels of heat strain soldiers would experience under typical hot and climatic conditions.
DTIC
Heat Tolerance; Human Performance; Physiological Effects; Workloads (Psychophysiology); Human Tolerances

20000038205 NASA Marshall Space Flight Center, Huntsville, AL USA
A Review of Electrical Impedance Spectrometry Methods for Parametric Estimation of Physiologic Fluid Volumes ***Final Report***
Dewberry, B., NASA Marshall Space Flight Center, USA; January 2000; 38p; In English
Contract(s)/Grant(s): Proj. 96-03
Report No.(s): NASA/TM-2000-210200; M-978; NAS 1.15:210200; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Electrical impedance spectrometry involves measurement of the complex resistance of a load at multiple frequencies. With this information in the form of impedance magnitude and phase, or resistance and reactance, basic structure or function of the load can be estimated. The ”load” targeted for measurement and estimation in this study consisted of the water-bearing tissues of the human calf. It was proposed and verified that by measuring the electrical impedance of the human calf and fitting this data to a model of fluid compartments, the lumped-model volume of intracellular and extracellular spaces could be estimated, by performing this estimation over time, the volume dynamics during application of stimuli which affect the direction of gravity can be viewed. The resulting data can form a basis for further modeling and verification of cardiovascular and compartmental modeling of fluid reactions to microgravity as well as countermeasures to the headward shift of fluid during head-down tilt or spaceflight.
Author
Impedance Measurement; Spectrometers; Electrical Impedance; Physiological Responses; Microgravity; Cardiovascular System

20000038225 NASA Langley Research Center, Hampton, VA USA

Aerospace Medicine and Biology: A Continuing Bibliography with Indexes, Supplement 496

January 2000; 35p; In English

Report No.(s): NASA/SP-2000-7011/SUPPL496; NAS 1.21:7011/SUPPL496; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This supplemental issue of Aerospace Medicine and Biology, A Continuing Bibliography with Indexes (NASA/SP#2000-7011) lists reports, articles, and other documents recently announced in the NASA STI Database. In its subject coverage, Aerospace Medicine and Biology concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth#s atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion. Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract. The NASA CASI price code table, addresses of organizations, and document availability information are included before the abstract section. Two indexes#subject and author are included after the abstract section.

Author

Aerospace Medicine; Exobiology; Life Support Systems; Physiological Effects; Interplanetary Space

20000038226 NASA Langley Research Center, Hampton, VA USA

Aerospace Medicine and Biology: A Continuing Bibliography With Indexes, Supplement 497

February 2000; 49p; In English

Report No.(s): NASA/SP-20000-7011/SUPPL497; NAS 1.21:7011/SUPPL 497; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This supplemental issue of Aerospace Medicine and Biology, A Continuing Bibliography with Indexes (NASA/SP#2000-7011) lists reports, articles, and other documents recently announced in the NASA STI Database. In its subject coverage, Aerospace Medicine and Biology concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention.

Author

Bibliographies; Indexes (Documentation); Aerospace Medicine; Exobiology

20000038227 NASA Langley Research Center, Hampton, VA USA

Aerospace Medicine and Biology: A Continuing Bibliography With Indexes, Supplement 499

April 2000; 99p; In English

Report No.(s): NASA/SP-2000-7011/SUPPL499; NAS 1.21:7011/SUPPL499; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

This supplemental issue of Aerospace Medicine and Biology, A Continuing Bibliography with Indexes (NASA/SP#1999-7011) lists reports, articles, and other documents recently announced in the NASA STI Database. In its subject coverage, Aerospace Medicine and Biology concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth#s atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion. Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract. The NASA CASI price code table, addresses of organizations, and document availability information are included before the abstract section. Two indexes-subject and author are included after the abstract section.

Derived from text

Aerospace Medicine; Exobiology; Life Support Systems; Physiological Effects; Pharmacology

20000038228 NASA Langley Research Center, Hampton, VA USA
Aerospace Medicine and Biology: A Continuing Bibliography with Indexes, Supplement 498
March 2000; 141p; In English
Report No.(s): NASA/SP-1999-7011/SUPPL498; NAS 1.21:7011/SUPPL498; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This supplemental issue of Aerospace Medicine and Biology, A Continuing Bibliography with Indexes (NASA/SP-1999-7011) lists reports, articles, and other documents recently announced in the NASA STI Database. In its subject coverage, Aerospace Medicine and Biology concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion. Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract.
Author
Aerospace Medicine; Bibliographies; Exobiology; Indexes (Documentation)

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BEHAVIORAL SCIENCES

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

20000033842 Old Dominion Univ., Dept. of Psychology, Norfolk, VA USA
Preliminary Analysis of Photoreading ***Final Report, Period ending 30 Sep. 1999***
McNamara, Danielle S., Old Dominion Univ., USA; January 2000; 28p; In English
Contract(s)/Grant(s): NAG2-1319
Report No.(s): ODURF-193021; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this project was to provide a preliminary analysis of a reading strategy called PhotoReading. PhotoReading is a technique developed by Paul Scheele that claims to increase reading rate to 25,000 words per minute (Scheele, 1993). PhotoReading itself involves entering a "relaxed state" and looking at, but not reading, each page of a text for a brief moment (about 1 to 2 seconds). While this technique has received attention in the popular press, there had been no objective examinations of the technique's validity. to examine the effectiveness of PhotoReading, the principal investigator (i.e., trainee) participated in a PhotoReading workshop to learn the technique. Parallel versions of two standardized and three experimenter-created reading comprehension tests were administered to the trainee and an expert user of the PhotoReading technique to compare the use of normal reading strategies and the PhotoReading technique by both readers. The results for all measures yielded no benefits of using the PhotoReading technique. The extremely rapid reading rates claimed by PhotoReaders were not observed; indeed, the reading rates were generally comparable to those for normal reading. Moreover, the PhotoReading expert generally showed an increase in reading time when using the PhotoReading technique in comparison to when using normal reading strategies to process text. This increase in reading time when PhotoReading was accompanied by a decrease in text comprehension.
Author
Reading; Character Recognition; Readers; Standards

20000033997 Georgia State Univ., Sonny Carter Life Sciences Lab., Atlanta, GA USA
Behavior and Performance Project ***Final Report***
Washburn, David A., Georgia State Univ., USA; Rumbaugh, Duane M., Georgia State Univ., USA; Shlyk, Galina, Institute for Biomedical Problems, Russia; Vassilieva, Oxana, Institute for Higher Nervous Activity, Russia; Richardson, W. Kirk, Georgia State Univ., USA; April 1998; 35p; In English
Contract(s)/Grant(s): NAG2-438; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Behavior is an overt manifestation of underlying biology. As such, alterations in biological systems that result from spaceflight would be expected to evidence themselves in subtle or even pronounced changes in the behavior of that organism. These alterations in visible behavior may then indicate or even be diagnostic of alterations in the physical well-being of humans and other animals as they adapt to space environments or readapt to Earth--alterations that might not otherwise be detected without relatively invasive and frequently expensive procedures. Moreover, behavior and performance constitute the central standard for evaluating the mission success of spaceflight ventures. The success or failure of any excursion into space is primarily indexed

by the ability of astronauts and cosmonauts to perform the tasks and experiments of any particular mission, to land a re-entry vehicle after extended exposure to microgravity (as with the space shuttle), or to make time-critical and life-saving repairs or other decisions while in orbit (as with the recent Mir events). Thus, understanding the effects spaceflight on behavior and performance is inherently important, in addition to those insights that behavior can provide about the physiological consequences of space adaptation.
Derived from text
Aerospace Medicine; Space Flight; Psychomotor Performance; Human Behavior

20000034019 Mississippi State Univ., Dept. of Industrial Engineering, Mississippi State, MS USA
Situation Awareness and Levels of Automation ***Final Report, 1 Jan. - 31 Dec. 1999***
Kaber, David B., Mississippi State Univ., USA; [1999]; 8p; In English
Contract(s)/Grant(s): NCC1-330; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

During the first year of this project, a taxonomy of theoretical levels of automation (LOAs) was applied to the advanced commercial aircraft by categorizing actual modes of McDonald Douglas MD-11 autoflight system operation in terms of the taxonomy. As well, high LOAs included in the taxonomy (e.g., supervisory control) were modeled in the context of MD-11 autoflight systems through development of a virtual flight simulator. The flight simulator was an integration of a re-configurable simulator developed by the Georgia Institute Technology and new software prototypes of autoflight system modules found in the MD-11 cockpit. In addition to this work, a version of the Situation Awareness Global Assessment Technique (SAGAT) was developed for application to commercial piloting tasks. A software package was developed to deliver the SAGAT and was integrated with the virtual flight simulator.
Author
Flight Simulators; MD 11 Aircraft; Cockpits; Taxonomy

20000034053 Army Aeromedical Research Lab., Fort Rucker, AL USA
The Effects of Sleep Deprivation on Spatial Disorientation ***Final Report***
LeDuc, Patricia A.; Riley, Dean; Hoffman, Siobban M.; Brock, Mary E.; Norman, David; Dec. 1999; 35p; In English
Contract(s)/Grant(s): Proj-301611011B91C
Report No.(s): AD-A372369; USAARL-2000-09; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Spatial disorientation is an inaccurate impression of one's position in space with respect to the earth's surface. As sleep loss is known to produce visual disturbances, this study was designed to investigate the effects of fatigue on aviator response to in-flight, disorienting events. Eight UH-60 rated aviators served as volunteer subjects. The subjects reported to the Laboratory at 1700 on Monday for in processing and baseline testing, retired at 2300, and awoke at 0700 on Tuesday. Throughout the day, aviators repeated one 6-hour practice test block three times. Each block included a 1-hour UH-60 simulator flight, objective and subjective measures of alertness, and several cognitive tests. to control for order effects, half of the subjects remained awake from 0700 Tue. to 2300 Wed. and were exposed to the disorienting events for the first time when they were sleep deprived. The other half of the subjects remained awake from 0700 Wed. to 2300 Thu. and saw the events first when they were fully rested. Analyses showed that nearly all measures of performance, to include mood, alertness, cognition, spatial orientation, postural stability, flight accuracy, and recovery from in-flight disorientation, were detrimentally impacted by fatigue. Aviators also reported a significant increase in oculomotor disturbances following fatigued simulator flights. New methods are being developed to assess the impact of visual disturbances on aviator performance during periods of extended operations.
DTIC
Sleep Deprivation; Disorientation

20000034852 Civil Aeromedical Inst., Oklahoma City, OK USA
The Effects of Previous Computer Experience on Air Traffic-Selection and Training (AT-SAT) Test Performance ***Final Report***
Heil, Michael C., Civil Aeromedical Inst., USA; Agnew, Brandy O., Civil Aeromedical Inst., USA; April 2000; 22p; In English
Report No.(s): DOT/FAA/AM-00/12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Many tests that have traditionally been administered in paper-and-pencil format are now administered on a computer workstation. One disadvantage of computer administered tests, however, is the inadvertent measurement of extraneous abilities related to prior experience with a computer keyboard or mouse. Surprisingly, there has been little written in the scientific literature about the use of computers in the selection process by organizations. The current study examines the relationship between computer experience and test performance using a computerized selection test. Specifically, some computerized tests, often referred to as "page-turner" tests, present items that have been(adapted to the computer and require the examinee to use the board

to select a response to the questions, which are presented one at a time. Another type of test is that which takes the form of dynamic virtual scenarios, work samples, or simulations. These may resemble a video or computer game and often require extensive use of both a mouse and a keyboard. The two main objectives of this study are: to determine if examinees with more computer experience perform better than examinees with less computer experience, and to determine if the relationship between computer experience and computerized test performance remains consistent, regardless of the type of test being presented in the computerized format. A total of 96 people between the ages of 18 and 30 participated in the study. Computer experience was measured using the Computer Use and Experience Questionnaire. The personnel selection test used was the Air Traffic-Selection and Training (AT-SAT) test. The relationship between computer experience and performance on the computerized selection test was investigated using Pearson's product-moment correlations and hierarchical multiple regression. MANOVA and t-tests were also used to identify group differences on the dependent variables. Education was most predictive of AT-SAT performance, and people with more computer experience received higher composite AT-SAT scores. Future studies should explore the extent to which computer experience adds incremental validity over a selection test in predicting job performance, as well as investigate how training may change the relationship between computer experience and rest performance so that the effect on personnel decision-making is minimized.
Author
Air Traffic; Air Traffic Control; Personnel Selection; Performance Prediction; Decision Making

20000037705 National Defence Research Establishment, Sundbyberg, Sweden
Models of Pilot Performance for Systems and Mission Evaluation: Psychological and Psychophysiological Aspects ***Interim Report, May 1997-Mar 1999***
Svensson, Erland, National Defence Research Establishment, Sweden; Angelborg-Thanderz, Maud, National Defence Research Establishment, Sweden; Wilson, Glenn F., Air Force Research Lab., USA; Aug. 1999; 57p; In English
Contract(s)/Grant(s): F41624-94-D-6000; AF Proj. 7184
Report No.(s): AD-A374852; AFRL-HE-WP-TR-1999-0215; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy
The purpose of this study was to analyze the effects of mission complexity and information load on Pilot Mental Workload (PMWL), Situational Cognizance (SC), and Operative Effectiveness (OE) or operative performance. Previous assessment of operative performance or effectiveness has been developed with task analyses using psychological indices constructed with factor analysis. Generally, PMWL is affected by mission complexity and PMWL affects different aspects of Pilot Performance (PP). The specific purposes were to (1) validate psychological, psychophysiological, and performance based measures of PMWL, SC, and OE, (2) develop models of pilot performance for systems and mission evaluation, (3) compare real and simulated missions, and (4) discuss the application of these results to the systematic evaluation of systems and missions with the pilot in the loop. In the first phase, 20 fighter pilots performed 150 flight missions. In the second phase, 15 pilots performed 40 simulated missions. Questionnaires were used to tap mission complexity, information load, mental workload, mental capacity, motivation, situational cognizance, and performance. Additionally, during the simulated missions eye movements, heart and blink rates were obtained. From the flight and simulation data, the model analyses showed that mission complexity affects different aspects of information processing and mental workload and that these aspects, in their turn, affect situational cognizance and pilot performance. Significant relationships were found between heart rate, workload ratings, mental capacity, operative performance, and motivation. Heart rate and eye fixation rates increased, and blink rate decreased with increasing task complexity. A combination of these dynamic measures and the psychological indices form a reliable and valid technique for systems and mission evaluation.
DTIC
Psychophysiology; Pilot Performance; Workloads (Psychophysiology); Factor Analysis

20000038216 Institute for Human Factors TNO, Soesterberg, Netherlands
Guidelines Supporting the Analysis of Team Tasks and The Design of Team Training Scenarios ***Interim Report Richtlijnen ter Ondersteuning van het Analyseren van Teamtaken en het Ontwerpen van Teamtraingsscenario's***
vanBerlo, M. P. W., Institute for Human Factors TNO, Netherlands; Feb. 22, 1999; 106p; In English
Contract(s)/Grant(s): B98-052; TNO Proj. 730.2
Report No.(s): TD99-0018; TM-99-B002; Copyright; Avail: Issuing Activity
Recent research (Van Berlo, 1 996, 1 997a) shows that, within the military of the Netherlands, there is a need for support with respect to developing team training systems. Important bottlenecks relate to, amongst others, conducting a team task analysis (required for specifying the instructional objectives), and, based on the instructional objectives, designing effective team training scenarios. Based on: (1) a model of team performance, (2) expertise in the field of instructional design, and (3) instructional and psychological principles of training teams, models and guidelines have been developed supporting the analysis of team tasks and the design of team training scenarios. These models and guidelines are profoundly discussed in this report. In the last chapter the

direction of further research is described: this will primarily be aimed at the experimental validation of the quality and applicability of the guidelines.
Author
Research; Education; Performance Prediction; Design Analysis

20000038218 Institute for Human Factors TNO, Soesterberg, Netherlands
The Use of IETMs in Training ***Final Report Het Gebruik van IETMs in Opleiding en Training***
Barnard, Y. F., Institute for Human Factors TNO, Netherlands; Riemersma, J. B. J., Institute for Human Factors TNO, Netherlands; Feb. 18, 1999; 183p; In English; Original contains color illustrations
Contract(s)/Grant(s): A96/KLu/344; A95/KLU/823; TNO Proj. 730.1
Report No.(s): TD98-0289; TM-98-A074; Copyright; Avail: Issuing Activity

In this study, the state-of-the-art concerning IETMs and training is described. This shows promising opportunities to integrate IETMs in existing and innovative training environments, These opportunities have been partly explored with regard to re-use of IETM underlying data-bases in preparing classroom presentations and syllabi and with regard to the design of problem-based assignments as an innovative extension of current practices. All explored applications have been demonstrated by building prototypes, using only COTS software. to further enhance the future re-use of IETM data for training purposes, the existing mark-up languages have to be enriched with educational terms. A first proposal for such an ontology is presented. Further work along the same lines is pursued in a larger, European Esprit project.
Author
Research; Procedures; Manuals

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing. For related information see also 16 Space Transportation.

20000034035 Norwegian Defence Research Establishment, Kjeller, Norway
Penetration Analyses of Protective Suits and Boots Against Jet Fuel (JP-8)
Pedersen, Bjorn, Norwegian Defence Research Establishment, Norway; Jan. 31, 2000; 22p; In English; Original contains color illustrations
Contract(s)/Grant(s): FFIBM/Oppdr Proj. 311501/138
Report No.(s): FFI/RAPPORT-2000/00660; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Penetration analyses with jet fuel have been carried out on three different protective suits and one pair of protective boots. The analyses were performed with a single cell permeation system developed at Norwegian Defence Research Establishment, Division for Protection and Materiel (FFIBM). A permeation rate of 1 microgram/(cm squared min) was used as breakthrough limit in these analyses. The analyses showed that the protective suits had limited protection against jet fuel based on our test criteria. The protective boots showed better protection properties.
Author
JP-8 Jet Fuel; Penetration; Protective Clothing; Boots (Footwear)

20000034079 Air Force Research Lab., Human Effectiveness Directorate, Wright-Patterson AFB, OH USA
The Human-Electronic Crew: The Right Stuff? Proceedings of the 4th Joint GAF/RAF/USAF Workshop on Human-Computer Teamwork
Reising, John; Taylor, Robert; Onken, Reiner; Dec. 1999; 226p; In English
Contract(s)/Grant(s): Proj-2403
Report No.(s): AD-A373926; AFRL-HE-WP-TR-1999-023; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The components integral to the operation of an Electronic Crew member (EC) have started to take shape. Questions have been raised as to the nature of the EC when finished. What are the key components that will ensure a successful emergence of this new technology? How can we plan for their development and incorporate the software and hardware elements to function in concert with one another. The purpose of this workshop was to examine these concerns. The key questions to be addressed were: (1) What are the core qualities that the Electronic Crew member must possess? (2) How does one estimate the amount of software code

involved? (3) What are the key software modules? (4) What is necessary to ensure the modules function symbiotically? (5) What is sufficient functionality within the Electronic Crew member to satisfy the human operator requirements?
DTIC
Conferences; Cockpits; Human Factors Engineering; Human-Computer Interface; Aircraft Pilots

20000034183 San Jose State Univ., CA USA
Modifying the Human-Machine Interface Based on Quantitative Measurements of the Level of Awareness ***Final Report, 1 Jun. 1998 - 30 Nov. 1999***
Freund, Louis E., San Jose State Univ., USA; Knapp, Benjamin, San Jose State Univ., USA; Nov. 30, 1999; 1p; In English
Contract(s)/Grant(s): NAG2-1223; No Copyright; Avail: Issuing Activity; Abstract Only

This project got underway without funding approved during the summer of 1998. The initial project steps were to identify previously published work in the fields of error classification systems, physiological measurements of awareness, and related topics. This agenda was modified at the request of NASA Ames in August, 1998 to include supporting the new Cargo Air Association (CAA) evaluation of the Human Factors related to the ADS-B technology. Additional funding was promised to fully support both efforts. Work on library research ended in the late Fall, 1998 when the SJSU project directors were informed that NASA would not be adding to the initial funding of the research project as had been initially committed. However, NASA did provide additional funding for the CAA project activity. NASA elected to leave the research grant in place to provide a pathway for the CAA project funding to SJSU (San Jose State University) to support Dr. Freund's work on the CAA tasks. Dr. Knapp essentially terminated his involvement with the project at this time.
Author
Human Factors Engineering; Human-Computer Interface; Physiological Effects; Revisions

20000037836 Boeing Co., Mesa, AZ USA
Test and Evaluation of the Man-Machine Interface Between the Apache Longbow(tm) and an Unmanned Aerial Vehicle
Kraay, Anthony G., Boeing Co., USA; Pouliot, Michelle L., Boeing Co., USA; Wallace, William J., Boeing Co., USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B14-1 - B14-7; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

The Boeing Company is studying a concept that involves teaming a manned rotorcraft, the Apache Longbow, with a unmanned air vehicle (UAV). During 1997 Boeing developed a preliminary man-machine interface between the Apache Longbow and an unmanned air vehicle. An early assessment of the man-machine interface in a virtual simulation environment was conducted. The study concentrated on the effects of crew workload during manned- unmanned teaming operations and acceptability of the design in terms of presentation of the data, functionality, and utility. A limited assessment of operational measures of effectiveness was also conducted. Subject pilots were satisfied with the man-machine interface, did not experience task overload and were able to perform UAV control tasks. Subjects did experience some difficulty with target acquisition and tracking, however. Initial data suggests that the potential exists to detect targets beyond the organic sensor range of current attack/reconnaissance rotorcraft without being exposed to threat detection.
Author
Pilotless Aircraft; Rotary Wing Aircraft; Man Machine Systems; Human-Computer Interface

20000038215 Institute for Human Factors TNO, Soesterberg, Netherlands
Heat Strain in NBC-Protective Suits ***Warmtebelasting in NBC-Pakken***
denHartog, E. A., Institute for Human Factors TNO, Netherlands; Wammes, L. J. A., Institute for Human Factors TNO, Netherlands; Dec. 21, 1998; 23p; In English
Contract(s)/Grant(s): A98/KL/356; TNO Proj. 789.2
Report No.(s): TD98-0287; TM-98-A072; Copyright; Avail: Issuing Activity

It has been found that the NBC-protective suits currently in use by the Netherlands Armed Forces (M82), are not suitable for warm climates. The heat strain for the wearer is too high and the body temperature rises quickly. A new NBC-protective suit 'Out of Area' is available, of which the fabric has a higher air permeability, with maintenance of protection. This may result in an improved ventilation under the suit and, as a consequence, a lower vapour resistance. The improved ventilation should cause a considerable decrease in the heat strain of the wearer, because of the increased possibility to evaporate his sweat. In a previous study it was shown that an NBC-protective suit with an increased air-permeability has a lower vapour resistance. However, in experiments at 36 C we found no significant differences in heat strain for the wearer. This may have been due to the relatively low heat strain that was imposed in those experiments. Therefore, the experiments were repeated in a climate of 40 C, with a relative humidity of 20%. Together with the currently used (M82) suit and the new 'Out of Area' (OoA) suit, another configuration

was also compared (PYJ). In this configuration the NBC-protection is worn as an undergarment with a combat suit on top of it. The 7 subjects had to walk on a horizontal treadmill for 90 minutes at a speed of 1.4 m/s, in a wind of 5 m/s. All three suits were worn in different sessions, each session was performed on a different day. In agreement with previous studies we found significantly larger mass loss in the OoA suit (732 g/hr) compared with the current M82 suit (670 g/hr, p = 0.03). Both suits (MB2 and OoA) were not significantly different from the NBC-pyjamas (PYJ, 692 g/hr). Therefore, the heat loss by evaporation was also significantly larger in the OoA suit (494W) than in the M82 suit (452W), and both did not differ from the PYJ-suit (467W). However, this increased heat loss was counteracted by the increased ”dry’ heat gain in the OoA suit (157W) versus the M82 suit (93W) and the PYJ suit (92W). The net result was that there were no significant differences between all three suits for the physiological parameters: skin temperature, rectal temperature, heart rate and oxygen consumption and thus for metabolism. The difference in efficiency of sweat evaporation, which is the ratio (in %) of evaporated sweat to produced sweat, was significant between the NBC-undergarment (PYJ) and the current M82 suit i93% vs. 86%, p =0.02), but not significantly different in the OoA-suit (91 %) compared to both other suits (OoA vs. M82, p =0.10; OoA vs. PYJ, p = 0.64). For the subjective scores there was no difference in temperature and comfort. For the subjective score on humidity there was only a significant difference between the current M82 and the new OoA suit. At air temperatures, higher than skin temperature, the heat stress in the new ’Out of Area’ NBC-protective suit is not significantly decreased compared to the current suit. The currently obtained increase in evaporative heat loss in the new Out of Area suit is counteracted by the increase in dry heat gain. Under conditions with lower air temperatures (lower than 33 C) there is probably a benefit in the use of NBC-protective clothing with a higher air-permeability. In hotter climates personal cooling systems may lead to a better balance between protection and heat stress. The configuration in which the NBC-protection is worn as an under garmet (PYJ) was also not significantly different in heat strain from both other suits and was in this aspect equivalent to the M82 suit.

Author

Protective Clothing; Body Temperature; Comfort; Cooling Systems; Dry Heat; Evaporation; Heat Tolerance; Physiology; Ventilation

20000038222 Institute for Human Factors TNO, Soesterberg, Netherlands

The Role of Stereo Vision in Driving Armored Vehicles in Rough Terrain ***Final Report De Rol van Stereo-Zien bij het Besturen van Pantservoertuigen in ruw Terrein***

vanErp, J. B. F., Institute for Human Factors TNO, Netherlands; vanWinsum, W., Institute for Human Factors TNO, Netherlands; Feb. 22, 1999; 26p; In English

Contract(s)/Grant(s): A98/KL/375; TNO Proj. 788.1

Report No.(s): TD-99-0019; TM-99-A016; Copyright; Avail: Issuing Activity

Under contract of the Royal Netherlands Army, a study was conducted after the role of stereo vision in driving armored vehicles in rough terrain. This knowledge is essential in the formulation of design criteria of viewing systems for driving vehicles under armour and controlling Unmanned Ground Vehicles (UGVs). The study consisted of two parts. The first part is a literature review of the mechanisms involved in stereo vision and the role of stereo vision in general. The second part was a field experiment in which participants drove an armored vehicle through rough terrain in different viewing conditions. The hypothesis is that the role of stereo vision increases when the quality of other visual depth cues decreases, Although the literature reports no studies that can be applied to the current situation directly, there are suggestions for the role of stereo vision, e.g. it enhances the judgement of time to contact and the perception of terrain features. The field experiment shows that stereo vision can improve driving performance, and make the driving task less difficult. Furthermore, cues are found that the positive effect of stereo vision increases under degraded visual circumstances. Because the results of the literature review and the field experiment both suggest that stereo vision may improve driving performance, it is recommended to implement a viewing system that provides the driver with stereoscopic depth cues, e.g. a head coupled camera-monitor system. Human factors issues involved in the successful application of such a system include the field size of the instantaneous field of view, the magnification factor, the spatial resolution, and the minimal rotational speed and acceleration of the system.

Author

Stereoscopic Vision; Research; Design Analysis; Visual Stimuli; Viewing; Cameras; Armor; Military Vehicles

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EXOBIOLOGY

20000033858 NASA Marshall Space Flight Center, Huntsville, AL USA
ATLAS of Microorganisms from Ancient Phosphorites of Khubsugul (Mongolia)
Zhengallo, Elena A., Academy of Sciences (USSR), USSR; Rozanov, Alexei Yu., Academy of Sciences (USSR), USSR; Ushatinskaya, Galina T., Academy of Sciences (USSR), USSR; Hoover, Richard B., NASA Marshall Space Flight Center, USA; Gerasimenko, Ludmila M., Academy of Sciences (USSR), USSR; Ragozina, Alla L., Academy of Sciences (USSR), USSR; February 2000; 178p; In English; In Russian; Original contains color illustrations
Contract(s)/Grant(s): RFBR-96-04-48372; RFBR-96-05-64130; RFBR-96-05-64806; RFBR-97-05-65069; RFBR-98-05-64765
Report No.(s): NASA/TP-2000-209901; NAS 1.60:209901; M-957; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

A photographic atlas of scanning electron microscope (SEM) images of Cambrian (Tommotian) microfossils from the phosphorites of Khubsugul Mongolia is presented. SEM images of modern cyanobacteria and bacteria are provided for comparison. The importance of bacterial fossils and morphological biomarkers to astrobiology and the understanding of the origin of phosphorites is considered.
Author
Microorganisms; Mongolia; Scanning Electron Microscopy; Exobiology; Phosphates; Minerals; Paleontology

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COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware, and data processing. For components see 33 Electronics and Electrical Engineering.

20000034080 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
Export Controls: National Security Risks and Revisions to Controls on Computers
Johnson, Harold J.; Feb. 28, 2000; 11p; In English; Testimony before the Committee on Armed Services, U. S. Senate.
Report No.(s): AD-A373927; GAO/T-NSIAD-00-104; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report discusses export controls for high performance computers. U.S. policy with respect to the export of sensitive technology, including computers, is to seek a balance between the U.S. economic interest in promoting exports with its national security interests in both maintaining a military advantage over potential adversaries and denying the spread of technologies used in developing weapons of mass destruction. The USA has long controlled the export of high performance computers to sensitive destinations, such as Russia and China. These computers have both civilian (dual use) and military applications and technological advancements in computing power have been rapid. The Department of Commerce has primary responsibility for managing the licensing of these dual use items and weighing the promotion of commercial interests in exporting items against the protection of national security interests. For the past several years, there has been continuing congressional concern about and debate over whether our national security is being harmed by relaxing export controls on high performance computers and over the rationale for subsequent revised controls. The author discusses the General Accounting Office's observations about how the executive branch (1) assesses the national security risks associated with the export of high performance computers going to countries of concern and (2) determines when the exports of computers at existing performance levels can no longer be controlled.
DTIC
Computers; Security; International Trade; Risk

20000036603 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
Filling the Memory Access Gap: A Case for On-Chip Magnetic Storage
Schlosser, Steven W.; Griffin, John L.; Nagle, David F.; Ganger, Gregory R.; Nov. 1999; 23p; In English
Report No.(s): AD-A374599; CMU-CS-99-174; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

For decades, The memory hierarchy access gap has plagued computer architects with the RAM/disk gap widening to about 6 orders of magnitude in 1999. However, an exciting new storage technology based on MicroElectroMechanical Systems (MEMS) is poised to fill a large portion of this performance gap, delivering significant performance improvements and enabling many new types of applications. This research explores the impact MEMS-based storage will have on computer systems. Working closely with researchers building MEMS-based storage devices, we examine the performance impact of several design points. Results from five different applications show that MEMS-based storage can reduce application I/O stall times by 80-99%, with

overall performance improvements ranging from 1.1x to 20x for these applications. Most of these improvements result from the fact that average access times for MEMS-based storage are 5 times faster than disks (e.g., 1-3ms). Others result from fundamental differences in The physical behavior of MEMS-based storage. Combined, these characteristics create numerous opportunities for restructuring the storage/memory hierarchy.
DTIC
Microelectromechanical Systems; Architecture (Computers); Magnetic Storage; Random Access Memory

20000037704 Templex Technology, Inc., Eugene, OR USA
Optical Dynamic RAM ***Final Report, Aug. 1998-Sep. 1999***
Johnson, Alan E., Templex Technology, Inc., USA; Maniloff, Eric S., Templex Technology, Inc., USA; Mossberg, Thomas W., Templex Technology, Inc., USA; Sep. 1999; 17p; In English
Contract(s)/Grant(s): F49620-98-C-0052
Report No.(s): AD-A374849; AFRL-SR-BL-TR-00-0047; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Optical Dynamic RAM (ODRAM) is a memory architecture designed for fast access to large stores of data. In particular, ODRAM would enable microsecond random access to data stores of up to fifty gigabits in a single unit. This is to be compared to the millisecond random access time achievable with existing disk based technology. Relative to ODRAM, the only common technology that is faster is silicon RAM. During Phase 2, we have designed, characterized and demonstrated several of the subsystems and data storage techniques required for the construction of ODRAM. Concurrently with our development efforts, the price of the competition, silicon RAM, has fallen dramatically. In fact, it is now possible to achieve nanosecond random access times to comparably large data stores using silicon RAM at a price equal to our projected ODRAM price. Given the advantage in speed and the current commercial popularity of silicon DRAM, the chances for commercial success with ORAM are vanishingly small.
DTIC
Memory (Computers); Architecture (Computers); Computer Storage Devices

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COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM.

20000033846 Purdue Univ., School of Engineering and Technology, Indianapolis, IN USA
Dynamic Load-Balancing for Distributed Heterogeneous Computing of Parallel CFD Problems ***Final Report***
Ecer, A., Purdue Univ., USA; Chien, Y. P., Purdue Univ., USA; Boenisch, T., Purdue Univ., USA; Akay, H. U., Purdue Univ., USA; March 2000; 16p; In English; Computational Aerosciences, 15-17 Feb. 2000, Moffett Field, CA, USA; Sponsored by Jet Propulsion Lab., California Inst. of Tech., USA
Contract(s)/Grant(s): NAS3-2260; RTOP 509-10-24
Report No.(s): NASA/CR-2000-209939; E-12187; NAS 1.26:209939; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The developed methodology is aimed at improving the efficiency of executing block-structured algorithms on parallel, distributed, heterogeneous computers. The basic approach of these algorithms is to divide the flow domain into many sub-domains called blocks, and solve the governing equations over these blocks. Dynamic load balancing problem is defined as the efficient distribution of the blocks among the available processors over a period of several hours of computations. In environments with computers of different architecture, operating systems, CPU speed, memory size, load, and network speed, balancing the loads and managing the communication between processors becomes crucial. Load balancing software tools for mutually dependent parallel processes have been created to efficiently utilize an advanced computation environment and algorithms. These tools are dynamic in nature because of the chances in the computer environment during execution time. More recently, these tools were extended to a second operating system: NT. In this paper, the problems associated with this application will be discussed. Also, the developed algorithms were combined with the load sharing capability of LSF to efficiently utilize workstation clusters for parallel computing. Finally, results will be presented on running a NASA based code ADPAC to demonstrate the developed tools for dynamic load balancing.
Author
Computational Fluid Dynamics; Dynamic Loads; Heterogeneity; Parallel Processing (Computers); Algorithms

20000033850 NASA Glenn Research Center, Cleveland, OH USA

Remote Control and Data Acquisition: A Case Study

DeGennaro, Alfred J., Cleveland State Univ., USA; Wilkinson, R. Allen, NASA Glenn Research Center, USA; February 2000; 22p; In English

Contract(s)/Grant(s): RTOP 101-53-00

Report No.(s): NASA/TM-2000-209634; E-11963; NAS 1.15:209634; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper details software tools developed to remotely command experimental apparatus, and to acquire and visualize the associated data in soft real time. The work was undertaken because commercial products failed to meet the needs. This work has identified six key factors intrinsic to development of quality research laboratory software. Capabilities include access to all new instrument functions without any programming or dependence on others to write drivers or virtual instruments, simple full screen text-based experiment configuration and control user interface, months of continuous experiment run-times, order of 1% CPU load for condensed matter physics experiment described here, very little imposition of software tool choices on remote users, and total remote control from anywhere in the world over the Internet or from home on a 56 Kb modem as if the user is sitting in the laboratory. This work yielded a set of simple robust tools that are highly reliable, resource conserving, extensible, and versatile, with a uniform simple interface.

Author

Remote Control; Data Acquisition; Real Time Operation; Scientific Visualization; Software Development Tools

20000033853 OR Applications, Huntsville, AL USA

Systems Engineering Programmatic Estimation Using Technology Variance

Mog, Robert A., OR Applications, USA; February 2000; 14p; In English; Original contains color illustrations

Contract(s)/Grant(s): NASA Order H-32236-D

Report No.(s): NASA/CR-2000-210135; NAS 1.26:210135; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Unique and innovative system programmatic estimation is conducted using the variance of the packaged technologies. Covariance analysis is performed oil the subsystems and components comprising the system of interest. Technological ”returns” and ”variation” parameters, are estimated. These parameters are combined with the model error to arrive at a measure of system development stability. The resulting estimates provide valuable information concerning the potential cost growth of the system under development.

Author

Estimating; Procedures; Systems Engineering; Covariance

20000034031 Institute for Computer Applications in Science and Engineering, Hampton, VA USA

Achieving High Sustained Performance in an Unstructured Mesh CFD Application ***Final Report***

Anderson, W. K., NASA Langley Research Center, USA; Gropp, W. D., Argonne National Lab., USA; Kaushik, D. K., Argonne National Lab., USA; Keyes, D. E., Institute for Computer Applications in Science and Engineering, USA; Smith, B. F., Argonne National Lab., USA; January 2000; 16p; In English

Contract(s)/Grant(s): NAS1-97046; W-31-109-eng-38; ANL-983572401; NAS1-19480; ANL-982232402; LLNL-B347882; NSF ECS-95-27169; RTOP 505-90-52-01

Report No.(s): NASA/CR-2000-210080; NAS 1.26:210080; ICASE-2000-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper highlights a three-year project by an interdisciplinary team on a legacy F77 computational fluid dynamics code, with the aim of demonstrating that implicit unstructured grid simulations can execute at rates not far from those of explicit structured grid codes, provided attention is paid to data motion complexity and the reuse of data positioned at the levels of the memory hierarchy closest to the processor, in addition to traditional operation count complexity. The demonstration code is from NASA and the enabling parallel hardware and (freely available) software toolkit are from DOE, but the resulting methodology should be broadly applicable, and the hardware limitations exposed should allow programmers and vendors of parallel platforms to focus with greater encouragement on sparse codes with indirect addressing. This snapshot of ongoing work shows a performance of 15 microseconds per degree of freedom to steady-state convergence of Euler flow on a mesh with 2.8 million vertices using 3072 dual-processor nodes of Sandia’s ”ASCI Red” Intel machine, corresponding to a sustained floating-point rate of 0.227 Tflop/s.

Author

Unstructured Grids (Mathematics); Partial Differential Equations; Computational Fluid Dynamics; Structured Grids (Mathematics); Distributed Memory; Multiprocessing (Computers); Parallel Processing (Computers); Computation

20000034131 Institute for Computer Applications in Science and Engineering, Hampton, VA USA

Model Checking is Refinement: Relating Buchi Testing and Linear-Time Temporal Logic ***Final Report***

Cleaveland, Rance, State Univ. of New York, USA; Luettgen, Gerald, Institute for Computer Applications in Science and Engineering, USA; March 2000; 25p; In English; 25th; Mathematical Foundations of Computer Science, Unknown

Contract(s)/Grant(s): NAS1-97046; F49620-95-1-0508; ARO-P-38682-MA; NSF CCR-95-05562; NSF CCR-99-96086; NSF INT-99-96095; RTOP 505-90-52-01

Report No.(s): NASA/CR-2000-210090; NAS 1.26:210090; ICASE-2000-14; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper develops a semantic foundation for reasoning about reactive systems specifications featuring combinations of labeled transition systems and formulas in linear-time temporal logic (LTL). Using Buchi automata as a semantic basis, the paper introduces two refinement preorders based on DeNicola and Hennessy's notion of may- and must- testing. Alternative characterizations for these relations are provided and used to show that the new preorders are conservative extensions of the traditional DeNicola and Hennessy preorders. The paper then establishes a tight connection between LTL formula satisfaction and the Buchi must-preorder. More precisely, it is shown that a labeled transition system satisfies an LTL formula if and only if it refines an appropriately defined Buchi automaton that can be constructed from the formula. Consequently, the Buchi must-preorder allows for a uniform treatment of traditional notions of process refinement and model checking. The implications of the novel theory are illustrated by means of a simple example system, in which some components are specified as transition systems and others as LTL formulas.

Author

Automata Theory; Algebra; Temporal Logic; Formalism; Computer Programming

20000034148 Naval Postgraduate School, Monterey, CA USA

Design of a Persistence Server for the Relational Hypergraph Model

Le, Hanh C.; Dec. 1999; 293p; In English

Report No.(s): AD-A374166; No Copyright; Avail: CASI; A03, Microfiche; A13, Hardcopy

The fundamental purpose of this research is to develop an automated software evolution tool, CASES, for large and complex systems. CASES (Computer-Aided Software Evolution System) is based on the Relational Hypergraph model that is a formal model for describing software evolution processes. This model provides the preliminary mathematical definitions to support the development of CASES. There are five basic functions related to software evolution steps: step refinement, project evaluation, constraint management, personnel management, and step management. There are also five functions related to software evolution components: component management, component traceability, version control and configuration management, dependency management, and inference rule management. CASES is implemented by using Java JDK 1.1.7 and Swing 1.0.3 under the Visual Cafe version 3.0 environment. The primary contributions of this research include: (1) Providing an automated tool for software evolution; (2) Validating a software evolution model, the RH model; (3) Allowing reuse of software evolution components; (4) Describing the software evolution processes; (5) Automating the version control of software evolution objects; (6) Tracing the software evolution activities; and (7) Managing and controlling job scheduling and assignment.

DTIC

Complex Systems; Computer Programs; Software Engineering; Computer Aided Design

20000034850 CFD Research Corp., Huntsville, AL USA

Automated, Parametric Geometry Modeling and Grid Generation for Turbomachinery Applications ***Final Report, 22 Oct. 1999 - 20 Apr. 2000***

Harrand, Vincent J., CFD Research Corp., USA; Uchitel, Vadim G., CFD Research Corp., USA; Whitmire, John B., CFD Research Corp., USA; Apr. 19, 2000; 46p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS3-00001

Report No.(s): Rept-8229/3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this Phase I project is to develop a highly automated software system for rapid geometry modeling and grid generation for turbomachinery applications. The proposed system features a graphical user interface for interactive control, a direct interface to commercial CAD/PDM systems, support for IGES geometry output, and a scripting capability for obtaining a high level of automation and end-user customization of the tool. The developed system is fully parametric and highly automated, and, therefore, significantly reduces the turnaround time for 3D geometry modeling, grid generation and model setup. This facilitates design environments in which a large number of cases need to be generated, such as for parametric analysis and design optimization of turbomachinery equipment. In Phase I we have successfully demonstrated the feasibility of the approach. The system has been tested on a wide variety of turbomachinery geometries, including several impellers and a multi stage rotor-stator

combination. In Phase II, we plan to integrate the developed system with turbomachinery design software and with commercial CAD/PDM software.
Author
Turbomachinery; Design Analysis; Grid Generation (Mathematics)

20000036490 University of Southern California, Dept. of Contracts and Grants, Los Angeles, CA USA
Architectures, Models, Algorithms, and Software Tools for Configurable Computing ***Final Report***
Prasanna, Viktor K.; Mar. 06, 2000; 453p; In English
Contract(s)/Grant(s): DABT63-96-C-0049
Report No.(s): AD-A374632; No Copyright; Avail: CASI; A20, Hardcopy; A04, Microfiche

The Models, Algorithms, and Architectures for Reconfigurable Computing (MAARC) project developed a sound framework for algorithmic configurable computing and for exploiting this technology for embedded signal and image processing applications. Fundamental configurable computing models and performance metrics were developed to evaluate the scalability of configurable hardware. The developed models and the performance metrics were utilized to analyze dynamic reconfiguration and design model based algorithm mapping techniques for signal processing applications. Mapping techniques were developed to identify the core computational kernels of signal processing applications and map them onto configurable hardware. The mapping techniques are efficient and yield significant performance speed ups and logic utilization. An interpretive simulation framework was proposed to analyze and visualize dynamic reconfiguration and the proposed mapping techniques. A prototype of the framework. Dynamically Reconfigurable Systems Interpretive Simulation and Visualization Environment (DRIVE) was developed and demonstrated. A model based compiler framework and compiler optimization technologies were designed targeting reconfigurable platforms.
DTIC
Algorithms; Dynamic Models; Systems Simulation; Architecture (Computers); Software Development Tools

20000036528 Department of the Navy, Washington, DC USA
A Technique for Estimating the Pose of Surface Shapes Using Tripod Operators
Pipitone, Frank, Inventor; Dec. 08, 1999; 30p; In English
Patent Info.: Filed 8 Dec. 1999; US-Patent-Appl-SN-09/457,007
Report No.(s): AD-D019614; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A software procedure, with associated hardware, for estimating the pose of an object from a range image containing the object. A range image is a two dimensional array of numbers which represent the distances from a reference point in the range imaging instrument to observed surface points in a scene. All six parameters of the pose of an object are estimated; three translational and three angular parameters. A new technique known as ”non-pose-distinctive placement removal” is combined with of tripod operators (TOs), a method for interpreting range images, and is comprised of two steps. The first is training the system on a new object so that it will later be able to estimate the pose of that object when seen again in some range image. The second is the actual pose estimation, where a to is placed at a random location on a new range image containing the object of interest. Then the nearest neighbor in feature space, the near point, is computed. If the distance to the near point is less than some appropriate threshold, then the surface is recognized and pose estimation proceeds by computing the six pose parameters of a central triangle of the new placement in the coordinate system of the range imaging instrument. Then the pose parameters associated with the near point are retrieved. An estimate of the pose of the surface shape in the new image is recoverable using those two pose six-vectors; the pose of the central to triangle in the new image and the retrieved pose of the central TO triangle in the training image are composed together to determine an estimate where the object actually is with respect to the location of its original model used in training.
DTIC
Target Recognition; Software Engineering; Computer Vision; Surface Properties; Tripods

20000036544 Space and Naval Warfare Systems Command, San Diego, CA USA
Windows NT (Trade name) Operating System Primitives ***Final Report***
Drummond, J.; Feb. 2000; 16p; In English
Report No.(s): AD-A374708; SPAWAR/CA-TR-1817; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report focuses on Microsoft (registered) Windows NT (registered) operating system primitives, specifically low level kernel primitives. Low level kernel primitives were examined to provide some insight into Windows NT (registered) system characteristics and capabilities. Context switch, pre-emption, and interrupt latency exhibited a high degree of bearing on given systems capability and potential for real time response. The overall discoveries and subsequent details of this report confirm earlier

findings that the Microsoft (registered) Windows NT (registered) operating system is capable of supporting limited soft real time deadlines.
DTIC
Object-Oriented Programming; Software Engineering; Kernel Functions; Operating Systems (Computers)

20000036604 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
Counterexample-guided Abstraction Refinement
Clarke, E.; Grumberg, O.; Jha, S.; Lu, Y.; Veith, H.; Jan. 2000; 26p; In English
Contract(s)/Grant(s): NSF-CCR98-03774
Report No.(s): AD-A374597; CMU-CS-00-103; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present an automatic iterative abstraction-refinement methodology in which the initial abstract model is generated by an automatic analysis of the control structures in the program to be verified. Abstract models may admit erroneous (or ”spurious”) counterexamples. We devise new symbolic techniques which analyze such counterexamples and refine the abstract model correspondingly. The refinement algorithm keeps the size of the abstract state space small due to the use of abstraction functions which distinguish many degrees of abstraction for each program variable. We describe an implementation of our methodology in NuSMV. Practical experiments including a large Fujitsu IP core design with about 500 latches and 10000 lines of SMV code confirm the effectiveness of our approach.
DTIC
Structural Analysis; Automatic Control; Proving

20000037674 Minnesota Univ., Natural Resources Research Inst., Duluth, MN USA
Quantitative Characterization of Molecular Similarity Spaces: Tools for Computational Toxicology ***Final Report, 1 Jul. 1996 - 31 Dec. 1999***
Basak, Subnash C.; Jan. 20, 2000; 261p; In English
Contract(s)/Grant(s): F49620-96-1-0330
Report No.(s): AD-A374363; NRRI/TR-2000/02; AFRL-SR-BL-TR-00-0031; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

During the course of the project, most of the work focused on the first three tasks of the project; (a) characterization of molecular similarity spaces, (b) selection of analogs, and (c) similarity-based estimation of properties; has continued. However, in the last approximately eighteen months the focus shifted to the fourth and final task of the project - the application of neural networks in property estimation.
DTIC
Toxicology; Analogies; Molecular Biology; Computation

20000037714 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
Automated parallelization of discrete state-space generation
Nicol, David M., Dartmouth Coll., USA; Ciardo, Gianfranco, College of William and Mary, USA; March 2000; 24p; In English; Also published in Journal of Parallel and Distributed Computing, vol. 47, 1997, pp. 153-167
Contract(s)/Grant(s): NAS1-19480; 96-SC-NSF-1011; NSF CCR-92-01195; NSF NCR-95-27163; RTOP 505-90-52-01
Report No.(s): NASA/CR-2000-210082; NAS 1.26:210082; ICASE-2000-11; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We consider the problem of generating a large state-space in a distributed fashion. Unlike previously proposed solutions that partition the set of reachable states according to a hashing function provided by the user, we explore heuristic methods that completely automate the process. The first step is an initial random walk through the state space to initialize a search tree, duplicated in each processor. Then, the reachability graph is built in a distributed way, using the search tree to assign each newly found state to classes assigned to the available processors. Furthermore, we explore two remapping criteria that attempt to balance memory usage or future workload, respectively. We show how the cost of computing the global snapshot required for remapping will scale up for system sizes in the foreseeable future. An extensive set of results is presented to support our conclusions that remapping is extremely beneficial.
Author
Markov Chains; Random Walk; Monte Carlo Method; Mapping

20000037783 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Strategies and Patterns for Softboard-Based Software Systems Development ***Estrategias e Padroes para o Desenvolvimento de Sistemas de Software Baseados em Softboard***

Dias, Alexandre Siqueira, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 284p; In Portuguese

Report No.(s): INPE-7262-TDI/704; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

Nowadays, there is many preoccupation into organizations about the quality of the produced Software Systems, as well as the productivity of the development teams. Then, it is needed to look for solutions which try to eradicate, or at least to minimize, the problems found during these Systems development, which negatively influence the quality and productivity. One of these problems consists in the lack of a precise definition, into the organization, to a System for the Software Systems development. This System must comprehend a development process, as well as the available infrastructure and people. In this work, it is introduced a System for SOFTBOARD-based Software Systems, detailing the development process activities correspondent to the SOFTBOARD Problem Domain Component (CDP), through utilization of strategies and patterns concepts.

Author

Software Engineering; Systems Engineering; Computer Programs; Strategy

20000037891 Delegation Generale de l'Armement, Architecture des Systemes de Drones, Paris, France

Tools for Optimization and Validation of System Architecture and Software

Fargeon, C., Delegation Generale de l'Armement, France; Development and Operation of UAVs for Military and Civil Applications; April 2000, pp. 3-1 - 3-22; In English; See also 20000037887; Copyright Waived; Avail: CASI; A03, Hardcopy

UAV systems architectures rank among the most complex ones with high safety requirements. Some new software tools have recently emerged that are worth to be known. This lecture was given to advertise four of them on the following topics : 1) Static verification of real time software, to avoid run-time errors, typically what happen for Ariane V ; 2) Simulation of real time architecture to optimize conception and validate the final choice ; 3) edition of command and control software with interpreted properties like on-line automatic reprogramming ; 4) optimization under constraints for continuous and discrete processes.

Author

Architecture (Computers); On-Line Systems; Command and Control; Program Verification (Computers); Safety

20000038134 NASA Goddard Space Flight Center, Greenbelt, MD USA

Improving the MODIS Global Snow-Mapping Algorithm

Klein, Andrew G., Universities Space Research Association, USA; Hall, Dorothy K., NASA Goddard Space Flight Center, USA; Riggs, George A., Research and Data Systems, Inc., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 227-228; Repr. from 1997 International Geoscience and Remote Sensing Symposium (IGARSS 1997), v. 2 p 619-621; In English; Geoscience and Remote Sensing, 3-8 Aug. 1997, Singapore, Singapore

Report No.(s): IEEE-97CH36042; LC-97-70575; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

An algorithm (Snowmap) is under development to produce global snow maps at 500 meter resolution on a daily basis using data from the NASA MODIS instrument. MODIS, the Moderate Resolution Imaging Spectroradiometer, will be launched as part of the first Earth Observing System (EOS) platform in 1998. Snowmap is a fully automated, computationally frugal algorithm that will be ready to implement at launch. Forests represent a major limitation to the global mapping of snow cover as a forest canopy both obscures and shadows the snow underneath. LANDSAT Thematic Mapper (TM) and MODIS Airborne Simulator (MAS) data are used to investigate the changes in reflectance that occur as a forest stand becomes snow covered and to propose changes to the Snowmap algorithm that will improve snow classification accuracy forested areas.

Author

Snow Cover; Spectroradiometers; Algorithms; Mapping; Remote Sensing

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COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

20000033827 NASA Glenn Research Center, Cleveland, OH USA
An Assessment of Gigabit Ethernet Technology and Its Applications at the NASA Glenn Research Center
Bakes, Catherine Murphy, Kent State Univ., USA; Kim, Chan M., NASA Glenn Research Center, USA; Ramos, Calvin T., NASA Glenn Research Center, USA; February 2000; 32p; In English
Contract(s)/Grant(s): RTOP 509-10-24
Report No.(s): NASA/TM-2000-209803; E-12108; NAS 1.15:209803; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes Gigabit Ethernet and its role in supporting R&D programs at NASA Glenn. These programs require an advanced high-speed network capable of transporting multimedia traffic, including real-time visualization, high- resolution graphics, and scientific data. GigE is a 1 Gbps extension to 10 and 100 Mbps Ethernet. The IEEE 802.3z and 802.3ab standards define the MAC layer and 1000BASE-X and 1000BASE-T physical layer specifications for GigE. GigE switches and buffered distributors support IEEE 802.3x flow control. The paper also compares GigE with ATM in terms of quality of service, data rate, throughput, scalability, interoperability, network management, and cost of ownership.
Author
Technology Assessment; Real Time Operation; High Speed; Costs; Ethernet

20000033851 Ohio Univ., Athens, OH USA
Advantages of Parallel Processing and the Effects of Communications Time ***Final Report***
Eddy, Wesley M., Ohio Univ., USA; Allman, Mark, Bolt, Beranek, and Newman, Inc., USA; February 2000; 16p; In English
Contract(s)/Grant(s): NAS3-99175; RTOP 632-50-5A
Report No.(s): NASA/CR-2000-209455; E-11953; NAS 1.26:209455; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Many computing tasks involve heavy mathematical calculations, or analyzing large amounts of data. These operations can take a long time to complete using only one computer. Networks such as the Internet provide many computers with the ability to communicate with each other. Parallel or distributed computing takes advantage of these networked computers by arranging them to work together on a problem, thereby reducing the time needed to obtain the solution. The drawback to using a network of computers to solve a problem is the time wasted in communicating between the various hosts. The application of distributed computing techniques to a space environment or to use over a satellite network would therefore be limited by the amount of time needed to send data across the network, which would typically take much longer than on a terrestrial network. This experiment shows how much faster a large job can be performed by adding more computers to the task, what role communications time plays in the total execution time, and the impact a long-delay network has on a distributed computing system.
Author
Parallel Processing (Computers); Communicating; Time Dependence; Tasks; Computer Networks

20000034037 GTE Technology Organization, Cleveland, OH USA
FTP Extensions for Variable Protocol Specification ***Final Report***
Allman, Mark, GTE Technology Organization, USA; Ostermann, Shawn, Ohio Univ., USA; February 2000; 12p; In English
Contract(s)/Grant(s): NAS3-99175; RTOP 632-50-5A
Report No.(s): NASA/CR-2000-209414; E-12027; NAS 1.26:209414; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The specification for the File Transfer Protocol (FTP) assumes that the underlying network protocols use a 32-bit network address and a 16-bit transport address (specifically IP version 4 and TCP). With the deployment of version 6 of the Internet Protocol, network addresses will no longer be 32-bits. This paper species extensions to FTP that will allow the protocol to work over a variety of network and transport protocols.
Author
Specifications; Document Storage; Protocol (Computers)

20000034049 General Accounting Office, Accounting and Information Management Div., Washington, DC USA
Year 2000 Computing Challenge: Leadership and Partnerships Results in Limited Rollover Disruptions
Jan. 27, 2000; 25p; In English; Testimony: Before the Subcommittee on Government Management, Information and Technology, Committee on Government Reform, and the Subcomittee on Technology, Committee on Science, House of Representatives.
Report No.(s): AD-A372848; GAO/T-AIMD-00-70; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Because of its urgent nature and the potentially devastating impact it could have had on critical government operations, in February 1997 we designated the Year 2000 problem a high-risk area for the federal government. Since that time, we have issued over 160 reports and testimony statements detailing specific findings and numerous recommendations related to the Year 2000 readiness of a wide range of federal agencies. We have also issued guidance to help organizations successfully address the issue. The public faced the risk that critical services provided by the government and the private sector could be disrupted by the change of century rollover. As we have previously testified, financial transactions could have been delayed, flights grounded, power lost, and national defense affected. Fortunately, as we testified before your Subcommittees in November 1999, at the urging of congressional leaders and others, the Office of Management and Budget (0MB) and federal agencies dramatically increased the amount of attention and oversight given to the Year 2000 issue.
DTIC
Computer Programs; Computer Program Integrity; Reliability Analysis; Defense Program; Leadership

20000034128 Saclay Research Centre, Dept. d'Electronique et d'Instrumentation Nucleaire, Gif-sur-Yvette, France
Optimal task mapping in safety-critical real-time parallel systems
Aussagues, C.; Dec. 11, 1998; 208p; In French; In English
Report No.(s): DE99-635219; FRCEA-TH-729; No Copyright; Avail: Department of Energy Information Bridge

This PhD thesis is dealing with the correct design of safety-critical real-time parallel systems. Such systems constitutes a fundamental part of high-performance systems for command and control that can be found in the nuclear domain or more generally in parallel embedded systems. The verification of their temporal correctness is the core of this thesis. our contribution is mainly in the following three points: the analysis and extension of a programming model for such real-time parallel systems; the proposal of an original method based on a new operator of synchronized product of state machines task-graphs; the validation of the approach by its implementation and evaluation. The work addresses particularly the main problem of optimal task mapping on a parallel architecture, such that the temporal constraints are globally guaranteed, i.e. the timeliness property is valid. The results incorporate also optimally criteria for the sizing and correct dimensioning of a parallel system, for instance in the number of processing elements. These criteria are connected with operational constraints of the application domain. Our approach is based on the off-line analysis of the feasibility of the deadline-driven dynamic scheduling that is used to schedule tasks inside one processor. This leads us to define the synchronized-product, a system of linear, constraints is automatically generated and then allows to calculate a maximum load of a group of tasks and then to verify their timeliness constraints. The communications, their timeliness verification and incorporation to the mapping problem is the second main contribution of this thesis. FInally, the global solving technique dealing with both task and communication aspects has been implemented and evaluated in the framework of the OASIS project in the LETI research center at the CEA/Saclay.
NTIS
Safety; Parallel Processing (Computers); Real Time Operation

20000034147 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Information System Incidents: The Development of a Damage Assessment Model
Horony, Mark D.; Dec. 1999; 77p; In English
Report No.(s): AD-A374167; AFIT/GIR/LAS/99D-5; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

Information system (IS) incidents are on the rise. With low manning and undertrained information security specialists it is difficult for organizations to stop IS incidents from occurring. Once an incident has occurred it is the IS manager's responsibility to ensure that a full and accurate damage assessment has been accomplished. However, most IS managers lack the necessary tools to assess the damage from an incident. This exploratory thesis developed an IS incident damage assessment model (DAM) that can be part of the IS manager's tool kit. During the development of the model, it became apparent that the model was supported by a foundation of business processes. Therefore, the most important thing an IS manager can do is define their organization's business processes and bow they relate to information systems. The model is based on eight primary factors to considered: (1) recovery, (2) education/training, (3) business expenses, (4) productivity, (5) data, (6) lost revenue, (7) reputation, and (8) human life. Each factor is then further expanded into sub-factors that better define and explain the primary factors. These sub-factors can

be directly mapped to business processes previously defined by the information system manager. The final product is an IS incident DAM tailored to the needs of the IS manager's organization.
DTIC
Information Systems; Systems Engineering; Systems Management; Damage Assessment

20000034251 Naval Postgraduate School, Monterey, CA USA
Implementation of Real-Time MSHN Using Ace and TAO
Papadatos, Panagiotis; Sep. 1999; 140p; In English
Report No.(s): AD-A374040; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The Management System for Heterogeneous Networks (MSHN) project is a part of the DARPA/ITO QUORUM program. MSHN targets the execution of multiple, disparate tasks that use a set of shared, heterogeneous resources in a way that maximizes a collection of application specific quality of service (QoS) measures. This thesis examines some of the architectural requirements demanded of MSHN for it to be able to operate in a real time environment, and presents an implementation of a MSHN communication schema using components designed for supporting real time applications. This implementation is built over the Adaptive Communication Environment (ACE), a freely available, open source, object oriented (OO) framework for building concurrent communication. to support the communication between MSHN components, we used the Common Object Request Broker Architecture (CORBA), particularly The ACE ORB (TAO), a standards based, CORBA middleware framework. Both ACE and TAO are being developed at the Washington University in St. Louis, MO. In our experiments, we define and measure the latency (communication time required to start an application) and agility (communication time required to migrate an application given a platform failure). We find that MSHN has the potential for supporting certain types of real time systems, such as vehicle control.
DTIC
Communication Networks; Real Time Operation; Communication Equipment

20000034265 Naval Postgraduate School, Monterey, CA USA
Identifying Accurate Resource. Monitoring Tools and Techniques
Jacobs, Ronald, Jr; Sep. 1999; 84p; In English
Report No.(s): AD-A374261; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Distributed applications concurrently share and compete for resources in heterogeneous systems. The objective of the Management System for Heterogeneous Networks (MSHN) is to use admission control, smart scheduling, and adaptation awareness in applications to successfully cope with the dynamics of resource availability. MSHN therefore requires knowledge of the expected resource utilization of applications that execute within the MSHN environment and the current state of these resources. MSHN relies on the above information to correctly identify resources to be assigned to these applications. This thesis investigates the capabilities of currently available communication resource status monitoring tools for the purpose of identifying those tools that, with low overhead, can provide accurate, end-to-end communication status information in a Windows NT environment. The techniques used by the various tools are described and the methods for determining the accuracy of these tools are specified. Results of the experiments with the various tools show that they add between 2% - 3% overhead in most cases and as much as 10% overhead in the worst case. Finally, none of the existing commercial tools studied gave an accurate assessment of the end-to-end communication throughput and latency for Windows NT 4.0.
DTIC
Computer Networks; Scheduling; Information Management; Management Systems

20000034266 Naval Postgraduate School, Monterey, CA USA
Internet Telephony
Perri, Richard Paul; Dec. 1999; 66p; In English
Report No.(s): AD-A374104; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

During the mid 90s, data and voice began to merge, propelled by advances in compression technology. The ubiquity of routed Internet Protocol (IP) networks, and the desire to trim telephony costs are the major driving forces of the deployment of Voice over IP (VoIP). One advantage of VoIP technologies is that they leverage existing network resources and dramatically reduce, or major eliminate telephone costs. If there is an existing Wide Area Network (WAN) then VoIP could be employed over the WAN. However, a WAN link may not be available at each node location. Then only local point of presence (POP) for router based Internet connectivity would be required for VoIP over the Internet. The Internet could be the part of the backbone for the routing of the voice packets. The advantages of deployment of VoIP are evident. The issue of whether or not to deploy VoIP is more concerned with technical implementation and Quality of Service (QoS) that with a cost benefit analysis. This thesis analysis some of the

technical issues surrounding the use of Internet Telephony. Specifically, the Internet Architecture and required QoS for reliable voice, and issues that arise from a dynamic network such as the Internet, and both software and hardware approaches to workstation solution to Internet Telephony.
DTIC
Wide Area Networks; Telephony; Voice Communication; Internets; Wave Packets

20000034854 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
A New TFTP-Like Service for Secure Data Transfer ***Proposta e Implementacao de um Servico Seguro de Transferencia de Dados***
deBarros, Eduardo Gomes, Instituto Nacional de Pesquisas Espacias, Brazil; 2000; 154p; In Portuguese
Report No.(s): INPE-7508/TDI/722; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The increasing use of the Internet for the transfer of digital data requires computational systems able to provide the privacy, integrity and accessability of such data. Furthermore, the computational system itself shall be safe, ensure the serviceability of its computers and local network and attend the requirements of a given institution or company. The specification of this computational system shall be made in order to conform the adopted safety policy. The current work proposes a safe computational system, designed to meet the requirements of the safety policy of a particular institution or company. As part of this system, it was developed and tested the prototype of a software aimed for safe data transfer. This software was derived from the Trivial File Transfer Protocol (TFTP). As this service is intended for files that are limited in size, it was suitable to choose the connectionless protocol User Datagram Protocol (UDP). Data integrity and inviolability is ensured by cryptography and also authentication and authorization procedures. The proposed service uses a methodology for data encryptation, which is based on two public domain cryptography algorithms.
Author
Computer Information Security; Cryptography; Information Theory; Access Control; Information Transfer; Selective Dissemination of Information; Information Resources Management

20000034860 Emory Univ., Dept. of Chemistry, Atlanta, GA USA
Personal Computer Cluster for Theoretical Studies of Gas Phase Elementary Reactions ***Final Report, 1 Mar. 1998-28 Feb. 1999***
Morokuma, Keiji; Jun. 01, 1999; 11p; In English
Contract(s)/Grant(s): F49620-98-1-0345
Report No.(s): AD-A373770; AFRL-SR-BL-TR-00-0036; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Three graduate students, a postdoctoral fellow, and Emerson Center staff and workstation expert and the PI of this project formed a team and work together very hard. The team did extensive literature studies (mainly visiting many web sites), detailed discussions on technical aspects had pricing studies(via internet and fax) before ordering any hardware and software. In particular, Dr. Szilagyi served as the team captain and put often overheated discussions into reality. Mr. Khoroshun has been the system manager of our PC cluster, and spend hundreds of hours in front of the Master Console in installed, tested, an integrated new hardware and software into the system. It is quite obvious that a few/several devoted graduate student and/or postdoctoral fellows are essential for any success of this kind of PC project.
DTIC
Distributed Processing; Microcomputers; Software Engineering; Gas Dynamics; Vapor Phases; Computer Programs; Systems Management

20000036520 Carnegie-Mellon Univ., Dept. of Psychology, Pittsburgh, PA USA
Parallel Supercomputing in Cognitive Brain Imaging Other Massive 3-D Dataspaces ***Final Report, 1 Mar. 1998-28 Feb. 1999***
Just, Marcel A.; Dec. 08, 2000; 4p; In English
Contract(s)/Grant(s): F49620-98-1-0186
Report No.(s): AD-A374854; AFRL-SR-BL-TR-00-0070; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This instrumentation grant supported the purchase of a small supercomputer for cognitive brain imaging and other large 3D dataspaces. The machine that was purchased was an SGI (Silicon Graphics) Origin 2000 parallel supercomputer with 14 CPU's, 7 gigabytes of main memory, 750 gigabytes of disk storage, and 5 terabytes of fast tape storage. In addition, 6 SGI UNIX workstations were purchased for graphics display and processing, and 9 NT/Intel workstations for local data analysis. The machines are networked in a 100mbit LAN. The area of computing in functional brain imaging and other massive 3-D dataspaces has extraordinary scientific, medical, and commercial potential. The potential application to DoD is the ability to measure brain

function during the performance of high workload tasks, such as decision making, communication, and visualization. The measurement of the brain function provides a new way to measure cognitive workload, its limitations, and its efficiencies. These new methods have implications for the selection and training of personnel, and for the design of human computer interfaces. The research develops methods for measuring brain activation in the cortex during the performance of high level cognitive tasks and in dynamic decision making, in order to evaluate the cognitive workload imposed on an operator by various tasks, situations, interfaces, or instruments. The fMRI data are acquired at a high rate (one brain slice about 5 mm thick consisting of 64x128 voxels approximately every 200 msec), in tasks taking a total of about 15 minutes each. The data are then subjected to signal processing and statistical modeling techniques, to discover the spatial and temporal patterns of cortical activation in a network of brain areas that underlie higher level cognition.
DTIC
Supercomputers; Imaging Techniques; Statistical Analysis; Parallel Processing (Computers)

20000036521 University of Southern California, Information Sciences Inst., Marina del Rey, CA USA
Tera-node Network Technology (TASK 1) ReSerVation Protocol (RSVPTNT) ***Final Report, 1 Jul. 1995-30 Jun. 1999***
Braden, Robert; Estrin, Deborah; Berson, Steven; Herzog, Shai; Kann, Jeff; Mar. 14, 2000; 19p; In English
Contract(s)/Grant(s): DABT63-95-C-0095
Report No.(s): AD-A374855; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
RSVP, a setup protocol to create flow specific reservation state in routers and hosts, is a component of the QoS extensions to the Internet architecture known as Integrated Services. RSVP was designed to provide robust, efficient, flexible, and extensible reservation service for multicast and unicast data flows. This report provides an overview of the development of RSVP, including an analysis of the key design decisions for the protocol as the protocol has evolved.
DTIC
Internets; Protocol (Computers)

20000036522 University of Southern California, Information Sciences Inst., Marina del Rey, CA USA
SCOPE - Scalable Computing Infrastructure Tera-node Network Technology (Task 2) ***Final Report, 16 Jul. 1995-17 Jul. 1999***
Neuman, B. Clifford; Gullapalli, Sridhar; Rao, Santosh; Mar. 14, 2000; 17p; In English
Contract(s)/Grant(s): DABT63-95-C-0095
Report No.(s): AD-A374857; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The Scalable Computing Infrastructure project at the Information Sciences Institute of the University of Southern California investigated, developed, and deployed distributed systems software and services that enable the sharing of heterogeneous computing resources, within and across organizations, on an Internet wide basis. These services enable cooperating organizations to establish agreements for helping one another in replacing computing capacity that is unavailable due to failure. It also enables individual users and organizations to purchase computing cycles from service providers to handle infrequent excess demand of applications when the frequency of such excess demands does not justify investment in permanent capacity. Software for SCOPE is was layered on top of, and includes extensions to, the Prospero Resource Manager (PRM) . PRM was integrated with authentication and payment products and resource discovery services developed as part of related ISI projects.
DTIC
Topology; Computer Systems Programs; Computer Information Security; Distributed Processing

20000036537 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
Supporting Best-Effort Traffic with Fair Service Curve
Ng, T. E.; Stephens, Donpaul C.; Stoica, Ion; Zhang, Hui; Feb. 2000; 36p; In English; Sponsored in part by Grants NSF-NCR96-24979, NSF-ANI98-14929.
Contract(s)/Grant(s): N66001-96-C-8528; E30602-97-2-0287
Report No.(s): AD-A374645; CMU-CS-99-169; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Packet Fair Queueing (PFQ) algorithms are the most popular and well studied scheduling algorithms for integrated services networks for two reasons: (1) With reservation, they can provide per-flow end-to-end delay guarantees for real-time traffic flows. (2) Without the reservation, they can provide protection among competing best-effort flows while allowing dynamic bandwidth sharing. However, PFQ algorithms have two important limitations. The first one is that, since only one parameter (a weight) is used to allocate resource for each flow, there is a coupling between delay and bandwidth allocation. This can result in network under-utilization when real-time flows have diverse delay and bandwidth requirements. The second and less well known limitation is that, due to the instantaneous fairness property of PFQ algorithms, when used for best-effort service, PFQ algorithms

favor continuously-backlogged throughput-oriented applications such as FTP over bursty applications such as WWW and telnet. In a previous study, we proposed the Fair Service Curve (FSC) algorithm which enables more flexible delay and bandwidth allocation for real-time traffic through the use of non-linear service curves. In this paper, we show that, when used for best-effort traffic, FSC can improve performance of delay-sensitive bursty applications without negatively affecting the performance of throughput-oriented applications.
DTIC
Computer Networks; Internets; World Wide Web; Algorithms

20000037676 Texas Univ., Austin, TX USA
Examining the Relationship Between Interactivity on the Internet and the Four Public Relations Models in Federal Government Agencies
Highley, Samuel Barrett; Feb. 14, 2000; 71p; In English
Report No.(s): AD-A374333; AFIT-FY00-90; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
Little research has been done on the concept of interactivity as it relates to the World Wide Web, and none has been in the context of the four models of public relations as defined by James Grunig. This thesis is a quantitative analysis of federal agency Web sites. Eighteen sites were content analyzed and assigned interactivity scores. These scores were correlated with public relations model mean scores gathered in a previous study. No significant correlations were found between the various interactivity scores and the models of public relations. It is hypothesized that this lack of significance is due to public relations practitioners applying the models situationally. Because the World Wide Web demands high levels of interactivity, two way models of public relations will be used regardless of the dominant model used by the agency as a whole.
DTIC
Internets; Public Relations; World Wide Web; Governments

20000037679 Syracuse Univ., Office of Sponsored Programs, NY USA
Design, Development, Benchmarking and Evaluation of Parallel Applications for High Performance Embedded Systems ***Final Report, Nov 1996 - May 1999***
Liao, Wei-Keng; Weiner, Donald; Choudhary, Alok; Jan. 2000; 302p; In English
Contract(s)/Grant(s): F30602-97-C-0026; AF Proj. HPCM
Report No.(s): AD-A374311; AFRL-IF-RS-TR-1999-269; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche
Due to the nature of the algorithms typically employed in applications such as STAP, sensor data fusion, and target detection, it was decided to integrate the signal processing areas of space time adaptive processing and signal detection. In particular, the following algorithms were parallelized: (1) AFRL (Rome) version of a PEI staggered post-Doppler STAP algorithm. This algorithm, comprised of more than 23,000 lines of code, included the steps of (a) Doppler filter processing, (b) weight computation, (c) beam forming, (d) pulse compression, and (e) constant false alarm rate (CFAR) processing. (2) Ozturk (clutter characterization) algorithm. This algorithm is used to analyze random data and includes the steps of (a) goodness of fit test and (b) probability distribution approximation. (3) Ordered statistic CFAR algorithm. This CFAR algorithm is in addition to the cell averaging CFAR algorithm contained in the PRI staggered post-Doppler STAP algorithm. In carrying out the algorithm parallelizations, the following tasks/technical requirements were accomplished: (1) Efficient techniques for high speed, high volume I/O applicable to embedded high performance systems were designed and implemented. (2) Data distribution and redistribution strategies for both inter-task and intra-task data communications in real time pipelined and parallelized applications were designed and implemented. (3) A documented beta code release was implemented to illustrate the full system with all major functional, technical, programming, documentation, installation, and user application features to be included in the full delivery. (4) The individual algorithms, as well as the integrated applications, were implemented, demonstrated, benchmarked, and evaluated on the Intel Parago and, IBM SP2.
DTIC
False Alarms; Algorithms; Computer Programming; Signal Processing; Multisensor Fusion; Target Acquisition

20000037737 Xerox Palo Alto Research Center, CA USA
Virtual Internetwork Testbed (VINT): Methods and Systems ***Final Report, 26 Sep. 1996 - 21 Feb. 2000***
Breslau, Lee, Xerox Palo Alto Research Center, USA; Feb. 21, 2000; 96p; In English
Contract(s)/Grant(s): DABT63-96-C-0105
Report No.(s): AD-A374871; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
The goal of this project, as outlined in our original proposal, was to enhance the state of the art of network protocol design through the creation of a network simulator and related tools, and to validate this software by using it in our ongoing research.

As described below, we have met these objectives. This VINT Project has made several releases of the ns simulator, the nam network animator and other related tools (e.g., topology generators). In addition, this simulator has been used in our ongoing research program, resulting in several technical papers on a range of topics. More importantly, the simulator has been widely adapted by a broad community of networking researchers and has been used in a wide range of research reflected in scores of technical papers.
DTIC
Queueing Theory; Communication Networks; Networks; Topology

20000037740 University of Southern California, Information Sciences Inst., Marina del Rey, CA USA
Tera-node Network Technology (Task 3) Scalable Personal Telecommunications ***Final Report, 18 Jul. 1995-17 Jul. 1999***
Bannister, Joseph; Mar. 14, 2000; 10p; In English
Contract(s)/Grant(s): DABT63-95-C-0095
Report No.(s): AD-A374885; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The goal of the TNT/SPT project was to develop and demonstrate technologies to support the use of personal conferencing on the Internet. The project has focused on supporting streaming applications. It has also made definitive contributions in the field of end to end quality adaptive streaming applications, TCP Friendly congestion control and avoidance, and rate adaptation mechanisms.
DTIC
Internets; Conferences; Topology

63
CYBERNETICS

Includes feedback and control theory, artificial intelligence, robotics and expert systems. For related information see also 54 Man/System Technology and Life Support., Artificial Intelligence and Robotics

20000033856 Carnegie-Mellon Univ., Robotics Inst., Pittsburgh, PA USA
Robotic Rock Classification ***Final Report, 15 May - 14 Aug. 1999***
Hebert, Martial, Carnegie-Mellon Univ., USA; [1999]; 7p; In English
Contract(s)/Grant(s): NCC2-5319; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This report describes a three-month research program undertook jointly by the Robotics Institute at Carnegie Mellon University and Ames Research Center as part of the Ames' Joint Research Initiative (JRI.) The work was conducted at the Ames Research Center by Mr. Liam Pedersen, a graduate student in the CMU Ph.D. program in Robotics under the supervision Dr. Ted Roush at the Space Science Division of the Ames Research Center from May 15 1999 to August 15, 1999. Dr. Martial Hebert is Mr. Pedersen's research adviser at CMU and is Principal Investigator of this Grant. The goal of this project is to investigate and implement methods suitable for a robotic rover to autonomously identify rocks and minerals in its vicinity, and to statistically characterize the local geological environment. Although primary sensors for these tasks are a reflection spectrometer and color camera, the goal is to create a framework under which data from multiple sensors, and multiple readings on the same object, can be combined in a principled manner. Furthermore, it is envisioned that knowledge of the local area, either a priori or gathered by the robot, will be used to improve classification accuracy. The key results obtained during this project are: The continuation of the development of a rock classifier; development of theoretical statistical methods; development of methods for evaluating and selecting sensors; and experimentation with data mining techniques on the Ames spectral library. The results of this work are being applied at CMU, in particular in the context of the Winter 99 Antarctica expedition in which the classification techniques will be used on the Nomad robot. Conversely, the software developed based on those techniques will continue to be made available to NASA Ames and the data collected from the Nomad experiments will also be made available.
Author
Research; Research and Development; Robotics; Robots; Remote Control; Telerobotics

20000034078 Massachusetts Inst. of Tech., Lab. of Electronics, Cambridge, MA USA
Training Spatial Knowledge Acquisition Using Virtual Environments ***Annual Report, 1 Feb. 1998-31 Jan. 1999***
Durlach, Nathaniel I.; Feb. 25, 2000; 82p; In English
Contract(s)/Grant(s): N00014-96-1-0379
Report No.(s): AD-A373901; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report summarizes the work done by MIT in Year 3 (1 February 1998 through 31 January 1999) of the ONR Grant N00014-96-1-0937 entitled ”Training Spatial Knowledge Acquisition Using Virtual Environments. ” It has been prepared by Dr. Thomas E. V. Wiegand, Nathaniel Durlach (PI), Sam Madden, and Rebecca Lee Garnett. The main effort during this period has been directed towards the development of a hardware/software system (The ”VE Construction System”) to facilitate the creation of complex virtual building environments. Virtual environment modeling of complex spaces is presently a manually intensive task in which required labor increases markedly with the level of three-dimensional detail that must be represented. As most real-world spaces worth modeling are of high complexity, the cost of this process can have a significant negative impact on the scope and timeliness of such projects. The tools we have developed during this year of our program greatly reduce the amount of time acquired to build the complex photorealistic VE models necessary for performing our envisioned VSPAN experiments. Also, of course, these tools should prove useful for other programs conducted at other laboratories.
DTIC
Virtual Reality; Education; Software Engineering; Architecture (Computers)

20000034149 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Defining Virtual Interactions: A Taxonomy for Researchers and Practitioners
Oxborrow, Glade G.; Nov. 1999; 114p; In English
Report No.(s): AD-A374165; AFIT/GIR/LAS/99D-8; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy

Many uses for virtual technology are being identified by diverse organizational entities around the world. Before these technologies can be fully utilized, it is important to have a common definition and understanding of what is meant by the term virtual. It is also important to understand the structural configurations possible using virtual technology and the types of virtual interactions that may occur using these technologies. This thesis will define the basic premises, structures, and definitions applicable to vial interactions. It also defines various types of virtual interactions that may occur using virtual technology. These designations will help both practitioners and researchers to focus on appropriate virtual technologies and identify the critical factors that will determine success or failure in each instance. Above all, this taxonomy will provide a foundation upon which to build a coherent, sustained, and directed study of virtual interactions that will result in improved integration of technology into organizational strategic plans. Such integration will optimize financial outlays for information technology and produce the maximum benefits for all virtual components involved.
DTIC
Information Systems; Taxonomy; Virtual Reality

20000034861 Alphatech, Inc., Burlington, MA USA
Workshop: Future Directions in Systems and Control Theory, Wednesday, June 23. Viewgraphs - Volume 2
Tenney, Robert R.; Pascoal, A.; Kaminer, I.; Oliveira, P.; Silvestre, C.; Jun. 23, 1999; 121p; In English
Report No.(s): AD-A373778; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This report contains several reports concerning future directions in systems and control theory.
DTIC
Control Theory; Robotics; Autonomous Navigation; Drone Aircraft

20000034864 Brown Univ., Providence, RI USA
Model Acquisition for Markov Decision Problems ***Final Report, 1 Dec. 1996-31 Jul. 1998***
Dean, Thomas L.; Oct. 31, 1998; 6p; In English
Contract(s)/Grant(s): F49620-97-1-0031
Report No.(s): AD-A373795; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In this research, we developed new models and techniques for representing stochastic processes that enabled us to compactly represent problems that couldn’t be represented at all with previous techniques. We also developed new algorithms for efficiently solving such problems by directly exploiting the structure in the representations. Our models achieved efficiency in representation by factoring the state and action spaces of a dynamical system using a set of features (variously called state variables or fluents). We were able to explain the sources of combinatorial leverage in our and other structured models such as those of Boutilier et al. We found that the structure was due to certain symmetries in the dynamics that, in certain cases, could be exploited to significantly reduce computation time. Using these insights, we developed new algorithms that realized these reductions in computation time.
DTIC
Mathematical Models; Artificial Intelligence; Markov Processes

20000036542 Science Applications International Corp., Dayton, OH USA
Imagery Analyst Workstation User-Interface Analysis and User-Interface Requirements Document ***Interim Report, Feb. 1997-Jun. 1998***
Malek, David A.; Brett, Bryan E.; Martin, Edward A.; Hoagland, David G.; Dec. 1999; 60p; In English
Contract(s)/Grant(s): F33615-92-D-2293; AF Proj. 2830
Report No.(s): AD-A374699; AFRL-HE-WP-TR-1999-0245; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This document describes the approach and method employed in conducting an Imagery Analyst and Intelligence Analyst Workstation Interface analysis and documents the results and recommendations from this analysis including a user interface requirement document for imagery analysis workstations.
DTIC
Graphical User Interface; Imagery; Workstations

20000036546 Ohio State Univ., Dept. of Computer and Information Science, Columbus, OH USA
Neural Scene Segmentation by Oscillatory Correlation*, of May 1996-Sep 1999*
Wang, DeLiang; Mar. 2000; 21p; In English
Contract(s)/Grant(s): N00014-96-1-0676
Report No.(s): AD-A374715; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The segmentation of a visual scene into a set of coherent patterns (objects) is a fundamental aspect of perception, which underlies a variety of important tasks such as figure/ground segregation, and scene analysis. An innovative approach has been developed that uses neural oscillator networks to segment images. The framework, called oscillatory correlation, encodes the binding of pixels by phases of neural oscillators, resulting in a dynamical systems approach. The approach has been evaluated by computer simulations using both synthetic and real imagery, including intensity, range, motion, texture images. The results have been very competitive.
DTIC
Neural Nets; Pattern Recognition; Scene Analysis; Dynamical Systems; Oscillators

20000037828 Defence Evaluation Research Agency, Land Systems, Robotic Land Vehicles Dept., Chertsey, UK
UK Military Requirements for Unmanned Land Vehicle Combat Engineer Support
Warren, H. A., Defence Evaluation Research Agency, UK; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B6-1 - B6-5; In English; See also 20000037804; Copyright Waived; Avail: CASI; A01, Hardcopy
The paper describes the operational requirements and methods of achieving remote operation of Combat Engineer Equipments for use by the UK Army during periods immediately prior to combat, possibly during combat and extensively in post conflict clearance operations. The techniques could also be used in peace support or for non-military applications. Unmanned ground vehicles have several potential applications on the battlefield including reconnaissance, mine clearance and other engineer tasks. The paper examines the teleoperational requirements for the adaptation of existing Combat Engineer Vehicles such as the Chieftain Armoured Vehicle Royal Engineer (CHAVRE), and the Combat Engineer Tractor (CET) and future requirements for service replacement vehicles such as Future Engineer Tank (FET) and Terrier (replacement CET). The benefits of the use of technologies to improve remote control equipment for the combat engineer are discussed with the evolutionary approach of developing vehicles which have greater intelligence, independence, versatility, and which reduce certain manpower tasks at favourable costs savings. The paper discusses specific topics on:- UK Engineer support requirements, direction of UK RLV programme, design philosophy, advantages and disadvantages of using UGVs instead of manned vehicles, safety features and some technology limitations.
Author
Combat; UK; Military Technology; Pilotless Aircraft; Support Systems; Operations

20000037829 Defence Evaluation Research Agency, Land Systems, Robotic Land Vehicles Dept., Chertsey, UK
UK Experience with Unmanned Land Vehicles for Combat Engineer Applications
Gibson, P. J., Defence Evaluation Research Agency, UK; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B7-1 - B7-4; In English; See also 20000037804; Copyright Waived; Avail: CASI; A01, Hardcopy
DERA is currently conducting applied research in support of the UK MOD programme for Combat Engineer Equipments which includes Robotic Land Vehicles. Three examples of research into remote operation of combat engineer equipment are described, the Scatterable Mine Clearance Device (SMCD) on a 15 tonne truck, Chieftain Armoured Vehicle Royal Engineers (CHAVRE) with mine plough and fascines, and Combat Engineer Tractor (CET) fitted with 4-in- 1 bucket. The paper addresses the advantages and limitations of operating via remote control and suggests techniques that alleviate some of these problems. All

of the systems described used applique kits on in-service vehicles with no vehicle modifications and were intended to be capable of use in operational environments. Adaptation was achievable in less than a day and there was minimum interference with normal operation, change-over to remote control being near instantaneous. The presentation includes a short video clip of aspects such as tele-operation from moving vehicles, vision needs and problems encountered when undertaking specific tasks such as digging and obstacle negotiation. Results of our trials are summarized and pointers given to future research and features that should be incorporated in future systems. Mr. Peter Gibson - Robotics Technical Expert, Defence Evaluation and Research Agency (DERA), Land Systems, Chobham Lane, Chertsey, Surrey, KT16 OEE, UK
Author
UK; Pilotless Aircraft; Combat; Engineers

20000037830 Institute for Human Factors TNO, Soesterberg, Netherlands
Controlling Unmanned Vehicles: The Human Factors Solution
vanErp, Jan B. F., Institute for Human Factors TNO, Netherlands; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B8-1 - B8-12; In English; See also 20000037804; Copyright Waived; Avail: CASI; A03, Hardcopy

Recent developments and experiences have proven the usefulness and potential of Unmanned Vehicles (UVs). Emerging technologies enable new missions, broadening the applicability of UVs from simple remote spies towards unmanned combat vehicles carrying lethal weapons. However, despite the emerging technology, unmanned does not implicate that there is no operator involved. Humans still excel in certain tasks, e.g. tasks requiring high flexibility or tasks that involve pattern perception, and decision making. An important subsystem in which the technology driven aspects and the human factors driven aspects of UVs meet is in the data-link between the remote vehicle and the operator. The human factors engineer wants to optimize operator performance, which may require a data-link with an extremely large capacity, while other design criteria typically limit the bandwidth (e.g. to lower costs, or because no more bandwidth is available in certain situations). This field of tension is the subject of the present paper. The paper describes two human factors approaches that may help to resolve this field of tension. The first approach is to reduce data-link requirements (without affecting operator performance) by presenting task-critical information only. Omitting information that is not needed by the operator to perform the task frees capacity. The second approach is to optimize performance by developing advanced interface designs which present task-critical information without additional claims on the data-link. An example will be given of both approaches.
Author
Human Factors Engineering; Tension; Operator Performance; Pilotless Aircraft

20000037831 Defence Evaluation Research Agency, Manpower Integration Dept., Farnborough, UK
An Evaluation of Input Devices and Menu Systems for Remote Workstations
White, J., Defence Evaluation Research Agency, UK; McCrerie, C., Defence Evaluation Research Agency, UK; Miles, C., Defence Evaluation Research Agency, UK; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B9-1 - B9-8; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

It is likely that the future air fleet will include uninhabited air vehicles (UAVs) that can be controlled by an operator in a remote location. Such a system will require the operator to experience the same view as the onboard camera to maintain control and keep track of the uninhabited vehicle. It should be borne in mind that uninhabited vehicles are not likely to be continuously operational but deployed only when necessary. The interface must therefore be intuitive, as long periods of time could elapse between missions. The training needs of the operator should therefore be less intensive than those currently necessary for the manned aircraft fleet. As missions may employ a semi-autonomous mode of operation, there is a requirement for transparency between the system and the operator inputs. This paper reports an investigation of the utility of three Windows- driven menu systems and four input devices. Performance with a touchscreen, touchpad, keyboard and mouse was compared on a waypoint re-routing task. It was anticipated that the innovative touchscreen would enhance performance when compared to the more conventional input methods of keyboard or mouse. The literature suggested that performance with the touchpad would not be optimal. The experiment was run in three phases, each phase using a different menu structure. Pull-down menus, pop-up menus and horizontal menus were included. The results show that in this type of scenario, less emphasis should be placed on the menu system to be used than the input device, although pop-up menus may be less desirable. The mouse and the touchscreen provide performance advantages in comparison to the keyboard and the touchpad.
Derived from text
Workstations; Pilotless Aircraft; Control Systems Design; Computer Programs; Devices

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NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

20000034027 NASA Glenn Research Center, Cleveland, OH USA
Solving ODE Initial Value Problems With Implicit Taylor Series Methods
Scott, James R., NASA Glenn Research Center, USA; March 2000; 114p; In English
Contract(s)/Grant(s): RTOP 522-81-11
Report No.(s): NASA/TM-2000-209400; NAS 1.15:209400; E-11836; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

In this paper we introduce a new class of numerical methods for integrating ODE initial value problems. Specifically, we propose an extension of the Taylor series method which significantly improves its accuracy and stability while also increasing its range of applicability. to advance the solution from t (sub n) to t (sub n+1), we expand a series about the intermediate point t (sub n+mu):=t (sub n) + mu h, where h is the stepsize and mu is an arbitrary parameter called an expansion coefficient. We show that, in general, a Taylor series of degree k has exactly k expansion coefficients which raise its order of accuracy. The accuracy is raised by one order if k is odd, and by two orders if k is even. In addition, if k is three or greater, local extrapolation can be used to raise the accuracy two additional orders. We also examine stability for the problem y'= lambda y, Re (lambda) less than 0, and identify several A-stable schemes. Numerical results are presented for both fixed and variable stepsizes. It is shown that implicit Taylor series methods provide an effective integration tool for most problems, including stiff systems and ODE's with a singular point.
Author
Differential Equations; Numerical Analysis; Taylor Series; Boundary Value Problems; Problem Solving

20000034036 Norwegian Defence Research Establishment, Kjeller, Norway
IEEE-754 Floating-Point Adder Optimized for Throughput ***Addisjonskrets For IEEE-754 Flyttall Optimalisert For Gjennomstromning***
Gundersen, Rune, Norwegian Defence Research Establishment, Norway; Blom, Harald, Norwegian Defence Research Establishment, Norway; Jan. 14, 2000; 94p; In English
Contract(s)/Grant(s): FFIE Proj. 726/170
Report No.(s): FFI/RAPPORT-2000/00138; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report contains a description of a floating-point adder optimized for throughput rather than latecy. It is confirmed with IEEE-754 standard for binary floating-point arithmetic. The design is fully tested and verified. Synthesis results for the Alcatel Mietec MTC45000 technology are presented.
Author
Floating Point Arithmetic; Integrated Circuits; Design Analysis; Optimization

20000036488 Naval Postgraduate School, Monterey, CA USA
Numerical Study for Global Detection of Cracks Embedded in Beams
Lipsey, Stephen A.; Dec. 1999; 64p; In English
Report No.(s): AD-A374636; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Damage reduces the flexural stiffness of a structure, thereby altering its dynamic response. Considerable effort has been put into obtaining a correlation between the changes in modal parameters and the location and amount of the damage within the structure. Most numerical research employed elements with reduced beam stiffiness to simulate damage in the beam. This approach to damage simulation neglects the non-linear effect that a crack has on the structural dynamic response. In the present study, finite element modeling techniques are utilized to directly represent an embedded crack. The results of the dynamic analysis of the present model are then compared to the results of the dynamic analysis of the reduced modulus finite element model. Different modal parameters are investigated to determine the most sensitive indicator of damage and fts location. Nonlinear effects, such as crack closure and opening, of an embedded crack on the structural dynamic response were also studied from transient nonlinear analysis. The modeling technique is then applied to sandwich composite beams with simulated delamination to investigate damage detection techniques through the use of damping caused by frictional dissipation of energy on the crack surface.
DTIC
Numerical Analysis; Detection; Finite Element Method; Cracks

20000037736 Illinois Univ., Circle Dept. of Mechanical Engineering, Chicago, IL USA
A Finite Element Study of the Geometric Centrifugal Stiffening Effect
Berzeri, Marcello, Illinois Univ., USA; Shabana, Ahmed A., Illinois Univ., USA; Dec. 1999; 44p; In English
Contract(s)/Grant(s): DAAG55-97-1-0303
Report No.(s): AD-A374870; MBS99-5-UIC; ARO-35711.21-EG; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The finite element absolute nodal coordinate formulation is used in this investigation to study the centrifugal stiffening effects on rotating two-dimensional beams. It is demonstrated that the geometric stiffening effects can be automatically accounted for in the above mentioned finite element formulation by using an expression for the elastic forces obtained with a general continuum mechanics approach. The Hill equation that governs the vibration of the rotating beam is obtained in terms of a set of generalized coordinates that describe the beam displacements and slopes. Under the assumption of small deformation, the Hill equation is linearized, and the complete solution is obtained and used to demonstrate analytically that such a solution does not exhibit instabilities as the angular velocity of the beam increases. The results obtained using this finite element procedure are compared with the results reported in the literature.
DTIC
Stiffening; Finite Element Method; Beams (Radiation); Hill Method; Centrifugal Force

20000038236 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
Strong Stability Preserving High-order Time Discretization Methods ***Final Report***
Gottlieb, Sigal, Massachusetts Univ., USA; Shu, Chi-Wang, Institute for Computer Applications in Science and Engineering, USA; Tadmor, Eitan, California Univ., USA; April 2000; 28p; In English
Contract(s)/Grant(s): NAS1-97046; DAAG55-97-I-0318; DAAG55-97-I-0318; F49620-99-I-0077; N00014-I-J-1076; NAG1-2070; NSF ECS-96-27849; NSF DMS-98-04985; NSF ECS-99-06606; NSF INT-96-01084; NSF DMS-97-06827; RTOP 505-90-52-01
Report No.(s): NASA/CR-2000-210093; NAS 1.26:210093; ICASE-2000-15; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this paper we review and further develop a class of strong-stability preserving (SSP) high-order time discretizations for semi-discrete method-of-lines approximations of partial differential equations. Termed TVD (total variation diminishing) time discretizations before, this class of high-order time discretization methods preserves the strong stability properties of first-order Euler time stepping and has proved very useful especially in solving hyperbolic partial differential equations. The new contributions in this paper include the development of optimal explicit SSP linear Runge-Kutta methods, their application to the strong stability of coercive approximations, a systematic study of explicit SSP multi-step methods, and a study of the strong-stability preserving property of implicit Runge-Kutta and multi-step methods.
Author
Time Dependence; Partial Differential Equations; TVD Schemes; Discretization (Mathematics); Numerical Stability; Approximation; Runge-Kutta Method

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STATISTICS AND PROBABILITY

Includes data sampling and smoothing: Monte Carlo method; and stochastic processes.

20000036549 Wright State Univ., Dept. of Mathematics and Statistics, Dayton, OH USA
High Volume Communication Channels: A Mathematical Investigation ***Final Report, 1 Jul. 1996-30 Nov. 1999***
Arasu, K. T.; Feb. 09, 2000; 8p; In English
Contract(s)/Grant(s): F49620-96-1-0328
Report No.(s): AD-A374779; AFRL-SR-BL-TR-00-0057; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Time-discrete one and two-dimensional sequences and arrays with perfect auto correlation functions are studied. Such sequences find applications in signal processing and as aperture functions for electromagnetic and acoustic imaging. Two dimensional perfect arrays are also applicable in 2-D synchronization and time frequency coding. Mathematical tools from algebraic number theory, representation theory and group theory are employed to investigate the theory of their existence leading to new families of these arrays and sane generalizations thereof.
DTIC
Autocorrelation; Synchronism; Acoustic Imaging; Group Theory; Sequencing

20000037703 Syracuse Univ., Electrical Engineering and Computer Science Dept., NY USA
Distributed Detection Theory and Data Fusion ***Final Report, 1 May 1996-30 Sep 1999***
Varshney, Pramod K., Syracuse Univ., USA; Dec. 21, 1999; 12p; In English
Contract(s)/Grant(s): F49620-96-1-0185; AF Proj. 2304
Report No.(s): AD-A374837; AFRL-SR-BL-TR-00-0056; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This report presents a summary of research results obtained during the course of this grant in the area of distributed signal detection and decision fusion. Specifically, distributed detection and estimation with fuzzy information, intelligent CFAR detection, computational algorithms for system design and BDT based signal classification were considered. A brief discussion of these results is provided here. For more details, the reader is referred to the list of published papers.
DTIC
Multisensor Fusion; Research; Detection; Data Transmission

66
SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research. and Operations Research

20000034150 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
The Effects of Display Highlighting and Event History on Operator Decision Making in a National Missile Defense System Application
Smith, Melissa A.; Feb. 15, 2000; 73p; In English
Report No.(s): AD-A374146; AFIT-FY-00-63; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

A proposed display for the National Missile Defense (NMD) task was developed to aid operator decision making. Subjects were required to monitor a simulated battle, consisting of launches of enemy missiles against the US, and counter-launches of defensive missiles against these incoming warheads. Defensive missiles were not perfect at destroying targeted enemy missiles, there was an estimated probability of .20 that a defensive missile will miss its assigned target. The risk associated with the probabilistic outcomes was displayed to the operator as a distribution in part of the display. The counter-launches were accomplished by a tully automated system, with the human operator as a monitor. The subject controlled a pool of reserve missiles (which are limited in number), not included in the system automation, which were deployed when the subject determined that the threat called for such action. Subjects had to make risk- resource tradeoffs concerning the risk associated with the threat and the limited resources of the reserve missiles. Twenty military subjects saw 40, two minute scenarios, with two enemy launches of six missiles each. They were required to respond as to how many reserve missiles they wanted to withdraw at four times during each scenario.
DTIC
Decision Making; Defense Program; Display Devices

20000037824 National Aerospace Lab., Amsterdam, Netherlands
A Framework for the Automation of Air Defence Systems
Choenni, Sunil, National Aerospace Lab., Netherlands; Leijnse, Kees, National Aerospace Lab., Netherlands; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B1-1 - B1-8; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

The need for more efficiency in military organizations is growing. It is expected that a significant increase in efficiency can be obtained by an integration of communication and information technology. This integration may result in (sub)systems that are fully automated, i.e., systems that are unmanned, including unmanned vehicles. In this paper, we focus on the automation of air defence systems! in which integration of communication and information technology is a major issue. We propose an architecture, in which each weapon system has the capability to control itself, whilst act- ing in a co-ordinated manner with other systems. to realise this task, a weapon system is exactly informed about the activities of all other weapon systems. In our architecture, the role of the men is reduced to the supervision of weapon systems.
Author
Air Defense; Automatic Control; Telecommunication; Information Systems

20000037827 Tusas Aerospace Industries, Design and Development Dept., Ankara, Turkey

An Analysis on Operability of Tactical Unmanned Aerial Vehicle Systems over Turkish Territory

Ertem, Ozcan, Tusas Aerospace Industries, Turkey; Mandas, Gokhan, Tusas Aerospace Industries, Turkey; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B5-1 - B5-7; In English; See also 20000037804; No Copyright; Avail: CASI; A02, Hardcopy

The requirements for operational arena of Tactical Unmanned Aerial Vehicles (TUAV) are highly effected with the geographical and weather conditions. A TUAV requirement for a flat terrain with moderate weather over the year varies dramatically from a mountainous terrain with severe weather conditions. Availability of the infrastructure such as airfields, highways is another contributing factor towards the system requirements. Transportability brings another concern when TUAV system is to be deployed by existing aerial assets. This paper evaluates the conditions of Turkish territory and infrastructure; transportability/mobility and therefore tries to approach to the best set of requirements for a TUAV system, with a review of crew and ground vehicles that can operate in Turkish Armed Forces.

Author

Pilotless Aircraft; Turkey; Operational Problems; Geography; Armed Forces

20000037842 General Atomics Aeronautical Systems, Inc., San Diego, CA USA

US Predator Operations: Update

Porter, John C., General Atomics Aeronautical Systems, Inc., USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B24-1 - B24-5; In English; See also 20000037804; Copyright Waived; Avail: CASI; A01, Hardcopy

The U.S. Predator unmanned aerial vehicle system produced by General Atomics Aeronautical Systems. Inc. has completed three extended operational deployments and has recently commenced a fourth deployment in support of United Nations and American operations in Bosnia-Herzegovina. The Predator system has also recently commenced a deployment to a site in Kuwait. Predator provides operational commanders and their intelligence staffs with valuable and timely live imagery and imagery derived intelligence, often not available from any other source. Through the conduct of these deployments, the operational concept to make best use of the real time reconnaissance capability of Predator has continued to evolve. This paper will provide an overview of the system and a description of the operations with a focus on the changes that have occurred since the original deployment in July 1995.

Derived from text

Deployment; Pilotless Aircraft; USA; Operations Research

20000037843 Bundesamt fuer Wehrtechnik und Beschaffung, Koblenz, Germany

Short Range Reconnaissance: The LUNA Experimental UAV Program

Sabarz, Werner, Bundesamt fuer Wehrtechnik und Beschaffung, Germany; Wernicke, Joachim, EMT Ingenieurgesellschaft Dip. Ing. Hartmut Euer m.b.H., Germany; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B25-1 - B25-5; In English; See also 20000037804; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper reports on the background, the performance requirements, technical characteristics, special program features and lessons learned from the LUNA Experimental UAV Program. This program is being funded by the R&D Program of the Bundeswehr. This 18 month effort will be finalized by phase 2 field trials in may/june 1999. Main goals to be proven are, reconnaissance performance in an operational environment and easy handling i.e. mission planning, mission conduct and maintenance. The lessons learned from LUNA so far can be applied to other programs - already today, but also particularly in the future.

Derived from text

Pilotless Aircraft; Aerial Reconnaissance; Aircraft Performance

20000038201 Universities Space Research Association, Columbia, MD USA

NASA Institute for Advanced Concepts *Annual Report, 10 Feb. 1998 - 10 Feb. 1999*

Cassanova, Robert A., Universities Space Research Association, USA; Feb. 10, 1999; 46p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS5-98051; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of NASA Institute for Advanced Concepts (NIAC) is to provide an independent, open forum for the external analysis and definition of space and aeronautics advanced concepts to complement the advanced concepts activities conducted within the NASA Enterprises. The NIAC will issue Calls for Proposals during each year of operation and will select revolutionary advanced concepts for grant or contract awards through a peer review process. Final selection of awards will be with the concurrence of NASA's Chief Technologist. The operation of the NIAC is reviewed biannually by the NIAC Science, Exploration

and Technology Council (NSETC) whose members are drawn from the senior levels of industry and universities. The process of defining the technical scope of the initial Call for Proposals was begun with the NIAC ”Grand Challenges” workshop conducted on May 21-22, 1998 in Columbia, Maryland. These ”Grand Challenges” resulting from this workshop became the essence of the technical scope for the first Phase I Call for Proposals which was released on June 19, 1998 with a due date of July 31, 1998. The first Phase I Call for Proposals attracted 119 proposals. After a thorough peer review, prioritization by NIAC and technical concurrence by NASA, sixteen subgrants were awarded. The second Phase I Call for Proposals was released on November 23, 1998 with a due date of January 31, 1999. Sixty-three (63) proposals were received in response to this Call. On December 2-3, 1998, the NSETC met to review the progress and future plans of the NIAC. The next NSETC meeting is scheduled for August 5-6, 1999. The first Phase II Call for Proposals was released to the current Phase I grantees on February 3,1999 with a due date of May 31, 1999. Plans for the second year of the contract include a continuation of the sequence of Phase I and Phase II Calls for Proposals and hosting the first NIAC Annual Meeting and USRA/NIAC Technical Symposium in NASA HQ.
Author
NASA Space Programs; Research and Development; Aerospace Industry; Technology Utilization

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ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see 45 Environmental Pollution.

20000033826 NASA Glenn Research Center, Cleveland, OH USA
Prediction of Sound Waves Propagating Through a Nozzle Without/With a Shock Wave Using the Space-Time CE/SE Method
Wang, Xiao-Yen, Taitech, Inc., USA; Chang, Sin-Chung, NASA Glenn Research Center, USA; Jorgenson, Philip C. E., NASA Glenn Research Center, USA; March 2000; 18p; In English; 38th; Aerospace Sciences, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS3-97186; RTOP 523-90-33
Report No.(s): NASA/TM-2000-209937; E-12283; NAS 1.15:209937; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The benchmark problems in Category 1 (Internal Propagation) of the third Computational Aeroacoustics (CAA) Work-shop sponsored by NASA Glenn Research Center are solved using the space-time conservation element and solution element (CE/SE) method. The first problem addresses the propagation of sound waves through a nearly choked transonic nozzle. The second one concerns shock-sound interaction in a supersonic nozzle. A quasi one-dimension CE/SE Euler solver for a nonuniform mesh is developed and employed to solve both problems. Numerical solutions are compared with the analytical solution for both problems. It is demonstrated that the CE/SE method is capable of solving aeroacoustic problems with/without shock waves in a simple way. Furthermore, the simple nonreflecting boundary condition used in the CE/SE method which is not based on the characteristic theory works very well.
Author
Sound Waves; Wave Propagation; Nozzles; Numerical Analysis; Shock Wave Interaction; Supersonic Nozzles

20000034025 Joint Inst. for Advancement of Flight Sciences, Washington, DC USA
Aeroacoustics Research Program in JIAFS *Final Report*
Myers, Michael K., Joint Inst. for Advancement of Flight Sciences, USA; [2000]; 21p; In English
Contract(s)/Grant(s): NCC1-14; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents a final report on Aeroacoustics Research Program in JIAFS (Joint Institute For Advancement of Flight Sciences). The objectives of the program were to conduct research at the NASA Langley Research Center and to provide a comprehensive education program at the Center leading to advanced degrees in aeroacoustics.
Derived from text
Aeroacoustics; Education

20000034048 Army Research Lab., Sensors and Electron Devices Directorate, Adelphi, MD USA
Efficient Maximum Likelihood Estimation for Multiple and Coupled Harmonics *Final Report, Sep. 1997 - Mar. 1998*
Lake, Douglas, Army Research Lab., USA; Dec. 1999; 41p; In English
Contract(s)/Grant(s): AF Proj. AH16
Report No.(s): AD-A372834; ARL-TR-2014; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The maximum likelihood estimates (MLEs) and Cramer-Rao bounds (CRBs) for parameters of harmonics in Gaussian noise have been well studied. If the phase of the signal is defined in the middle of the time interval rather than at the beginning (as is more common), the information matrix is approximately diagonal, and the formulation and analysis of the MLEs and CRBs are simplified. More significantly, this simple modification decouples the estimation of phase and frequency and leads to efficient MLE gradient descent algorithms. In this report, these MLE procedures and CRB analysis are presented for the multiple and coupled harmonic case, as well as for colored noise. A new criterion on the required sample size is presented to give uniform bounds on the accuracy of diagonal information matrix approximation; uniform bounds are needed to ensure the effectiveness of the gradient descent methods. These methods are demonstrated on real data from battlefield acoustic sensors, where they can be used to help identify targets of interest, such as tanks or trucks.
DTIC
Maximum Likelihood Estimates; Harmonics; Signal Processing; Target Recognition; Signal Detectors; Acoustics

20000034261 Clarkson Univ., Dept. of Mechanical and Aeronautical Engineering, Potsdam, NY USA
Jet Mixing Enhancement by Feedback Control ***Final Report, 1 Jan. - 31 Dec. 1999***
Glauser, Mark, Clarkson Univ., USA; Taylor, Jeffrey, Clarkson Univ., USA; [1999]; 22p; In English
Contract(s)/Grant(s): NCC1-325; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this work has been to produce methodologies for high speed jet noise reduction based on natural mechanisms and enhanced feedback control to affect frequencies and structures in a prescribed manner. In this effort the two-point hot wire measurements obtained in the Langley jet facility by Ukeiley were used in conjuction with linear stochastic estimation (LSE) to implement the LSE component of the complementary technique. This method combines the Proper Orthogonal Decomposition (POD) and LSE to provide an experimental low dimensional time dependent description of the flow field. From such a description it should be possible to identify short time high strain rate events in the jet which contribute to the noise. The main task completed for this effort is summarized: LSE experiments were performed at the downstream locations where the two point hot wire measurements have been obtained by Ukeiley. These experiments involved sampling simultaneously hot wire signals from a relatively course spatial grid in gamma and theta. From this simultaneous data, coupled with the two-point measurements of Ukeiley via the LSE components of the complementary technique, an experimental low dimensional description of the jet at 4, 5, 6, 7 and 8 diameters downstream was obtained for Mach numbers of 0.3 and 0.6. We first present an overview of the theory involved. We finish up with a statement of the work performed and finally provide charts from a 1999 APS talk which summarizes the results.
Derived from text
Feedback Control; Jet Aircraft Noise; Jet Mixing Flow; Noise Reduction; Fluid Jets; Augmentation

20000034268 Science Applications International Corp., San Diego, CA USA
Multi-Sensor Data Fusion Project ***Final Report, 26 Jul. 1996-28 Feb. 2000***
LeBras, Robert J.; Feb. 28, 2000; 81p; In English
Contract(s)/Grant(s): DASG60-96-C-0151
Report No.(s): AD-A374102; SAIC-00/3003; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Comprehensive Nuclear Test-Ban Treaty (CTBT) calls for the establishment of networks of seismic, hydroacoustic, infrasonic, and radionuclide sensors to monitor the earth for unannounced underground, underwater, and atmospheric nuclear tests. Seismic processing at the prototype International Data Center (pIDC) has been operating continuously since the GSETT-3 experiment that started in late 1994. Seismic is the most mature of the four monitoring technologies in automatic processing and interactive analysis. The other three technologies are in an earlier stage of development and evaluation. Since late 1996, efforts have been made under the Multi-Sensor Data Fusion project funded by the Defense Threat Reduction Agency (DTRA) to integrate hydroacoustic and infrasonic monitoring technologies into the existing pIDC automatic processing and interactive review framework. Signal processing of hydroacoustic and infrasonic waveform data was integrated into the pIDC monitoring system, and network processing was enhanced to include two hydroacoustic phase types, H-phase (in-water generated) and T-phase (underground generated) and one additional infrasound phase, I. A joint bulletin including the three waveform technologies is produced at the pIDC on a continuous basis. The bulletin includes arrivals from natural and man-made events recorded by all three sensor types. Enhancements have been made to the travel-time handling system to take into account temporal variations which may be significant for both acoustic technologies. When no specific travel time tables are available for a station, a default constant velocity model is used which makes the software ready for network expansion in the three waveform technologies. Case studies,

network simulations and results from the pIDC operational system were used to normalize and evaluate the capability of data fusion in the pIDC monitoring system.
DTIC
Underwater Acoustics; Multisensor Applications; Signal Processing; Underwater Tests; Underground Explosions

20000036519 Naval Postgraduate School, Monterey, CA USA
Pritchard's Approximation in Array Modeling, *Apr.-Sep. 1999*
Scandrett, Clyde L.; Baker, Steven R.; Dec. 1999; 29p; In English
Contract(s)/Grant(s): N00014-99-WR-30167
Report No.(s): AD-A374851; NPS-UW-99-001; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An investigation into the applicability and accuracy of Pritchard's approximation for closely packed transducer arrays is undertaken. A new, modal Pritchard approximation is developed, based upon normal modes of the acoustic medium, and is tested for arrays of acoustically hard spheres to ascertain its accuracy in determining the mutual acoustic radiation impedance between array elements. For ka=1, it is found that the modal Pritchard approximation works quite well in approximating the mutual radiation impedance of a two element array, even for relatively close spacing, but for arrays of three or more scatterers in close proximity, the approximation may have relatively large errors. The effect of neglecting inter-element scattering is analyzed for the monopole to monopole scattering of various configurations of a three element array and a sixteen element double line array.
DTIC
Underwater Acoustics; Sound Waves; Transducers; Impedance

20000036539 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
Active Shielding and Control of Environmental Noise
Loncaric, J.; Ryabenkii, V. S.; Tsynkov, S. V.; Feb. 2000; 31p; In English
Contract(s)/Grant(s): NAS1-97046
Report No.(s): AD-A374658; ICASE-2000-9; NASA-CR-2000-209862; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present a mathematical framework for the active control of time-harmonic acoustic disturbances. Unlike many existing methodologies, our approach provides for the exact volumetric cancellation of unwanted noise in a given predetermined region of space while leaving unaltered those components of the total acoustic field that are deemed as friendly. Our key finding is that for eliminating the unwanted component of the acoustic field in a given area, one needs to know relatively little; in particular, neither the locations nor structure nor strength of the exterior noise sources needs to be known. Likewise, there is no need to know the volumetric properties of the supporting medium across which the acoustic signals propagate, except, maybe, in the narrow area of space near the boundary (perimeter) of the domain to be shielded. The controls are built based solely on the measurements performed on the perimeter of the region to be shielded; moreover, the controls themselves (i.e., additional sources) are concentrated also only near this perimeter. Perhaps as important, the measured quantities can refer to the total acoustic field rather than to its unwanted component only, and the methodology can automatically distinguish between the two. In the paper, we construct a general solution to the aforementioned noise control problem. The apparatus used for deriving the general solution is closely connected to the concepts of generalized potentials and boundary projections of Calderon's type. For a given total wave field, the application of Calderon's projections allows us to definitively split between its incoming and outgoing components with respect to a particular domain of interest, which may have arbitrary shape. Then, the controls are designed so that they suppress the incoming component for the domain to be shielded or alternatively, the outgoing component for the domain, which is complementary to the one to be shielded.
DTIC
Numerical Integration; Signal Transmission; Acoustics; Active Control; Sound Waves

20000037778 NASA Langley Research Center, Hampton, VA USA
Large Eddy Simulation of the Sound Emission from Unsteady Flow Separation *Final Report*
Piomelli, Ugo, Maryland Univ., USA; [2000]; 3p; In English
Contract(s)/Grant(s): NAG1-1880; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This research aimed at applying calculating the sound emission from a driven cavity using LES (Large Eddy Simulation).
Derived from text
Acoustic Emission; Large Eddy Simulation; Unsteady Flow; Boundary Layer Separation

20000038209 NASA Langley Research Center, Hampton, VA USA

Flight Test Measurements From The TU-144LL Structure/Cabin Noise Follow-On Experiment

Rizzi, Stephen A., NASA Langley Research Center, USA; Rackl, Robert G., Boeing Co., USA; Andrianov, Eduard V., ANTK Tupolev, Russia; February 2000; 108p; In English; Original contains color illustrations

Contract(s)/Grant(s): RTOP 537-06-37-20

Report No.(s): NASA/TM-2000-209859; L-17951; NAS 1.15:209859; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This follow-on flight experiment on the TU-144LL Supersonic Flying Laboratory, conducted during the period September 1998 to April 1999, was a continuation of previous Structure/Cabin Noise Experiment 2.1. Data was obtained over a wide range of altitudes and Mach numbers. Measured were: turbulent boundary layer pressure fluctuations on the fuselage over its length; structural response on skin panels using accelerometers; and flow direction over three windows using 'flow cones'. The effect of steps in the flow was also measured using two window blank pairs; each pair bridged by a plate which created small sharp forward and aft facing steps. The effect of transducer flushness with the exterior surface was also measured during flight. Height test points were chosen to cover much of the TU-144's flight envelope, as well as to obtain as large a unit Reynolds number range as possible at various Mach numbers: takeoff, subsonic, transonic, and supersonic cruise conditions up to Mach 2. Data on engine runups and background noise were acquired on the ground. The data in the form of time histories of the acoustic signals, together with auxiliary data and basic MATLAB processing modules, are available on CD-R disks.

Author

Flight Tests; TU-144 Aircraft; Aircraft Noise; Acceleration Measurement; Aircraft Structures

20000038213 NASA Langley Research Center, Hampton, VA USA

Flight Test Measurements From The TU- 144LL Structure/Cabin Noise Experiment

Rizzi, Stephen A., NASA Langley Research Center, USA; Rackl, Robert G., Boeing Co., USA; Andrianov, Eduard V., ANTK Tupolev, Russia; 20000101; 206p; In English

Contract(s)/Grant(s): RTOP 537-06-37-20

Report No.(s): NASA/TM-2000-209858; NAS 1.15:209858; L-17950; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

During the period September 1997 to February 1998, the Tupolev 144 Supersonic Flyine Laboratory was used to obtain data for the purpose of enlarging the data base used by models for the prediction of cabin noise in supersonic passenger airplanes. Measured were: turbulent boundary layer pressure fluctuations on the fuselage in seven instrumented window blanks distributed over the length of the fuselage; structural response with accelerometers on skin panels close to those window blanks-, interior noise with microphones at the same fuselage bay stations as those window blanks. Flight test points were chosen to cover much of the TU- 144's flight envelope, as well as to obtain as large a unit Reynolds number range as possible at various Mach numbers: takeoff, landing, six subsonic cruise conditions, and eleven supersonic conditions up to Mach 2. Engine runups and reverberation times were measured with a stationary aircraft. The data in the form of time histories of the acoustic signals, together with auxiliary data and basic MATLAB processing modules, are available on CD-R disks.

Author

Flight Tests; Tupolev Aircraft; Aircraft Noise; Acceleration Measurement; Supersonic Aircraft; Aircraft Structures

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ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

20000033978 Office of Atomic Energy for Peace, Bangkok, Thailand

Proceedings of the Nuclear Science and Technology Conference

Dec. 31, 1998; 751p; In English; 7th, 1-2 Dec. 1998, Bangkok, Thailand

Report No.(s): DE99-633359; INIS-TH-007; No Copyright; Avail: Department of Energy Information Bridge

The 7. conference on nuclear science and technology was held on 1-2 December 1998 in Bangkok. This conference contain papers on non-power applications of nuclear technology in medicine, agriculture and industry. These application include irradiation of food for disinfestation; tram technologies used in diagnosis and therapy and radiation chemistry important to industrial processes. Some technologies which evolved from the development of nuclear power industry are also discussed.

NTIS

Conferences; Nuclear Medicine; Research and Development; Technologies

20000034050 Orion International Technologies, Albuquerque, NM USA

Chemical Processes in the Space Environment ***Final Report***

Williams, Skip, Orion International Technologies, USA; Levandier, Dale J., Orion International Technologies, USA; Jul. 29, 1999; 117p; In English

Contract(s)/Grant(s): F19628-94-C-0072; AF Proj. 2303

Report No.(s): AD-A372855; AFRL-VS-TR-1999-1523; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy

The present report discusses a series of ion-neutral collision experiments conducted in direct collaboration between Orion researchers and USAF customer affiliated sequentially with: PL/WSSI, PL/GPID, PL/GPOS, AFRL/VSBM, AFRL/VSBS. The work addresses hyperthermal chemical processes of importance in the space environment. The reaction between ionospheric ions and water were studied in detail as to the potential source of infrared radiation and ionospheric holes. New experiments were developed to study the reactions of atmospheric ions with metal vapors and to investigate metastable formation in the nonequilibrium environments of supersonic jets. The energy dependence of atmospheric ion + Na charge-transfer reactions were measured using a novel high-temperature octopole for which a US patent was granted. The results were transitioned to a model of atmospheric, meteoric metal layers. The methodology was developed to elucidate molecular ion excited state surface topography using photofragment recoil velocity analysis in an octopole ion guide.

DTIC

Space Processing; Aerospace Environments; Chemical Reactions; Charge Transfer; Ions; Metal Vapors; Molecular Ions

20000034923 International Atomic Energy Agency, International Nuclear Data Committee, Vienna, Austria

Cross section data for electron-impact inelastic processes of vibrationally excited hydrogen molecules and their isotopes

Celiberto, R.; Laricchiuta, A.; Capitelli, M.; Janev, R. K.; Wadehra, J. M.; Jun. 30, 1999; 255p; In English

Report No.(s): DE99-634322; INDC(NDS)-397; No Copyright; Avail: Department of Energy Information Bridge

An extensive cross section database for the electron-impact inelastic processes of vibrationally excited hydrogen molecules and their isotopes is presented. The following inelastic processes are covered: electronic excitation (dissociative and non-dissociative), direct ionization (dissociative and non-dissociative), excitation-radiative decay vibrational excitation and dissociation, dissociative electron attachment and resonant capture - vibrational excitation. The data have been compiled partly from the literature and partly generated theoretically for the present report. The data are presented in both tabular and graphical form. The data are also presented by sufficiently accurate analytic fit functions. Mass-scaling relations are provided for cross section evaluation of those isotope molecules for which calculated data are not available.

NTIS

Vibrational States; Electron Impact; Atomic Physics; Inelastic Scattering

20000034927 Hertfordshire Univ., Dept. of Physical Sciences, Hatfield, UK

Detection of Polarized MM and Sub-MM Emission From SGR A*

Aitken, D. K., Hertfordshire Univ., UK; Greaves, J., Joint Astronomy Centre, USA; Chrysostomou, Antonio, Hertfordshire Univ., UK; Jenness, T., Joint Astronomy Centre, USA; Holland, W., Joint Astronomy Centre, USA; Hough, J. H., Hertfordshire Univ., UK; Pierce-Price, D., Cavendish Lab., USA; Richer, J., Cavendish Lab., USA; Mar. 24, 2000; 18p; In English; Sponsored in part by the Netherlands OSR; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We report the detection of linear polarization from Sgr A* at 750, 850, 1350 and 2000 microns which confirms the contribution of synchrotron radiation. From the lack of polarization at longer wavelengths it appears to arise in the millimetre/sub-millimetre excess. There are large position angle changes between the millimetre and sub-millimetre results and these are discussed in terms of a polarized dust contribution in the submillimetre and various synchrotron models. In the model which best explains the data the synchrotron radiation from the excess is self-absorbed in the millimetre region and becomes optically thin in the sub-millimetre. This implies that the excess arises in an extremely compact source approx. 2 Schwarzschild radii.

Author

Millimeter Waves; Submillimeter Waves; Detection; Linear Polarization

20000036547 Florida International Univ., Dept. of Physics, Miami, FL USA

Controlling Electron Transfer through Single Molecules ***Final Report, 1 Jul. 1996-31 Dec. 1998***

Tao, Nongjian; Dec. 31, 1999; 13p; In English

Contract(s)/Grant(s): F49620-96-1-0346; AF Proj. 2305

Report No.(s): AD-A374725; AFRL-SR-BL-TR-00-0051; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This project is aimed at probing electron transfer through a single molecule sandwiched between two electrodes (”source” and ”drain”) in an electrolyte. The electron flow is controlled by the bias voltage between the electrodes, the separations between molecule and the electrodes as well as by a third electrode (”gate”) inserted into the electrolyte. The long-term goal of this project is to develop transistors and switches based on single molecules. Since transistors and switches are central components in every electronic circuit and devices based on single molecules are several orders of magnitude smaller than current semiconductor transistors, this project may lead to the ultimate miniaturization of analog and digital circuitry.
DTIC
Semiconductor Devices; Electron Transfer; Electric Potential; Semiconductors (Materials)

20000038199 Columbia Univ., New York, NY USA
17th Conference on the Dynamics of Molecular Collision held in Lake Harmony, Pennslyvania on 18-23 July 1999 ***Final Report, 1 May - 31 Aug. 1999***
Valentini, James J.; Feb. 25, 2000; 167p; In English; 17th; Dynamics of Molecular Collision, 18-23 Jul. 1999, Lake Harmony, PA, USA
Contract(s)/Grant(s): F49620-99-1-0225
Report No.(s): AD-A374282; AFRL-SR-BL-TR-00-0046; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
This was the seventeenth edition of the Conference on the Dynamics of Molecular Collisions, which initially concentrated on molecular beams research but soon was broadened. Financial support for the conference was provided by the U.S. Air Force Office of Scientific Research and Lambda Physic. Administrative support has been contributed by Columbia University. Printing of the meeting program was contributed by Brookhaven Science Associates, operators of Brookhaven National Laboratory under contract with the U.S. Department of Energy.
DTIC
Conferences; Molecular Collisions; Particle Collisions; Atomic Collisions; Molecular Beams; Atomic Beams

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NUCLEAR PHYSICS

20000034116 Grand Accelerator National d’Ions Lourds, Caen, France
Research at GANIL. A compilation 1996-1997
Balanzat, E.; Bex, M.; Galin, J.; Geswend, S.; Dec. 31, 1998; 189p; In English
Report No.(s): DE99-634862; INIS-FR-044; No Copyright; Avail: Department of Energy Information Bridge
The present compilation gives an overview of experimental results obtained with the GANIL facility during the period 1996-1997. It includes nuclear physics activities as well as interdisciplinary research. The scientific domain presented here extends well beyond the traditional nuclear physics and includes atomic physics, condensed matter physics, nuclear astrophysics, radiation chemistry, radiobiology as well as applied physics. In the nuclear physics field, many new results have been obtained concerning nuclear structure as well as the dynamics of nuclear collisions and nuclear disassembly of complex systems. Results presented deal in particular with the problem of energy equilibration, timescales and the origin of multifragmentation. Nuclear structure studies using both stable and radioactive beams deal with halo systems, study of shell closures far from stability, the existence of nuclear molecules as well as measurements of fundamental data s half lives, nuclear masses, nuclear radii, quadrupole and magnetic moments. In addition to traditional fields of atomic and solid state physics, new themes such as radiation chemistry and radiobiology are progressively being tackled.
NTIS
Nuclear Structure; Nuclear Astrophysics; Atomic Physics; Radiation Chemistry

20000034173 Nuclear Energy Agency, Issy-les-Moulineaux, France
Status of pseudo-fission-product cross-sections for fast reactors
Gruppelaar, H.; Pijlgroms, B. J.; Kloosterman, J. L.; Rimpault, G.; Kawai, M.; Dec. 31, 1998; 106p; In English
Report No.(s): DE99-633384; NEA-WPEC-17; ECN-R-98-014; No Copyright; Avail: Department of Energy Information Bridge
Within the framework of the Subgroup 17 (SG17) benchmark organized by a Working Party of the Nuclear Science Committee of the Nuclear Energy Agency (FR) , a comparison of lumped or pseudo-fission-product cross-sections for fast reactors has been made. Several parameters have been compared: the one- group cross-sections and reactivity worths of the

lumped nuclide for several partial absorption and scattering cross-sections, and the one-group cross sections of individual fission products. Graphs of the multi-group cross-sections and those of capture cross-sections for 27 nuclides have also been compared.
NTIS
Fission Products; Absorption Cross Sections; Fast Nuclear Reactors; Nuclear Physics

20000034174 Nuclear Energy Agency, Issy-les-Moulineaux, France
Effects of shape differences in the level densities of three formalisms on calculated cross-sections
Fu, C. Y.; Larson, D. C.; Dec. 31, 1998; 39p; In English
Report No.(s): DE99-633383; NEA-WPEC-16; No Copyright; Avail: Department of Energy Information Bridge

Effects of shape differences in the level densities of three formalisms on calculated cross-sections and particle emission spectra are described. Reactions for incident neutrons up to 20 MeV on (sup 58)Ni are chosen for illustrations. Level density parameters for one of the formalisms are determined from the available neutron resonance data for one residual nuclide in the binary channels and from fitting the measured (n,n'), (n,p) and (n, (alpha)) cross-sections for the other two residual nuclides. Level density parameters for the other two formalisms are determined such that they yield the same values as the above one at two selected energies. This procedure forces the level densities from the three formalisms used for the binary pat of the calculation to be as close as possible. The remaining differences are in their energy dependences (shapes). It is shown that these shape differences alone are enough to cause the calculated cross-sections and particle emission spectra to be different by up to 60%.
NTIS
Scattering Cross Sections; Shapes; Energy Levels; Flux Density; Nuclear Physics

20000034176 Nuclear Energy Agency, Issy-les-Moulineaux, France
Nuclear models to 200 MeV for high-energy data evaluations, Volume 12
Chadwick, M.; Reffo, G.; Dunford, C. L.; Oblozinsky, P.; Dec. 31, 1998; 19p; In English
Report No.(s): DE99-633381; NEA-WPEC-12; No Copyright; Avail: Department of Energy Information Bridge

The work of the Nuclear Energy Agency's Subgroup 12 is described, which represents a collaborative effort to summarize the current status of nuclear reaction modelling codes and prioritize desired future model improvements. Nuclear reaction modelling codes that use appropriate physics in the energy region up to 200 MeV are the focus of this study, particularly those that have proved useful in nuclear data evaluation work. This study is relevant to developing needs in accelerator-driven technology programs, which require accurate nuclear data to high energies for enhanced radiation transport simulations to guide engineering design.
NTIS
Nuclear Models; Nuclear Physics

20000034177 Nuclear Energy Agency, Issy-les-Moulineaux, France
Evaluation of (sup 242)Pu data for the incident neutron energy range 5-20 MeV
Tudora, A.; Dec. 31, 1998; 119p; In English
Report No.(s): DE99-633380; NEA-SEN-NSC-WPPR-98-1; JEF/DOC-768; No Copyright; Avail: Department of Energy Information Bridge

Models, procedures and parameters are presented for the calculation of neutron cross sections, the neutron angular distributions and the neutron energy distributions of (sup 242)Pu in the energy range 5-20 MeV. The interaction takes place through direct interaction and compound nucleus mechanism. For heavy deformed nucleus the direct interaction was treated with the coupled channel process, using the ECIS code. For the compound nucleus mechanism, a statistical treatment was used for fission, neutron elastic and inelastic scattering, radiative capture, (n,2n), (n,3n), (n,4n) cross section calculations, using the GNASH code.
NTIS
Nuclear Physics; Neutron Distribution; Plutonium

20000034178 Lyon-1 Univ., Lyon, France
Study of the reactions resulting in heavy fragment formation in the collisions (sup 40)Ar + Cu, Ag and Au at 8 to 115 MeV/u
Colin, E. Y.; Nov. 06, 1998; 163p; In French; In English
Report No.(s): DE99-633378; LYCEN-T-9894; No Copyright; Avail: Department of Energy Information Bridge

This work concerns the study of nuclear collisions showing a heavy fragment in (sup 40)Ar + Cu, Ag and Au from 8 A MeV to 115 A MeV. The reactions are classified by centrality or collision violence via the multiplicity of charged particles detected in a 4(pi) array. For the most peripheral reactions (low multiplicities) we always find a projectile-like fragment with velocity near

to that of the beam and a heavy target-like fragment with very small velocity. For the more central collisions we find the well-known incomplete fusion reactions at 17 and 27 A MeV. Above 27 A MeV two groups of very dissipative reactions are observed, both with high charged particle multiplicities. The first reaction group forms several fragments with Z (<=) 10 and average longitudinal velocity near to that of c.m. These are very rare, and are found only for the highest 1% of multiplicities. They produce a heavy fragment and a forward spray ((theta)(<=)60 angle) of particles with charge going from 1 to (approx-equal) 13. The momentum carried out by the spray is randomly spread over all the particles. In spite of the increase of momentum carried by this spray with increasing beam energy, a heavy emission source is formed with 1 - 2 GeV of excitation energy. After a phase of expansion, especially signaled by Z = 1 particles, this source then evaporates many particles. Finally we observed the remaining heavy residual nucleus.
NTIS
Fragments; Particle Collisions; Nuclear Physics

20000034924 International Atomic Energy Agency, International Nuclear Data Committee, Vienna, Austria
Fission rate determination in delayed neutron emission measurements with T(p,n) and D(d,n) neutrons
Piksaikin, V. M.; Shorin, V. S.; Tertytchnyi, R. G.; Aug. 31, 1999; 15p; In English
Report No.(s): DE99-634321; INDC(CCP)-422; No Copyright; Avail: Department of Energy Information Bridge

A method for accurate measurement of the fission rate in the samples irradiated by neutrons from the T(p,n)(sup 3) He and D(d,n)(sup 3) He reactions is described. The method is based on the measurements of the fission rate in two fission chambers placed in the vicinity of the sample and Monte-Carlo calculations of fission rates in the sample and in the chambers' fissionable layers. The Monte-Carlo calculations employ a neutron source procedure taking into account most of the factors influencing on the neutron spectra characteristics in conditions of a real experiment. An experimental procedure developed for testing the proposed method is discussed. The performance of the method is demonstrated by the results obtained in the measurements of the total delayed neutron yields from neutron induced fission of (sup 237)Np and (sup 235) U.
NTIS
Neutron Emission; Fission; Nuclear Physics

20000036568 NASA Marshall Space Flight Center, Huntsville, AL USA
Atomic-Based-Combined-Cycle Analysis
Han, Sam, NASA Marshall Space Flight Center, USA; Bai, Don, NASA Marshall Space Flight Center, USA; Schmidt, George, NASA Marshall Space Flight Center, USA; [2000]; 2p; In English; 36th, 16-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Atomic-based-combined-cycle (ABCC) engine combines an air-breathing ramjet engine with an atomic reactor to increase the mission-averaged specific impulse and thereby increasing the dry-mass ratio. ABCC engine is similar to RBCC engine except that energy needed for the propulsive power is derived from nuclear reaction rather than chemical combustion used in the RBCC engine. The potential performance improvement of an ABCC engine over a RBCC engine comes from two factors. Firstly, the energy density of nuclear reaction is several order of magnitudes higher than the chemical combustion. Secondly, hydrogen can produce much higher nozzle exit velocity because of its small molecular weight. A one-dimensional, transient numerical model was used to analyze a generic scramjet engine and it is used as a baseline to evaluate an imaginary ABCC engine performance. A nuclear reactor is treated as a black box energy source that replaces the role of the primary rocket and the chemical combustion chamber in a RBCC engine. Hydrogen is heated by the reactor and accelerated to produce high-speed ejection velocity. The ejection velocity up 10,000 m/sec is theoretically possible because of high energy density from the reactor and large gas constant of the hydrogen. Oxygen contained in the entrained air reacts with hydrogen and produces propulsive power for ejector mode operation. to provide enough thrust for initial acceleration, relatively large amount of hydrogen must be pumped through the reactor. Amount of oxygen contained in the entrained air may not be sufficient to burn all hydrogen and consequently combustion could occur at the end of exit nozzle. It is assumed that this combustion process is constant-pressure combustion at 1.0 atmospheric pressure and thus not affects the nozzle exit condition.
Author
Supersonic Combustion Ramjet Engines; Combined Cycle Power Generation; Electric Generators; Air Breathing Engines

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OPTICS

Includes light phenomena; and optical devices. For lasers see 36 Lasers and Masers.

20000033934 LOTS Technology, Inc., Sunnyvale, CA USA
Optical Head Design for 1TB Optical Tape Drive
Manavi, Mahdad, LOTS Technology, Inc., USA; Wegner, Aaron, LOTS Technology, Inc., USA; Shu, Qi-Ze, LOTS Technology, Inc., USA; Cheng, Yeou-Yen, LOTS Technology, Inc., USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 265-278; In English; See also 20000033909; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A multi-channel Optical Head has been developed to be incorporated with an Optical Tape Drive that enables greater than 1 TB capacity and greater than 25 MB/s data transfer rate on a 0.5 mil thick, 0.5 inch wide optical tape that fits in a 3480 style cartridge. The optical design has been optimized to perform at 532 nm with maximum through put in the write path. With use of a 0.6 NA objective lens, sub-micron size marks can be written on a WORM type phase change medium. A single laser, a hologram, and a multichannel modulator increase reliability and manufacturability of this design.
Author
Optical Data Storage Materials; Recording Heads; Data Transfer (Computers); Computer Compatible Tapes

20000033936 Sadashige Associates, Inc., Voorhees, NJ USA
Optical Recording and Recordable DVD Overview
Sadashige, Koichi, Sadashige Associates, Inc., USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 295-312; In English; See also 20000033909; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The entire DVD infrastructure is being driven by the large commercial business. Continuing technology advances are assured because of the rapidly growing markets demanding higher performance and feature-packed products. DVD-RAM is an attractive data storage technology, offering a high data capacity per unit volume, with expected storage life of 60 years or longer. It could potentially displace magnetic tape in certain applications. Magneto-Optical recording, while making steady progress in data storage density, is used in the data storage area only, lacking the support enjoyed by DVD from the consumer industry. It can record faster than DVD, and is certain to maintain its place in the overall data storage infrastructure. Write-once technology, represented by CD-R and DVD-R, is developing a unique position in both private life and business environs. It is a replacement for paper-based notebooks, log books, ledgers, and a convenient and low cost storage for music and pictures.
Derived from text
Optical Data Storage Materials; Data Recording

20000034233 California State Univ., Hayward, CA USA
Gravitational and Optical Effects on Perceived Location and Orientation ***Final Report, 1 Jul. 1995 - 3 Jun. 1998***
Stoper, Arnold E., California State Univ., USA; [1999]; 6p; In English
Contract(s)/Grant(s): NCC2-529; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper presents a final technical report on Gravitational and Optical effects on Perceived Location and Orientation. Included are abstracts of these studies.
CASI
Abstracts; Gravitational Effects; Position (Location); Visual Perception

20000034857 NASA Marshall Space Flight Center, Huntsville, AL USA
Development of Constellation-X Optics Technologies at MSFC
Ramsey, B. D., NASA Marshall Space Flight Center, USA; ODell, S. L., NASA Marshall Space Flight Center, USA; Jones, W. D., NASA Marshall Space Flight Center, USA; Smith, W. S., NASA Marshall Space Flight Center, USA; Engelhaupt, D., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English, 13-22 Feb. 2000, Yamagata, Japan; No Copyright; Avail: Issuing Activity; Abstract Only

One of the major technological challenges for the Constellation X-ray Mission is the development of light-weight, high-resolution, grazing-incidence optics. NASA's Marshall Space Flight Center is developing and evaluating candidate technologies, based upon full-shell replication off precision mandrels. Here we report on recent progress in meeting the weight

and imaging-performance requirements, using very thin, high- strength electroformed nickel alloys, In addition, we briefly describe MSFC's optics fabrication, metrology, and x-ray test facilities.
Author
Constellations; X Rays; Optical Equipment; Imaging Techniques; Fabrication

20000034933 NASA Langley Research Center, Hampton, VA USA
Raman Shifting a Tunable ArF Excimer Laser to Wavelengths of 190 to 240 nm With a Forced Convection Raman Cell
Balla, R. Jeffrey, NASA Langley Research Center, USA; Herring, G. C., NASA Langley Research Center, USA; April 2000; 54p; In English
Contract(s)/Grant(s): RTOP 522-31-61-01
Report No.(s): NASA/TM-2000-209710; NAS 1.15:209710; L-17909; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Tunable radiation, at ultraviolet wavelengths, is produced by Raman shifting a modified 285-mJ ArF excimer laser. Multiple Stokes outputs are observed in H2, CH4, D2, N2, SF6, and CF4 (20, 22, 53, 21, 2.1, and 0.35 percent, respectively). Numbers in parentheses are the first Stokes energy conversion efficiencies. We can access 70 percent of the frequency range 42000-52000 cm (exp -1) (190-240 nm) with Stokes energies that vary from 0.2 microJoule to 58 mJ inside the Raman cell. by using 110 mJ of pump energy and D 2 , the tunable first Stokes energy varies over the 29-58 mJ range as the wavelength is tuned over the 204-206 nm range. Dependence on input energy, gas pressure, He mixture fraction, and circulation of the gas in the forced convection Raman cell is discussed; Stokes conversion is also discussed for laser repetition rates from 1 to 100 Hz. An empirical equation is given to determine whether forced convection can improve outputs for a given repetition rate.
Author
Tunable Lasers; Argon; Fluorides; Forced Convection; Raman Spectra; Frequency Ranges

20000036594 Alabama Univ., Propulsion Research Center, Huntsville, AL USA
Measurement of Injector Face Temperature Using Optical Diagnostic Techniques ***Final Report, 30 Jun. - 30 Sep. 1998***
Moser, Marlow D., Alabama Univ., USA; [1999]; 8p; In English
Contract(s)/Grant(s): NAS8-97095; NASA Order H-28520-D; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A CCD camera was previously set up to record infrared images of the injector face of a small rocket combustor. Good semi-quantitative results were obtained but it was found that non-linearities in the camera system made accurate determinations of temperature difficult. A Pulnix CCD camera was purchased and calibrated. The system was calibrated for temperatures between 500 and 850 C. The best filter to use was found to be a BG850 glass filter. The actual calibrations are presented in the report. The system was to be used on a hydrogen oxygen system but the tests did not take place as scheduled. Attempts were made with a methane oxygen system but the carbon in the system interfered with the viewing of the injector face.
Author
Temperature Measurement; Injectors; Infrared Imagery; CCD Cameras; Calibrating

20000036609 NASA Goddard Space Flight Center, Greenbelt, MD USA
Design and Flight Testing of an Inflatable Sunshield for the NGST
Adams, Michael L., NASA Goddard Space Flight Center, USA; Culver, Harry L., NASA Goddard Space Flight Center, USA; Kaufman, David M., NASA Goddard Space Flight Center, USA; Pacini, Linda K., NASA Goddard Space Flight Center, USA; Sturm, James, NASA Goddard Space Flight Center, USA; Lienard, Sebastien, Universities Space Research Association, USA; 20000403; 10p; In English; 41st; Structures, Structural Dynamics and Materials Conference and Exhibit, 3-6 Apr. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-1797; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Next Generation Space Telescope (NGST) mission is scheduled to launch in 2007 and be stationed at L2 for a mission life of ten years. The large aperture mirror and optical detectors aboard NGST require shielding from the constant solar energy seen at this orbit. The government reference NGST design, called the Yardstick, baselined a sunshield using an inflation deployment system. During the formulation phase, NGST is spending approximately 25% of the overall budget to foster the development of new technology. The goal is to develop and demonstrate enabling or enhancing technology and provide innovative solutions for the design of the NGST observatory. Inflatable technology falls in the category of enhancing technology due to its advantages in weight, stowed volume and cost. The Inflatable Sunshield in Space (ISIS) flight experiment will provide a realistic space flight demonstration of an inflatable sunshield. The supporting technology development program will provide an information base for the design, manufacture, assembly and testing of large thin membranes and inflatable structural elements for space structures. The ISIS experiment will demonstrate the feasibility of using inflatable technology to passively cool optical

systems for NGST and provide correlation between analytical predictions and on orbit results. The experiment will be performed on a Hitchhiker/Space Shuttle mission in late 2001. The ISIS mission is an effort to address several major technical challenges of the NGST inflatable sunshield, namely controlled inflation deployment, plenarity and separation of large stretched membranes, space rigidization of inflatable booms, and dynamic modeling and simulation. This paper will describe the design of the flight experiment and the testing to be performed on-orbit.
Author
Flight Tests; Design Analysis; Inflatable Space Structures; Deployment; Experiment Design; Prediction Analysis Techniques; Shielding; Solar Energy; Spaceborne Experiments

20000037792 Alabama Univ., Huntsville, AL USA
Technology Development of Stratified Volume Diffractive Optics for Waveguide Coupling ***Final Report, 26 Feb. - 30 Sep. 1999***
Chambers, Diana M., Alabama Univ., USA; Jan. 05, 2000; 3p; In English
Contract(s)/Grant(s): NAS8-97095; NASA Order H-30199-D; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Stratified Volume Diffractive Optical Elements (SVDOE) appear to be viable as high-efficiency waveguide couplers. Preliminary design studies were conducted under this task to provide initial device parameters for evaluation. However, these designs should be revisited prior to fabrication of a device for testing. The emphasis of this task has been development and implementation of fabrication procedures necessary for SVDOE'S, namely alignment of grating layers, Including offsets, to within required tolerances. Progress in this area Indicates that the alignment technique chosen is viable and tolerances have been reached that allow reasonable performance ranges. Approaches have been identified to improve alignment tolerances even further.
Author
Diffractive Optics; Waveguides; Technology Assessment; Coupling; Strata; Fabrication

20000038092 Communications Research Lab., Tokyo, Japan
Development of Fundamental Techniques for High-Resolution Infrared Spatial Interferometry
Yoshikado, Shin, Communications Research Lab., Japan; Asai, Kazuhiro, Communications Research Lab., Japan; Tsukakoshi, Motowo, Communications Research Lab., Japan; Minoh, Arimichi, Communications Research Lab., Japan; Ishizu, Mitsuo, Communications Research Lab., Japan; Takami, Hideki, Communications Research Lab., Japan; Aruga, Tadashi, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Mar. 1994; ISSN 0914-9279; Volume 40, No. 1, pp. 1-10; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We have developed fundamental techniques for high-resolution infrared spatial interferometry (IRSI), such as CO2-laser heterodyne detection of infrared radiation, and a wideband analog correlator technique, and constructed a 2 element IRSI system for basic research. The maximum baseline of 2.25 m results in an expected angular resolution limit of about 5 micro-frad for 10 micro-m-band radiation. Through preliminary laboratory experiments using a CO2 laser as a test radiation source, we confirm that the major elements of the system perform their fundamental functions, and that the total phase stability is sufficient for future imaging operation.
Author
Carbon Dioxide Lasers; Heterodyning; Imaging Techniques; Correlators; Interferometry

20000038129 NASA Goddard Space Flight Center, Greenbelt, MD USA
Field Evaluation of Anti-Biofouling Compounds on Optical Instrumentation
McLean, Scott, Satlantic, Inc., Canada; Schofield, Bryan, Satlantic, Inc., Canada; Zibordi, Giuseppe, Joint Research Centre of the European Communities, Italy; Lewis, Marlon, Dalhousie Univ., Canada; Hooker, Stanford, NASA Goddard Space Flight Center, USA; Weidemann, Alan, Naval Research Lab., USA; Laboratory for Hydrospheric Processes Research Publications; 1997, pp. 239-240; Repr. from Proceedings of Ocean Optics 13, v. 2963 p 708-713; In English; 13th; Ocean Optics, 22-25 Oct. 1996, Halifax, Canada; Copyright; Avail: Issuing Activity (Lab. for Hydrospheric Processes, NASA Goddard Space Flight Center, Greenbelt, MD 20771), Hardcopy, Microfiche

Biofouling has been a serious question in the stability of optical measurements in the ocean, particularly in moored and drifting buoy applications. Many investigators coat optical surfaces with various compounds to reduce the amount of fouling; to our knowledge, however, there are no objective, in-situ comparative testing of these compounds to evaluate their effectiveness with respect to optical stability relative to untreated controls. We have tested a wide range of compounds at in-situ locations in Halifax Harbour and in the Adriatic Sea on passive optical sensors. Compounds tested include a variety of TBT formulations,

antifungal agents, and low-friction silicone-based compounds; time-scales of up to four months were evaluated. The results of these experiments are discussed.
Author
Adriatic Sea; Antifouling; Optical Measuring Instruments

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PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 Geophysics. For space plasmas see90 Astrophysics.

20000033852 Michigan Univ., Space Physics Research Lab., Ann Arbor, MI USA
Research on Orbital Plasma: Electrodynamics (ROPE) ***Final Report, 1 Apr. 1987 - 31 Dec. 1999***
Samir, Uri, Michigan Univ., USA; Fontheim, Ernest G., Michigan Univ., USA; [2000]; 6p; In English
Contract(s)/Grant(s): NAS8-37108
Report No.(s): NASA/CR-2000-210134; NAS 1.26:210134; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Enhancements of the temperature of electrons in spacecraft plasma wakes have been reported for numerous cases and this phenomenon has been discussed both empirically and theoretically. However, very few measurements seem to have been made of the ion temperature within plasma wakes-possibly because the great majority of ion measurements were focussed on obtaining geophysical parameters and, hence, were confined to the region ahead of the spacecraft. Recently, however, an enhancement of the temperature of ions was discovered in data obtained in the wake of the Space Shuttle during the Spacelab-2 mission. At the time of that publication, this was the only known observation of this type. Herein, we report an additional case of ion temperature enhancement in a plasma wake. The data were taken during the Tethered Satellite System Reflight mission (TSS-1R) in the wake of the tethered satellite during passive (no current flow) operations. The measurements were obtained with the Differential Ion Flux Probe, or DIFP.
Author
Ion Temperature; Wakes; Ionospheric Currents; Spacelab; Electrons

20000034109 International Centre for Theoretical Physics, Trieste, Italy
Ultra-low-frequency dust-electromagnetic modes in self-gravitating magnetized dusty plasmas
Mamun, A. A.; Jul. 31, 1999; 13p; In English
Report No.(s): DE99-634849; IC-99/76; No Copyright; Avail: Department of Energy Information Bridge
Obliquely propagating ultra-low-frequency dust-electromagnetic waves in a self-gravitating, warm, magnetized two fluid dusty plasma system have been investigated. Two special cases, namely, dust-Alfven mode propagating parallel to the external magnetic field and dust-magnetosonic mode propagating perpendicular to the external magnetic field have also been considered. It has been shown that effects of self-gravitational field, dust fluid temperature, and obliqueness significantly modify the dispersion properties of these ultra- low-frequency dust-electromagnetic modes. It is also found that these effects of self-gravitational field and dust/ion fluid temperature play no role in parallel propagating dust-Alfven mode, but in obliquely propagating dust-Alfven mode or perpendicular propagating dust-magnetosonic mode the effect of self- gravitational field plays a destabilizing role whereas the effect of dust/ion fluid temperature plays a stabilizing role.
NTIS
Electromagnetic Radiation; Gravitational Fields; Magnetohydrodynamic Waves; Dust; Plasma Physics

20000034110 International Centre for Theoretical Physics, Trieste, Italy
Dust-cyclotron and dust-lower-hybrid modes in self-gravitating magnetized dusty plasmas
Mamun, A. A.; Jul. 31, 1999; 10p; In English
Report No.(s): DE99-634850; IC-99/77; No Copyright; Avail: Department of Energy Information Bridge
A theoretical investigation has been made of two new ultra-low-frequency electrostatic modes, namely, dust-cyclotron mode and dust-lower-hybrid mode, propagating perpendicular to the external magnetic field, in a self-gravitating magnetized two fluid dusty plasma system. It has been shown that the effect of the self-gravitational force, acting on both dust grains and ions, significantly modifies the dispersion properties of both of these two electrostatic modes. It is also found that under certain conditions, this self- gravitational effect can destabilize these ultra-low-frequency electrostatic modes. The implications of these

results to some space and astrophysical dusty plasma systems, especially to planetary ring-systems and cometary tails, are briefly mentioned.
NTIS
Plasma Physics; Dust; Magnetic Fields; Gravitational Effects

20000034118 International Atomic Energy Agency, Vienna Austria
ITER EDA newsletter
Jun. 30, 1999; Volume 8, No. 6; 6p; In English
Report No.(s): DE99-634873; INIS-XA-171; No Copyright; Avail: Department of Energy Information Bridge
A ceremony was held on 1 June 1999 at the Naka Fusion Research Establishment of JAERI to celebrate the successful development and fabrication of the ITER Central Solenoid Model Coil Inner Module and Outer Module and the CS Insert Coil. At this occasion, Dr. Martha Krebs from the US-DOE regretted the withdrawal of the USA from the ITER project, the US is now looking for Japan, the European Union and the Russian Federation to continue making progress. In response to this speech, Mr. Tsutomu Imamura said, that that was to be regretted and stated that Japan actively promoted the ITER project. Then, Dr. Michel Huguet, representing the JCT, presented a message from Dr. R. Aymar, the director of the ITER program. In this message he indicated that each and every one who had been involved in that project could take great pride. The ceremony was concluded by warm and thoughtful words from Dr. Masami Fujiwara and a toast by Dr. Masaji Yoshikawa. At the end, all participants praised each other for their efforts and the three coils, the CS Model Coil Inner Module, the Outer Module and the the CS Insert Coil, seemed to be smiling at them.
NTIS
Fusion Reactors; Thermonuclear Reactions; Tokamak Devices

20000034855 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
The ETE Spherical Tokamak Project
Ludwig, Gerson Otto, Instituto Nacional de Pesquisas Espacias, Brazil; deAndrade, Maria Celia Ramos, Instituto Nacional de Pesquisas Espacias, Brazil; Barbosa, Luis Filipe Wiltgen, Instituto Nacional de Pesquisas Espacias, Brazil; Barreto, Patricia Regina Pereira, Instituto Nacional de Pesquisas Espacias, Brazil; Berni, Luiz Angelo, Instituto Nacional de Pesquisas Espacias, Brazil; DelBosco, Edson, Instituto Nacional de Pesquisas Espacias, Brazil; Ferreira, Julio Guimaraes, Instituto Nacional de Pesquisas Espacias, Brazil; Montes, Antonio, Instituto Nacional de Pesquisas Espacias, Brazil; deMoraesOliveira, Rogerio, Instituto Nacional de Pesquisas Espacias, Brazil; Junior, Heitor Patire, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 15p; In English; Latin American Workshop on Plasma Physics (LAWPP'98), 1998, Tandil, Argentina
Report No.(s): INPE-7301/RPQ/699; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This paper describes the general characteristics of spherical tokamaks, with a brief overview of work in the area of spherical torus already performed or in progress at several institutions. The paper presents also the historical development of the ETE (Experimento Tokamak Esferico) project, its research program, technical characteristics and status of construction in September, 1998 at the Associated Plasma Laboratory (LAP) of the National Institute for Space Research (INPE) in Brazil.
Author
Tokamak Devices; Spherical Shells; Spheres; Toruses

20000037699 Kings Coll., London, UK
Controlling Chaos in Plasma Filled Diodes ***Final Report, 1 Dec. 1996-30 Nov. 1999***
Lindsay, Peter A., Kings Coll., UK; Chen, Xiaodong, Kings Coll., UK; Watkins, John, Kings Coll., UK; Zhang, Jianxin, Kings Coll., UK; Feb. 28, 2000; 138p; In English
Contract(s)/Grant(s): F49620-97-I-0035
Report No.(s): AD-A374641; AFRL-SR-BL-TR-00-0063; No Copyright; Avail: CASI; A02, Microfiche; A07, Hardcopy
The Report starts with a brief historical introduction to current investigations and a description of possible physical embodiments of the system. This is followed by a detailed discussion of the mathematical model of the system, the methods used in solving the corresponding integro-differential equations and some analytical solutions in the two accessible cases of a steady state and harmonic oscillations. The main body of the report is concerned with detailed analysis of the dynamical behavior of the system and various methods of controlling chaos by a suitable adjustment of the relevant parameters of the system.
DTIC
Diodes; Chaos; Ion Selective Electrodes; Plasma Diodes; Mathematical Models; Integral Equations

20000038210 Alabama Univ., Dept. of Electrical and Computer Engineering, Huntsville, AL USA

Three-Dimensional Kinetic Simulation of the Nonlinear Evolution of Lower-Hybrid Waves in the Auroral Plasma ***Final Report***

Singh, Nagendra, Alabama Univ., USA; [2000]; 10p; In English

Contract(s)/Grant(s): NAG5-4604; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Under this grant we have done research on the following topics. 1) Development of Parallel PIC Codes (PPIC); 2) Evolution of Lower-Hybrid Pump Waves; 3) Electron-beam Driven Plasma Electrodynamics; and 4) Studies on Inertial and Kinetic Alfven Waves. A brief summary of our findings and resulting publications are given.

Derived from text

Auroras; Nonlinearity; Plasmas (Physics); Computerized Simulation; Three Dimensional Models; Kinetic Energy

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SOLID-STATE PHYSICS

Includes superconductivity. For related information, see also 33 Electronics and Electrical Engineering and 36 Lasers and Masers.

20000033720 Yale Univ., New Haven, CT USA

The Growth of Low Band-Gap InAs on (111)B GaAs Substrates

Weiser, R. E., Yale Univ., USA; Guido, L. J., Yale Univ., USA; Space Photovoltaic Research and Technology 1995; October 1995, pp. 137-141; In English; See also 20000033702

Contract(s)/Grant(s): NGT-50832; NSF ECS-92-53760; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

Growth on the (111)B orientation exhibits a number of advantageous properties as compared to the (100) during the early stages of strained-layer epitaxy. In accordance with a developing model of nucleation and growth, we have deposited thin (60 A - 2500 A), fully relaxed InAs films on (111)B GaAs substrates. Although thicker InAs films are subject to the formation of twin defects common to epitaxy on the (111)B orientation, appropriate control of the growth parameters can greatly minimize their density. Using this knowledge base, InAs films up to 2 microns in thickness with improved morphology and structural quality have been grown on (111)B GaAs substrates.

Author

Epitaxy; Crystal Growth; Indium Arsenides; Morphology

20000033771 Defence Research Establishment Ottawa, Ottawa, Ontario Canada

Comparison of Proton, Neutron and Electron Radiation-Induced Electron Traps in N-GaAs Epilayers Studied by Deep Level Transient Spectroscopy

Khanna, S. M., Defence Research Establishment Ottawa, Canada; Yousefi, G. H., National Research Council of Canada, Canada; Webb, J. B., National Research Council of Canada, Canada; Wasilewski, Z., National Research Council of Canada, Canada; Dec. 1999; 24p; In English

Report No.(s): AD-A372781; DREO-TM-1999-129; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This paper compares the deep level transient spectroscopy (DLTS) study of proton radiation-induced defects in molecular beam epitaxy (MBE) n-GaAs with the defects generated in n-GaAs by high energy electron and neutron radiation. For proton irradiation, it was found that the density of radiation-induced traps increased with radiation fluence. The activation energies, capture cross sections and trap densities with respect to radiation fluence are reported. Some of the observed traps have the same signatures as those reported previously for proton irradiated vapour phase epitaxy (VPE) and liquid phase epitaxy (LPE) GaAs. The detailed structure of the trap perviously designated as PR4 by Eisen et al is also presented This structure is observed for the first time as two distinct peaks in the DLTS spectra of proton-irradiated MBE n-GaAs corresponding to two bulk traps in GaAs film independent of their position within the film. The results are compared to previous studies of neutron and electron irradiated n-GaAs performed in our laboratory. The results indicate that some defect centres are generated by all three types of high energy particles discussed in this work but that others are radiation-type dependent. The significance of the nature of the irradiating particle and the unirradiated GaAs in the growth of radiation-induced defects is pointed out.

DTIC

Molecular Beam Epitaxy; Gallium Arsenides; Crystal Defects; Radiation Damage; Thin Films; Spectroscopic Analysis; Irradiation

20000034075 Iowa Univ., Dept. of Physics and Astronomy, Iowa City, IA USA

Optical Studies of the Influence of Microscopic Structure on the Optoelectronic Properties of 6.1 Angstrom-Lattice Constant III-V Superlattices ***Final Report, Jan. 1999-2000***

Hasenberg, Thomas C.; Flatte', Michael E.; Boggess, Thomas F.; Feb. 2000; 17p; In English

Contract(s)/Grant(s): N00014-99-1-0379

Report No.(s): AD-A373828; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The influence of the microscopic structure (particularly at material interfaces) on the optoelectronic properties of 6.1 Angstrom-lattice constant III-V superlattices is presented. Included are discussions of four research areas: 1) Theoretical studies of binary antimonide superlattices, 2) MBE growth of these superlattices. 3) Structural characterization using X-ray diffraction. and 4) continuous-wave and ultrafast optical characterization. The theoretical effort included spin lifetime calculations for bulk GaAs and InAs as well as for GaAs/AlGaAs and InGaAs/InP quantum wells. A fourteen bulk-band basis was utilized to account for the constituent zinc blende symmetry. The spin lifetimes agree with recent experiments within experimental and theoretical error. The experimental effort, multiple quantum well samples were grown with InAs (7ML)/GaSb (12ML) superlattice quantum wells and AlSb barrier regions. Two different MBE growth procedures were used at the material interfaces: 1) 5-second Sb-soaks and 2) migration- enhanced epitaxy (MEE). Use of MEE was an attempt to realize more abrupt interfaces and reduce the defect concentrations. The structures were characterized using time-resolved photoluminescence and time-resolved differential transmission. Excellent Shockley-Read-Hall lifetimes in the 4-6 ns range were measured. Furthermore, spin lifetime measurements were made on a sample grown using the Sb-soaks as well as on a previous InAs/GaInSb/InAs/InGaAlAsSb 4-layer superlattice sample.

DTIC

Superlattices; Quantum Wells; Molecular Beam Epitaxy; Semiconductors (Materials); Microstructure; X Ray Diffraction

20000034100 NASA Marshall Space Flight Center, Huntsville, AL USA

Float-Zone Growth of Gel-xSix (x ? 10 at .%) Single Crystals: Influence of Thermocapillary and Solutocapillary Convection

Campbell, Tom A., NASA Marshall Space Flight Center, USA; Schweizer, Markus, NASA Marshall Space Flight Center, USA; Dold, P., NASA Marshall Space Flight Center, USA; Croell, Arne, NASA Marshall Space Flight Center, USA; Benz, K. W., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Gel-xSix (x ? 10 at.%) single crystals have been grown with the float-zone technique applied within a monoellipsoid mirror furnace. The feed crystal consisted of synthesized GeO.95siO.05 polycrystalline material. Two Boron-doped (much much more than 1-2 (raised dot) 1017 at/cm3) crystals were grown under identical conditions using is less than 100> Ge seeds. One Ge:Ga-doped (much much more than 1018 at/cm3) reference crystal was also grown in the same furnace. Compositional profiles were measured with an energy dispersive analysis by X-ray (EDAX). The maximum silicon concentration attained was 10 at.%. Micrographs of the etched crystals show sharp changes in interface curvature at the crystal edges. These are considered to be caused by solutal Marangoni convection, whose strength is assumed to be a direct function of silicon concentration, Theoretical considerations show that the flow direction, velocity, and strength varies significantly from a solutal Marangoni convection regime directly in front of the solid-liquid interface to a thermal Marangoni convection regime within the bulk melt.

Author

Crystal Growth; Float Zones; Single Crystals; Thermocapillary Migration; Gels; Marangoni Convection

20000034112 International Centre for Theoretical Physics, Trieste, Italy

Pairing mechanism and superconducting state parameters of cubic perovskite Ba(sub 0,6)K(sub 0,4)BiO3

Varshney, D.; Tosi, M. P.; Jul. 31, 1999; 17p; In English

Report No.(s): DE99-634852; IC-99/84; No Copyright; Avail: Department of Energy Information Bridge

We develop an effective three-dimensional dynamic interaction, which incorporates screening of charge carriers by optical phonons and plasmons, to discuss the nature of the pairing mechanism leading to superconductivity in cubic perovskite Ba(sub 0.6)K(sub 0.4)BiO3. The potassium-doped barium-bismuth oxide system (Ba-K-BiO) is treated as an ionic solid containing carriers and a model dielectric function is set up which fulfills the appropriate sum rules on the ionic and electronic polarizabilities. The values of the coupling strength and of the Coulomb interaction parameter indicate that the superconductor is in the strong coupling regime. Following strong-coupling theory, the superconducting transition temperature of optimally doped Ba-K-BiO is estimated as 30 K. The energy gap ratio is slightly enhanced and the isotope exponent is severely reduced relative to the BCS

values. The present analysis points to the importance of both plasmons and optical phonons in determining the effective electron-electron interaction leading to superconductivity in doped cubic perovskites.
NTIS
Superconductivity; Perovskites; Barium Oxides; Potassium; Bismuth

20000034115 International Centre for Theoretical Physics, Trieste, Italy
Explicitly non-local relation between kinetic and exchange energy densities in the Bardeen model of a planar metal surface
March, N. H.; Aug. 31, 1999; 7p; In English
Report No.(s): DE99-634855; IC-99/95; No Copyright; Avail: Department of Energy Information Bridge

The infinite barrier model of a planar metal surface, going back to Bardeen, is shown to permit the kinetic energy density to be written explicitly in terms of the ground-state electron density and its first derivative. The exchange energy density is then written in what proves to be an explicitly non-local form in terms of the electron density. Finally, by integrating the first-order equation for the electron density in terms of the kinetic energy density, a precise relation is established in this metal surface model between exchange and kinetic energy densities.
NTIS
Kinetic Energy; Electron Density (Concentration); Flux Density

20000034904 NASA Marshall Space Flight Center, Huntsville, AL USA
Growth of Homoepitaxial ZnO Semiconducting Films
Zhu, Shen, Universities Space Research Association, USA; Su, C.-H., NASA Marshall Space Flight Center, USA; Lehoczky, S. L., NASA Marshall Space Flight Center, USA; Harris, M. T., Air Force Research Lab., USA; George, M. A., Alabama Univ., USA; McCarty, P., Alabama Univ., USA; [1999]; 1p; In English; Electronic, Electro-Optical, Photonic, and Electro-Magnetic Materials, 6-7 Oct. 1999, Redstone Arsenal, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

As a high temperature wide-band-gap (3.3 eV at room temperature) semiconductor, ZnO has been used for many applications such as wave-guides, solar cells, and surface acoustic wave devices, Since ZnO has a 60 meV excitonic binding energy that makes it possible to produce excitonic lasing at room temperature, a recent surge of interest is to synthesize ZnO films for UV/blue/green laser diodes. These applications require films with a smooth surface, good crystal quality, and low defect density. Thus, homoepitaxial film growth is the best choice. Homoepitaxial films have been studied in terms of morphology, crystal structure, and electrical and optical properties. ZnO single crystal substrates grown by the hydrothermal method are mechanically polished and annealed in air for four hours before the films are deposited. The annealing temperature-dependence on ZnO substrate morphology and electrical properties is investigated. Films are synthesized by off-axis reactive sputtering deposition. This produces films that have very smooth surfaces with roughness less than or equal to 5 nm on a 5 microns x 5 microns area. The full width at half maximum of film theta rocking curves measured by the x-ray diffraction is slightly larger than that of the crystal substrate. Films are also characterized by measuring resistivity, optical transmittance, and photoluminescence. The properties of ZnO films grown on (0001) ZnO and (0001) sapphire substrates will also be compared and discussed.
Author
Zinc Oxides; Epitaxy; Semiconducting Films; Crystal Defects; Crystal Growth; Deposition; Electrical Properties; X Ray Diffraction

20000034908 NASA Marshall Space Flight Center, Huntsville, AL USA
Magnetic Susceptibility Effects and Lorentz Damping in Diamagnetic Fluids
Ramachandran, Narayanan, Universities Space Research Association, USA; Leslie, Fred W., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; ITAM Conference, 27 Aug. 2000, Chicago, IL, USA
Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only

A great number of crystals (semi-conductor and protein) grown in space are plagued by convective motions which contribute to structural flaws. The character of these instabilities is not well understood but is associated with density variations in the presence of residual gravity and g-jitter. Both static and dynamic (rotating or travelling wave) magnetic fields can be used to reduce the effects of convection in materials processing. In semi-conductor melts, due to their relatively high electrical conductivity, the induced Lorentz force can be effectively used to curtail convective effects. In melts/solutions with reduced electrical conductivity, such as aqueous solutions used in solution crystal growth, protein crystal growth and/or model fluid experiments for simulating melt growth, however, the variation of the magnetic susceptibility with temperature and/or concentration can be utilized to better damp fluid convection than the Lorentz force method. This paper presents a comprehensive, comparative numerical study of the relative damping effects using static magnetic fields and gradients in a simple geometry subjected to a thermal gradient. The governing equations are formulated in general terms and then simplified for the numerical calculations. Operational regimes,

based on the best damping technique for different melts/solutions are identified based on fluid properties. Comparisons are provided between the numerical results and available results from experiments in surveyed literature.
Author
Magnetic Fields; Lorentz Force; Diamagnetism; Fluid Flow; Stability; Semiconductors (Materials); Protein Crystal Growth; Melts (Crystal Growth); Gravitation

20000038203 Alabama Univ., Consortium for Materials Development in Space, Huntsville, AL USA
Activities of UAH *Final Report, 4 Dec. 1996 - 3 Dec. 2000*
Li, Ning, Alabama Univ., USA; [2000]; 4p; In English
Contract(s)/Grant(s): NCC8-124; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
From its start in December 1996, the Cooperative Agreement allowed that some tasks could be performed primarily by UAH, some primarily by MSFC and some in a joint manner. The detailed distribution of effort has evolved in a pragmatic fashion, with each organization focusing on those tasks that seemed most urgent and for which appropriate capabilities existed. The final, all-up experiments were envisioned as a very careful measurement process carried out jointly using components developed at both UAH and MSFC. The total project began with an air of optimism that the necessary apparatus for the adopted objectives could be quickly and easily assembled. Not surprisingly, technological difficulties were encountered by all parties and it has proven impossible to complete the challenging experiments in the term of this cooperative agreement. The UAH accomplishments toward the ultimate experiments are reported here in a taskwise manner.
Derived from text
Agreements; Materials Science; Aerospace Environments

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PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

20000034111 International Centre for Theoretical Physics, Trieste, Italy
D1/D5 moduli in SCFT and gauge theory, and Hawking radiation
David, J. R.; Mandal, G.; Wadia, S. R.; Jul. 31, 1999; 26p; In English
Report No.(s): DE99-634851; IC-99/79; TIFR/TH-99-34; No Copyright; Avail: Department of Energy Information Bridge
We construct marginal operators of the orbifold SCFT corresponding to all twenty near-horizon moduli in supergravity, including operators involving twist fields which correspond to the blowing up modes. We identify the operators with the supergravity moduli in a 1-1 fashion by inventing a global SO(4) algebra in the SCFT. We analyze the gauge dynamics of the D1/D5 system relevant to the splitting (Q(sub 1), Q(sub 5)) (yields) (Q'(sub 1), Q'(sub 5)) + (Q''(sub 1), Q''(sub 5)) with the help of a linear sigma model. We show in supergravity as well as in SCFT that tile absorption cross-section for minimal scalars is the same all over the near-horizon moduli space.
NTIS
Gauge Theory; Elementary Particles

20000034886 International Centre for Theoretical Physics, Trieste, Italy
Radiative corrections to the Planckian-energy scattering in quantum gravity
Nguyen Suan Han,; Apr. 30, 1999; 6p; In English
Report No.(s): DE99-634319; IC/IR-99/4; No Copyright; Avail: Department of Energy Information Bridge
It is shown that the contributions of the radiative corrections to the Planckian energy scattering in quantum gravity in the straight-line paths approximation are factorized and are determined by the quantity R(t), which depends only upon the square of momentum transfers and do not affect the asymptotic in s at high energies. The apparently our result corresponds to the correct account of contributions of the so-called 'soft gravitons', for which the straight-line path approximation is valid.
NTIS
Correction; Elastic Scattering; Gravitation

20000034888 International Centre for Theoretical Physics, Trieste, Italy
Additional phases induced by the supersymmetric CP phases
Demir, D. A.; May 31, 1999; 23p; In English
Report No.(s): DE99-634317; IC-99/62; No Copyright; Avail: Department of Energy Information Bridge

The explicit CP violation in the MSSM radiatively induces a finite unremovable alignment between the Higgs doublets. This additional phase can be as large as the original CP phases in certain portions of the MSSM parameter space. Considering the specific case of the charginos, this additional phase is shown to induce a conceivable amount of CP violation near the would-be CP conserving points. Moreover, the CP violation in the absence of this phase is smaller than the one in the presence of it, and the former can never compete with the latter, however large tan (beta) is.
NTIS
Supersymmetry; Invariance

20000034889 International Centre for Theoretical Physics, Trieste, Italy
Discrete Planck spectrum of a spherical cavity
Vlad, V. I.; Ionescu-Pallas, N.; Mar. 31, 1999; 19p; In English
Report No.(s): DE99-634316; IC-99/27; No Copyright; Avail: Department of Energy Information Bridge

The energy spectrum of black body radiation at the absolute temperature, T, in an ideal spherical cavity of radius, R, is studied. The departures from the classical predictions of Planck's theory, due to the discrete energies of the radiation quanta confined inside the cavity, depend on the adiabatic invariant RT and are significant for RT (<=) 40 cm (center-dot) K. Special attention was paid to evidence strong changes in the spectrum intensities, forbidden bands of frequency, as well as major modifications of the total energy for RT (is less than =) 2 cm (center-dot) K. Similar effects were present in the case of a cubic cavity.
NTIS
Cavities; Energy Spectra

80
SOCIAL AND INFORMATION SCIENCES (GENERAL)

20000038211 NASA Marshall Space Flight Center, Huntsville, AL USA
1997 NASA/MSFC Summer Teacher Enrichment Program *Final Report*
June 1999; 80p; In English
Contract(s)/Grant(s): NAG8-1388; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This is a report on the follow-up activities conducted for the 1997 NASA Summer Teacher Enrichment Program (STEP), which was held at the George C. Marshall Space Flight Center (MSFC) for the seventh consecutive year. The program was conducted as a six-week session with 17 sixth through twelfth grade math and science teachers from a six-state region (Alabama, Arkansas, Iowa, Louisiana, Mississippi and Missouri). The program began on June 8, 1997, and ended on July 25, 1997. The long-term objectives of the program are to: increase the nation's scientific and technical talent pool with a special emphasis on underrepresented groups, improve the quality of pre-college math and science education, improve math and science literacy, and improve NASA's and pre-college education's understandings of each other's operating environments and needs. Short-term measurable objectives for the MSFC STEP are to: improve the teachers' content and pedagogy knowledge in science and/or mathematics, integrate applications from the teachers' STEP laboratory experiences into science and math curricula, increase the teachers' use of instructional technology, enhance the teachers' leadership skills by requiring them to present workshops and/or inservice programs for other teachers, require the support of the participating teacher(s) by the local school administration through a written commitment, and create networks and partnerships within the education community, both pre-college and college. The follow-up activities for the 1997 STEP included the following: academic-year questionnaire, site visits, academic-year workshop, verification of commitment of support, and additional NASA support.
Derived from text
Education; Instructors; Summer; NASA Programs

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20000033841 Institute for Research on Learning, Menlo Park, CA USA
Evaluation Framework for NASA's Educational Outreach Programs ***Final Report***
Berg, Rick, Institute for Research on Learning, USA; Booker, Angela, Institute for Research on Learning, USA; Linde, Charlotte, Institute for Research on Learning, USA; Preston, Connie, Institute for Research on Learning, USA; September 1999; 4p; In English
Contract(s)/Grant(s): NAG2-1298; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective of the proposed work is to develop an evaluation framework for NASA's educational outreach efforts. We focus on public (rather than technical or scientific) dissemination efforts, specifically on Internet-based outreach sites for children.The outcome of this work is to propose both methods and criteria for evaluation, which would enable NASA to do a more analytic evaluation of its outreach efforts. The proposed framework is based on IRL's ethnographic and video-based observational methods, which allow us to analyze how these sites are actually used.
Derived from text
Education; NASA Programs; Evaluation; Computer Programs

20000038217 Institute for Human Factors TNO, Soesterberg, Netherlands
Guidelines Supporting the Analysis of Team Tasks ***Interim Report Richtlijnen ten Behoeve van het Analyseren van Teamtaken***
vanBerlo, M. P. W., Institute for Human Factors TNO, Netherlands; Dec. 09, 1998; 62p; In Dutch
Contract(s)/Grant(s): B98-052; TNO Proj. 730.2
Report No.(s): TD98-0280; TM-98-B015; Copyright; Avail: Issuing Activity

In both military and civil organizations many tasks are being performed by teams rather than by individual operators. Despite the acknowledgment of the importance of team performance and team training, relatively few endeavours have been undertaken to train teams in a systematic way. A possible explanation could be that there is no methodology to guide the instructional developers and trainers in designing, executing and evaluating team training systems. One of the results of a literature and a field study is that conducting a team task analysis is a serious bottleneck in the instructional design process. The results of a team task analysis provide the necessary information to specify clear instructional objectives, and consequently design effective team training programs. Task analysis is therefore a first and essential step in the instructional design process, but probably the most difficult as well. This report describes guidelines that should support the instructional designer during this process. After the general introduction (chapter 1) and introducing the topic of team task analysis (chapter 2) a detailed description of the guidelines is presented in chapter 3. An expert-evaluation, based on applying the guidelines to an experimental team task, is described in chapter 4. The direction of future research is indicated in chapter 5.
Author
Human Performance; Training Devices; Education

82
DOCUMENTATION AND INFORMATION SCIENCE

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

20000033909 NASA Goddard Space Flight Center, Greenbelt, MD USA
Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems
Kobler, Benjamin, Editor, NASA Goddard Space Flight Center, USA; Hariharan, P. C., Editor, Systems Engineering and Security, Inc., USA; Eighth Goddard Conferencee on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage System; March 2000; 488p; In English; 8th; 17th; Eighth Goddard Conference on Mass Storage Systems and Technologies, 27-30 Mar., 2000, College Park, MD, College Park, MD, USA, USA; Sponsored by NASA Goddard Space Flight Center, USA; See also 20000033910 through 20000033946
Report No.(s): NASA/CP-2000-209888; Rept. 2000-01419-0; NAS 1.55:209888; No Copyright; Avail: CASI; A21, Hardcopy; A04, Microfiche

This document contains copies of those technical papers received in time for publication prior to the Eighth Goddard Conference on Mass Storage Systems and Technologies which is being held in cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems at the University of Maryland University College Inn and Conference Center March 27-30, 2000. As one of an ongoing series, this Conference continues to provide a forum for discussion of issues relevant to the management of large volumes of data. The Conference encourages all interested organizations to discuss long term mass storage requirements and experiences in fielding solutions. Emphasis is on current and future practical solutions addressing issues in data management, storage systems and media, data acquisition, long term retention of data, and data distribution. This year's discussion topics include architecture, future of current technology, new technology with a special emphasis on holographic storage, performance, standards, site reports, vendor solutions. Tutorials will be available on stability of optical media, disk subsystem performance evaluation, I/O and storage tuning, functionality and performance evaluation of file systems for storage area networks.
Author
Data Management; Data Storage; Magnetic Storage; Optical Data Storage Materials; Computer Storage Devices

20000033910 Minnesota Univ., Lab. for Computational Science and Engineering, Minneapolis, MN USA
Disk Subsystem Performance Evaluation: From Disk Drives to Storage Area Networks
Ruwart, Thomas M., Minnesota Univ., USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 1-24; In English; See also 20000033909; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Disk subsystems span the range of configuration complexity from single disk drives to large installations of disk arrays. They can be directly attached to individual computer systems or configured as larger, shared access Storage Area Networks (SANs). It is a significant task to evaluate the performance of these subsystems especially when considering the range of performance requirements of any particular installation and application. Storage subsystems can be designed to meet different performance criteria such as bandwidth, transactions per second, latency, capacity, connectivity, ...etc. but the question of how the subsystem will perform depends on the software and hardware layering and the number of layers an I/O request must traverse in order to perform the actual operation. As an I/O request traverses more and more software and hardware layers, alignment and request size fragmentation can result in performance anomalies that can degrade the overall bandwidth and transaction rates. Layer traversal can have a significant negative impact on the observed performance of even the fastest hardware components. This paper walks through the Storage Subsystem Hierarchy, defining these layers, presents a method for testing in single and multiple computer environments, and demonstrates the significance of careful, in-depth evaluation of Storage Subsystem Performance.
Author
Computer Systems Performance; Magnetic Disks; Performance Tests

20000033911 Silicon Graphics, Inc., Silver Spring, MD USA
I/O and Storage Tuning: An Introduction to I/O and Storage Tuning Tips and Techniques
Kreiser, Randy, Silicon Graphics, Inc., USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 25-30; In English; See also 20000033909; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Computational power is getting cheap. Thus, it can be argued that the real cost of computing today lies in reliably storing, and rapidly moving, big data. This article will introduce some principles and methods with which to fine-tune I/0 and storage in RAID (Redundant Array of Independent Disks) storage systems. The existence of an important but unrecognized or under-appreciated RAID capacity/performance relationship should be noted here. It is common to recommend a hardware size for a system predicated on the predicted capacity required by the operation. However, users have performance requirements that must often supersede their capacity requirements. For this reason, in correctly analyzed and sized data storage configurations, one will often find more physical system capacity than is strictly required by the I/0 and storage workload. The extra capacity is not unnecessary overhead; it is capacity needed to fulfill both the users' storage requirements and the users' performance requirements.
Author
Data Storage; Input/Output Routines; Computer Systems Performance; Data Transfer (Computers); Tuning

20000033912 Alabama Univ., Center for Materials for Information Technology, Tuscaloosa, AL USA

Accelerated Aging Studies and the Prediction of the Archival Lifetime of Optical Disk Media

Nikles, David E., Alabama Univ., USA; Wiest, John M., Alabama Univ., USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 31-40; In English; See also 20000033909; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Data archivists expect information storage media to have a lifetime greater than ten years. Furthermore they desire the ability to predict when the media will fail in order to plan for its replacement. Archival lifetime predictions are based on accelerated aging studies, where the media are subjected to conditions of high temperature and high humidity. The rate of failure is measured and the data extrapolated to obtain rates of failure under ambient conditions. This extrapolation is reasonable provided the degradation process is activated and the Arrhenius relationship holds. However, this may not be the case for the complicated materials packages in optical data storage media. A primary concern for the polymeric materials is any phase transition, such as glass transition or a beta relaxation, that may occur at temperatures between ambient and the accelerated aging conditions. It is not clear how one extrapolates through those transitions. These phase transitions can give rise to large changes in the rates of diffusion for water, oxygen and other agents of degradation. Furthermore, for polymers, such as polycarbonate, the mode of failure is often hydrolysis and the degradation products can catalyze further hydrolysis, an autocatalytic degradation. The polymer degradation will change the phase transition temperatures. The degradation products may also plasticize the polymer, causing further changes in diffusion rates. We provide here a simple analysis of accelerated aging techniques and discuss other factors that may be involved.
Author

Accelerated Life Tests; Aging (Materials); Data Storage; Optical Disks; Life (Durability)

20000033913 Patuxent Technology Partners, LLC, Fairfax Station, VA USA

Functionality and Performance Evaluation of File Systems for Storage Area Networks (SAN)

Bancroft, Martha, Patuxent Technology Partners, LLC, USA; Bear, Nick, Patuxent Technology Partners, LLC, USA; Finlayson, Jim, Patuxent Technology Partners, LLC, USA; Hill, Robert, Patuxent Technology Partners, LLC, USA; Isicoff, Richard, Patuxent Technology Partners, LLC, USA; Thompson, Hoot, Patuxent Technology Partners, LLC, USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 41-60; In English; See also 20000033909; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The demand for consolidated, widely accessible data stores continues to escalate. With the volume of data being retained mounting as well, a variety of markets are recognizing the advantage of shared data in terms of both cost and performance. Traditionally, common access has been addressed with network-attached fileservers employing data sharing protocols such as the Network File System (NFS). A new approach, poised to deliver high bandwidth access by multiple, heterogeneous platforms to a common storage repository at reduced cost, is beginning to emerge. Storage Area Networking (SAN) is an open-storage architecture designed to eliminate many of the traditional bottlenecks associated with secondary and tertiary storage devices. Conventional high performance computing (HPC) sites and compute-intensive production sites can benefit from such architectures as the need to share computational input and output data sets expands and the mix of computational platforms continues to diversify. Recognizing the potential value of SAN solutions in their overall data management roadmap, the Storage Technologies Knowledge Based Center of the Department of Defense commissioned a research project in mid-1999 to evaluate the functionality and performance of emerging SAN technologies. The initial focus has been on SAN file systems that offer management of disk-resident data. The desire, however, is to expand the effort to include other traditional data storage functions such as backup, hierarchical storage and archiving using tape technologies. The underlying goal is high bandwidth and reliable access to data with guaranteed long-term retention while presenting a seamless and transparent interface to the users regardless of data location. Operational stability and ease of administration are key requirements as is overall data integrity. When complete solutions will be available and just how robust the family of products will be remains unclear. The magnitude of this challenge is realized when considering that production use of these technologies will entail serving numerous, likely 41 heterogeneous clients managing a variety of file sizes (tens of kilobytes to multiple gigabytes) and dealing with a mix of applications and access patterns. As a starting point for the testing, the Center established an environment that features a pair of SGI(TM) Origin(TM)2OOOs, two SGI 320 Windows NT(R) platforms and a fibre channel switch fabric with shared connectivity to over one terabyte of RAID storage. This configuration is expected to grow in number and types of computers (operating systems) as well as with the addition of fabric-attached tape technologies. This preliminary report deals with using the environment to evaluate third-party SAN file systems and related infrastructure technologies. It is a snapshot in time with only initial testing completed. More comprehensive, on-going status and plans, observations and performance data are available on-line at http://www.patuxent-tech.com/SANresearch. During this stage of the evaluation, each file system product is being exercised to determine its performance under load, its operability and scalability as a function of clients and traffic, and its overall functionality

and usability. The motivation is to assess the readiness of SAN file systems to move into production and set realistic timeframe expectations for making such a transition. Although this initiative is conducted under the auspices of the Department of Defense, this research should prove relevant to any large data center operation.
Author
Data Storage; Data Management; Operating Systems (Computers); File Maintenance (Computers); Computer Networks; Architecture (Computers)

20000033914 Northwestern Univ., Center for Parallel and Distributed Computing, Evanston, IL USA
April: A Run-Time Library for Tape-Resident Data
Memik, Gokhan, Northwestern Univ., USA; Kandemir, Mahmut T., Northwestern Univ., USA; Choudhary, Alok, Northwestern Univ., USA; Taylor, Valerie E., Northwestern Univ., USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 61-74; In English; See also 20000033909
Contract(s)/Grant(s): W-7405-Eng-48; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Over the last decade, processors have made enormous gains in speed. But increase in the speed of the secondary and tertiary storage devices could not cope with these gains. The result is that the secondary and tertiary storage access times dominate execution time of data intensive computations. Therefore, in scientific computations, efficient data access functionality for data stored in secondary and tertiary storage is a must. In this paper, we give an overview of APRIL, a parallel runtime library that can be used in applications that process tape-resident data. We present user interface and underlying optimization strategy. We also discuss performance improvements provided by the library on the High Performance Storage System (HPSS). The preliminary results reveal that the optimizations can improve response times by up to 97.2%.
Author
Data Storage; Computer Storage Devices; Data Transfer (Computers); Run Time (Computers); Input/Output Routines

20000033915 Lawrence Livermore National Lab., Livermore, CA USA
Performance of an MPI - IO Implementation Using Third-Party Transfer
Hedges, Richard, Lawrence Livermore National Lab., USA; Jones, Terry, Lawrence Livermore National Lab., USA; May, John, Lawrence Livermore National Lab., USA; Yates, R. Kim, Lawrence Livermore National Lab., USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 75-88; In English; See also 20000033909
Contract(s)/Grant(s): W-7405-Eng-48; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

We present a unique new implementation of Message Passing Interface-Input/Output (MPI-IO) (as defined in the recent MPI-2 message passing standard) that is easy to use, fast, efficient, and complete. Our implementation is layered over the High-Performance Storage System, using HPSS's third-party transfers and parallel I/O descriptors.
Author
Message Processing; Input/Output Routines; Data Transfer (Computers); Computer Systems Performance

20000033916 State Univ. of New York, Experimental Computer Systems Lab., Stony Brook, NY USA
Implementation of a Fault-Tolerant Real-Time Network-Attached Storage Device
Raniwala, Ashish, State Univ. of New York, USA; Sharma, Srikant, State Univ. of New York, USA; Neogi, Anindya, State Univ. of New York, USA; Chiueh, Tzi-cker, State Univ. of New York, USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 89-104; In English; See also 20000033909; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Phoenix is a fault-tolerant real-time network-attached storage device (NASD). Like other NASD architectures, Phoenix provides an object-based interface to data stored on network-attached disks. In addition, it features many functionalities not available in other NASDs. Phoenix supports both best-effort reads/writes and real-time disk read accesses required to support real-time multimedia applications. A standard cycle-based scan-order disk scheduling algorithm is used to provide guaranteed disk I/O performance. Phoenix ensures data availability through a RAID5-like parity mechanism, and supports service availability by maintaining the same level of quality of service (QoS) in event of single disk failures. Given a spare disk, Phoenix automatically reconstructs the failed disk data onto the spare disk while servicing on-going real-time clients without degradation in service quality. Phoenix speeds up this reconstruction process by dynamically maintaining additional redundancy beyond the RAID5-style parity on the unused space left on the disks. Phoenix attempts to improve the reliability of the disk subsystem by

reducing its overall power consumption, using active prefetching techniques in conjunction with disk low-power modes. This paper describes the design and implementation details of the first Phoenix prototype.
Author
Computer Storage Devices; Computer Networks; Input/Output Routines; Architecture (Computers); Data Transfer (Computers)

20000033917 California Univ., Lawrence Berkeley Lab., Scientific Data Management Research Group, Berkeley, CA USA
Access Coordination of Tertiary Storage for High Energy Physics Applications
Bernardo, Luis M., California Univ., Lawrence Berkeley Lab., USA; Shoshani, Arie, California Univ., Lawrence Berkeley Lab., USA; Sim, Alexander, California Univ., Lawrence Berkeley Lab., USA; Nordberg, Henrik, California Univ., Lawrence Berkeley Lab., USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 105-118; In English; See also 20000033909
Contract(s)/Grant(s): DE-AC03-76SF00098; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

We describe a real implementation of a software component that manages caching of files from a tertiary storage management system to a large disk cache developed for use in the area of High Energy Physics (HEP) analysis. This component, called the Cache Manager, is a part of a Storage Access Coordination System (STACS), and is responsible for the interaction with a mass storage system that manages the robotic tapes (we used HPSS). The Cache Manager performs several functions, including managing the queue of file transfer requests, reordering requests to minimize tape mounts, monitoring the progress of file transfers, handling transient failures of the mass storage system and the network, measuring end-to-end file transfer performance, and providing time estimates for multi-file requests. These functions are described in detail, and illustrated with performance graphs of real-time runs of the system.
Author
Computer Storage Devices; Data Transfer (Computers); Architecture (Computers); Data Storage; Access Control

20000033918 Maryland Univ., Dept. of Computer Science, College Park, MD USA
DataCutter: Middleware for Filtering Very Large Scientific Datasets on Archival Storage Systems
Beynon, Michael, Maryland Univ., USA; Ferreira, Renato, Maryland Univ., USA; Kurc, Tahsin, Maryland Univ., USA; Sussman, Alan, Maryland Univ., USA; Saltz, Joel, Maryland Univ., USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 119-134; In English; See also 20000033909
Contract(s)/Grant(s): NSF ACI-9619020; N6600197C8534; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

In this paper we present a middleware infrastructure, called DataCutter, that enables processing of scientific datasets stored in archival storage systems across a wide area network. DataCutter provides support for subsetting of datasets through multidimensional range queries, and application specific aggregation on scientific datasets stored in an archival storage system. We also present experimental results from a prototype implementation.
Author
Data Management; Wide Area Networks; Data Transfer (Computers)

20000033919 European Organization for Nuclear Research, EP Division, Geneva, Switzerland
Towards Mass Storage Systems with Object Granularity
Holtmaen, Koen, European Organization for Nuclear Research, Switzerland; Willers, Ian, European Organization for Nuclear Research, Switzerland; vanderStok, Peter, Technische Univ., Netherlands; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 135-150; In English; See also 20000033909; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Many applications that need mass storage manipulate data sets with KB - MB size objects. In contrast, mass storage devices work most efficiently for the storage and transfer of large files in the MB - GB range. Reflecting these device characteristics, mass storage systems typically have a file level granularity. to overcome the impedance mismatch between small objects and large files, we propose a move towards mass storage systems with object granularity. With an object granularity system, the application programmer stores and retrieves objects rather than files. The system internally maps and re-maps these objects into files. The system can adapt to changing object access patterns by re-mapping objects. This allows the application to be more efficient than if it were built on top of a traditional file granularity mass storage system, employing a fixed mapping of objects to files. In this paper, we report on investigations on the potential benefits of object granularity systems. We present an architecture that incorporates solutions to the scalability and fragmentation problems associated with object granularity.
Author
Computer Storage Devices; Data Transfer (Computers); Architecture (Computers); Data Management; Object Programs

20000033920 Minnesota Univ., Lab. for Computational Science and Engineering, Minneapolis, MN USA

The InTENsity Power Wall: A Case Study for a Shared File System Testing Framework

Elder, Alex, Minnesota Univ., USA; Ruwart, Thomas M., Minnesota Univ., USA; Allen, Benjamin D., Minnesota Univ., USA; Bartow, Angela, Minnesota Univ., USA; Anderson, Sarah E., Minnesota Univ., USA; Porter, David H., Minnesota Univ., USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 151-162; In English; See also 20000033909

Contract(s)/Grant(s): NSF ACI-96-19019; W-7405-Eng-48; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The InTENsity PowerWall is a display system used for high-resolution visualization of very large volumetric data sets. The display is linked to two separate computing environments consisting of more than a dozen computer systems. Linking these systems is a common shared storage subsystem that allows a great deal of flexibility in the way visualization data can be generated and displayed. These visualization applications demand very high bandwidth performance from the storage subsystem and associated file system. The InTENsity PowerWall system presents a real-world application environment in which to apply a distributed performance testing framework under development at the Laboratory for Computational Science and Engineering at the University of Minnesota. This testing framework allows us to perform focused, coordinated performance testing of the hardware and software components of storage area networks and shared file systems. We use this framework to evaluate various performance characteristics of the PowerWall system's storage area network. We describe our testing approach and some of the results of our testing, and conclude by describing the direction of our future work in this area.

Author

Computer Storage Devices; Computer Networks; Data Management; Performance Tests; Computer Systems Performance; Distributed Memory; Human-Computer Interface; Data Storage

20000033921 Fujitsu Laboratories Ltd., Nakahara, Japan

Alternatives of Implementing a Cluster File Systems

Shinkai, Yoshitake, Fujitsu Laboratories Ltd., Japan; Tsuchiya, Yoshihiro, Fujitsu Laboratories Ltd., Japan; Murakami, Takeo, Fujitsu Laboratories Ltd., Japan; Williams, Jim, Amdahl Corp., USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 163-178; In English; See also 20000033909; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

With the emergence of Storage Networking, distributed file systems that allow data sharing through shared disks will become vital. We refer to Cluster File Systems as a distributed file systems optimized for environments of clustered servers. The requirements such file systems is that they guarantee file systems consistency while allowing shared access from multiple nodes in a shared-disk environment. In this paper we evaluate three approaches for designing a cluster file system - conventional client/server distributed file systems, symmetric shared file systems and asymmetric shared file systems. These alternatives are considered by using our prototype cluster file system, HAMFS (Highly Available Multi-server File System). HAMFS is classified as an asymmetric shared file system. Its technologies are incorporated into our commercial cluster file system product named SafeFILE. SafeFILE offers a disk pooling facility that supports off-the-shelf disks, and balances file load across these disks automatically and dynamically. From our measurements, we identify the required disk capabilities, such as multi-node tag queuing. We also identify the advantages of an asymmetric shared file system over other alternatives.

Author

Data Storage; Distributed Processing; Data Management; Data Transfer (Computers)

20000033922 FileTek, Inc., El Segundo, CA USA

StorHouse/Relational Manager (RM)-Active Storage Hierarchy Database System and Applications

Carino, Felipe, Jr., FileTek, Inc., USA; Burgess, John, FileTek, Inc., USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 179-186; In English; See also 20000033909; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper describes how database systems can use and exploit a cost-effective active storage hierarchy. by active storage hierarchy we mean a database system that uses all storage media (i.e. optical, tape, and disk) to store and retrieve data and not just disk. We describe and emphasize the active part, whereby all storage types are used to store raw data that is converted to strategic business information. We describe an evolution to the Data Warehouse concept, called Atomic Data Store, whereby atomic data is stored in the database system. Atomic data is defined as storing all the historic data values and executing queries against the historic queries. We also describe a Data Warehouse information collection, flow and central data store Hub-and-Spoke architecture, used to feed data into Data Marts. We also describe a commercial product; StorHouse/Relational Manager (RM).

RM is a commercial relational database system that executes SQL queries directly against data stored on the storage hierarchy (i.e. tape, optical, disk). We conclude with a brief overview of a real world AT&T Call Detail Warehouse (CDW) case study.
Author
Data Base Management Systems; Data Management; Architecture (Computers); Data Storage

20000033923 Lockheed Martin Space Mission Systems and Services, Upper Marlboro, MD USA
Fault Tolerant Design in the Earth Observing System Archive
Lake, Alla, Lockheed Martin Space Mission Systems and Services, USA; Crawford, Jonathan, Lockheed Martin Space Mission Systems and Services, USA; Simanowith, Raymond, Lockheed Martin Space Mission Systems and Services, USA; Koenig, Bradley, Lockheed Martin Space Mission Systems and Services, USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 187-192; In English; See also 20000033909; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The archive for the Earth Observing System (EOS) is one of the largest and highest data rate archives in the world. The EOS archive is referred to as EOS Core System (ECS) and is a multi-site distributed data warehouse of Earth-oriented satellite images and science algorithms/reports. Its data holdings are projected to approach five petabytes by 2002. Each distributed site is referred to as a ”Distributed Active Archive Center” or DAAC. The DAAC sites are being incrementally delivered with final deployment by the end of 2000. One of the sites, the EROS Data Center (EDC) in South Dakota, is receiving and archiving LANDSAT data in addition to the data generated by the instruments on the Terra satellite launched in December o 1999. Four of the DAACs will begin receiving Terra data in early 2000. The ECS archive architecture is based on a multi-site, distributed, client-server model. Its components are interdependent. As in any large and reasonably complex system robustness and ability of functional components to recover from faults is of great importance. In particular, ECS places heavy emphasis on data integrity and data capture robustness. This paper briefly describes the design of the hardware and software to insure the EOS data is captured and distributed in spite of faults. The description of hardware failover is confined to the Ingest Component design. The paper is intended as an introduction to the Poster Presentation material, and other components are discussed in the Poster Presentation itself.
Author
Data Bases; Data Storage; Client Server Systems; Data Base Management Systems; Data Management

20000033924 Deutsches Klimarechenzentrum G.m.b.H., Hamburg, Germany
Connection of a Climate Model Database and Mass Storage Archive(s)
Lautenschlager, Michael, Deutsches Klimarechenzentrum G.m.b.H., Germany; Thiemann, Hannes, Deutsches Klimarechenzentrum G.m.b.H., Germany; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 193-196; In English; See also 20000033909; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

An overview of an existing climate database which allows for storage of terabyte data volume is presented. Some features like the general architecture and the integration with a Hierarchical Storage Management (HSM) are highlighted in more detail.
Author
Data Bases; Data Storage; Data Management; Data Integration; Data Base Management Systems

20000033925 State Univ. of New York, Stony Brook, NY USA
New Prospects for Electrostatic Data Storage Systems
Korotkov, Alexander N., State Univ. of New York, USA; Likharev, Konstantin K., State Univ. of New York, USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 197-202; In English; See also 20000033909; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Magnetic data storage is a unique technology which has maintained an impressive bit density growth during the past few decades. It seems, however, that this growth will saturate somewhere near 100 Gbits/sq in, due to several fundamental factors. Recognition of this situation has triggered a wave of research in search of alternative technologies which would enable the current data storage scaling trend to continue after the magnetic systems run out of steam. The natural candidate for an alternative technology is electrostatic data storage, where a digital bit is retained in the form of a minute (few-electron) charge of a small metallic grain or a group of grains. However, earlier attempts to implement such storage systems ran into several problems, including: the lack of sensitive and fast solid state electrometers for reading heads, and low speed of write/erase process. During the past decade, the situation with the first problem has been radically improved due to the invention, demonstration, and gradual improvement of single-electron transistors (SET). These devices may serve as very good electrometers, with experimentally

demonstrated charge sensitivity (at low temperatures) better than 10(exp -5) e/vHz. Recently, the first operational room-temperature SET was demonstrated. Though the charge sensitivity of room-temperature SETs has not yet been measured, theory predicts that beyond the l/f noise range it may be of the order of 10(exp -7) e/vHz. This would be sufficient for readout of a few-electron signal at a very high (GHz-scale) speed. Therefore the write/erase speed seems to have become the key problem for the practical introduction of electrostatic storage systems. We have carried out a theoretical analysis of various possible solutions to this problem, and run into what we believe is a very promising opportunity. Its brief description is the objective of this report.
Derived from text
Computer Storage Devices; Data Storage; Electrostatics; Data Management; Transistors

20000033926 Northwestern Univ., Dept. of Electrical Engineering, Evanston, IL USA
Tertiary Storage Organization for Large Multidimensional Datasets
More, Sachin, Northwestern Univ., USA; Choudary, Alok, Northwestern Univ., USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 203-210; In English; See also 20000033909
Contract(s)/Grant(s): B347875; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Large multidimensional datasets are found in diverse application areas, such as data warehousing, satellite data processing, and high-energy physics. According to current estimates, these datasets are expected to hold terabytes of data. Since these datasets hold mainly historical and aggregate data, their sizes are increasing. Daily accumulation of raw data and jobs generating aggregate data from the raw data are responsible for this increase. Hence, estimates for the dataset sizes run into several petabytes. Though cost per byte as well as area per byte for secondary storage has been dropping, it is still not cost effective to store petabyte-sized datasets in the secondary storage. Efficient storage organization for multidimensional data has been investigated extensively. Chen et al discuss organization of multidimensional data on a hierarchical storage system. The authors prove that the problem of efficient organization of multidimensional data on a one-dimensional storage system, such as tertiary storage, is NP-complete when arbitrary range queries are allowed. They present a five step strategy based on heuristics for the problem. Jagadish et al investigated the problem of efficient organization of a data warehouse on secondary storage. The workload consists of a restricted set of range queries using hierarchies defined on the dimensions. They cast the problem as finding an optimal path through a lattice. They propose a dynamic programming based algorithm that determines how various dimensions are laid out. We are not aware of any work that takes into consideration practical constraints like the order in which the data already exists or will be generated. Given an order in which data currently exists (or will be generated), and a limited amount of temporary storage space, we investigate issues in efficiently organizing multidimensional datasets on tertiary storage. We cast the problem as permutation of the input data stream using limited storage space. The rest of this document is organized as follows: The problem is formulated in Section 2. Section 3 describes our approach. In Section 4, we present performance results. Section 5 presents conclusions.
Author
Data Transfer (Computers); Data Storage; Data Management; Heuristic Methods; Greedy Algorithms

20000033927 Colossal Storage, Fremont, CA USA
Ferroelectric Molecular Optical Storage Nanotechnology
Thomas, Michael E., Colossal Storage, USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 211-216; In English; See also 20000033909; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Colossal Storage has invented new ways of non-contact reading and writing with non destructive reading of information to a ferroelectric molecule.
Author
Computer Storage Devices; Data Storage; Ferroelectricity; Optical Memory (Data Storage)

20000033928 Houston Univ., Dept. of Computer Science, TX USA
A Stack Model Based Replacement Policy for a Non-Volatile Write Cache
Paris, Jehan-Francois, Houston Univ., USA; Haining, Theodore R., California Univ., USA; Long, Darrell D. E., California Univ., USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 217-224; In English; See also 20000033909
Contract(s)/Grant(s): N00014-92-J-1807; PO-10152754; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The use of non-volatile write caches is an effective technique to bridge the performance gap between I/O systems and processor speed. Using such caches provides two benefits: some writes will be avoided because dirty blocks will be overwritten

in the cache, and physically contiguous dirty blocks can be grouped into a single I/O operation. We present a new block replacement policy that efficiently expels only blocks which are not likely to be accessed again and coalesces writes to disk. In a series of trace-based simulation experiments, we show that a modestly sized cache managed with our replacement policy can reduce the number of writes to disk by 75 percent and often did better. We also show that our new policy is more effective than block replacement policies that take advantage of either spatial locality or temporal locality, but not both.
Author
Computer Storage Devices; Data Transfer (Computers); Input/Output Routines; Data Management

20000033929 Minnesota Univ., Dept. of Computer Science and Engineering, Minneapolis, MN USA
Switched FC-AL: An Arbitrated Loop Attachment for Fibre Channel Switches
Sinha, Vishal, Minnesota Univ., USA; Du, David H. C., Minnesota Univ., USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 225-236; In English; See also 20000033909; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Fibre Channel Arbitrated Loop (FC-AL) is a loop architecture. It can support any combination of hosts and storage devices, up to a maximum of 127 nodes. With 100 Mbytes/sec bandwidth, the loop structure enables rapid exchange of data between the devices. A major problem with the existing FC-AL is scalability. Theoretically, a maximum of 127 devices can be attached to a loop. However, past research has indicated that the loop can be saturated by as few as 32 devices. This number is expected to decrease rapidly, as the disks become faster and faster. to overcome this limitation, we investigated the possibility of extending the existing FC-AL protocol. Switched FC-AL protocol aims at using a switch to accommodate Arbitrated Loop devices without requiring a true fabric connection. Ideally, both fabric and loop devices should be able to share a single switch and enjoy their own 100Mbytes/s segments on each switch port, and yet be logically grouped together for high-speed transactions. We designed and simulated two different approaches to implement the switched FC-AL protocol. In the first approach, which is a circuit switched approach, the initiator establishes a connection with the target on the remote loop before initiating the data transfer. This approach is useful for applications that have hard Quality of Service (QOS) requirements. In the second approach, which is a packet switched approach, the exchange of data takes place in hops. The initiator needs to establish a local connection only. Each of these approaches has it's own pros and cons. The objective of our research is to investigate the design issues and trade-offs of both these approaches.
Author
Computer Storage Devices; Data Transfer (Computers); Data Storage; Protocol (Computers); Packet Switching; Switching

20000033930 Georgia Inst. of Tech., College of Computing, Atlanta, GA USA
Evaluating Backup Algorithms
Kurmas, Zachary, Georgia Inst. of Tech., USA; Chervenak, Ann L., USC Information Sciences Inst., USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 235-242; In English; See also 20000033909
Contract(s)/Grant(s): NSF CCR-97-02609; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

We present a trace-driven simulator that evaluates the performance of backup algorithms. We use this simulator to compare the performance of the commonly-used level scheme (our name for the algorithm used by the UNIX dump utility) with that of a new algorithm called the Z scheme. We show that the Z scheme has better backup performance than the level scheme and slightly worse restore performance. We also show that the Z scheme consumes less media for backups than the level scheme.
Author
Algorithms; Magnetic Storage; Computer Systems Simulation

20000033931 Minnesota Univ., Parallel Computer Systems Lab., Minneapolis, MN USA
An Overview of Version 0.9.5 Proposed SCSI Device Locks
Barry, Andrew, Minnesota Univ., USA; Tilstra, Mike, Minnesota Univ., USA; O'Keefe, Matthew, Minnesota Univ., USA; Preslan, Kenneth, Sistina Software, USA; Houlder, Gerry, Seagate Technology, USA; Coomes, Jim, Seagate Technology, USA; Wayda, James, Dot Hill Systems Corp., USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 243-249; In English; See also 20000033909; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Symmetric shared disks file systems are functional, versatile, and just plain cool. For these file systems to work, they require a global lock space, acessable to all clients. This paper describes a proposal for the implementation of the SCSI device lock command which provides a global lock space on storage devices. This paper details how Dlocks behave. This paper is a condensed overview of the 0.9.5 version of the proposed SCSI device locks specification. The full paper includes a thorough description of

Dlock implementation, optional features of Dlocks, and a discussion of how Dlocks are used by the Global File System. For a postscript version of the full 0.9.5 Dlock specification, please visit our web site http://www.globalfilesystem.org . This paper is an evolution of the 0.9.4 Specification of SCSI Device Locks, which can also be found at the GFS web site.
Author
Computer Storage Devices; Access Control; Protocol (Computers); Client Server Systems

20000033932 Lockheed Martin Space Mission Systems and Services, Upper Marlboro, MD USA
A Scalable Architecture for Maximizing Concurrency
Crawford, Jonathan M., Lockheed Martin Space Mission Systems and Services, USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 253-258; In English; See also 20000033909; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper describes a design that addresses limitations inherent in the initial implementation of the Archive for the Earth Observing Systems (EOS). The design consists of two elements: a Request Manager client interface and a Thread Manager design pattern. In combination, these design elements provide dramatic improvements in reliability and scalability. Moving to a transaction processing-based design also provides substantial gains for operability.
Author
Client Server Systems; Concurrent Processing; Architecture (Computers)

20000033937 NASA Goddard Space Flight Center, Greenbelt, MD USA
EOSDIS: Archive and Distribution Systems in the Year 2000
Behnke, Jeanne, NASA Goddard Space Flight Center, USA; Lake, Alla, Lockheed Martin Space Mission Systems and Services, USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 313-324; In English; See also 20000033909; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Earth Science Enterprise (ESE) is a long-term NASA research mission to study the processes leading to global climate change. The Earth Observing System (EOS) is a NASA campaign of satellite observatories that are a major component of ESE. The EOS Data and Information System (EOSDIS) is another component of ESE that will provide the Earth science community with easy, affordable, and reliable access to Earth science data. EOSDIS is a distributed system, with major facilities at seven Distributed Active Archive Centers (DAACs) located throughout the USA. The EOSDIS software architecture is being designed to receive, process, and archive several terabytes of science data on a daily basis. Thousands of science users and perhaps several hundred thousands of non-science users are expected to access the system. The first major set of data to be archived in the EOSDIS is from LANDSAT-7. Another EOS satellite, Terra, was launched on December 18, 1999. With the Terra launch, the EOSDIS will be required to support approximately one terabyte of data into and out of the archives per day. Since EOS is a multi-mission program, including the launch of more satellites and many other missions, the role of the archive systems becomes larger and more critical. In 1995, at the fourth convening of NASA Mass Storage Systems and Technologies Conference, the development plans for the EOSDIS information system and archive were described. Five years later, many changes have occurred in the effort to field an operational system. It is interesting to reflect on some of the changes driving the archive technology and system development for EOSDIS. This paper principally describes the Data Server subsystem including how the other subsystems access the archive, the nature of the data repository, and the mass-storage I/O management. The paper reviews the system architecture (both hardware and software) of the basic components of the archive. It discusses the operations concept, code development, and testing phase of the system. Finally, it describes the future plans for the archive.
Author
EOS Data and Information System; Data Transfer (Computers); Data Base Management Systems; Architecture (Computers); Data Management; Data Storage

20000033938 NASA Goddard Space Flight Center, Greenbelt, MD USA
Mass Storage System Upgrades at the NASA Center for Computational Sciences
Tarshish, Adina, NASA Goddard Space Flight Center, USA; Salmon, Ellen, NASA Goddard Space Flight Center, USA; Macie, Medora, NASA Goddard Space Flight Center, USA; Saletta, Marty, NASA Goddard Space Flight Center, USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 325-334; In English; See also 20000033909; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The NASA Center for Computational Sciences (NCCS) provides supercomputing and mass storage services to over 1200 Earth and space scientists. During the past two years, the mass storage system at the NCCS went through a great deal of changes

both major and minor. Tape drives, silo control software, and the mass storage software itself were upgraded, and the mass storage platform was upgraded twice. Some of these upgrades were aimed at achieving year-2000 compliance, while others were simply upgrades to newer and better technologies. In this paper we will describe these upgrades.
Author
Computer Storage Devices; Data Storage; Data Management; Computer Systems Design; Data Collection Platforms

20000033939 National Oceanic and Atmospheric Administration, Silver Spring, MD USA
Data Volume Proliferation in the 21st Century: The Challenges Faced by the NOAA National Data Centers (NNDC)
Jensen, John, National Climatic Data Center, USA; Kinsfather, John, National Geophysical Data Center, USA; Dwivedi, Parmesh, National Oceanographic Data Center, USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 335-350; In English; See also 20000033909; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper describes the challenges facing the three NOAA National Data Centers (NNDC), as well as the Information Technology Storage Area Network Systems (SANS) and Telecommunications industries in successfully meeting one component of the NOAA mission, Long Term Stewardship (Archiving and Access) of environmental data in the 21st Century. The collective holdings of digital data for the three data centers are approaching 800TeraBytes (TB), and steadily growing by several hundred terabytes of new data each year. by the year 2001, it is anticipated that the NNDC will be ingesting and processing over two hundred TeraBytes (TB) of new data each year, while managing and providing access to over one PetaByte (PB) of data and information. There is an immediate need to explore what Information Technologies (IT) and Data-Handling Techniques will be available to successfully meet the challenges regarding ingest, processing, convenient access, and efficient mass storage of very large volumes of environmental data. Early in the last decade of the Century/Millennium, it was clear that developments in Information Technologies (IT) would place powerful tools in the hands of most everyone, which could process and display large volumes of data at a relatively small cost. by 1995, NOAA developed a strategic vision and embarked on a program to build a dynamic and responsive IT architecture that would provide worldwide electronic access to the enormous volumes of climatic, geophysical, and oceanographic data under the long term stewardship of the three NOAA National Data Centers (NNDC). Electronic access and mass storage issues required examination from a total enterprise systems perspective taking into account connectivity between the data collection platforms, the processing and storage_ facilities, and users anywhere in the world. In 1996, the three centers, under the leadership of the National Environmental Satellite and Information Services (NESDIS) office, embarked on an initial five-year plan to address these issues and meet the challenges of the 21st Century. This plan is referred to as the NOAA Virtual Data System (NVDS) Initiative. At that time, the cumulative digital holdings were about 300TB, and it was projected that by 2000 the total volume of new data would increase to over one hundred terabytes per year. by 1998, the annual volume of new data exceeded the projected Year 2000 figure. The volume of new data per year for 2001 is currently projected to be over two hundred terabytes per year. If history is any indicator, this projection is conservative. How will NOAA successfully achieve a solution for the end-to-end stewardship of the proliferation of data volume and variety that will be a reality in the very near future?
Author
Data Storage; Data Management; Data Collection Platforms; Digital Data; Data Bases

20000033940 Minnesota Univ., Parallel Computer Systems Lab., Minneapolis, MN USA
Implementing Journaling in a Linux Shared Disk File System
Preslan, Kenneth W., Sistina Software, Inc., USA; Barry, Andrew, Minnesota Univ., USA; Brassow, Jonathan, Minnesota Univ., USA; Cattelan, Russell, Minnesota Univ., USA; Manthei, Adam, Minnesota Univ., USA; Nygaard, Erling, Minnesota Univ., USA; VanOort, Seth, Minnesota Univ., USA; Teigland, David, Minnesota Univ., USA; Tilstra, Mike, Minnesota Univ., USA; O'Keefe, Matthew, Minnesota Univ., USA; Erickson, Grant, Minnesota Univ., USA; Agarwal, Manish, Minnesota Univ., USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 351-378; In English; See also 20000033909
Contract(s)/Grant(s): 9720954; NAG2-1308; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

In computer systems today, speed and responsiveness is often determined by network and storage subsystem performance. Faster, more scalable networking interfaces like Fibre Channel and Gigabit Ethernet provide the scaffolding from which higher performance computer systems implementations may be constructed, but new thinking is required about how machines interact with network-enabled storage devices. In this paper we describe how we implemented journaling in the Global File System (GFS), a shared-disk, cluster file system for Linux. Our previous three papers on GFS at the Mass Storage Symposium discussed our first three GFS implementations, their performance, and the lessons learned. Our fourth paper describes, appropriately enough, the evolution of GFS version 3 to version 4, which supports journaling and recovery from client failures. In addition, GFS scalability tests extending to 8 machines accessing 8 4-disk enclosures were conducted: these tests showed good scaling. We describe the

GFS cluster infrastructure, which is necessary for proper recovery from machine and disk failures in a collection of machines sharing disks using GFS. Finally, we discuss the suitability of Linux for handling the big data requirements of supercomputing centers.
Author
Computer Systems Performance; Data Storage; Performance Tests; Data Management

20000033941 Maryland Univ. Baltimore County, Dept. of Computer and Electrical Engineering, Catonsville, MD USA
Design for a Decentralized Security System for Network Attached Storage
Freeman, William, Maryland Univ. Baltimore County, USA; Miller, Ethan, Maryland Univ. Baltimore County, USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 379-392; In English; See also 20000033909; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper describes an architecture for a secure file system based on network attached storage that guarantees end-to-end encryption for all user data. We describe the design of this system, focusing on the features that allow it to ensure that data is written and read only by authorized users, even in the face of attacks such as network snooping and physically capturing the storage media. Our work shows that such a system is feasible given the speeds of today's microprocessors, and we discuss benchmark results using several popular encryption and authentication algorithms that could be used on storage devices in such a system. Based on these calculations, we present the overall performance of the system, showing that it is nearly as fast as the non-encrypted file systems in wide use today.
Author
Computer Systems Design; Computer Information Security; Access Control

20000033942 Sun Microsystems, Inc., The Java Centers, Broomfield, CO USA
Jiro(TM) Storage Management
Haddon, Bruce K., Sun Microsystems, Inc., USA; Connor, William H., Sun Microsystems, Inc., USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 393-412; In English; See also 20000033909; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Jiro(TM) technology provides an environment intended for the implementation of storage management solutions. A product based on Jiro technology is an implementation based on the Federated Management Architecture (FMA) Specification, which describes extensions to the Java(TM) language environment. The FMA initiative addresses system management, particularly storage management. In addition to the platform, the FMA Specification defines a component model, i.e., the FederatedBeans(TM) model, and a set of services. The Jiro technology is effectively the application of this model to the design and implementation of storage management solutions. The FMA assumes a three-tier architecture for the design of storage management applications: the first or top tier is the client/presentation layer, or interaction layer with user's or systems acting as a client of the storage management application; the third or lowest tier represents the storage and related resources being managed; and the second or middle tier is that containing the logic (the programs) that define and effect the management actions required by the user upon the storage resources. It is the middle tier in which the FederatedBeans components are deployed. FederatedBeans components are each implementations of the concept of a Jini(TM) service. Each FederatedBeans component is an embodiment of some function that provides a service to other entities in the second and first tier. The success of the initiative surrounding the Jiro technology will be availability of a wide variety of FederatedBeans components from different suppliers, each providing significant functionality for the construction of storage management applications. The FMA platform supports automated communication between networked Java Virtual Machines, thus promoting applications that are federations of the constituent components. Within FMA, the resources being managed are expected to conform to the Common Information Model (CIM), although provision is made for the management of resources by other means. The CIM provides modeling for all common storage system elements.
Author
Data Management; Architecture (Computers); Management Systems

20000033943 Leeds Univ., ISS Dept., UK

A Blueprint for Representation Information in the OAIS Model

Holdsworth, David, Leeds Univ., UK; Sergeant, Derek M., Leeds Univ., UK; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 413-428; In English; See also 20000033909; Sponsored in part by the JISC/e-LIB programme.; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The CEDARS project within UK academia seeks to develop a demonstrator system to recommend techniques for long-term storage of digital data primarily within the research library context. The intention is that this demonstrator will conform to (the spirit of) the OAIS (Open Archival Information System) model, and put some flesh on the model's generic bones. This paper describes our current scheme for representation information.

Author

Digital Data; Data Storage; Information Systems

20000033944 Army Research Lab., Computational and Information Sciences Directorate, Aberdeen Proving Ground, MD USA

Project 1244: IEEE Storage System Standards

Cole, John L., Army Research Lab., USA; Eighth Goddard Conference on Mass Storage Systems and Technologies in Cooperation with the Seventeenth IEEE Symposium on Mass Storage Systems; March 2000, pp. 429-442; In English; See also 20000033909; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Approaching its tenth anniversary, the IEEE Storage System Standards effort is in the process of balloting Media Management System (MMS) standards. These represent the first standards for the IEEE Storage System Standards Working Group (SSSWG), and the first storage system standards for the world. In the early years, SSSWG produced the Mass Storage System Reference Model (MSSRM), directly influencing the design of many successful commercial products and the MMS standards themselves. The IEEE Storage System Standards Committee (SSSC), sponsor of SSSWG, will work in the coming year to complete work on the suite of MMS standards, and begin work on new projects. New projects for SSSC in 2000 include tape standards, tape recommended practice, and a project to develop a Guide for Storage System Design. Existing and new collaborations with other groups developing storage-related standards will be fostered in 2000. The SSSC is driven by the urgent need for interoperable storage system software, and storage systems that are highly scalable and functional in distributed, heterogeneous environments.

Author

Data Storage; Data Management; Standards

20000034146 Massachusetts Univ., Multimedia Indexing and Retrieval Group, Amherst, MA USA

Browsing, Discovery, and Search in Large Distributed Databases of Complex and Scanned Documents, *1 Oct. - 31 Dec. 1999*

Croft, W. Bruce; Jan. 07, 2000; 11p; In English

Contract(s)/Grant(s): F19628-95-C-0235

Report No.(s): AD-A372353; TR-5281811299; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This project aims to integrate powerful, new techniques for interactive browsing, discovery, and retrieval in very large, distributed databases of complex and scanned documents. Emphasis is placed on going beyond MI text retrieval techniques developed in the DARPA TIPSTER program to support different types of access and non-textual content. These techniques should be particularly relevant to the patent domain where it is important to find relationships between documents and where the patent or trademark may be based on a visual design. The specific tasks identified involve studying representation techniques for long documents with complex structure, browsing and discovery techniques for large text databases, image retrieval and scanned document retrieval techniques, and architectures for large, distributed databases.

DTIC

Data Retrieval; Information Retrieval; Data Management

20000034153 Army Construction Engineering Research Lab., Champaign, IL USA

Knowledge Worker System, Version 3.6, Reference Guide *Final Report*

Thomas, Beverly E.; Dec. 1999; 242p; In English

Report No.(s): AD-A374073; CERL-ADP-99/105; No Copyright; Avail: CASI; A03, Microfiche; A11, Hardcopy

The Knowledge Worker System (KWS) is an automated tool that enables an organization to define the tasks, information resources, and computer applications required to perform its business processes. Essentially, the information within KWS is an on-line process model for an organization. KWS represents process information in a temporal hierarchical task structure. This

structure contains information about the tasks that need to be done and when. Anywhere within this structure, procedural details, information resources, and computer applications can be associated with an individual task via steps, attachments, and Do Its, respectively. These components provide an organization with help in executing tasks and in some cases with automatic task execution. This reference guide describes KWS functionality and provides KWS users with detailed instructions on using KWS Version 3.6.
DTIC
Information Systems; Data Management; Information Management; Computer Techniques; Software Development Tools; User Manuals (Computer Programs)

20000034175 Nuclear Energy Agency, Issy-les-Moulineaux, France
Intermediate energy data
Koning, A. J.; Fukahori, T.; Hasegawa, A.; Dec. 31, 1998; 22p; In English
Report No.(s): DE99-633382; NEA-WPEC-13; ECN-RX-98-014; No Copyright; Avail: Department of Energy Information Bridge

Subgroup 13 (SG13) on Intermediate Energy Nuclear data was formed by NEA Nuclear Science Committee to solve common problems of these types of data for nuclear applications. An overview is presented in this final report of the present activities of SG13, including data needs, high-priority nuclear data request list (nuclides), compilation of experimental data, specialists meetings and benchmarks, data formats and data libraries. Some important accomplishments are summarized, and recommendations are presented.
NTIS
Data Collection Platforms; Nuclides

20000034922 International Atomic Energy Agency, International Nuclear Data Committee, Vienna, Austria
Summary report of the consultants' meeting on assessment of nuclear data needs for thorium and other advanced cycles
Pronyaev, V. G.; Aug. 31, 1999; 18p; In English
Report No.(s): DE99-634325; INDC(NDS)-408; No Copyright; Avail: Department of Energy Information Bridge

The report summarizes the results of discussions at the Consultants' Meeting on Assessment of Nuclear Data Needs for Thorium and other Advanced Cycles. The requirements to the nuclear data for power systems with Th-U fuel cycles are reviewed and updated. The meeting participants recommended to the IAEA Nuclear Data Section to organize the Co-ordinated Research Project 'Nuclear Data for Thorium-Uranium Fuel Cycle' to co-ordinate the activity on national programmes for improvement of the data in accordance with the new requirements.
NTIS
Information; Data Acquisition; Assessments

20000037690 Army Cold Regions Research and Engineering Lab., Hanover, NH USA
Bibliography on Cold Regions Science and Technology, Volume 53
Goldblatt, Roberta W., Editor, Army Cold Regions Research and Engineering Lab., USA; Minkus, Carl, Editor, Army Cold Regions Research and Engineering Lab., USA; Dec. 1999; 269p; In English
Report No.(s): AD-A374914; No Copyright; Avail: CASI; A03, Microfiche; A12, Hardcopy

The Bibliography on Cold Regions Science and Technology was first published in 1951 and is a continuing publication of the Cold Regions Bibliography Project (CRBP) in the Federal Research Division of the Library of Congress. It is sponsored by and prepared for the Cold Regions Research and Engineering Laboratory (formerly Snow, Ice and Permafrost Research Establishment) of the U.S. Army Corps of Engineers. Volumes 1-15 were issued as the Bibliography on Snow, Ice, and Permafrost, SIPRE Report 12. Beginning with volume 16 the designation was changed to CRREL Report 12. With Volume 20 the title was changed to Bibliography on Snow Ice and Frozen Ground, with Abstracts, and with volume 23 the current title was adopted. The present volume contains material accessioned between October 1998 and September 1999. It contains full citations of 5301 items, in many cases with abstracts. Indexing for the volume is issued as Volume 53, Part 2. This publication is available from the National Technical Information Service, Springfield, Virginia 22151. When ordering, the author and subject indexes (Part 2) should also be requested, as the usefulness of the bibliography would be severely limited without them. For online searching of the entire database from the early 1950s to the present - visit the CRBP website: lcweb. loc.gov/rr/scitech/coldregions/welcome. html. to search monthly accessions to the database, visit the CRREL website: www.orrel.usace.army.mil/library. The editors would like

to express their gratitude to Karen Berube, Editorial Assistant, for her endless resourcefulness and tireless efforts, without which the quality of this volume and the online database would be greatly diminished.
DTIC
Bibliographies; Snow; Ice; Permafrost; Technologies; Low Temperature Environments; Abstracts

20000037691 Army Cold Regions Research and Engineering Lab., Hanover, NH USA
Bibliography on Cold Regions Science and Technology, Volume 53
Goldblatt, Roberta W., Editor, Army Cold Regions Research and Engineering Lab., USA; Minkus, Carl, Editor, Army Cold Regions Research and Engineering Lab., USA; Dec. 1999; 547p; In English
Report No.(s): AD-A374915; No Copyright; Avail: CASI; A04, Microfiche; A23, Hardcopy

This companion issue to Volume 53, Part 1, contains author and subject headings for the volume. In the author index, principal and joint personal and corporate authors are listed along with the title, date, pagination, and language of the document and the accession number. The subject index is composed of four basic elements: 1) terms taken from a controlled vocabulary based on the Thesaurus of Engineering and Scientific Terms (LEX-EJC) 2) free terms added as needed 3) geographic names, generally entered under countries 4) cross references suggesting additional appropriate terms. The terms are listed in a single alphabetical arrangement, along with title (original, translated, abridged, expanded, or supplied), principal author, date, pagination, and language of pertinent documents, and their accession numbers. This publication is available from the National Technical Information Service, Springfield, Virginia 22151. When ordering, both Parts 1 and 2 should be requested, as they are complementary.
DTIC
Bibliographies; Snow; Ice; Permafrost; Organizations; Low Temperature Environments; Indexes (Documentation)

20000037753 National Center for Post-Traumatic Stress Disorder, White River Junction, VT USA
PILOTS Database Instruments Authority List
Lerner, F., Compiler; Feb. 2000; 220p; In English
Report No.(s): PB2000-103279; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Lists all projective tests, self-report questionnaires, structured interviews, and other instruments that have been used in papers indexed in the PILOTS database, and electronic index to published literature on post-traumatic stress disorder and other mental health sequelae of exposure to traumatic events. Bibliographic citations are provided for most instruments.
NTIS
Stress (Psychology); Psychological Tests; Personality Tests; Mental Health

20000037798 NASA Dryden Flight Research Center, Edwards, CA USA
50 Years of Flight Research: An Annotated Bibliography of Technical Publications of NASA Dryden Flight Research Center, *1946-1996*
Fisher, David F., NASA Dryden Flight Research Center, USA; Binkley, Robert L., NASA Dryden Flight Research Center, USA; March 2000; In English; CD-ROM contains full text document in pdf formation of the bibliography, an audio and text of the welcome and introduction, plus selected video clips from the NASA Dryden Movie Gallery
Contract(s)/Grant(s): RTOP 953-36-00
Report No.(s): NASA/TP-1999-206568; NAS 1.60:206568; H-2346; No Copyright; Avail: CASI; C01, CD-ROM

Titles, authors, report numbers, and abstracts are given for more than 2200 unclassified and unrestricted technical reports and papers published from September 1946 to December 1996 by NASA Dryden Flight Research Center and its predecessor organizations. These technical reports and papers describe and give the results of 50 years of flight research performed by the NACA and NASA, from the X-1 and other early X-airplanes, to the X-15, Space Shuttle, X-29 Forward Swept Wing, and X-31 aircraft. Some of the other research airplanes tested were the D-558, phase 1 and 2; M-2, HL-10 and X-24 lifting bodies; Digital Fly-By-Wire and Supercritical Wing F-8; XB-70; YF-12; AFTI F-111 TACT and MAW; F-15 HiDEC; F-18 High Alpha Research Vehicle, and F-18 Systems Research Aircraft. The citations of reports and papers are listed in chronological order, with author and aircraft indices. In addition, in the appendices, citations of 233 contractor reports, more than 200 UCLA Flight System Research Center reports and 25 video tapes are included.
Author
Abstracts; F-111 Aircraft; F-15 Aircraft; HL-10 Reentry Vehicle; X-29 Aircraft; X-31 Aircraft; Yf-12 Aircraft

20000038220 Institute for Human Factors TNO, Soesterberg, Netherlands

Human Factors Aspects of Automated Command and Information Systems ***Interim Report Cognitief-Ergonomische Aspecten van Geautomatiseerde Commandovoerings- en Informatiesystemen***

Schraagen, J. M. C., Institute for Human Factors TNO, Netherlands; vanderKleij, R., Institute for Human Factors TNO, Netherlands; Rasker, P. C., Institute for Human Factors TNO, Netherlands; Hoeksema-vanOrden, C. Y. D., Institute for Human Factors TNO, Netherlands; Kerstholt, J. H., Institute for Human Factors TNO, Netherlands; Dec. 21, 1998; 54p; In Dutch

Contract(s)/Grant(s): A97/KL/301; TNO Proj. 731.1; TNO Proj. 787.2

Report No.(s): TD-98-0286; TM-98-A071; Copyright; Avail: Issuing Activity

Due to changes in the role of the military and fewer funds available, an increasing reliance on information technology by the armed forces is apparent. Because of these changes, the Royal Netherlands Army (RNLA) wants to examine the impact of the use of information technology. In operations, information is the 'force multiplier'. to assess how information technology can aid the Command & Control (C2) process, the current study was carried out. In particular, human factors aspects of Command and Information Systems (CIS's) are discussed. First, a model is presented which can be used to describe the effects of CIS's on the C2 process. Next, several studies are examined in a literature review on the effects of IT on communication, decision making, and team building. Interviews with experts in the RNLA have been carried out to assess possibilities and limitations of the current CIS's in use in the RNLA. Finally, a number of topics is mentioned that should be put on the research agenda: The role of chart information in decision making; 'micromanagement'; fixation on the current battle; the role of CIS's in different types of operations; transfer of commander's intent with various communication media; information flow of varying levels of abstraction across different hierarchical levels; and 'information overload'.

Author

Command and Control; Automatic Control; Human Factors Engineering; Information Systems

20000038223 Institute for Human Factors TNO, Soesterberg, Netherlands

Explorations on the Construction, Usage and Validation of Geospecific Terrain Databases ***Final Report Verkenningen in Opbouw, Gebruik en Validatie van Geospecifieke Terreindatabases***

deVries, S. C., Institute for Human Factors TNO, Netherlands; Bots, M. J., Institute for Human Factors TNO, Netherlands; Riemersma, J. B. J., Institute for Human Factors TNO, Netherlands; Toet, A., Institute for Human Factors TNO, Netherlands; Feb. 11, 1999; 74p; In Dutch; Original contains color illustrations

Contract(s)/Grant(s): A96/KL/342; TNO Proj. 788.1

Report No.(s): TD-99-0015; TM-99-A013; Copyright; Avail: Issuing Activity

Simulator technology has matured to a level at which not only individual vehicle operators can be trained, but also large scale combined operations on geospecific simulated terrains can be prepared and rehearsed. The Royal Dutch Army has recognized the importance of this technology and has therefore commissioned TNO-HFRI to study production and validation aspects of these geo-specific simulations. TNO-HFRI created a database of a Dutch military training site "De Leusderheide" and performed two validation experiments, comparing search and detection performance at the actual site and in simulation. In addition to measuring task performance we examined crew coordination and communication behaviour, for which a scoring methodology was developed. This report deals with all aspects of this project: Building the database, specifying the lessons learned here, and the (partial) experimental validation of the database. The main focus is on a helicopter-experiment in which a helicopter crew had to find a number of objects during several sorties. The results show that on several aspects simulation and field performance and behaviour diverge, indicating that building a valid simulation is not a trivial feat. An important result from the research is that the tool developed for performing a behavioural validation (something rarely done, but nevertheless of considerable importance) has a more than adequate discriminating capability.

Author

Data Bases; Detection; Human Performance; Simulation; Simulators

89
ASTRONOMY

Includes radio, gamma-ray, and infrared astronomy, and astrometry.

20000033998 National Optical Astronomy Observatories, Tucson, AZ USA
NOAO's Next Generation Optical Spectrograph
Barden, Samuel C., National Optical Astronomy Observatories, USA; Harmer, Charles F. W., National Optical Astronomy Observatories, USA; Blakley, Rick D., National Optical Astronomy Observatories, USA; Parks, Rachel J., North Park Univ., USA; March 2000; 9p; In English
Report No.(s): NOAO-Preprint-876; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The National Optical Astronomy Observatory is developing a new, wide-field, imaging spectrograph for use on its existing 4-meter telescopes. This Next Generation Optical Spectrograph (NGOS) will utilize volume-phase holographic (VPH) grating technology and will have a mosaiced detector array to image the spectra over a field of view that will be something like 10.5 by 42 arc-minutes on the sky. The overall efficiency of the spectrograph should be quite high allowing it to outperform the current RC spectrograph by factors of 10 to 20 and the Hydra multi-fiber instrument by a factor of five to ten per object. The operational range of the instrument will allow observations within the optical and near-IR regions. Spectral resolutions will go from R=1000 to at least R=5000 with 1.4 arc-second slits. The large size of this instrument, with a beam diameter of 200 mm and an overall length of nearly 3 meters, presents a significant challenge in mounting it at the Cassegrain location of the telescope. Design trades and options that allow it to fit are discussed.
Author
Spectrographs; Spectroscopic Analysis; Spectroscopy; Holographic Spectroscopy; Gratings (Spectra); Spectrum Analysis; Signal Analysis

20000034105 NASA Marshall Space Flight Center, Huntsville, AL USA
Near-Simultaneous Spectroscopic and Broadband Polarimetric Observations of Be Stars
Ghosh, K., NASA Marshall Space Flight Center, USA; Iyengar, K. V. K., NASA Marshall Space Flight Center, USA; Ramsey, B. D., NASA Marshall Space Flight Center, USA; Austin, R. A., NASA Marshall Space Flight Center, USA; Astronomical Journal; August 1999; Volume 118, pp. 1061-1072; In English; Copyright; Avail: Issuing Activity

Near simultaneous optical spectroscopic (on four nights) and broadband linear continuum (B, V, R, and I bands) polarimetric (on seven nights) observations of 29 Be stars were carried out during 1993 November-December. The program Be stars displayed wavelength dependence of intrinsic polarizations with no frequency dependence of polarimetric position angles. Some of the Be stars displayed long-term polarization variability. The Be and Be-shell stars could not be distinguished from one another solely on the basis of their polarization values. Full widths at half-maximum of the H.alpha profiles and the intrinsic linear continuum polarizations are closely correlated with the projected rotational velocities of the program stars. Photospheric-absorption-corrected equivalent widths of H.alpha profiles [W(alpha)] and the radii of H.alpha-emitting or -absorbing envelopes (R(sub e) or R(sub a)) are nonlinearly correlated with the intrinsic continuum polarizations of these stars. However, W(alpha) and R(sub e) are linearly correlated. With large uncertainties, there is a trend of spectral dependence of polarization. Detailed discussion of these results is presented in this paper.
Author
Spectroscopy; Polarimetry; Spectral Emission; Emission Spectra; Line Spectra; B Stars; Stellar Envelopes

20000034894 Smithsonian Astrophysical Observatory, Cambridge, MA USA
High Resolution X-Ray Astronomy with the Chandra Observatory Stellar Point Sources and Extended Gaseous Emission of Cen Chandra X-Ray Observations of Clusters of Galaxies
Kim, Dong-Woo, Smithsonian Astrophysical Observatory, USA; [2000]; 1p; In English
Contract(s)/Grant(s): NAS8-39073; No Copyright; Avail: Issuing Activity; Abstract Only

I will introduce the Chandra Observatory and new results obtained during the Chandra OAC phase. These include the newly discovered X-ray jet in PKS 0637-752; X-ray jet, characteristics of point sources and extended emission in Cen A; and contact discontinuities and merger evidence of A2142.
Author
X Rays; Galactic Clusters; High Resolution; Point Sources

20000034899 Smithsonian Astrophysical Observatory, Cambridge, MA USA

Simultaneous Spectral and Timing Observations of Accreting Neutron Stars ***Final Report, 1 Jun. 1998 - 30 Nov. 1999***

Kaaret, P., Smithsonian Astrophysical Observatory, USA; March 2000; 3p; In English

Contract(s)/Grant(s): NAG5-7334; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

All six Rossi Timing Explorer (RXTE) observations approved for this proposal were car- ried out. Four of the observations were simultaneous with BeppoSAX (two of the source 4Ul820-30, and one each of 4U1636-536 and 4U0614+091) and two were simultaneous with ASCA (of 4Ul636-536 and of 4U0614+091). RXTE experienced a single event upset and went into a safe hold mode during the first 4U0614+091 observation and remained in safe hold until after the scheduled start of the second 4U0614+091 observation. An additional observation of 4U0614+091 was performed with RXTE to make up for the lost time. However, it was not possible to arrange for simultaneous observations with either BeppoSAX or ASCA. Our work has led to three papers directly related to observations made - one paper for each source observed - and one additional paper summarizing our progress in this field. In addition, several reports on these results were made at various conferences.

Derived from text

Neutron Stars; X Ray Timing Explorer; Accretion Disks; Spectrum Analysis

20000034906 NASA Marshall Space Flight Center, Huntsville, AL USA

The Chandra X-Ray Observatory Overview, Part 1

Weisskopf, Martin C., American Physical Society, USA; [2000]; 1p; In English, 30 Apr. 2000, Long Beach, CA, USA; Sponsored by American Physical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Chandra X-Ray Observatory was launched early in the morning of July 23, 1999 by the Space Shuttle Columbia. The Shuttle launch was only the first step in placing NASA's latest great observatory into orbit. After release from the cargo bay, the Inertial Upper Stage performed two firings and separated from the observatory as planned. Finally, after five firings of Chandra's own Integral Propulsion System - the last of which took place 15 days after the initial launch - the observatory was placed in its highly elliptical orbit of 140,000 km apogee and 10,000 km perigee. After Observatory activation, the first x-rays focussed by the telescope were observed on August 12, 1999. Beginning with this initial observation one could conclude that the telescope had survived the launch environment and was operating as expected. The month following the opening of the sunshade door was spent adjusting the focus for each set of instrument configurations, determining the optical axis, calibrating the star camera, establishing the relative response functions, determining the energy scale(s), and performing a series of "publicity" images. Each observation proved to be far more revealing than was expected. Preliminary results will be presented and the status of the instrumentation on the observatory will be discussed.

Author

Calibrating; Cameras; Inertial Upper Stage; Observatories; Telescopes; X Rays

20000036513 Smithsonian Astrophysical Observatory, Cambridge, MA USA

Initial Performance of the Attitude Control and Aspect Determination Subsystems on the Chandra Observatory

Cameron, R., Smithsonian Astrophysical Observatory, USA; Aldcroft, T., Smithsonian Astrophysical Observatory, USA; Podgorski, W. A., Smithsonian Astrophysical Observatory, USA; Freeman, M. D., Smithsonian Astrophysical Observatory, USA; [2000]; 1p; In English; Astronomical Telescopes and Instrumentation, 27-31 Mar. 2000, Munich, Germany; Sponsored by International Society for Optical Engineering, Unknown

Contract(s)/Grant(s): NAS8-39073; No Copyright; Avail: Issuing Activity; Abstract Only

The aspect determination system of the Chandra X-ray Observatory plays a key role in realizing the full potential of Chandra's X-ray optics and detectors. We review the performance of the spacecraft hardware components and sub-systems, which provide information for both real time control of the attitude and attitude stability of the Chandra Observatory and also for more accurate post-facto attitude reconstruction. These flight components are comprised of the aspect camera (star tracker) and inertial reference units (gyros), plus the fiducial lights and fiducial transfer optics which provide an alignment null reference system for the science instruments and X-ray optics, together with associated thermal and structural components. Key performance measures will be presented for aspect camera focal plane data, gyro performance both during stable pointing and during maneuvers, alignment stability and mechanism repeatability.

Author

Attitude Control; Star Trackers; Attitude Stability; Real Time Operation

20000038206 Alabama Univ., Huntsville, AL USA
StarCam *Final Report*
Swift, Wesley, Alabama Univ., USA; Oct. 30, 1999; 21p; In English
Contract(s)/Grant(s): NASA Order H-30747-D
Report No.(s): UAH-5-20383; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This project can be defined by it's three phases. The goals of Phase A of this contract are to (1) Determine the required dynamic range of the combined sky and stellar image and to (2) Specify camera and optics. That was accomplished and reported in the Phase A report attached. The goals of Phase B of this contract are to 1) Produce and demonstrate algorithms for starfield background removal, 2) Produce and demonstrate star tracking and centroiding algorithms, 3) Prepare and demonstrate pointing and auto-focus algorithms, and 4) Consult with those who develop flight software on above algorithms. We are pleased to report that the above has been accomplished and delivered to NASA via our contracting contact for this project, Cheryl Alexander and are attached here. We are proud to present this final report with the expectations that all should work as planned and under budget as well: two cameras for the expected price of one.
Derived from text
Astronomical Photography; Stellar Luminosity; Imaging Techniques; CCD Star Tracker; Dynamic Range

90
ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust. For related information see also 75 Plasma Physics.

20000033859 NASA Goddard Space Flight Center, Greenbelt, MD USA
Bulk Compositional Trends in Meteorites: A Guide for Analysis and Interpretation of NEAR XGRS Data from Asteroid 433 EROS
Nittler, Larry R., NASA Goddard Space Flight Center, USA; Clark, P. E., NASA Goddard Space Flight Center, USA; McCoy, T. J., Smithsonian Institution, USA; Murphy, M. E., NASA Goddard Space Flight Center, USA; Trombka, J. I., NASA Goddard Space Flight Center, USA; [1999]; 2p; In English; 31st; 31th Lunar and Planetary Science Conference, 13-17 Mar. 1999, Houston, TX, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Near Earth Asteroid Rendezvous (NEAR) spacecraft is to orbit the S-class asteroid 433 Eros for about one year beginning on February 14, 2000. The X-ray/gamma-ray O, Mg, Al, Si, Fe, and K; possibly H, Ca, S, Ti, and Th) of Eros with a spatial resolution ranging from a few km for X-rays to approx. 25% of the asteroid's surface for gamma-rays. The major scientific goals for the NEAR XGRS are to relate the composition of Eros to known classes of meteorites, to assess compositional heterogeneity and to identify geological processes that have occurred on the asteroid. Comparing remote-sensing data from asteroids to laboratory data from meteorites requires that the latter be well determined and understood. How well particular classes of meteorites can be identified as analogues of Eros depends not only on the error of the XGRS measurement, but also on the spread in abundances observed among different members of a given meteorite class. to prepare for the return of XGRS data from Eros, we have compiled a large database of bulk elemental compositions of meteorites, using data from a wide variety of published and unpublished sources. Custom software was developed to easily extract statistical information and make plots of data from different meteorite classes. Here, we use the meteorite compositional database to investigate which abundances and abundance ratios, of those measureable by the NEAR XGRS, are most diagnostic for distinguishing meteorite classes and identifying geological processes that have occurred on the samples' parent asteroids.
Derived from text
Asteroid Missions; Eros Asteroid; Meteorites; Remote Sensing; X Ray Spectroscopy; Chemical Composition; Gamma Ray Spectrometers

20000034113 International Centre for Theoretical Physics, Trieste, Italy
Applications of harmonic morphisms to gravity
Mustafa, M. T.; Aug. 31, 1999; 16p; In English
Report No.(s): DE99-634853; IC-99/91; No Copyright; Avail: Department of Energy Information Bridge

We introduce the notion of gravity coupled to a horizontally conformal submersion as a modification of the well-known concept of gravity coupled to a harmonic map, thus obtaining a coupled gravity system with more geometric flavour. by using integral techniques we determine the necessary conditions for coupling and cosmological constants. Finally, in the context of higher dimensional gravitation theory, we show that harmonic morphisms provide a natural ansatz to trigger spontaneous splitting

and reduction of the gravity system coupled to a harmonic map on (4 + D) (D (is greater than or equal to) 1) dimensional spacetimes.
NTIS
Gravitation; Harmonics; Morphology

20000034770 Lunar and Planetary Inst., Houston, TX USA
Workshop on Extraterrestrial Materials from Cold and Hot Deserts
Schultz, Ludolf, Editor, Lunar and Planetary Inst., USA; Franchi, Ian A., Editor, Lunar and Planetary Inst., USA; Reid, Arch M., Editor, Lunar and Planetary Inst., USA; Zolensky, Michael E., Editor, Lunar and Planetary Inst., USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999]; 114p; In English, 6-8 Jul. 1999, Pilanesberg, South Africa; Sponsored by Lunar and Planetary Inst., USA; See also 20000034771 through 20000034797
Contract(s)/Grant(s): NASW-4574
Report No.(s): LPI-Contrib-997; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Since 1969 expeditions from Japan, the USA, and European countries have recovered more than 20,000 meteorite specimens from remote ice fields of Antarctica. They represent approximately 4000-6000 distinct falls, more than all non-Antarctic meteorite falls and finds combined. Recently many meteorite specimens of a new ”population” have become available: meteorites from hot deserts. It turned out that suitable surfaces in hot deserts, like the Sahara in Africa, the Nullarbor Plain in Western and South Australia, or desert high plains of the U.S. (e.g., Roosevelt County, New Mexico), contain relatively high meteorite concentrations. For example, the 1985 Catalog of Meteorites of the British Museum lists 20 meteorites from Algeria and Libya. Today, 1246 meteorites finds from these two countries have been published in MetBase 4.0. Four workshops in 1982, 1985, 1988, and 1989 have discussed the connections between Antarctic glaciology and Antarctic meteorites, and the differences between Antarctic meteorites and modern falls. In 1995, a workshop addressed differences between meteorites from Antarctica, hot deserts, and modem falls, and the implications of possible different parent populations, infall rates, and weathering processes. Since 1995 many more meteorites have been recovered from new areas of Antarctica and hot deserts around the world. Among these finds are several unusual and interesting specimens like lunar meteorites or SNCs of probable martian origin. The Annual Meeting of the Meteoritical Society took place in 1999 in Johannesburg, South Africa. As most of the recent desert finds originate from the Sahara, a special workshop was planned prior to this meeting in Africa. Topics discussed included micrometeorites, which have been collected in polar regions as well as directly in the upper atmosphere. The title ”Workshop on Extraterrestrial Materials from Cold and Hot Deserts” was chosen and the following points were emphasized: (1) weathering processes, (2) terrestrial ages, (3) investigations of ”unusual” meteorites, and (4) collection and curation.
Derived from text
Deserts; Extraterrestrial Matter; Antarctic Regions; Meteorites; Australia

20000034771 Arkansas Univ., Cosmochemistry Group, Fayetteville, AR USA
The Natural Thermoluminescence Survey of Antarctic Meteorites: Ordinary Chondrites at the Grosvenor Mountains, Macalpine Hills, Pecora Escarpment and Queen Alexandra Range, and New Data for the Elephant Moraine, Ice Fields
Benoit, Paul H., Arkansas Univ., USA; Sears, Derek W. G., Arkansas Univ., USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 11-14; In English; See also 20000034770; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The natural TL (Thermoluminescence) survey of Antarctic meteorites was started in 1987 at the request of the Antarctic Meteorite Working Group in order to provide an initial description of radiation and thermal histories. It was intended to be a complement to the mineralogical and petrographic surveys performed at the Johnson Space Center and the Smithsonian Institution. All ANSMET (Antarctic Search for Meteorites) samples recovered since then, besides those that were heated throughout by atmospheric passage, have been measured. To date this amounts to about 1200 samples. As the data for each ice field reaches a significant level, we have been conducting a thorough examination of the data for that field with a view to identifying pairing, providing an estimate of terrestrial age and residence time on the ice surface, looking for differences in natural TL between ice fields, looking for variations in natural TL level with location on the ice, looking for meteorites with natural TL levels outside the normal range. Pairing is a necessary first step in ensuring the most productive use of the collection, while geographical variations could perhaps provide clues to concentration mechanisms. Samples with natural TL values outside the normal range are usually inferred to have had either small perihelia or recent changes in orbital elements. In addition, induced TL data have enabled us to look for evidence for secular variation in the nature of the flux of meteorites to Earth, and look for petrologically unusual meteorites, such as particularly primitive ordinary chondrites, heavily shocked meteorites, or otherwise anomalous meteorites. to date we have published studies of the TL properties of 167 ordinary chondrites from Allan Hills, 107 from Elephant Moraine and 302 from Lewis Cliff and we have discussed the TL properties of fifteen H chondrites collected at

the Allan Hills by Euromet after a storm during the 1988 season. We now have additional databases for a reasonable number of ordinary chondrites from Grosvenor Mountains (39 meteorites), MacAlpine Hills (70 meteorites), Pecora Escarpment (60 meteorites), and Queen Alexandra Range (173 meteorites) and we have data for a further 101 samples from Elephant Moraine. The results are summarized. We also have fairly minimal databases (10-15 meteorites) for Dominion Range, Graves Nunataks, Reckling Peak and Wisconsin Range that will not be discussed here.
Derived from text
Antarctic Regions; Chondrites; Ice; Meteorites; Mountains; Thermoluminescence; Escarpments; Geological Surveys

20000034772 Western Australian Museum, Dept. of Earth and Planetary Sciences, Perth, Australia
Meteorites from the Nullarbor, Australia: An Update
Bevan, Alex W. R., Western Australian Museum, Australia; Bland, Phil A., Museum of Natural History, UK; Jull, A. J. Timothy, Arizona Univ., USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 15-16; In English; See also 20000034770; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The gibber plains of the Nullarbor in Australia are important meteorite accumulation sites. Situated on the border between Western Australia and South Australia, the Nullarbor consists of flat-lying limestones of Early Miocene age exposed over a total area of ca. 240,000 km squared and covered with a thin calcareous loam. Prolonged aridity has allowed the accumulation of meteorites in the region, and a physiographically stable surface over the last 30 ka combined with low weathering rates are model circumstances for the estimation of the meteorite flux with time. Moreover, quantification of weathering effects in ordinary chondrites from the Nullarbor is providing a new palaeoclimatic tool. Similar to Antarctica, the masses of most stony meteorites from the Nullarbor are 100 g or less, with a peak in the mass distribution between 10-50 g. Statistical analysis of meteorite types from the Nullarbor shows that stony meteorites are most abundant with chondrites accounting for 92.7% of the total. Only 1.5% of distinct meteorites so far described from the Nullarbor are irons, which is much less than that (ca. 5%) predicted from the modern flux of meteorites. The small number of distinct irons from the Nullarbor is difficult to explain and human interference cannot be ruled out. Nevertheless, out of the four irons known, three, Mundrabilla, Haig, and Watson make up more than 99% of the total mass of meteorites collected from the Nullarbor. C-14 terrestrial ages for chondritic meteorites from the Nullarbor indicate an age range from present day to ca. 35 ka. Evidence suggests that meteorites are lying on, or near to, the surfaces on which they fell and that physiographically, the reason has remained essentially undisturbed for at least the last 30 ka. For this reason, the Nullarbor has provided important data on the flux of meteorites over the accumulation period. One significant factor affecting flux calculations using meteorite accumulations is the determination of the number of distinct falls represented in the population. The lack of transportation processes in the Nullarbor allows confident 'Pairing' of meteorites. Consequently, most paired meteorites are detected. Statistics confirm that there are few undetected pairs in the population of meteorites so far described from the Western Australian Nullarbor. The constitution of the population of meteorites by type from the Nullarbor is very similar to the Antarctic population but slightly different from the Saharan population. Mass frequencies of stony meteorite types are also very similar in most accumulation sites. However, compared with modem falls, the Nullarbor population includes a high proportion of rare and anomalous chondritic meteorites. This may be related to the period of accumulation of Nullarbor meteorites, to their ease of recognition in that setting compared with the rest of the world, or may result from meteoroid streams.
Author
Australia; Deserts; Paleoclimatology; Plains; Meteorites

20000034773 Museum of Natural History, Dept. of Mineralogy, London, UK
Ice Flow as the Principal Sink for Antarctic Meteorites
Bland, Phil A., Museum of Natural History, UK; Jull, A. J. Timothy, Arizona Univ., USA; Bevan, W. R., Western Australian Museum, Australia; Smith, T. B., Open Univ., UK; Berry, F. J., Open Univ., UK; Pillinger, C. T., Open Univ., UK; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 17-20; In English; See also 20000034770; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

It has previously been shown that Mossbauer spectroscopy is capable of providing a quantitative measure of weathering in ordinary chondrite (OC) meteorites. Used in conjunction with C-14 terrestrial ages, we have used this method to constrain weathering rates for individual hot desert meteorite populations. Typically, oxidation over time may be effectively modelled using an appropriate power-law, suggesting an initial rapid weathering phase, followed by more gradual oxidation. by quantifying oxidation over time, and modelling the effect of oxidation in destroying samples (from oxidation-frequency distributions) we can derive a decay-rate for meteorites in an accumulation, or a weathering half-life of a meteorite in a population. This, combined with a knowledge of the number of individual meteorites on the ground today, enables an estimate of the flux of meteorites over the lifetime of the site. Hot desert OC's typically show a peak in their oxidation-frequency distribution at 40% (ie. 40% of the iron in a meteorite is ferric): until this point oxidation is accommodated by available porosity; after this point porosity is exceeded and

the sample erodes. If this interpretation is correct, the oxidation-frequency distribution describes the response of OC's to a given amount of chemical weathering, and should be similar between different sites. Ordinary chondrites at the Allan Hills, despite their far longer residence times, are found to have a peak in there oxidation-frequency distribution at 10-15%, 25-30% lower than hot desert OC's. In addition (and contrary to earlier studies, although the data show more scatter than is typical of hot desert populations, we have shown that there is a correlation between weathering, and terrestrial age for the Allan Hills meteorites, allowing an (approximate) estimate of the rate of weathering over time. The plot of oxidation over time, although indicating much slower weathering rates than for hot desert meteorites, is qualitatively similar in its form: it can be modelled using an appropriate power-law, and shows an initial rapid weathering phase.
Derived from text
Antarctic Regions; Ice; Meteorites; Structural Basins; Weathering

20000034774 NASA Johnson Space Center, Houston, TX USA
Pairing Among the EET87503 Group of Howardites and Polymict Eucrites
Buchanan, Paul C., NASA Johnson Space Center, USA; Lindstrom, D. J., NASA Johnson Space Center, USA; Mittlefehldt, D. W., Lockheed Martin Corp., USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 21-24; In English; See also 20000034770; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The ten HED polymict breccias EET82600, EET87503, EET87509, EET87510, EET87512, EET87513, EET87518, EET87528, EET87531, and EET92022 were found over a broad area in the Elephant Moraine collecting region of Antarctica. Locations are scattered among the Main (Elephant Moraine), Meteorite City, and Texas Bowl icefields and the Northern Ice Patch. It was previously suggested that these polymict breccias are paired. However, degree of terrestrial alteration among these meteorites varies from relatively pristine (type A) to extensively altered (type B/C) and there are textural, mineralogical, and compositional differences. This study is a reevaluation of the pairing of these meteorites.
Derived from text
Antarctic Regions; Breccia; Meteoritic Composition; Ice; Achondrites; Geochemistry

20000034775 Washington Univ., Dept. of Earth and Planetary Sciences, Saint Louis, MO USA
Chemical Alterations of Hot Desert Meteorites: The Case of Shergottite Dar Al Gani 476
Crozaz, Ghislaine, Washington Univ., USA; Wadhwa, Meenakshi, Field Museum of Natural History, USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 25-27; In English; See also 20000034770; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

During the last three decades, many cosmochemical studies have been stimulated by the recovery of large numbers of meteorites from Antarctica. Similarly, the more recent discoveries of meteorites in hot deserts significantly increase the number of known meteorites. It is likely that new meteorite types will be found in these hot deserts and that the number of rare meteorites that can be studied in the laboratory using an array of state of the art techniques will be expanded. However, meteorites found in both cold and hot deserts have much longer terrestrial ages than others and, thus, it is critical to ascertain whether their properties reflect processes that occurred prior to their fall on earth or whether some of their characteristics have been modified by their extensive residence on our planet. Here, we study the microdistribution of lanthanides (REE) and use them as indicators of terrestrial alteration. These elements are important because they are commonly used to decipher the petrogenesis and chronology of meteorites.
Derived from text
Antarctic Regions; Deserts; Meteorites; Shergottites; Rare Earth Elements; Cosmochemistry

20000034776 State Univ. of New York, Dept. of Physics, Plattsburgh, NY USA
Chemical Compositions of Large Interplanetary Dust Particles from the Stratosphere and Small Antarctic Micrometeorites: Evidence for Element Loss and Addition in the Antarctic Micrometeorites
Flynn, George J., State Univ. of New York, USA; Sutton, S. R., Chicago Univ., USA; Kloeck, W., Martin Luther-Univ., German Democratic Republic; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 28-32; In English; See also 20000034770; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The largest interplanetary dust particles (IDPS) collected from the Earth's stratosphere overlap in size with the smallest micrometeorites collected from the polar ices. This size overlap, for particles from about 25 to 75 microns in diameter, offers the opportunity to compare particles that were, presumably, identical prior to their respective terrestrial residence, collection, and curation. Differences between the IDPs and the polar micrometeorites are likely to result from contamination or weathering in the respective environments of each particle. This size range from 25 co 75 microns is particularly interesting, because the mass-frequency distribution for particles incident on the Earth's atmosphere is sharply peaked in the 10 (exp -6) to 10 (exp -5)

gram mass range (particles a few hundred microns in diameter). Thus, the 25 to 75 micron diameter IDPs and polar micrometeorites are close in size to the peak in the mass- frequency distribution, and these particles are likely to reflect the composition of the bulk of the interplanetary material accreting onto the Earth.
Author
Chemical Composition; Interplanetary Dust; Micrometeorites; Stratosphere; Antarctic Regions

20000034777 Open Univ., Planetary Sciences Research Inst., Milton Keynes, UK
The Influence of Terrestrial Weathering on Implanted Solar Gases in Lunar Meteorites
Franchi, Ian A., Open Univ., UK; Verchovsky, A. V., Open Univ., UK; Pillinger, C. T., Open Univ., UK; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 33-35; In English; See also 20000034770; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The recent discovery of two large lunar meteorites in the Dar al Gani (DaG) region of the Libyan Sahara desert (DaG 262 and DaG 400) have sparked considerable and wide ranging interest in lunar material. The addition of lunar meteorites to the collections of extraterrestrial material have greatly complemented the suite of samples returned by the Apollo and Luna missions almost 30 years ago, extending the range of materials available for investigation. However, care may be required in interpreting variations seen in the lunar meteorite population and also any differences with the returned lunar samples. As has been noted previously in the comparison of ordinary chondrite populations from Antarctica, hot deserts and observed falls, variations between the populations may be attributed to their interaction with the different terrestrial environments they have been exposed to rather than indigenous, preatmospheric differences. In the case of the lunar samples this effect may be even more extreme as all the lunar meteorites are finds whereas the returned lunar samples were collected and subsequently stored in as near to ideal conditions as practically possible. Other factors related to the high levels of radiation damage suffered by materials in the lunar regolith may also make certain aspects of the lunar meteorites susceptible to terrestrial weathering. The particular interest behind this paper is how terrestrial weathering may have influenced the abundance and release characteristics of the implanted solar gases.
Derived from text
Lunar Geology; Meteorites; Weathering; Extraterrestrial Matter; Rare Gases; Libyan Desert

20000034778 Museum of Natural History, Dept. of Mineralogy, London, UK
Meteorites from Cold and Hot Deserts: How Many, How Big, and What Sort?
Grady, Monica M., Museum of Natural History, UK; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 36-40; In English; See also 20000034770; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

In the 5 years since the first workshop on meteorites from cold and hot deserts, there has been a big rise in the number of meteorites returned from desert localities. The number of meteorites found in the Sahara has grown three-fold, several new Antarctic localities have yielded plentiful harvests (e.g. Grosvenor Mountains, Queen Alexandra Range), and return visits to well-documented Antarctic sites have also resulted in many additional meteorites (e.g. Elephant Moraine). Although classification of new meteorites is regularly reported in the Meteoritical Bulletin, the total number of different types from all localities has not been published for many years. The present Symposium provides an opportunity to draw together statistical data for meteorites from cold and hot deserts, for comparison with data for modem falls; data are taken from the (almost published) 5th Edition of the Catalogue of Meteorites. All numbers are correct as of 1 st May 1999. The breakdown of different meteorite types is shown. The occurrence frequency of different meteorite types for the most productive collection areas are summarized; The mass frequency distribution for hot deserts is given, and for cold deserts. The mass frequency distribution for modern falls is plotted on both figures for comparison. Note that no correction is made for pairing. It has long been recognized that one consequence of the ease with which meteorites are located on the ice is that the mean size of meteorites in the Antarctic collection is smaller than that of modern falls and finds. This effect is readily visible; The median and modal specimen weights for each locality are listed. A further characteristic of desert meteorite collections is that there are more rare and unusual meteorite types compared to modern falls and finds, an effect that is illustrated.
Derived from text
Meteorites; Meteoritic Composition; Sahara Desert (Africa); Antarctic Regions

20000034779 Arizona Univ., Dept. of Physics, Tucson, AZ USA
Using C14 and C-14 Be-10 For Terrestrial Ages of Desert Meteorites
Jull, A. J. Timothy, Arizona Univ., USA; Bland, Phil A., Museum of Natural History, UK; Klandrud, S. E., Arizona Univ., USA; McHargue, L. R., Arizona Univ., USA; Bevan, Alex W. R., Western Australian Museum, Australia; Kring, David A., Arizona Univ., USA; Wlotzka, F., Max-Planck-Inst. fuer Chemie, Germany; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 41-43; In English; See also 20000034770; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The arid regions of the world appear to be great storage locations for meteorites, where they can survive for long periods of time in such environments. Large numbers of meteorites have been recovered from diverse areas of and and semi-arid regions of North Africa, Arabia, North America and Western Australia. The cold desert of Antarctica is a further storehouse of meteorites. One of the first recognized areas for collections of meteorites was Roosevelt County, New Mexico. The Nullarbor region of Australia and the northern Sahara Desert in Africa are also prolific sources of meteorites. The study of the terrestrial ages of these meteorites gives us useful information concerning the storage and weathering of meteorites and the study of fall times and terrestrial age. The most useful for many meteorite collection areas is C-14 (t (sub l/2)=5730 years). For the Nullarbor and for some other locations, we can show an approximately exponential drop-off of number of meteorites with increasing terrestrial age. Terrestrial ages of meteorites from North Africa and this region have been reported. Different climatic regimes and local geology can affect the distribution of terrestrial ages of meteorites from areas such as the Sahara desert and Roosevelt County, as weathering occurs at different rates depending on sample chemistry and local climatic effects. In this paper, we explore the usefulness and limitations of using C-14 for terrestrial age determinations and we also introduce a method of dating using both C-14 and Be-10. Since both of these radionuclides are produced by the same spallation reactions on oxygen, their production in meteorites is almost always at a constant ratio. This allows us to correct for shielding effects, the only assumption being that the exposure age of the meteorite is sufficient to saturate Be-10. This exposure age can also be verified by noble-gas data.
Derived from text
Deserts; Meteorites; Carbon 14; Beryllium 10; Arid Lands; Radioactive Isotopes; Chronology

20000034780 Arizona Univ., Lunar and Planetary Lab., Tucson, AZ USA
The Gold Basin Strewn Field, Mojave Desert, and Its Survival from the Late Pleistocene to the Present
King, David A., Arizona Univ., USA; Jull, A. J. Timothy, Arizona Univ., USA; Bland, Phil A., Museum of Natural History, UK; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 44-45; In English; See also 20000034770; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The Gold Basin strewn field occurs in the Mojave Desert of northwestern Arizona. When we first reported the find last year, approximately 2000 specimens had been recovered over a 160 kilometer squared area. More recent fieldwork has increased the number of samples to approx. 3000 over an area of about 225 kilometer squared. The area is currently part of the arid American Southwest, but climatic conditions have fluctuated since the time the meteorite fell. In this paper, we explore those changes and how they affected the weathering of the meteorite, comparing and contrasting these effects, where possible, with the effects seen among meteorites found in other hot desert regions of the world.
Derived from text
Meteorites; Mojave Desert (CA); Weathering; Structural Basins; Arid Lands; Ice

20000034781 Purdue Univ., Dept. of Chemistry, West Lafayette, IN USA
Thermally Mobile Trace Elements in Carbonaceous Chondrites from Cold and Hot Deserts
Lipschutz, M. E., Purdue Univ., USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 46-47; In English; See also 20000034770
Contract(s)/Grant(s): DE-FG02-95NE-38135; NAGW-3396; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Some decades ago, Anders and co-workers used RNAA to classify a number of trace elements as being volatile during nebular condensation and accretion into primitive objects based upon their strong depletion in (equilibrated) ordinary chondrites relative to C1 chondrites. Such elements, e.g. Ag, Bi, Cd, Cs, In, Se, Te, Tl, Zn and others, exhibit nearly constant, C1-normalized atomic abundances in C2 (CM2) and in C3 chondrites. They interpreted the near-constancy of these abundances according to a 2-component model in which volatiles were introduced into carbonaceous (and other) chondrites as Cl material which was diluted with differing proportions of high-temperature (i.e. volatile-free) components. In this view, mean volatile element abundances of 0.48 in C2 and 0.24-0.29 x C1 in C3 chondrites indicated that C2 and C3 chondrites are, respectively, about 1:1 and 1:2-3 mixtures of CL-like and high temperature materials. More recently, C1 normalized abundances of such volatile elements are nearly constant in most C2-6 chondrites (i.e. 25 non-Antarctic meteorites, nearly all falls, and 36 Antarctic finds) consistent with a 2- component mixing model. However, rather than being quantized, mean volatile element contents in each chondrite define a continuum from 0.92-0.14 x Cl for these 61 chondrites. A few carbonaceous chondrites - the first having been the NIPR consortium samples B-7904, Y-82162 and Y-86720 - show an altered pattern: many of the volatile elements in each exhibit the usual constancy of C1-normalized atomic abundances, but modified by further depletion of Cd and other elements like Tl and Bi. These are the most mobile trace elements, i.e. those most readily vaporized and lost from primitive meteorites during week-long heating at greater than or equal to 400 C under low ambient pressures (initially 10 (exp -5) atm H2), simulating metamorphic conditions in a primitive parent body. Similarities between mobile element data for B-7904, Y-82162 and Y-86720 with those for Murchison heated at 500-700 C suggest that these Antarctic C1 and C2-like chondrites were metamorphosed at temperatures like

these in the interiors of their parent bodies. Metamorphic temperatures inferred from RNAA data and textural/mineralogic alterations are internally consistent, agreeing with those evident in heated Murchison samples. These 3 chondrites were also heated late in their histories since all have lost cosmogenic 3-He, presumably during close solar approach, and B-7904 and Y-86720 seem also to have lost substantial proportions of radiogenic He-4 and Ar-40, cf. data. Similarities in spectral reflectance data for C-, G-, B- and F- asteroids, for these meteorites and for heated Murchison samples suggest that thermally metamorphosed interior materials in these asteroids were excavated by impacts and re-deposited on them, forming their present surfaces. Establishment of the thermal metamorphic histories of carbonaceouis chondrites, then, is essential to establishing the evolution and present-day nature of C-type and related asteroids.
Derived from text
Carbonaceous Chondrites; Deserts; Trace Elements; Metamorphism (Geology); High Temperature

20000034782 Harvard-Smithsonian Center for Astrophysics, Center for Astrophysics, Cambridge, MA USA
Historical Notes on Three Exceptional Iron Meteorites of Southern Africa: The Cape of Good Hope , Gibeon, and Hoba
Marvin, Ursula B., Harvard-Smithsonian Center for Astrophysics, USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 48-52; In English; See also 20000034770; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Africa, is among the richest of continents in meteorites from hot deserts. Namibia is the site of the world's largest individual meteorite, the 60-ton Hoba Ni-rich ataxite, and the largest known meteorite strewn field, that of the Gibeon fine octahedrite. In Egypt, history goes back at least as far as approx. 1340 B.C when an iron dagger with a small content of nickel was placed in the tomb of King Tutankhamen. History also comes up-to-date in northern Africa with recoveries in recent years of thousands of meteorites in the reaches of the Sahara from Libya to Mauretania. This paper will review the histories of three exceptional meteorites from southern Africa.
Author
Histories; Iron Meteorites; Republic of South Africa; Namibia

20000034783 Max-Planck-Inst. fuer Chemie, Abtelung Kosmochemie, Mainz, Germany
Saharan Meteorites with Short or Complex Exposure Histories
Merchel, Silke, Max-Planck-Inst. fuer Chemie, Germany; Altmaier, M, Cologne Univ., Germany; Korschinek, G, Technische Univ., Germany; Herpers, Ulrich, Cologne Univ., Germany; Knie, K., Technische Univ., Germany; Korschinek, G., Technische Univ., Germany; Kubik, P. W., Eidgenoessische Technische Hochschule, Switzerland; Neumann, S., Technische Hochschule, Germany; Michel, R., Technische Hochschule, Germany; Suter, M., Eidgenoessische Technische Hochschule, Switzerland; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 53-56; In English; See also 20000034770; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Long-lived radionuclides produced by cosmic rays in meteorites provide information that can be used to determine, on the one hand, the spectral distribution and the constancy of the cosmic ray flux and, on the other hand, to study the exposure history of the meteorites themselves. During the last four years we investigated a set of nearly one hundred meteorite samples with respect to cosmogenic radionuclides. Among them we found five meteorites from the Algerian and Libyan Sahara containing rather low radionuclide concentrations. To find out whether those reflect a short or a complex exposure time as meteoroids or "unusual" shielding conditions of the analyzed sample, we decided to look at stable cosmogenic nuclides, too. Comparing the complete set of data to theoretical model calculations offers the possibility to reveal the meteorite histories.
Derived from text
Exposure; Meteorites; Histories; Sahara Desert (Africa); Cosmology; Radioactive Isotopes

20000034784 Physical Research Lab., Ahmedabad, India
Cosmogenic and Trapped Gas Components in the Martian Meteorite Dar al Gani 476 from Hot Desert
Murty, Sripada V. S., Physical Research Lab., India; Mohapatra, R. K., Physical Research Lab., India; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 57-60; In English; See also 20000034770; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Dar al Gani 476 is the first Martian meteorite to be identified from the Libyan Sahara. It mostly consists of pyroxenes, feldspathic glass, olivine and also about a few percent of carbonate of certain terrestrial weathering origin. Based on the petrographic and chemical characteristics, it has recently been classified as a basaltic Shergottite. The meteorite appears highly fractured and shows effects of metamorphism under a shock pressure in the range of 40 to 50 GPa. A crystallization age of about 800 Ma, cosmic ray exposure age of 1.2 Ma and terrestrial age of greater than 32 Ka are reported for DaG476. We received two

subsamples, one from the surface (approx. 110 mg) and another from the interior (approx. 500 mg) from Dr. Zipfel (MPIC, Mainz) for the investigation of cosmogenic records and trapped gas composition.
Derived from text
Cosmology; Deserts; Gas Composition; SNC Meteorites; Rare Gases

20000034785 Kyushu Univ., Graduate School of Science, Fukuoka, Japan
Thermal Effects on Mineralogy, Noble-Gas Composition, and Carbonaceous Materials in CM Chondrites
Nakamura, Tomoki, Kyushu Univ., Japan; Kitajima, Fumio, Kyushu Univ., Japan; Takaoka, Nobuo, Kyushu Univ., Japan; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 61-63; In English; See also 20000034770; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Many CM chondrites have been found among Antarctic meteorites that have experienced thermal metamorphism after aqueous alteration. They are samples of hydrous asteroids recording more advanced evolution processes than normal CM chondrites. In the present study, mineralogy, noble-gas composition, and carbonaceous material of five CM chondrites were characterized, in order to see progressive changes of CM chondrites with increasing degree of heating.
Derived from text
Carbonaceous Materials; Chondrites; Mineralogy; Temperature Effects; Gas Composition; Rare Gases

20000034786 California Univ., Space Sciences Lab., Berkeley, CA USA
Terrestrial Ages of Antarctic Meteorites- Update 1999
Nishiizumi, Kunihiko, California Univ., USA; Welten, K. C., Lawrence Livermore National Lab., USA; Caffee, Marc W., California Univ., USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 64; In English; See also 20000034770; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

We are continuing our ongoing study of cosmogenic nuclides in Antarctic meteorites. In addition to the studies of exposure histories of meteorites, we study terrestrial ages and pairing of Antarctic meteorites and desert meteorites. Terrestrial ages of Antarctic meteorites provide information on meteorite accumulation mechanisms, mean weathering lifetimes, and influx rates. The determination of CL-36(half-life=3.01 x 10(exp 5) y) terrestrial ages is one of our long-term on-going projects, however, in many instances neither CL-36 or C-14 (5,730 y) yields an accurate terrestrial age. Using Ca-14 (1.04 x 10(exp 5) y) for terrestrial age determinations solves this problem by filling the c,ap in half-life between 14-C and CL-36 ages. We are now applying the new Ca-41- CL-36 terrestrial age method as well as the CL-36-Be-10 method to Antarctic meteorites. Our measurements and C-14 terrestrial age determinations by the University of Arizona group are always complementary. We have measured CL-36 in over 270 Antarctic meteorites since our previous compilation of terrestrial ages. Since a large number of meteorites have been recovered from many different icefields in Antarctica, we continue to survey the trends of terrestrial ages for different icefields. We have also measured detailed terrestrial ages vs. sample locations for Allan Hills, Elephant Moraine, and Lewis Cliff Icefields, where meteorites have been found with very long ages. The updated histograms of terrestrial ages of meteorites from the Allan Hills Main Icefield and Lewis Cliff Icefield are shown. These figures include C-14 ages obtained by the University of Arizona group. Pairs of meteorites are shown as one object for which the age is the average of all members of the same fall. The width of the bars represents 70,000 years, which was a typical uncertainty for CL-36 ages. We reduced the uncertainty of terrestrial age determinations to approx. 40,000 years by using pairs of nuclides such as Ca-41-CL-36 or CL-36-Be-10. Meteorites found at the Allan Hills Icefields are much older than any other meteorites. The terrestrial ages cover a wide range and are as old as 2 My. Many of the Lewis Cliff meteorites are as old as the Allan Hills meteorites. So far, no clear correlation has been found between the terrestrial ages and the locations of the Lewis Cliff meteorites.
Derived from text
Antarctic Regions; Chronology; Cosmology; Meteorites; Nuclides

20000034787 Max-Planck-Inst. fuer Chemie, Mainz, Germany
Do Weathering Effects Influence Cosmic Ray Exposure Ages of Enstatite Chondrites
Patzer, Andrea, Max-Planck-Inst. fuer Chemie, Germany; Schultz, Ludolf, Max-Planck-Inst. fuer Chemie, Germany; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 67-68; In English; See also 20000034770; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The cosmic ray record and exposure ages (CREA's) of 62 Enstatite chondrites have been reported recently. As one of the main results, an age spectrum has been given ranging between 1 and 60 Ma. A similar spectrum is known for the ordinary chondrites. One surprising aspect, however, that has not been observed for ordinary chondrites, is a significant difference between CREA's calculated from cosmogenic Ne-21 and Ar-38, respectively. Since Ne-21 exposure ages are believed to be the most reliable, not concordant Ar-ages need to be explained. In some Enstatite chondrites (EC) with high concentrations of trapped Ar, high

Ar-38-ages compared to Ne-21-ages are determined. This discrepancy is probably caused by insufficient correction for trapped Ar-38 as the trapped Ar-36/Ar-38 ratio is not well known. Other EC with lower abundances of trapped Ar show again in comparison with the Ne-21-ages - considerably lower Ar-38ages. In those cases we suggested that weathering effects may be responsible for the difference. Most notably Ca, one main target element of cosmogenic Ar-38, partly resides in minerals readily affected by terrestrial alteration. The comparatively abundant metal phase (Kamazite) represents another target nuclide. The dissolution or decomposition of both metal and Ca-bearing minerals, like oldhamite (CaS) as well as plagioclase, presumably results in a loss of cosmogenic Ar-38. As a consequence, the calculated Ar-38-exposure ages are too small.
Derived from text
Chondrites; Cosmic Rays; Enstatite; Exposure; Weathering; Chronology

20000034789 Max-Planck-Inst. fuer Chemie, Mainz, Germany
Noble Gases in 15 Meteorites from the Sahara: Eucrites, Ureilites, and Ordinary Chondrites
Scherer, Peter, Max-Planck-Inst. fuer Chemie, Germany; Paetsch, Matthias, Max-Planck-Inst. fuer Chemie, Germany; Schultz, Ludolf, Max-Planck-Inst. fuer Chemie, Germany; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 72-73; In English; See also 20000034770; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

In recent years the Sahara has become an important source of new meteorite finds. Especially in Libya the two recovery areas Dar al Gani (DaG) and Hammadah al Hamra (HaH) have yielded between 1990 and 1999 more than 850 meteorites. Several finds from hot deserts are heavily weathered and a meteoritic origin is not obvious from a first inspection. We report here noble gas analyses of 11 ordinary chondrites that are identified as meteorites by their noble gas record. These measurements have been carried out before other investigations took place and showed unambiguously that these rocks are meteorites. It should be mentioned that also several pseudometeorites with the appearance of meteorites were analyzed but their noble gas record did not indicate an extra-terrestrial origin; these results are not reported here. In addition, two eucrites and two ureilites from the Sahara were analyzed in connection with radionuclide measurements.
Derived from text
Chondrites; Meteorites; Rare Gases; Ureilites; Sahara Desert (Africa); Gas Analysis

20000034790 Verish (Robert S.), Sunland, CA USA
Deflation and Meteorites Exposure on Playa Lakes in the Southwestern USA: Unpaired Meteorites at Lucerne Dry Lake, California
Rubin, Alan E., California Univ., USA; Moore, Carleton B., Arizona State Univ., USA; Verish, Robert S., Verish (Robert S.), USA; Oriti, Ronald A.; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 74-75; In English; See also 20000034770; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Numerous dry lakes (playas) dot the Mojave Desert in Southern California and adjacent desert regions in Nevada and Arizona. Most have been significantly affected by deflation processes aided by the lack of protective vegetation and occurrence of fine-grained sediments. Meteorites have been found on several playas including Lucerne Dry Lake, Rogers (formerly Muroc) Dry Lake, Rosamond Dry Lake, Roach Dry Lake, Alkali Lake, and an unnamed dry lake near the town of Bonnie Claire in Nye County, Nevada. Unpaired meteorites have been found near one another on the same playa. Since 1963, 17 meteorite specimens (1.237.4 g), collectively called Lucerne Valley, have been found on Lucerne Dry Lake. Most appear to be completely covered with fusion crust, suggesting that their small size is due to fragmentation in the atmosphere and not to terrestrial weathering. The collection of meteorites on Lucerne Dry Lake is aided by the paucity of terrestrial rocks coarser than small pebbles; this is unusual for dry lakes in the region. Sixteen of the meteorite specimens from Lucerne Dry Lake were available for analysis.
Derived from text
Exposure; Lakes; Meteorites; Mojave Desert (CA); Playas; Pressure Reduction

20000034791 California Univ., Inst. of Geophysics and Planetary Physics, Los Angeles, CA USA
Iron Meteorites from Antarctica: More Specimens, Still 40% Ungrouped
Wasson, J. T., California Univ., USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 76-80; In English; See also 20000034770
Contract(s)/Grant(s): NAG5-4568; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

I summarize the data obtained to date on independent Antarctic iron meteorites by our UCLA neutron-activation laboratory. With about 5 exceptions, the listed values are the means of duplicate determinations. We have now analyzed 40 independent iron meteorites; I list 8 other irons that proved to be paired with meteorites. Because of the close relationship between pallasites and iron meteorites, I also list our data for two Antarctic pallasites that were studied at UCLA. Our new results confirm the previously reached conclusion about the abundance of ungrouped irons. In fact, the ungrouped fraction has increased slightly; of the 40 irons

16 are ungrouped, a fraction of 0.40. The two meteorites with pallasite structures are both small (approx. 50 g); one is ungrouped, the other a high-Ir anomalous member of the main-group pallasites (PMG).
Derived from text
Antarctic Regions; Iron Meteorites; Specimens; Meteoritic Composition

20000034792 Westfaelische Wilhelms Univ., Institut fuer Planetologie, Muenster, Germany
The Libyan Meteorite Population
Weber, Dietmar, Westfaelische Wilhelms Univ., Germany; Bischoff, A., Westfaelische Wilhelms Univ., Germany; Zipfel, Jutta, Max-Planck-Inst. fuer Chemie, Germany; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 81-82; In English; See also 20000034770; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

During the last decade more than 2000 meteorites were found in the Sahara. Two extraordinary recovery areas are the Hammadah al Hamra (HH) and the Dar al Gani (DG) regions in Libya, where more than 850 meteorites were collected from 1990 to 1999 (greater than 800 meteorites from 1994-1999). At present, more than 750 meteorites are classified by detailed mineralogical and chemical studies. The classifications include the meteorite class and usually the degrees of shock metamorphism and weathering, the chemical composition of major phases (e.g., olivine and pyroxene) and striking petrographic features such as brecciation or the occurrence of shock veins or impact melts. The mentioned find sites are large, flat and almost featureless desert areas (the so- called ”Regs”), covered with light-coloured sediments. The erosion rate is low as indicated by terrestrial ages of the meteorites up to 30000 years or even more. In these areas, the meteorite search is done by car. From the field of view, the average driving distance and find rate per day, a meteorite abundance of around 1.2 meteorites per square kilometer can be calculated. However, the single mass of a meteorite from the Sahara (and especially from DG and HH) is usually larger than 150g, which is, on average, higher than the typical masses of meteorites from Antarctica, Roosevelt County and Nullarbor, which range between 10 and 100g. It can be concluded that most small samples in the Sahara were overlooked and that, therefore, the meteorite abundance should be higher than the estimated value of 1.2 per square kilometers.
Derived from text
Libya; Meteorites; Populations; Metamorphism (Geology); Petrography; Classifications

20000034793 California Univ., Space Sciences Lab., Berkeley, CA USA
Degree of Weathering of H-Chondrites from Frontier Mountain, Antarctica
Welten, K. C., California Univ., USA; Nishiizumi, Kunihiko, California Univ., USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 83-87; In English; See also 20000034770
Contract(s)/Grant(s): NAG5-4992; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

One of the factors that determines the survival time of meteorites on the Earth’s surface is the rate of weathering. For meteorites from hot deserts, a clear correlation is found between the degree of weathering and the terrestrial age, but for Antarctic meteorites this correlation is weak or even lacking. The lack of a clear correlation can partly be attributed to the two-stage history of many Antarctic meteorites, which spend part of their terrestrial residence time in the ice before they are exposed on the ice. Recently, it was found that for Lewis Cliff (LEW) meteorites local conditions on the ice play an important role in the weathering process. This work focuses on weathering effects in ordinary chondrites from Frontier Mountain (FRO), North Victoria Land. Although most FRO meteorites were classified as weathering category A or B, many are contaminated with terrestrial uranium, deposited from meltwater. This suggests that weathering plays a more significant role than the qualitative A-B-C weathering index indicates. We therefore determined the degree of weathering more quantitatively, by deriving the amount of oxidized metal from the concentrations of Fe and Ni in the nonmagnetic fraction of 23 H-chondrites and 1 L-chondrite. The results will be compared with those of LEW meteorites and will be discussed in terms of terrestrial age and location of find on the ice.
Derived from text
Antarctic Regions; Chondrites; Meteorites; Mountains; Weathering

20000034794 California Univ., Space Sciences Lab., Berkeley, CA USA
Cosmogenic Radionuclides in Hot Desert Chondrites with Low C-14 Activities: A Progress Report
Welten, Kees, California Univ., USA; Nishiizumi, Kunihiko, California Univ., USA; Caffee, Marc W., Lawrence Livermore National Lab., USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 88-89; In English; See also 20000034770
Contract(s)/Grant(s): NAG5-4992; W-7405-eng-48; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Terrestrial ages of meteorites from hot deserts provide an important tool to estimate meteorite fluxes to the Earth. Most desert meteorites have terrestrial ages less than 40 ky, but a few achondrites from the Sahara region were recently shown to have significantly higher ages, up to approx. 100 ky. In general, C-14 (half-life = 5730 y) is the most suited radionuclide to determine

terrestrial ages for desert meteorites. However for meteorites with ages greater than 35 ky, the concentration of cosmogenic C-14 has decreased to a level at which it becomes difficult to distinguish between cosmogenic C-14 and terrestrial contamination. These meteorites may therefore be much older than 35 ky. We selected chondrites with low C-14 activities (less than or equal to 2 dpm/kg) for measurements of the concentrations of cosmogenic CL-36 (half-life= 3.01 x 10 (exp 5) y) and Ca-41 (half-life= 1.04 x 10 (exp 5) y) in the metal phase. Since the ratio of Ca-14/CL-36 in the metal phase of chondrites is relatively constant and well known, the measured ratio is a direct measure of the terrestrial age. A major problem is that most or sometimes all of the metal in these old ”hot desert” meteorites has been oxidized to hydrated Fe-Ni-oxides. Therefore, we also measured the concentrations of Be-10, Al-26 and CL-36 in the stony phase in order to constrain the terrestrial age as much as possible.
Derived from text
Carbon 14; Chondrites; Cosmology; Deserts; Radioactive Isotopes

20000034795 Eidgenoessische Technische Hochschule, Isotope Geology and Mineral Resources, Zurich, Switzerland
Noble Gases in Desert Meteorites: Howardites, Unequilibrated Chondrites, Regolith Breccias and an LL7
Wieler, Rainer, Eidgenoessische Technische Hochschule, Switzerland; Baur, H., Eidgenoessische Technische Hochschule, Switzerland; Busemann, H., Eidgenoessische Technische Hochschule, Switzerland; Heber, V. S., Eidgenoessische Technische Hochschule, Switzerland; Leya, I., Eidgenoessische Technische Hochschule, Switzerland; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 90-94; In English; See also 20000034770; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

We present He, Ne, and Ar data of 39 samples from 17 meteorites of various types. For three CV3 and two unequilibrated ordinary chondrites Kr and Xe data are also reported. The analyses served various purposes, e. g. to check for presence of solar noble gases, to determine concentrations of primordial noble gases, to study cosmic ray exposure ages including possible parent body exposures, and to recognize paired meteorites. The data are shown. Ne-21 exposure ages are calculated with the cosmogenic nuclide production model, assuming average chemical composition of the respective meteorite class and taking the (Ne-22/Ne-21)cos ratio as shielding parameter. In some cases we had to assume additionally a meteoroid radius less than or equal to 32 cm. We report an age range (T (exp 21) min - T (exp 21) max) rather than a single age to indicate that even when (Ne-22/Ne-21)cos is available, meteoroid size and sample depth are not unambiguously known, hence the Ne-21 production rate is only constrained to within certain limits. The mean production rates used here compare well with those given for (Ne-22/Ne-21)cos values between 1.08 - 1.12 (chondrites) and 1.10 - 1.15 (howardites), respectively. On the other hand, our values are up to 30% lower for high (Ne-22/Ne-21)cos values, i.e. small meteorites and low shielding.
Author
Achondrites; Breccia; Chondrites; Deserts; Meteorites; Rare Gases; Regolith

20000034796 NASA Johnson Space Center, Houston, TX USA
Identical Origin for Halide and Sulfate Efflorescences On Meteorite Finds and Sulfate Veins In Orgueil
Zolensky, Michael E., NASA Johnson Space Center, USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 95; In English; See also 20000034770; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Halide and sulfate efflorescences are common on meteorite finds, especially those from cold deserts. Meanwhile, the late-stage sulfate veins in Orgueil are universally accepted as having originated by the action of late-stage high fO2 aqueous alteration on an asteroid. I suggest here that these phenomena have essentially the same origin.
Author
Halides; Meteorites; Sulfates; Orgueil Meteorite

20000034797 NASA Johnson Space Center, Houston, TX USA
Type I Cosmic Spherules: Key to a Major, But Poorly Sampled, Asteroid Population
Nyquist, Larry E., NASA Johnson Space Center, USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 65-66; In English; See also 20000034770; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Fe, Ni, and Cr abundances in Type I cosmic spherules recovered from the deep sea, and also the isotopic fractionation of these elements during passage of the spherules through the terrestrial atmosphere was determined. Isotopic fractionation for all three elements is typically large, approx. 16%o/amu, corresponding to evaporative mass losses of approx. 80-85%, assuming Rayleigh distillation from an open system. The corrected, pre-atmospheric, Cr/Ni and Fe/Ni ratios are shown, where they are compared to these ratios in bulk chondrites and chondritic metal. Although the calculated pre-atmospheric Fe/Ni ratio for the spherules is relatively constant at 19 plus or minus 4 (sigma (sub mean)), the calculated pre-atmospheric Cr/Ni ratios vary by about two orders of magnitude. The Cr/Ni ratios are thus powerful discriminators for possible modes of origin of the spherules. For example, iron

meteorites typically have low Cr contents and low Cr/Ni ratios, less than or equal to 3 x 10(exp -4). Thus, Type I spherules do not appear to be ablation products of iron meteorites, in contrast to an earlier suggestion..
Derived from text
Asteroids; Populations; Spherules; Cosmology; Fractionation

20000034892 Oxford Univ., Dept. of Physics, Astrophysics, Oxford, UK
The Quasar Fraction in Low-Frequency Selected Complete Samples and Implications for Unified Schemes
Willott, Chris J., Oxford Univ., UK; Rawlings, Steve, Oxford Univ., UK; Blundell, Katherine M., Oxford Univ., UK; Lacy, Mark, Oxford Univ., UK; Mar. 31, 2000; 12p; In English
Report No.(s): OUAST/00/2; Copyright; Avail: Issuing Activity

Low-frequency radio surveys are ideal for selecting orientation-independent samples of extragalactic sources because the sample members are selected by virtue of their isotropic steep-spectrum extended emission. We use the new 7C Redshift Survey along with the brighter 3CRR and 6C samples to investigate the fraction of objects with observed broad emission lines - the 'quasar fraction' - as a function of redshift and of radio and narrow emission line luminosity. We find that the quasar fraction is more strongly dependent upon luminosity (both narrow line and radio) than it is on redshift. Above a narrow [OII] emission line luminosity of log(base 10) (L(sub [OII])/W) approximately is greater than 35 [or radio luminosity log(base 10) (L(sub 151)/ W/Hz.sr) approximately is greater than 26.5], the quasar fraction is virtually independent of redshift and luminosity; this is consistent with a simple unified scheme with an obscuring torus with a half-opening angle theta(sub trans) approximately equal 53 deg. For objects with less luminous narrow lines, the quasar fraction is lower. We show that this is not due to the difficulty of detecting lower-luminosity broad emission lines in a less luminous, but otherwise similar, quasar population. We discuss evidence which supports at least two probable physical causes for the drop in quasar fraction at low luminosity: (i) a gradual decrease in theta(sub trans) and/or a gradual increase in the fraction of lightly-reddened (0 approximately is less than A(sub V) approximately is less than 5) lines-of-sight with decreasing quasar luminosity; and (ii) the emergence of a distinct second population of low luminosity radio sources which, like M8T, lack a well-fed quasar nucleus and may well lack a thick obscuring torus.
Author
Quasars; Active Galactic Nuclei; Extragalactic Radio Sources; Radio Emission; Emission Spectra

20000034928 Hertfordshire Univ., Hatfield, UK
Populations of High-Luminosity Density-Bounded HII Regions in Spiral Galaxies? Evidence and Implications
Beckman, J. E., Instituto de Astrofisica de Canarias, Spain; Rozas, M., Instituto de Astrofisica de Canarias, Spain; Zurita, A., Instituto de Astrofisica de Canarias, Spain; Watson, R. A., Instituto de Astrofisica de Canarias, Spain; Knapen, J. H., Hertfordshire Univ., UK; [2000]; 30p; In English
Contract(s)/Grant(s): PB91-0525; PB94-1107; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this paper we present evidence that the H II regions of high luminosity in disk galaxies may be density bounded, so that a significant fraction of the ionizing photons emitted by their exciting OB stars escape from the regions. The key piece of evidence is the presence, in the Ha luminosity functions (LFs) of the populations of H iI regions, of glitches, local sharp peaks at an apparently invariant luminosity, defined as the Stromgren luminosity Lstr), LH(sub alpha) = Lstr = 10(sup 38.6) (+/- 10(sup 0.1)) erg/ s (no other peaks are found in any of the LFs) accompanying a steepening of slope for LH(sub alpha) greater than Lstr This behavior is readily explicable via a physical model whose basic premises are: (a) the transition at LH(sub alpha) = Lstr marks a change from essentially ionization bounding at low luminosities to density bounding at higher values, (b) for this to occur the law relating stellar mass in massive star-forming clouds to the mass of the placental cloud must be such that the ionizing photon flux produced within the cloud is a function which rises more steeply than the mass of the cloud. Supporting evidence for the hypothesis of this transition is also presented: measurements of the central surface brightnesses of H II regions for LH(sub alpha) less than Lstr are proportional to L(sup 1/3, sub H(sub alpha)), expected for ionization bounding, but show a sharp trend to a steeper dependence for LH(sub alpha) greater than Lstr, and the observed relation between the internal turbulence velocity parameter, sigma, and the luminosity, L, at high luminosities, can be well explained if these regions are density bounded. If confirmed, the density-bounding hypothesis would have a number of interesting implications. It would imply that the density-bounded regions were the main sources of the photons which ionize the diffuse gas in disk galaxies. Our estimates, based on the hypothesis, indicate that these regions emit sufficient Lyman continuum not only to ionize the diffuse medium, but to cause a typical spiral to emit significant ionizing flux into the intergalactic medium. The low scatter observed in Lstr, less than 0.1 mag rms in the still quite small sample measured to date, is an invitation to widen the data base, and to calibrate against primary standards, with the aim of obtaining a precise, approx. 10(exp 5) solar luminosity widely distributed standard candle.
Author
Luminosity; Spiral Galaxies; Boundaries; Density (Mass/Volume); Stellar Mass; Massive Stars; Ionization; H II Regions; Data

Bases

20000036515 NASA Marshall Space Flight Center, Huntsville, AL USA
Integration of the Empirical Exospheric GCPM Plasma Model into IRI
Gallagher, Dennis L., NASA Marshall Space Flight Center, USA; Bilitza, Dieter, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 33rd; 33rd COSPAR Scientific Assembly, 16-23 Jul. 2000, Warsaw, Poland; No Copyright; Avail: Issuing Activity; Abstract Only

The Global Core Plasma Model (GCPM) is an empirical description of typical thermal magnetospheric plasma densities in the plasmasphere, plasma trough, and polar cap. The GCPM makes use of the International Reference Ionosphere (IRI) for low altitudes. Densities are continuous and smooth. Plasmaspheric ion composition is also included in the GCPM. For the purpose of supporting the ionospheric community, the densities derived in the GCPM for high altitudes will be expressed as an extension of the IRI. The GCPM exospheric extension of IRI improves the topside densities and provides typical thermal plasma densities for the plasmasphere, trough, and polar cap. The GCPM is modular, having been designed for continued improvement as statistical density and composition measurements become available.
Author
Thermal Plasmas; Plasma Density; Density Measurement; Atmospheric Models; Exosphere

20000038208 Alabama Univ., Center for Space Plasma, Aeronomy and Astrophysics Research, Huntsville, AL USA
On the Origin and Evolution of Stellar Chromospheres, Coronae and Winds ***Final Report***
Musielak, Z. E., Alabama Univ., USA; [2000]; 10p; In English
Contract(s)/Grant(s): NAG5-3027; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This grant was awarded by NASA to The University of Alabama in Huntsville (UAH) to construct state-of-the-art, theoretical, two-component, chromospheric models for single stars of different spectral types and different evolutionary status. In our proposal, we suggested to use these models to predict the level of the ”basal flux”, the observed range of variation of chromospheric activity for a given spectral type, and the decrease of this activity with stellar age. In addition, for red giants and supergiants, we also proposed to construct self-consistent, purely theoretical wind models, and used these models to investigate the origin of ”dividing lines” in the H-R diagram. In the following, we describe our completed work. We have accomplished the first main goal of our proposal by constructing first purely theoretical, time-dependent and two-component models of stellar chromospheres.1 The models require specifying only three basic stellar parameters, namely, the effective temperature, gravity and rotation rate, and they take into account non-magnetic and magnetic regions in stellar chromospheres. The non-magnetic regions are heated by acoustic waves generated by the turbulent convection in the stellar subphotospheric layers. The magnetic regions are identified with magnetic flux tubes uniformly distributed over the entire stellar surface and they are heated by longitudinal tube waves generated by turbulent motions in the subphotospheric and photospheric layers. The coverage of stellar surface by magnetic regions (the so-called filling factor) is estimated for a given rotation rate from an observational relationship. The constructed models are time-dependent and are based on the energy balance between the amount of mechanical energy supplied by waves and radiative losses in strong Ca II and Mg II emission lines. to calculate the amount of wave energy in the non-magnetic regions, we have used the Lighthill-Stein theory for sound generation.
Derived from text
Stellar Evolution; Astrophysics; Chromosphere; Coronas; Wind Profiles

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LUNAR AND PLANETARY SCIENCE AND EXPLORATION

20000033855 NASA Ames Research Center, Moffett Field, CA USA
Seasonal Water Transport in the Atmosphere of Mars: Applications of a Mars General Circulation Model Using Mars Global Surveyor Data ***Final Report, 1 Jul. 1997 - 30 Nov. 1999***
Hollingsworth, Jeffery L., NASA Ames Research Center, USA; Bridger, Alison F. C., San Jose State Univ., USA; Haberle, Robert M., NASA Ames Research Center, USA; [1999]; 26p; In English
Contract(s)/Grant(s): NCC2-5230; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is a Final Report for a Joint Research Interchange (JRI) between NASA Ames Research Center and San Jose State University, Department of Meteorology. We present below a summary of progress made during the duration of this JRI. The focus of this JRI has been to investigate seasonal water vapor transport in the atmosphere of Mars and its effects on the planet’s present climate. to this end, the primary task has been to adapt a new dynamical processor for the adiabatic tendencies of the atmospheric

circulation into the NASA Ames Mars general circulation model (MGCM). Using identical boundary and initial conditions, several comparative tests between the new and old MGCMs have been performed and the nature of the simulated circulations have been diagnosed. With confidence that the updated version of the Ames MGCM produces quite similar mean and eddy circulation statistics, the new climate model is well poised as a tool to pursue fundamental questions related to the spatial and seasonal variations of atmospheric water vapor on Mars, and to explore exchanges of water with non-atmospheric reservoirs and transport within its atmosphere. In particular, the role of surface sources and sinks can be explored, the range of water-vapor saturation altitudes can be investigated, and plausible precipitation mechanisms can be studied, for a range of atmospheric dust loadings. Such future investigations can contribute to a comprehensive study of surface inventories, exchange mechanisms, and the relative importance of atmospheric transport Mars' water cycle. A listing of presentations made and manuscripts submitted during the course of this project is provided.
Author
Atmospheric General Circulation Models; Atmospheric Circulation; Mars Atmosphere; Mars Surface; Mars Global Surveyor; Hydrological Cycle; Hydrology Models

20000033862 NASA Goddard Space Flight Center, Greenbelt, MD USA
Latest Results from the Mars Orbiter Laser Altimeter (MOLA)
Smith, David E., NASA Goddard Space Flight Center, USA; Zuber, Maria T., Massachusetts Inst. of Tech., USA; Solomon, Sean C., Carnegie Institution of Washington, USA; Phillips, Roger J., Washington Univ., USA; Head, James W., Brown Univ., USA; Gavin, James B., NASA Goddard Space Flight Center, USA; Frey, Herbert V., NASA Goddard Space Flight Center, USA; Muhleman, Duane O., California Inst. of Tech., USA; Pettengill, Gordon H., Massachusetts Inst. of Tech., USA; Zwally, H. Jay, NASA Goddard Space Flight Center, USA; [2000]; 2p; In English; 31st; 31st Lunar and Planetary Science Conference, 13-17 Mar. 2000, Houston, TX, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The first MOLA data were acquired in Sept. 1997 shortly after the arrival of Mars Global Surveyor (MGS) at Mars and before the start of aerobraking. Subsequently, data were obtained during several months in the spring and summer of 1998. All these data were obtained over the northern hemisphere. At the beginning of March 1999 the mapping phase of the MGS mission began in the designed 400 km near circular, near polar orbit and MOLA began collecting continuous global data. by the end of 1999 MOLA had acquired over 250 million altimeter measurements of the radius of the planet at accuracies of the order of a few meters radially and about 100 meters horizontally. These observations revealed the detailed structure of the Martian surface, the form of the polar caps, as well as the shape of the planet. The early results provided a unique view of the north polar cap and subsequently of the south polar cap from which an estimate of the total volume of present-day surface water ice of 3.2 to 4.7 million cubic km was obtained. to obtain full coverage of the polar caps it was necessary for MOLA to be pointed off nadir approximately 20 degrees and on several occasions MGS has performed a roll maneuver to make these observations. It is hoped that these off-nadir observations of the central region of the cap (MGS only reaches to latitudes plus or minus 86.5) will assist in the detection of the seasonal deposition of CO2 since it is believed that these high latitudes regions may be the accumulation zone.
Author
Laser Altimeters; Mars Surface; Mars Atmosphere; Mars (Planet); Planetary Orbits

20000034070 Colorado Univ., Joint Inst. for Lab. Astrophysics, Boulder, CO USA
Laboratory Studies of Low Temperature Rate Coefficients: The Atmospheric Chemistry of the Outer Planets and Titan
Final Report, 1 Jan. 1997 - 31 Dec. 1999
Bogan, Denis, Colorado Univ., USA; [1999]; 13p; In English
Contract(s)/Grant(s): NAG5-4314; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Laboratory measurements have been carried out to determine low temperature chemical rate coefficients of ethynyl radical (C2H) for the atmospheres of the outer planets and their satellites. This effort is directly related to the Cassini mission which will explore Saturn and Titan. A laser-based photolysis/infrared laser probe setup was used to measure the temperature dependence of kinetic rate coefficients from approx. equal to 150 to 350 K for C2H radicals with H2, C2H2, CH4, CD4, C2H4, C2H6, C3H8, n-C4H10, i-C4H10, neo-C5H12, C3H4 (methylacetylene and allene), HCN, and CH3CN. The results revealed discrepancies of an order of magnitude or more compared with the low temperature rate coefficients used in present models. A new Laval nozzle, low Mach number supersonic expansion kinetics apparatus has been constructed, resulting in the first measurements of neutral C2H radical kinetics at 90 K and permitting studies on condensable gases with insufficient vapor pressure at low temperatures. New studies of C 2H with acetylene have been completed.
Author
Atmospheric Chemistry; Low Temperature; Titan; Reaction Kinetics; Radicals; Gas Giant Planets; Methyl Compounds

20000038056 NASA Kennedy Space Center, Cocoa Beach, FL USA
Magellan Science Briefing from NASA Headquarters
Oct. 29, 1991; In English; Videotape: 62 min. 40 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000036563; No Copyright; Avail: CASI; B04, Videotape-Beta; V04, Videotape-VHS

This video presents a Magellan Science update on the most recent findings from the Magellan Mission to Venus. Brian Dunbar, NASA Public Affairs, introduces Dr. Wes Huntress, Division Director Solar System and Exploration Division. Dr. Huntress explains the Magellan Mission to Venus, which tested the temperature and emissivity of Venus, and collected high resolution radar imagery of 92% of the surface of the planet. Dr. Steve Saunders, Magellan Project Scientist, Jet Propulsion Lab, presents a visual global view of the North Pole of Venus. He also presents planet wide patterns of fracture on Venus. Dr. Saunders showed a video presentation of radio mapping results from Artemis. Dr. Wood, Radar Investigator, Smithsonian Astrophysical Observatory explains Mat Mons, which is the second highest mountain on Venus. Dr. John Wood also presents a video presentation of his findings. Dr. Gordon Pettengill, Principle Investigator, Massachusetts Institute of Technology, presents a video on the Topography of the Magellan Mission, which is able to give resolution ten times finer and further into the South and into the North than was possible earlier. The video of the Magellan Science update ends with a question and answer period.
CASI
Magellan Project (NASA); Topography; Venus (Planet); Space Exploration; Venus Surface

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SOLAR PHYSICS

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

20000033986 NASA Marshall Space Flight Center, Huntsville, AL USA
Status of Cycle 23 Forecasts
Hathaway, D. H., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Space Weather, 20-24 Mar. 2000, Clearwater, FL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A number of techniques for predicting solar activity on a solar cycle time scale are identified, described, and tested with historical data. Some techniques, e.g,, regression and curve-fitting, work well as solar activity approaches maximum and provide a month- by-month description of future activity, while others, e.g., geomagnetic precursors, work well near solar minimum but provide an estimate only of the amplitude of the cycle. A synthesis of different techniques is shown to provide a more accurate and useful forecast of solar cycle activity levels. A combination of two uncorrelated geomagnetic precursor techniques provides the most accurate prediction for the amplitude of a solar activity cycle at a time well before activity minimum. This precursor method gave a smoothed sunspot number maximum of 154+21 for cycle 23. A mathematical function dependent upon the time of cycle initiation and the cycle amplitude then describes the level of solar activity for the complete cycle. As the time of cycle maximum approaches a better estimate of the cycle activity is obtained by including the fit between recent activity levels and this function. This Combined Solar Cycle Activity Forecast now gives a smoothed sunspot maximum of 140+20 for cycle 23. The success of the geomagnetic precursors in predicting future solar activity suggests that solar magnetic phenomena at latitudes above the sunspot activity belts are linked to solar activity, which occurs many years later in the lower latitudes.
Author
Solar Activity; Solar Cycles; Forecasting

20000033999 Science Applications International Corp., San Diego, CA USA
The Structure and Dynamics of the Solar Corona ***Final Report, 16 Jun. 1998 - 15 Aug. 1999***
Mikic, Zoran, Science Applications International Corp., USA; Mar. 22, 2000; 69p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS5-96081
Report No.(s): SAIC-00/8005:APPAT-239; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report covers technical progress during the third year of the NASA Space Physics Theory contract ”The Structure and Dynamics of the Solar Corona,” between NASA and Science Applications International Corporation, and covers the period June 16, 1998 to August 15, 1999. This is also the final report for this contract. Under this contract SAIC, the University of California, Irvine (UCI), and the Jet Propulsion Laboratory (JPL), have conducted research into theoretical modeling of active regions, the solar corona, and the inner heliosphere, using the MHD model. During the three-year duration of this contract we have published 49 articles in the scientific literature. These publications are listed in Section 3 of this report. In the Appendix we have attached

reprints of selected articles. We summarize our progress during the third year of the contract. Full descriptions of our work can be found in the cited publications, a few of which are attached to this report.
Derived from text
Magnetohydrodynamics; Mathematical Models; Solar Corona; Heliosphere; Sun

20000034021 Maryland Univ., Astronomy Dept., College Park, MD USA
Solar Flare Physics ***Final Report, 1 Jan. - 31 Mar. 2000***
Schmahl, Edward J., Maryland Univ., USA; Kundu, Mukul R., Maryland Univ., USA; Mar. 21, 2000; 14p; In English
Contract(s)/Grant(s): NAG5-8029; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In the extended portion of this grant (January 1-March 31, 2000), we have continued our previous efforts (January 1-December 31, 1999) in studies of Fourier imaging methods applied to hard X-ray flares. In particular, we have performed theoretical analysis of the ”Forward-Fitting” method in collaboration with Dr. Markus Aschwanden, (Lockheed-Martin Palo Alto Research lab) in support of the HESSI (High Energy Solar Spectroscopic Imager) mission to enable rapid imaging of solar flares in hard X-rays.
Author
Solar Flares; X Rays; Point Sources

20000034234 NASA Goddard Space Flight Center, Greenbelt, MD USA
What We Don’t Understand About Ion Acceleration Flares
Reames, Donald V., NASA Goddard Space Flight Center, USA; Ng, C. K., NASA Goddard Space Flight Center, USA; Tylka, A. J., NASA Goddard Space Flight Center, USA; [1999]; 14p; In English; High Energy Solar Physics: Anticipating HESSI, 18-20 Oct. 1999, College Park, MD, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

There are now strong associations between the (3)He-rich, Fe-rich ions in ”impulsive” solar energetic particle (SEP) events and the similar abundances derived from gamma-ray lines from flares. Compact flares, where wave energy can predominate, are ideal sites for the study of wave-particle physics. Yet there are nagging questions about the magnetic geometry, the relation between ions that escape and those that interact, and the relative roles of cascading Alfven waves and the EMIC waves required to enhance He-3. There are also questions about the relative timing of ion and electron acceleration and of heating; these relate to the variation of ionization states before and during acceleration and during transport out of the corona. We can construct a model that addresses many of these issues, but problems do remain. Our greatest lack is realistic theoretical simulations of element abundances, spectra, and their variations. By contrast, we now have a much better idea of the acceleration at CME-driven shock waves in the rare but large ”gradual” SEP events, largely because of their slow temporal evolution and great spatial extent.
Author
Ions; Electron Acceleration; Energetic Particles; Coronal Mass Ejection; Solar Flares

20000034248 NASA Goddard Space Flight Center, Greenbelt, MD USA
Initial Time Dependence of Abundances in Solar Energetic Particle Events
Reames, Donald V., NASA Goddard Space Flight Center, USA; Ny, C. K., NASA Goddard Space Flight Center, USA; Tylka, A. J., Naval Research Lab., USA; [1999]; 12p; In English
Contract(s)/Grant(s): NASA Order S-92662-F; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We compare the initial behavior of Fe/O and He/H abundance ratios and their relationship to the evolution of the proton energy spectra in ”small” and ”large” gradual solar energetic particle (SEP) events. The results are qualitatively consistent with the behavior predicted by the theory of Ng et al. (1999a, b). He/H ratios that initially rise with time are a signature of scattering by non-Kolmogorov Alfven wave spectra generated by intense beams of shock-accelerated protons streaming outward in large gradual SEP events.
Author
Time Dependence; Abundance; Particle Acceleration; Sun; Coronal Mass Ejection; Solar Flares

20000034258 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Record of the Solar Activity and of Other Geophysical Phenomenons in Tree Ring ***Registros da Atividade Solar e de Outros Fenomenos Geofisicos em Aneis de Crescimento de Arvores***
Rigozo, Nivaor Rodolfo, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 138p; In Portuguese
Report No.(s): INPE-7260-TDI/702; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Tree ring studies are usually used to determine or verify climatic factors which prevail in a given place or region and may cause tree ring width variations. Few studies are dedicated to the geophysical phenomena which may underlie these tree ring width

variations. In order to look for periodicities which may be associated to the solar activity and/or to other geophysical phenomena which may influence tree ring growth, a new interactive image analysis method to measure tree ring width was developed and is presented here. This method makes use of a computer and a high resolution flatbed scanner; a program was also developed in Interactive Data Language (IDL 5.0) to study ring digitized images and transform them into time series. The main advantage of this method is the tree ring image interactive analysis without needing complex and high cost instrumentation. Thirty-nine samples were collected: 12 from Concordia - S. C., 9 from Canela - R. S., 14 from Sao Francisco de Paula - R. S., one from Nova Petropolis - R. S., 2 from Sao Martinho da Serra - R. S. e one from Chile. Fit functions are applied to ring width time series to obtain the best long time range trend (growth rate of every tree) curves and are eliminated through a standardization process that gives the tree ring index time series from which is performed spectral analysis by maximum entropy method and iterative regression. The results obtained show periodicities close to 11 yr, 22 yr Hale solar cycles and 5.5 yr for all sampling locations 52 yr and Gleissberg cycles for Concordia - S. C. and Chile samples. El Nino events were also observed with periods around 4 e 7 yr.
Author
Research; Climatology; Spectrum Analysis; Solar Activity; Programming Languages; Periodic Variations; Image Analysis; Cycles; Dendrochronology

20000034849 NASA Ames Research Center, Moffett Field, CA USA
Observations of the Spectral Distribution of Solar Irradiance at the Ground During SUCCESS
Pilewskie, Peter, NASA Ames Research Center, USA; Goetz, Alexander F. H., Colorado Univ., USA; Beal, David A., Analytical Spectra Device, Inc., USA; Bergstrom, Robert W., Bay Area Environmental Research Inst., USA; Mariani, Peter, Bay Area Environmental Research Inst., USA; Geophysical Research Letters; Apr. 15, 1998; ISSN 0094-8534; Volume 25, No. 8, pp. 1141-1144; In English
Contract(s)/Grant(s): DRI-95-B26; NAG5-4447
Report No.(s): Paper-98GL00238; Copyright; Avail: Issuing Activity

During SUCCESS two independent and independently calibrated spectrometers were deployed at a surface site to determine the spectrally resolved downwelling solar irradiance. Preliminary evidence shows that for cloud-free conditions there is general agreement between measurements and model derived irradiance, at least to within instrumental and model uncertainties of 5%, with greatest disagreement Occurring in the 400 nm - 700 nm band. Cirrus effects are most prominent in the near-infrared bands beyond 1500 nm while the influence of very thin (subvisual) cirrus is evident in the scattered flux at the surface. Further remote sensing applications and the assessment of cloud absorption is contingent upon measurements of the surface spectral albedo.
Author
Solar Radiation; Irradiance; Albedo; Light (Visible Radiation); Near Infrared Radiation; Sky Brightness; Solar Energy

20000034893 NASA Marshall Space Flight Center, Huntsville, AL USA
Anticipating HESSI's Spatially Resolved View of Spectral Evolution
Newton, Elizabeth K., NASA Marshall Space Flight Center, USA; Giblin, Timothy, NASA Marshall Space Flight Center, USA; Tom, Metcalf, NASA Marshall Space Flight Center, USA; Jan. 15, 2000; 1p; In English; Proceedings of the High Energy Solar Physics Workshop, Oct. 1999, USA; Sponsored by NASA Marshall Space Flight Center, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The spectral evolution of observed flares' hard X-ray emission is found to conform to certain patterns in color-color diagrams. by combining the spectral resolution of BATSE Abstract: data with the spatial resolution of HXT data, we are able to address the nature of flare energy release and anticipate what kind of observations HESSI may make of the energy rele.ase/particle acceleration site in flares.
Author
Flare Stars; X Rays; Emission; Spectral Resolution; Color-Color Diagram

20000036567 NASA Langley Research Center, Hampton, VA USA
Shielding from Solar Particle Event Exposures in Deep Space
Wilson, John W., NASA Langley Research Center, USA; Cucinotta, F. A., NASA Langley Research Center, USA; Shinn, J. L., NASA Langley Research Center, USA; Simonsen, L. C., NASA Langley Research Center, USA; Dubey, R. R., Old Dominion Univ., USA; Jordan, W. R., Old Dominion Univ., USA; Jones, T. D., Christopher Newport Univ., USA; Kim, M. Y., National Academy of Sciences - National Research Council, USA; Radiation Measurements; 1999; ISSN 1350-4487; Volume 30, pp. 361-382; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The physical composition and intensities of solar particle event exposures or sensitive astronaut tissues are examined under conditions approximating an astronaut in deep space. Response functions for conversion of particle fluence into dose and dose

equivalent averaged over organ tissue, are used to establish significant fluence levels and the expected dose and dose rates of the most important events from past observations. The BRYNTRN transport code is used to evaluate the local environment experienced by sensitive tissues and used to evaluate bioresponse models developed for use in tactical nuclear warfare. The present results will help to the biophysical aspects of such exposure in the assessment of RBE and dose rate effects and their impact on design of protection systems for the astronauts. The use of polymers as shielding material in place of an equal miss of aluminum would prowide a large safety factor without increasing the vehicle mass. This safety factor is sufficient to provide adequate protection if a factor of two larger event than has ever been observed in fact occurs during the mission.
Author
Solar Flares; Astronauts; Biophysics; Dosage; Exposure; Organs; Relative Biological Effectiveness (RBE)

20000037756 NASA Marshall Space Flight Center, Huntsville, AL USA
An Assessment of Magnetic Conditions for Strong Coronal Heating in Solar Active Regions by Comparing Observed Loops with Computed Potential Field Lines
Gary, G. A., NASA Marshall Space Flight Center, USA; Moore, R. L., NASA Marshall Space Flight Center, USA; Porter, J. G., NASA Marshall Space Flight Center, USA; Falconer, D. A., Alabama Univ., USA; Astrophysical Journal; Jan. 10, 1999; Volume 528, pp. 1004-1014; In English; Copyright; Avail: Issuing Activity

We report further results on the magnetic origins of coronal heating found from registering coronal images with photospheric vector magnetograms. For two complementary active regions, we use computed potential field lines to examine the global non-potentiality of bright extended coronal loops and the three-dimensional structure of the magnetic field at their feet, and assess the role of these magnetic conditions in the strong coronal heating in these loops. The two active regions are complementary, in that one is globally potential and the other is globally nonpotential, while each is predominantly bipolar, and each has an island of included polarity in its trailing polarity domain. We find the following: (1) The brightest main-arch loops of the globally potential active region are brighter than the brightest main- arch loops of the globally strongly nonpotential active region. (2) In each active region, only a few of the mainarch magnetic loops are strongly heated, and these are all rooted near the island. (3) The end of each main-arch bright loop apparently bifurcates above the island, so that it embraces the island and the magnetic null above the island. (4) At any one time, there are other main-arch magnetic loops that embrace the island in the same manner as do the bright loops but that are not selected for strong coronal heating. (5) There is continual microflaring in sheared core fields around the island, but the main-arch bright loops show little response to these microflares. From these observational and modeling results we draw the following conclusions: (1) The heating of the main-arch bright loops arises mainly from conditions at the island end of these loops and not from their global non-potentiality. (2) There is, at most, only a loose coupling between the coronal heating in the bright loops of the main arch and the coronal heating in the sheared core fields at their feet, although in both the heating is driven by conditions/events in and around the island. (3) The main-arch bright loops are likely to be heated via reconnection driven at the magnetic null over the island. The details of how and where (along the null line) the reconnection is driven determine which of the split-end loops are selected for strong heating. (4) The null does not appear to be directly involved in the heating of the sheared core fields or in the heating of an extended loop rooted in the island. Rather, these all appear to be heated by microflares in the sheared core field.
Author
Magnetic Signatures; Coronal Loops; Solar Magnetic Field; Heating; Magnetic Cores

20000037789 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Observations of Broadband Solar UV-B Radiation ***Observacao da Radiacao Ultravioleta Solar Tipo B em Banda Larga***
Echer, Ezequiel, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 152p; In Portuguese
Report No.(s): INPE-7254-TDI/697; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The National Institute for Space Research (INPE), operates a network of solar ultraviolet B (UV-B) radiation meters, at ground level, since the 1990's, at sites in Brazil, Bolivia, Chile and Antarctica. The ultraviolet meters are broadband meters (UV-Biometer), and narrowband meters (Ground-based Ultraviolet Radiometers, Brewer Ozone Spectrophotometers). Several analyses of UV-B radiation are presented, with emphasis on a methodology derived from Langley's method to calculate the atmospheric total optical depth in the UV-B. This methodology was then applied to global radiation data measured by the Brewer spectrophotometer. The total optical depths obtained with global radiation were compared with total optical depths obtained with direct radiation data, also measured by the Brewer spectrophotometer, with good match. The methodology to calculate optical depths was then tested also for UV-Biometer data, although these do not follow the Langley requirements. The results obtained

with UV-Biometer data for total optical depth were in good agreement with optical depths calculated from the Brewer data, at 310 and 320 nm.
Author
Broadband; Narrowband; Solar Radiation; Ultraviolet Radiation

20000037954 Communications Research Lab., Tokyo, Japan
The New Solar Radio Observation System At Hiraiso
Kondo, Tetsuro, Communications Research Lab., Japan; Isobe, Takeshi, Communications Research Lab., Japan; Igi, Seiji, Communications Research Lab., Japan; Watari, Shin-ichi, Communications Research Lab., Japan; Tokumaru, Munetoshi, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Mar. 1994; ISSN 0914-9279; Volume 40, No. 1, pp. 85-102; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The Hiraiso Solar Terrestrial Research Center has been engaged in the prediction of significant disturbances in the solar terrestrial environment, and has therefore been monitoring solar radio emissions for more than 40 years. These observations had been at fixed frequencies until 1988 when a spectrograph (70-500 MHz) with a 10-m antenna was built. In FY1992 (April 1992-March 1993) the solar radio observation system at Hiraiso was renewed. Three old antennas were replaced by new ones, and total flux measurements at MHz were started. These were in to the fixed frequency measurements at 200 MHz and 500MHz. By adding two antennas, the frequency range of: the spectrograph was expanded from 70-500MHz to 25-2500 MHz. Routine observations of the sun using the new spectrograph (HiRAS: Hiraiso radio spectrograph) began late in May 1993 and daily operation is now fully automated. Everyday the antennas automatically track the sun from sunrise to sunset, and the data acquired by the HiRAS are processed by a workstation computer to produce dynamic spectrograms. An algorithm that removes interferences due to radio, television, and other artificial signals has significantly improved the signal to noise ratio of the spectrogram, thereby considerably increasing the HiRAS' ability to monitor solar radio bursts.
Author
Solar Radio Bursts; Type 2 Bursts; Radio Observation; Sun; Space Observations (From Earth)

20000037955 Communications Research Lab., Tokyo, Japan
Forty Years in Solar Radio Observations at Hiraiso
Isobe , Takeshi, Communications Research Lab., Japan; Yamashita, Fujio, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Mar. 1994; ISSN 0914-9279; Volume 40, No. 1, pp. 61-83; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Radio bursts from the sun were discovered in 1942 Ten years later, solar radio observations at Hiraiso started, and they have been continued for more than 40 years-mainly at a meter band. The observation system at Hiraiso has been renewed several times and improved with technological development. The initial receiving frequency was 200 MHz and observations at 9.5 GHz, 500MHz, and 100 MHz started in 1960, 1961, and 1968, respectively. Mapping observations at 32 GHz were carried out from 1980 to 1991. Dynamic spectrum observations in the frequency range from 70 to 500 MHz started in 1988, and the solar radio observation system at Hiraiso was wholly upgraded in 1992. This paper describes the history of the solar radio observation systems at Hiraiso and summarizes the observations made until 1992.
Author
Radio Observation; Space Observations (From Earth); Solar Radio Bursts; Astronomical Observatories

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SPACE RADIATION

Includes cosmic radiation; and inner and outer earth's radiation belts. For biological effects of radiation see 52 Aerospace Medicine. For theory see 73 Nuclear and High-Energy Physics.

20000033814 NASA Marshall Space Flight Center, Huntsville, AL USA
Hard Burst Emission from the Soft Gamma Repeater SGR 1900+14
Woods, Peter M., Alabama Univ., USA; Kouveliotou, Chryssa, NASA Marshall Space Flight Center, USA; VanParadijs, Jan, NASA Marshall Space Flight Center, USA; Briggs, Michael S., NASA Marshall Space Flight Center, USA; Hurley, Kevin, California Univ., USA; Gogus, Ersin, NASA Marshall Space Flight Center, USA; Preece, Robert D., NASA Marshall Space Flight Center, USA; Giblin, Timothy W., NASA Marshall Space Flight Center, USA; Thompson, Christopher, North Carolina Univ., USA; Duncan, Robert C., Texas Univ., USA; Astrophysical Journal; Dec. 10, 1999; Volume 527, pp. L47-L50; In English
Contract(s)/Grant(s): NCC8-65; JPL-958056; NAG5-3674; NAG5-7060; NAG5-7810; Copyright; Avail: Issuing Activity

We present evidence for burst emission from SGR 1900 + 14 with a power-law high-energy spectrum extending beyond 500 keV. Unlike previous detections of high-energy photons during bursts from soft gamma repeaters (SGRs), these emissions are not associated with extraordinarily bright flares. Not only is the emission hard, but the spectra are better fitted by D. Band's gamma-ray burst (GRB) function rather than by the traditional optically thin thermal bremsstrahlung model. We find that the spectral evolution within these hard events obeys a hardness/intensity anticorrelation. Temporally, these events are distinct from typical SGR burst emissions in that they are longer (approximately 1 s) and have relatively smooth profiles. Despite a difference in peak luminosity of approximately is greater than 10(exp 11) between these bursts from SGR 1900 + 14 and cosmological GRBs, there are striking temporal and spectral similarities between the two kinds of bursts, aside from spectral evolution. We outline an interpretation of these events in the context of the magnetar model.
Author
Hardness; Gamma Ray Bursts; Emission; Soft Gamma Repeaters; Magnetars

20000033863 NASA Marshall Space Flight Center, Huntsville, AL USA
Variable Spin-Down in the Soft Gamma Repeater SGR 1900+14 and Correlations with Burst Activity
Woods, Peter M., Alabama Univ., USA; Kouveliotou, Chryssa, NASA Marshall Space Flight Center, USA; VanParadijs, Jan, NASA Marshall Space Flight Center, USA; Finger, Mark H., NASA Marshall Space Flight Center, USA; Thompson, Christopher, North Carolina Univ., USA; Duncan, Robert C., Texas Univ., USA; Hurley, Kevin, California Univ., USA; Strohmayer, Tod, NASA Goddard Space Flight Center, USA; Swank, Jean, NASA Goddard Space Flight Center, USA; Murakami, Toshio, Institute of Space and Astronautical Science, Japan; Astrophysical Journal; Oct. 10, 1999; Volume 524, pp. L55-L58; In English
Contract(s)/Grant(s): NCC8-65; NAG5-3674; NAG5-7060; ARP-028; NAG5-8381; Copyright; Avail: Issuing Activity

We have analyzed Rossi X-ray Timing Explorer Proportional Counter Array observations of the pulsed emission from SGR 1900+ 14 during 1996 September, 1998 June-October, and early 1999. Using these measurements and results reported elsewhere, we construct a period history of this source for 2.5 yr. We find significant deviations from a steady spin-down trend during quiescence and the burst active interval. Burst and Transient Source Experiment observations of the burst emission are presented and correlations between the burst activity and spin-down rate of SGR 1900+14 are discussed. We find an 80 day interval during the summer of 1998 when the average spin-down rate is larger than the rate elsewhere by a factor approximately 2.3. This enhanced spin-down may be the result of a discontinuous spin-down event or "braking glitch" at the time of the giant flare on 1998 August 27. Furthermore, we find a large discrepancy between the pulsar period and average spin-down rate in X-rays as compared to radio observations for 1998 December and 1999 January.
Author
Pulsars; Radio Bursts; Gamma Ray Bursts; Soft Gamma Repeaters

20000033989 NASA Marshall Space Flight Center, Huntsville, AL USA
On Measuring Cosmic Ray Energy Spectra with the Rapidity Distributions
Bashindzhagyan, G., Moscow State Univ., Russia; Adams, J., NASA Marshall Space Flight Center, USA; Chilingarian, A., Academy of Sciences of the Armenian SSR, Armenia; Drury, L., Dublin Inst. for Advanced Studies, Ireland; Egorov, N., Research Inst. for Material Science and Technology, Russia; Golubkov, S., Research Inst. for Material Science and Technology, Russia; Korotkova, N., Moscow State Univ., Russia; Panasyuk, M., Moscow State Univ., Russia; Podorozhnyi, D., Moscow State Univ., Russia; Procqureur, J., Commissariat a l'Energie Atomique, France; [2000]; 1p; In English, 30 Apr. 2000, Long Beach, CA, USA; Sponsored by American Physical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

An important goal of cosmic ray research is to measure the elemental energy spectra of galactic cosmic rays up to 10(exp 16) eV. This goal cannot be achieved with an ionization calorimeter because the required instrument is too massive for space flight. An alternate method will be presented. This method is based on measuring the primary particle energy by determining the angular distribution of secondaries produced in a target layer. The proposed technique can be used over a wide range of energies (10 (exp 11) -10 (exp 16) eV) and gives an energy resolution of 60% or better. Based on this technique, a conceptual design for a new instrument (KLEM) will be presented. Due to its light weight, this instrument can have a large aperture enabling the direct measurement of cosmic rays to 1016 eV.
Author
Galactic Cosmic Rays; Spectral Energy Distribution; Energy Spectra; Measurement

20000034101 NASA Marshall Space Flight Center, Huntsville, AL USA
An Instrument to Measure Elemental Energy Spectra of Cosmic Ray Nuclei Up to 10(exp 16) eV
Adams, J., NASA Marshall Space Flight Center, USA; Bashindzhagyan, G., Moscow State Univ., Russia; Chilingarian, A., Academy of Sciences of the Armenian SSR, Armenia; Drury, L., Dublin Inst. for Advanced Studies, Ireland; Egorov, N., Research

Inst. for Material Science and Technology, Russia; Golubkov,S., Research Inst. for Material Science and Technology, Russia; Korotkova, N., Moscow State Univ., Russia; Panasyuk, M., Moscow State Univ., Russia; Podorozhnyi, D., Moscow State Univ., Russia; Procqureur, J., Commissariat a l'Energie Atomique, France; [2000]; 1p; In English; 33rd, 16-23 Jul. 2000, Warsaw, Poland; Sponsored by Committee on Space Research; No Copyright; Avail: Issuing Activity; Abstract Only

A longstanding goal of cosmic ray research is to measure the elemental energy spectra of cosmic rays up to and through the "knee" (approx. equal to 3 x 10 (exp 15) eV. It is not currently feasible to achieve this goal with an ionization calorimeter because the mass required to be deployed in Earth orbit is very large (at least 50 tonnes). An alternative method will be presented. This is based on measuring the primary particle energy by determining the angular distribution of secondaries produced in a target layer using silicon microstrip detector technology. The proposed technique can be used over a wide range of energies (10 (exp 11)- 10 (exp 16) eV) and gives an energy resolution of 60% or better. Based on this technique, a design for a new lightweight instrument with a large aperture (KLEM) will be described.

Author

Cosmic Rays; Energy Spectra; Measuring Instruments; Nuclei (Nuclear Physics)

20000034250 Smithsonian Astrophysical Observatory, Cambridge, MA USA

Hard X-Ray Emission of X-Ray Bursters ***Final Report, 1 Jun. 1998 - 30 Nov. 1999***

Kaaret, P., Smithsonian Astrophysical Observatory, USA; March 2000; 3p; In English

Contract(s)/Grant(s): NAG5-7477; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The primary goal of this proposal was to perform an accurate measurement of the broadband x-ray spectrum of a neutron-star low-mass x-ray binary found in a hard x-ray state. This goal was accomplished using data obtained under another proposal, which has provided exciting new information on the hard x-ray emission of neutron-star low-mass x-ray binaries. In "BeppoSAX Observations of the Atoll X-Ray Binary 4U0614+091", we present our analysis of the spectrum of 4U0614+091 over the energy band from 0.3-150 keV. Our data confirm the presence of a hard x-ray tail that can be modeled as thermal Comptonization of low-energy photons on electrons having a very high temperature, greater than 220 keV, or as a non-thermal powerlaw. Such a very hard x-ray spectrum has not been previously seen from neutron-star low-mass x-ray binaries. We also detected a spectral feature that can be interpreted as reprocessing, via Compton reflection, of the direct emission by an optically-thick disk and found a correlation between the photon index of the power-law tail and the fraction of radiation reflected which is similar to the correlation found for black hole candidate x-ray binaries and Seyfert galaxies. A secondary goal was to measure the timing properties of the x-ray emission from neutronstar low-mass x-ray binaries in their low/hard states.

Derived from text

Broadband; X Ray Spectra; X Ray Binaries; Neutron Stars; Black Holes (Astronomy)

20000034788 Los Alamos National Lab., Space and Remote Sensing Science Group, NM USA

Solar-Cosmic-Ray-Produced Nuclides in Extraterrestrial Matter

Reedy, Robert C., Los Alamos National Lab., USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; [1999], pp. 69-71; See also 20000034770; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

There are two main types of cosmic rays that have sufficient energy to induce nuclear reactions -- the galactic cosmic rays (GCR) and solar cosmic rays (also called solar energetic particles). Both types of particles can have production rates and production ratios in the small objects often found in cold and hot deserts that are different from those seen for most meteorites, which typically have radii of approx. 10-100 centimeters. GCR production rates are often lower than those for most meteorites. GCR production ratios, such as Ne-22/Ne-21, are also often different in small objects. Smaller meteoroids also are more likely to have nuclides made by solar-cosmic-ray (SCR) particles than typically-sized meteorites. The very small meteorite Salem had large amounts of SCR-produced radionuclides. Meteorites recovered in Antarctica are more likely to contain SCR-produced nuclides than other meteorites. Martian and lunar meteorites are also likely to have SCR-produced nuclides. Production rates and profiles for SCR-produced nuclides in meteoroids have been calculated previously. However, the cross sections for the nuclear reactions making many SCR-produced nuclides, such as Be-10 were not well measured then. New rates and profiles are calculated here using good cross sections for the reactions making these nuclides.

Derived from text

Extraterrestrial Matter; Nuclides; Solar Cosmic Rays; Radioactive Isotopes; Solar Physics

20000037776 NASA Kennedy Space Center, Cocoa Beach, FL USA

STS-37: Gamma Ray Observatory (2 of 2)

Mar. 24, 1991; In English; Videotape: 55 min. 20 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000013425; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

Live footage shows various unedited Gamma Ray Observatory (GRO) compiled processing shots. Shots depict work being performed on the STS-37 GRO payload, and the STS-37 Shuttle Amateur Radio Experiment (SAREX).
CASI
Gamma Ray Observatory; Spaceborne Astronomy; Spaceborne Telescopes; Spaceborne Experiments

20000037793 Alabama Univ., Huntsville, AL USA
[Compton GRO Cycle 7] ***Final Report***
Kippen, R. Marc, Alabama Univ., USA; [2000]; 2p; In English
Contract(s)/Grant(s): NAG5-6747; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
The goals of this project were to use the improved location accuracy of combined BATSE/Ulysses-IPN gamma-ray burst (GRB) data to search for small-angle clustering within the burst population and to search for possible correlations between bursts and catalogs of known astrophysical objects. The research was completed in several phases due to the length of time needed to process the basic BATSE/Ulysses data and to develop the appropriate analysis algorithms. In the first phase, BATSE/Ulysses data were gathered from their respective sources and processed to yield, final BATSE burst catalog locations and final BATSE/Ulysses IPN timing annuli. The final data are published. In the next phase, traditional statistical analysis techniques were used to search a subset of the data for small-angle clustering and. correlations, and to produce upper limits. Next, the unique analysis techniques and software described in the proposal were developed and,applied to the final set of data (corresponding to the 4B catalog). The final search did not find any significant self-clustering or correlations with supernovae, AGN, or near by galaxy clusters. The investigation ruled-out earlier findings that indicated (with marginal significance) such results, and. provided stringent limits on the allowable fraction of bursts that are self-clustered and associated with selected known objects. An added benefit of this research came in 1998 when it was suggested that some gamma-ray bursts may be associated with supernova (SN) explosions. We responded rapidly and applied the tools of this investigation to study this possibility. Using combined BATSE/Ulysses data, we were able to completely rule out any association between bright bursts and known supernovae, thereby questioning the validity of any GRB/SN association. If a GRB/SN association exists, it must be only with a small fraction of weak bursts.
Derived from text
Gamma Ray Bursts; Angular Distribution; Galactic Clusters; Astrophysics; Gamma Ray Observatory

20000038193 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-37: Gamma Ray Observatory Removal from Cannister at the PHSF
Feb. 08, 1990; In English; Videotape: 10 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000046434; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS
The primary objective of the STS-37 mission was to deploy the Gamma Ray Observatory. The mission was launched at 9:22:44 a.m. on April 5, 1991, onboard the space shuttle Atlantis. This video shows the Gamma Ray Observatory being moved from the cannister in the Payload Hazardous Servicing Facility (PHSF) to the work area.
Author
Gamma Ray Observatory; Space Transportation System

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GENERAL

20000034154 Department of the Air Force, Washington, DC USA
US Air Force Posture Statement 2000
Jan. 2000; 79p; In English
Report No.(s): AD-A373842; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy
The USA Air Force enters the 21st Century as the most powerful, swift and flexible military force in the world. Aerospace power was born in America with the Wright brothers and was proven decisive in combat by American commanders who understood the imperative of dominating the skies: Mitchell, MacArthur, Eisenhower, Nimitz, Arnold, and many more. Aerospace power became America's unique asymmetric advantage. For more than fifty years, the Air Force has been the nation's primary provider of aerospace power. Today, aerospace power gives the nation a strategic advantage and is its most rapid instrument of military choice. It is aerospace power that has made it possible for our nation to lead critical security commitments, while remaining ready to engage rapidly anywhere on the globe.
DTIC
Posture; Aerospace Systems

20000034200 NASA Langley Research Center, Hampton, VA USA

A Historical Perspective on Dynamics Testing at the Langley Research Center

Horta, Lucas G., NASA Langley Research Center, USA; Kvaternik, Raymond G., NASA Langley Research Center, USA; [2000]; 22p; In English; Dynamics Specialists, 5-6 Apr. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2000-1739; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The history of structural dynamics testing research over the past four decades at the Langley Research Center of the National Aeronautics and Space Administration is reviewed. Beginning in the early sixties, Langley investigated several scale model and full-scale spacecraft including the NIMBUS and various concepts for Apollo and Viking landers. Langley engineers pioneered the use of scaled models to study the dynamics of launch vehicles including Saturn I, Saturn V, and Titan III. In the seventies, work emphasized the Space Shuttle and advanced test and data analysis methods. In the eighties, the possibility of delivering large structures to orbit by the Space Shuttle shifted focus towards understanding the interaction of flexible space structures with attitude control systems. Although Langley has maintained a tradition of laboratory-based research, some flight experiments were supported. This review emphasizes work that, in some way, advanced the state of knowledge at the time.

Author

Dynamic Structural Analysis; Dynamic Tests; NASA Programs; Scale Models; Spacecraft Models; Dynamic Models

20000034931 NASA, Washington, DC USA

Remembering Apollo 11: The 30th Anniversary Data Archive CD-ROM, *1969-1999*

Cortright, Edgar M., Editor, NASA, USA; July 1999; In English; Original contains color illustrations

Report No.(s): NASA-NP-1999-06-249-HQ; NAS 1:83-06-249-HQ; NONP-NASA-CD-2000047914; No Copyright; Avail: CASI; C01, CD-ROM

On July 20, 1969, the human race accomplished its single greatest technological achievement of all time when a human first set foot on another celestial body. Six hours after landing at 4:17 p.m. Eastern Standard Time (with less than thirty seconds of fuel remaining), Neil A. Armstrong took the ”small step” into our greater future when he stepped off the Lunar Module, named Eagle, onto the surface of the Moon, from which he could look up and see Earth in the heavens as no one had done before him. He was shortly joined by Edwin ”Buzz” Aldrin, and the two astronauts spent twenty-one hours on the lunar surface and returned forty-six pounds of lunar rocks. After their historic walks on the Moon, they successfully docked with Michael Collins, patiently orbiting the cold but no longer lifeless Moon alone in the Command module Columbia. This CR-ROM is intended as a collection of hard to find technical data and other interesting information about the Apollo 11 mission, as well as the apollo program in general. It includes basic overviews, such as a retrospective analysis, an annotated bibliography, and history of the lunar-orbit rendezvous concept. It also contains technical data, such as mission operations reports, press kits, and news references for all of the Apollo missions, the Apollo spacecraft, and the Saturn V launch vehicle. Rounding out this CD-ROM are extensive histories of the lunar Orbiter program (the robotic predecessor to Apollo, biographies of the Apollo astronauts and other key individuals, and interesting audio-visual materials, such as video and audio clips, photo galleries, and blueprint-like diagrams of the Apollo spacecraft.

Derived from text

Bibliographies; Apollo 11 Flight; Apollo Project; Lunar Exploration; Lunar Landing; Histories

20000037678 Air Force Office of Scientific Research, Bolling AFB, Washington, DC USA

Research Highlights

Schaefer, Jean, Editor; Jan./Feb. 2000; 4p; In English

Report No.(s): AD-A374325; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Research Highlights is published every two months by the Air Force Office of Scientific Research. This newsletter provides brief descriptions of AFOSR basic research activities including topics such as research accomplishments, samples of technology transitions and technology transfer, notable peer recognition awards and honors, and other research program achievements. The purpose is to provide Air Force, DoD, government, industry and university communities with brief accounts to illustrate AFOSR support of the Air Force mission.

DTIC

Defense Program; Research and Development; Technology Utilization

Subject Term Index

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